# The Florida Litter Study

# Measuring and Managing Litter: Illegal Dumping City Costs KAB Litter Index Review

# **June 2000**

by the State University System of Florida

# FLORIDA CENTER FOR SOLID AND HAZARDOUS WASTE MANAGEMENT

2207 NW 13<sup>th</sup> Street, Suite D Gainesville, FL 32609

for the **FLORIDA LEGISLATURE** 

and the

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Report #S00-03

#### **ACKNOWLEDGMENTS**

The three studies included in this report were designed and conducted by Wade Davidson and Laura Helsel, Research Associates, and Donald Myers, who also served as the Project Manager. Carl Butterfield participated in the initial KAB field trials, analyzed the data and contributed to the formulation of the Illegal Dumping field studies. Ed Hilker provided initial technical advice and additional field support. The Florida Survey Research Center at the University of Florida provided advice and assistance on construction of the phone survey instrument, conducted the phone survey and provided data analyses. John Schert, Executive Director of the Florida Center for Solid and Hazardous Waste Management, was the Principal Investigator whose guidance and direction were pivotal to the completion of these studies. The following individuals provided staff support and assistance: Stephen Bissonnette, Research Assistant, Dotti Delfino, Assistant Director, Maria Hall, Research Associate, and Rhonda Rogers, Senior Information Specialist. Tana Silva edited the report.

Reviewers include Fletcher H. Herrald, IV, Contract Manager for the Florida Department of Environmental Protection; Ivan Lawyer, formerly with the Florida Business and Industry Recycling Program; and Frank Walper, Executive Director of Keep Florida Beautiful, Inc. The Center thanks them for their advice, support, and assistance.

The Center appreciates the many land managers, property owners, and public service employees who participated in the illegal dumping field and phone surveys. Also, the many city employees who provided cost figures and other helpful information and assistance for the study of city costs to manage litter. Researchers are indebted to the Keep America Beautiful organization, the Keep Florida Beautiful state office, and the individual Keep America Beautiful affiliate participants who invited the Center to participate in developing the Litter Index, provided materials and advice, and assisted with the field trials.

Funding was provided by the Florida Department of Environmental Protection.

Copies of this report can be obtained by contacting:

Florida Center for Solid and Hazardous Waste Management 2207 NW 13<sup>th</sup> Street, Suite D, Gainesville, FL 32609 Phone: 352-392-6264

Fax: 352-846-0183
E-mail: center@floridacenter.org
Internet: http://www.floridacenter.org

# TABLE OF CONTENTS

List of Tables	vi
List of Figures	vii
Executive Summary	viii
1. ILLEGAL DUMPING	1
1.1 Illegal Dumping Introduction	1
1.1.1 Background	1
1.1.2 Overview	1
1.1.3 Review of previous research	3
1.1.4 Objectives	4
1.1.5 Project staffing	4
1.1.6 Peer review	4
1.1.7 Definitions and acronyms	5
1.1.8 How this report is organized	6
1.2 Illegal Dumping Methodology	7
1.2.1 Overview	7
1.2.2 Pilot survey	7
1.2.3 Field survey	8
1.2.4 Phone survey	9
1.3 Illegal Dumping Results	11
1.3.1 Overview	11
1.3.2 Field survey	11
Northwest Florida Water Management District	13
Suwannee River Water Management District	16
St. Johns River Water Management District	19
Southwest Florida Water Management District	22
South Florida Water Management District	25
1.3.3 Phone survey results	28

1.4	Illegal Dumping Discussion	30
	1.4.1 Overview	30
	1.4.2 Field survey	31
	1.4.3 Phone survey	40
	1.4.4 Integrated discussion	42
1.5	Illegal Dumping Conclusions	51
2. (	CITY COSTS	55
2.1	City Costs Introduction	55
	2.1.1 Overview	55
	2.1.2 Previous research	55
	2.1.3 Objectives	56
	2.1.4 Definitions and acronyms	56
2.2	City Costs Methodology	56
2.3	City Costs Results	59
	2.3.1 Overview	59
	2.3.2 Jacksonville results	59
	2.3.3 Gainesville results	63
	2.3.4 St. Petersburg results	66
	2.3.5 Summary	67
2.4	City Costs Discussion	68
	2.4.1 Overview	68
	2.4.2 Jacksonville	69
	2.4.3 Gainesville	70
	2.4.4 St. Petersburg	72
	2.4.5 Integrated discussion	73
	2.4.6 Summary	74
3. ]	KEEP AMERICA BEAUTIFUL LITTER INDEX REVIEW	75
3.1	Litter Index Introduction	75
	3.1.1 Background	75
	3.1.2 Overview	75
	3.1.3 Review of previous research	76

	3.1.4 Objectives	76
	3.1.5 Definitions and acronyms	77
3.2	Litter Index Methodology	77
	3.2.1 Description of the Litter Index	77
	3.2.2 Training	78
	3.2.3 Rating area and sub-areas	78
	3.2.4 Scoring	79
	3.2.5 KAB pilot test, Gwinnett County, Georgia	79
3.3	Litter Index Results	80
	3.3.1 Overview	80
	3.3.2 City surveys	80
	3.3.3 Field Adaptations of the KAB-LI	82
3.4	Litter Index Discussion	83
Apı	pendices	87
r r	Appendix A – Florida Litter Law	89
	Appendix B – Illegal Dumping Survey Forms: Pilot, Field, Phone	93
	Appendix C – Water Management District Summaries	103
	Appendix D – Illegal Dumping Photographs	139
	Appendix E – Illegal Dumping Phone Master Questionnaire	145
	Appendix F – Survey Form: City Litter & Dumping Costs	151
	Appendix G – Sample Scoring for KAB-LI: Fort Lauderdale	155
Ref	erences	161

# LIST OF TABLES

Table 1-1	Phone Survey Target Respondent Categories	10
Table 1-2	Field Survey Summary of Acreage Covered	11
Table 1-3	Field Survey Summary of Costs and Number of Illegal Dump Sites	12
Table 1-4	Field Surveys and Land Use (NWFWMD)	14
Table 1-5	Extent of Illegal Dumping by Land Use (NWFWMD)	14
Table 1-6	Illegal Dumping Costs (NWFWMD)	15
Table 1-7	Recommendations To Reduce Illegal Dumping (NWFWMD)	16
Table 1-8	Field Surveys and Land Use (SRWMD)	17
Table 1-9	Extent of Illegal Dumping by Land Use (SRWMD)	17
Table 1-10	Illegal Dumping Costs (SRWMD)	18
Table 1-11	Recommendations To Reduce Illegal Dumping (SRWMD)	18
Table 1-12	Field Surveys and Land Use (SJWMD)	19
Table 1-13	Extent of Illegal Dumping by Land Use (SJWMD)	20
Table 1-14	Illegal Dumping Costs (SJWMD)	21
Table 1-15	Recommendations To Reduce Illegal Dumping (SJWMD)	21
Table 1-16	Field Surveys and Land Use (SWFWMD)	22
Table 1-17	Extent of Illegal Dumping by Land Use (SWFWMD)	23
Table 1-18	Illegal Dumping Costs (SWFWMD)	24
Table 1-19	Recommendations To Reduce Illegal Dumping (SWFWMD)	24
Table 1-20	Field Surveys and Land Use (SFWMD)	25
Table 1-21	Extent of Illegal Dumping by Land Use (SFWMD)	26
Table 1-22	Illegal Dumping Costs (SFWMD)	27
Table 1-23	Recommendations To Reduce Illegal Dumping (SFWMD)	27
Table 1-24	Number of Phones Completed for Each SIC	28
Table 1-25	Items Found in Illegal Dumps	29
Table 1-26	Government Activities To Reduce Illegal Dumping	30
Table 1-27	Costs Related to Illegal Dumping	30

Table 1-28	Illegal Dumping Trends with Land Use	33
Table 1-29	Illegally Dumped Items	34
Table 1-30	Change in Frequency of Illegal Dumping over the Previous Five Years	36
Table 1-31	Illegal Dumping Costs by Water Management District	37
Table 1-32	Illegal Dumping Costs by Land Use (Field)	38
Table 1-33	Illegal Dumping Costs by Land Manager Affiliation	38
Table 1-34	Illegal Dumping Costs by Landholding Size	39
Table 1-35	Illegal Dumping Trends with Land Use (Phone)	40
Table 1-36	Illegal Dumping Costs by Land Use	42
Table 1-37	Interviewee Recommendations	50
Table 2-1	Jacksonville Costs Associated with Litter and Illegal Dumping	60
Table 2-2	Gainesville Costs Associated with Litter and Illegal Dumping	63
Table 2-3	St. Petersburg Costs Associated with Litter and Illegal Dumping	66
Table 2-4	Summary of City Costs Associated with Litter and Illegal Dumping	68
Table 2-5	City Costs and Population	73
	LIST OF FIGURES	
Figure 1	Frequency Distribution of Illegally Dumped Items	41
Photos	See Annendix D	139

#### **EXECUTIVE SUMMARY**

The Florida Center for Solid and Hazardous Waste Management (the Center) is charged with researching litter measurement and management in the state of Florida. This report describes research findings on three issues of current importance: a study of illegal dumping on large tracts of rural land; a study of the costs to cities of managing litter and illegal dumping; and a review of the new Keep America Beautiful Litter Index using field trials in six Florida cities.

While it is believed that illegal dumping is a significant problem statewide on both public and private properties, there have been no systematic statewide studies of this problem. The Florida Department of Environmental Protection (DEP) commissioned the Center to survey illegal dumping on large, rural lands throughout Florida. This study is the first such effort to quantify both the number of dumps and the costs incurred by landowners and managers.

Research studies conducted at the Center in the previous two years examined the costs for counties, cities and businesses to manage litter and illegal dumping. The cost studies in this report continue that inquiry by developing case studies of costs to manage litter and illegal dumping in three Florida cities.

Field trials of the Keep America Beautiful (KAB) Litter Index are a follow-through on the Center's participation in the previous year on the KAB Litter Index Development Committee. The KAB Litter Index is being phased in to use nationwide and will be an important measurement tool for local KAB affiliates. It will be used in communities throughout the state to measure existing levels of litter and the progress of KAB litter abatement efforts. As an experienced leader in litter research and measurement in Florida, the Center cooperated with KAB by conducting "real time and on-the–ground" trials of the Index in six inner-city neighborhoods.

# **Illegal Dumping**

Illegal dumping is a statewide problem that poses serious environmental, public health, and economic problems. This study was conducted from January through March 2000. Its goals were to determine the extent of illegal dumping in Florida, establish estimates for costs associated with illegal dumping, and characterize illegal dumping.

The Center's research team designed a pilot survey to develop a survey instrument capable of gathering the information that would accomplish the study's goals. The pilot resulted in two survey instruments: a field survey and a phone survey. The Center's research team concluded that two surveys were needed in order to gather enough data within the study's time frame. The field survey was designed to gather information from various land uses within Florida's five water management districts using face-to-face interviews to conduct the surveys. Both public and private land managers were surveyed. In this way, researchers were able to view examples of illegal dumpsites and further assess the surroundings conducive to the act of dumping. Respondents could be approached and interviewed in person where they live and work. For the phone survey, the Center commissioned the Florida Survey Research Center (FSRC), located at the University of Florida, to conduct a phone survey asking the same basic questions as were

contained in the field survey. Phone survey respondents were taken from a database of businesses selected by Standard Industrial Classification (SIC) Codes listing those businesses likely to own or manage large tracts of land.

A total of 58 field surveys were completed, representing 19% (6.7 million acres) of Florida's dry land acreage and all five of Florida's water management districts. Large landholders who completed field surveys reported an estimated total of 1,910 illegal dumpsites on their lands in the previous year and they estimated spending of \$964,048 on illegal dumping-related activities. Half of the field survey respondents represented government agencies managing public lands. Landholders in the Suwannee River Water Management District reported the most illegal dumps, and those in the Suwannee River Water Management District spent the least. The landholders in the Suwannee River Water Management District spent the least on illegal dumping, and those in the South Florida Water Management District spent the most.

The FSRC completed 292 phone surveys and summarized the data. The phone survey respondents were private landholders who reported finding a total of 5,592 illegal dumpsites in the previous year and spending a total of \$913,568 on illegal dumping-related activities. They owned a total of 2.1 million acres in 60 of Florida's 67 counties.

The results of the two surveys combined quantify the illegal dumping problems faced by large landholders throughout Florida: 83% of the field survey respondents and 48% of the phone survey respondents reported finding a combined total of 7,500 dumpsites on their properties and spending about \$1.9 million on illegal dumping-related activities in the previous year. The combined total of 350 landowners and land managers who completed either the field or the phone survey owned or managed a total of 8.8 million acres, or 25% of Florida's dry land acreage.

The field and phone surveys showed that the amount of illegal dumping varies with land use. The field surveys indicated that forested areas and public lands had the highest level of illegal dumping. The phone surveys indicated that properties that are owned by farmers and real estate developers had the most illegal dumping among privately held lands. In the field surveys, the highest number of surveys came from farming and cattle operations, even though researchers sought and obtained a fairly even distribution of surveys from the major land uses. More than half the phone surveys completed were with real estate developers. Farming and cattle land managers were the second highest numbers of phone survey respondents. Rural areas that were near cities and had adequately high vegetative cover and road access seemed most likely to have illegal dumping. The items most often found at dumpsites were household trash, appliances and furniture, tires, construction and demolition debris and plant debris. Anecdotal evidence indicates that private landowners are sometimes hesitant to report illegal dumping on their lands for fear they will be fined and required to bear the costs of cleanup anyway. As a result, illegal dumping, especially of potentially environmentally hazardous materials, may be underreported on private lands.

#### City Costs

Every city has costs associated with litter and illegal dumping. Often, one department in a city is primarily responsible for cleanup activities and bears much of the cost for litter control, while other departments may incur some litter-related costs in the course of performing other services. Most cities' budgets are organized by department, and when several departments have litter-related expenses the true cost of managing litter and illegal dumping is difficult to establish. The objectives of this study were to determine which departments in selected cities spent money on programs and activities to manage litter and illegal dumping and to determine comprehensive costs for each city to manage litter and illegal dumping.

The cities of Gainesville, Jacksonville, and St. Petersburg were chosen for this study. After determining the structure of each city government, Center researchers contacted city departments to discover which ones have programs related to litter control and illegal dumping. They inquired about the programs' costs and what they covered (for example, salary, disposal fees, overhead). The researchers focused on three main categories of possible expenditures: cleanup, law enforcement, and prevention and education.

All three cities spent significant amounts on activities related to illegal dumping and litter even though they approached these problems using somewhat different organizational structures. In FY99 (Oct. 1 – Sept. 30), Jacksonville reported spending \$3,324,600 while Gainesville spent \$602,000 and St. Petersburg \$1,573,000. All three cities spent significantly more on cleanup than on enforcement or prevention. Researchers believe that the total expenditures reported here underestimate the cities' actual costs for handling litter and illegal dumping. That is because some costs for litter-related programs and clean up activities are often included under other budgetary items where city employees were unable to determine the amount that applied to litter activities. City departments do not usually track their illegal dumping and litter costs separately. The costs captured in this study are those that were most readily identified, or those that happened to be line items in departmental budgets.

#### Keep America Beautiful Litter Index

Keep America Beautiful (KAB) has developed a new litter measurement tool, called the Keep America Beautiful Litter Index (KAB-LI), to replace the previously used Photometric Index. This new litter measurement method was developed in response to a need for a tool that could produce consistent, realistic results, in various rural and urban settings and that would be easy to use. The Center conducted field trials of the KAB-LI in a number of Florida cities. The goal was to assess how well the instrument worked under actual field conditions in different parts of the state.

The KAB-LI is a visual or windshield survey method that uses a 4-point Likert-type ordinal scale to rate the amount of litter in an area of interest. Scoring utilizes standardized photos and descriptive categories to assign one of four scores:

- 1. No Litter
- 2. Slightly Littered
- 3. Littered
- 4. Extremely Littered.

After attending a training session, a team of scorers riding in a vehicle uses this scale to individually rate predefined sub-areas of a city or county. Score sheets provide a space to note specific details concerning a scored sub-area. Individual scores for each sub-area are then averaged to obtain an overall score for the entire area.

Center researchers prepared for the study by participating in a training session and pilot test of the KAB-LI with a KAB testing and development team in Gwinnett County, Georgia. Subsequently, they conducted rating trials at sites in Jacksonville, Brevard County, St. Petersburg, West Palm Beach, Fort Lauderdale, and Tallahassee. Center researchers initially followed the methodology outlined in the KAB-LI training materials as closely as possible. After each trial, they evaluated and discussed the methodology and results. They then made modifications aimed at improving the instrument's accuracy, reliability, and ease of use in the test locations. For example, researchers found that raters are only able to view and accurately score an average distance of 100 feet from either side of a vehicle. Since the width times the length of the rating route equals the area covered, sub-area rating routes of travel must be long enough in distance to cover the KAB recommended minimum of 20% of the entire area. In the Georgia trial, some sub-areas consisted of a single park or school and others were several miles of rural roadway. Smaller rating segments of several blocks each seem better adapted to rating city neighborhoods while longer routes of a mile or more are distances that work better on rural roadways. Center researchers tried standardizing the sizes of sub-areas to permit comparisons of scores. Four sub-areas of half-mile lengths were connected end-to-end consecutively to create a two-mile route. Ratings could then be examined for each individual segment or added together for a composite score of the longer route.

The new KAB Litter Index appears to be a useful measurement tool to portray litter conditions in a defined area. Center researchers found that each trial posed somewhat unique rating situations. Once a wide variety of communities begin to use this method, users are likely to recommend further refinements.

# 1. ILLEGAL DUMPING

#### 1.1 Introduction

Illegal dumping in Florida carries an economic cost as well as an environmental impact. Its monetary price is one that public and private landowners and managers statewide pay in order to prevent and clean up dumping on their properties. This report represents the Center's first systematic survey to assess the magnitude of this problem. This study was constructed to collect data concerning illegal dumping on rural lands exceeding 100 acres in size.

# 1.1.1 Background

The Center began roadside litter surveys in 1993. Since then, the Center's litter studies have broadened to include urban litter in general and, more specifically, the economic impacts of litter on Florida's businesses. In 1998 and 1999, the Center participated in the Urban Litter Partnership (ULP) with Keep America Beautiful, Inc., the U.S. Conference of Mayors, and major corporate sponsors to research, document, and publicize voluntary partnerships that effectively address urban litter and illegal dumping. At its National Summit in October 1999, the ULP released Urban Partnerships to Prevent Litter and Illegal Dumping, a manual of strategies used around the country to fight litter and illegal dumping. Center researchers reviewed that manual as part of their background research for this study.

# 1.1.2 Overview: The illegal dumping problem

Illegal dumping has several definitions. A previous Florida Litter Study defined it as the intentional, unauthorized, and inappropriate disposal of large quantities of solid waste for economic gain (FCSHWM, 1999). The U.S. Environmental Protection Agency (EPA) defines illegal dumping as the disposal of waste in an unpermitted area (EPA, 1998). The Florida Litter Law contains a complex legal definition of illegal dumping. For the purpose of this study, illegal dumping is the intentional, unauthorized, and inappropriate disposal of solid waste.

Illegally dumped items are largely non-hazardous solid wastes that are inconvenient and/or costly to dispose of properly. Typical items include:

- Household trash
- Household furniture and appliances
- Motor vehicles, auto parts, and tires
- Construction materials and demolition debris
- Yard waste and plant debris

Illegal dumping often occurs on undeveloped land or sparsely developed rural land, both public and private that is accessible from or near roads and populated areas. It occurs on agricultural, mining, recreational, conservation, transportation, and other lands that offer

secluded yet convenient areas for illegal dumping.

According to EPA (1998), the health risks associated with illegal dumping are significant and include physical hazards, chemical hazards, and increased breeding grounds for disease-carrying mosquitoes. Environmental risks include the potential for contaminants to wash into surface water bodies after storms and to leach into soil and ground water. The resulting water quality degradation could harm plants, wildlife and human health.

Illegal dumping can result when legal solid waste management services and disposal facilities are inconvenient and costly and when local government has limited authority to make those services mandatory. Socioeconomic factors might affect the amount of illegal dumping in an area; these include community demographics and availability of spare, abandoned, or undeveloped space (NCEDR, 2000). However, socioeconomic factors do not necessarily predict illegal dumping accurately. Some individuals choose to dump illegally regardless of the convenience or cost-effectiveness of collection and disposal services (NCEDR, 2000).

The economic burden of illegal dumping generally includes the costs of deterrence, cleanup, and enforcement. These costs can be difficult to track, because property owners and managers often do not distinguish them in their budgets from land management, operations, or maintenance costs. The dumping cost that seems easiest to break out is that of cleanup. These costs can be substantial. For example, during an unspecified period in Kentucky, state and county governments spent \$15 million to clean up approximately 10,000 illegal dumpsites (ENN, 1999).

Illegal dumpers can face prosecution under federal, state, or local law. Depending on the circumstances, any of several federal laws (see partial list below) could apply. At the state level, the Florida Litter Law is the primary authority for prosecuting illegal dumpers. A brief description of its provisions for illegal dumping also follows. Additionally, counties may enact ordinances to help deter, prosecute, and penalize illegal dumpers. Because county ordinances vary greatly, this report does not include a summary of them.

The federal laws under which illegal dumping may be prosecuted include, but are not limited to the:

- Refuge Administration Act
- Clean Water Act
- Endangered Species Act
- Federal Insecticide, Fungicide and Rodenticide Act
- Occupational Safety and Health Act
- Pollution Prevention Act
- Resource Conservation and Recovery Act
- Safe Drinking Water Act
- Toxic Substance Control Act

In most circumstances, illegal dumping violations under the above-mentioned laws are prosecuted as class B misdemeanors. The penalties are usually between \$100 and \$200, and may include restitution in addition to fines. In the most severe cases, such as for repeat offenders or

those who show blatant disrespect for the law, a \$5,000 fine, six months in jail, restitution, and forfeiture of equipment involved (i.e., automobile) may be assessed as punishment.

Under Florida's Litter Law (FS 403.413, Appendix A), it is illegal to dump litter, regardless of amount and method, unless authorized by law or permit. The law designates the following three levels of violation.

- Non-commercial dumping of less than 15 pounds or 27 cubic feet (one cubic yard): The violator pays a civil fine of \$50, and the court decides if the violator will pick up litter or perform another task based on the severity of the offense.
- Non-commercial dumping between 15 pounds or 27 cubic feet and 500 pounds or 100 cubic feet: The violator is guilty of a first-degree misdemeanor and must pick up litter or perform another community-service task. If a motor vehicle is involved in the offense, 3 points will be assessed on the violator's license.
- Dumping more than 500 pounds or 100 cubic feet, dumping any amount for commercial purposes, or dumping of hazardous wastes: The violator is guilty of a third-degree felony, and the court may order the violator to:
  - 1. Remove litter or make it harmless.
  - 2. Repair or restore property damage or pay for the damages.
  - 3. Perform public service to remove litter or restore a littered area.

A vehicle or other conveyance, container or machine used to dump the litter may be subject to forfeiture. Civil court damages for felony dumping are threefold the actual damages or \$200, whichever is greater, court costs and attorney's fees.

# 1.1.3 Review of previous research

Center staff conducted an Internet search of previous research on illegal dumping and of existing cleanup programs in the U.S. aimed at reducing the problems of litter and illegal dumping. The search turned up numerous newspaper and journal articles on illegal dumping, descriptions of many state and municipality programs, and several study reports and guidebooks. Two guidebooks proved to be of particular interest.

The National Center for Environmental Decision-Making Research (NCEDR) developed an on-line "Decision Maker's Guide to Controlling Litter and Illegal Dumping." NCEDR's research has shown that socioeconomic factors do not accurately predict illegal dumping and that some people dump illegally even if it is more convenient and efficient to dispose of the waste through regular collection and disposal services. According to a study cited by the guide, reducing the volume of illegal dumping requires both lowering the cost of legal disposal and raising the monetary penalties for violations.

EPA published its "Illegal Dumping Prevention Guidebook" in March 1998. In preparing this guidebook, EPA conducted a study to characterize illegal dumping in urban and rural areas of the Midwest. The study found that illegal dumping lowers property values and makes areas undesirable to developers. The study found that local governments and industry spent significant

amounts of money cleaning up illegal dumpsites and that factors contributing to illegal dumping included demographics, physical characteristics of an area, lack of alternative waste disposal options and recycling programs, and inadequate solid waste codes and ordinances.

# 1.1.4 Objectives

The primary objective of the current study was to obtain information about the extent of illegal dumping in Florida and its associated costs to Florida government, business, and industry.

An additional objective was to characterize illegal dumping in Florida with respect to:

- what is being dumped;
- where it is being dumped;
- how often it is occurring;
- whether the amount of dumping is changing over time;
- what kind of deterrents are being used;
- whether dumping is being reported;
- to whom dumping is reported;
- what enforcement efforts are taking place; and
- what landowners feel should be done to deter dumping.

# 1.1.5 Project staffing

Wade Davidson designed and conducted research studies as a graduate student at the University of Kentucky from 1996 to 2000. He holds a B.S. in Forest Science from the University of Kentucky and a M.S. in Forest Soil Science. He has experience with statistical design and computer science.

Laura Helsel holds a B.S. in Geology from Syracuse University, a M.S. in Geology from Dartmouth College, and a M.S. in Hydrology from the University of Nevada, Reno. Prior to working on this project, she was an Environmental Scientist at the Nevada Division of Environmental Protection for seven years.

Donald Myers was the Project Manager for this study. As a Center research associate he was co-researcher in 1998 and 1999 in a study of the economic impacts of litter on Florida businesses. He has participated both in the work of the Urban Litter Partnership and on the development committee for the Keep America Beautiful Litter Index. He holds a B.A. in Political Science from Kent State University and a M.S. in Vocational Rehabilitation Counseling from the University of Florida.

#### 1.1.6 Peer review

Frank Walper of Keep Florida Beautiful, Inc., Ivan Lawyer, formerly of the Florida Business and Industry Recycling Program, and Fletcher Herrald, Florida Department of Environmental Protection, reviewed the final draft of this report.

# 1.1.7 Definitions and acronyms

The following are definitions of terms and acronyms used in this report:

Amnesty days: Organized solid waste or toxic waste collection or disposal opportunities on specified dates. There is usually little or no fee charged for disposal of specified items on these days. These days may be designated for disposal of quantities or types of materials exceeding ordinary collection guidelines. Amnesty days may include, but are not limited to, toxic roundup days. Tires and computers are examples of materials sometimes collected on amnesty days.

<u>Household trash</u>: Personal effects and housewares discarded from normal household use, such as: clothing, papers, containers, small appliances, tools, toys, kitchenware, hardware, mechanical parts, etc. Large appliances and household furniture are normally considered as separate categories. Likewise, discarded building materials, whether from commercial or residential use, are usually considered separately as construction and demolition (C&D) debris. Discarded yard, garden and tree clippings, leaves and plants are usually referred to as yard waste or plant debris and considered separately from household trash.

<u>Illegal dumping</u>: The intentional, unauthorized and inappropriate disposal of solid waste.

<u>Rural land</u>: Land more than half of which is outside a city boundary.

<u>The Center, or FCSHWM</u>: The Florida Center for Solid and Hazardous Waste Management, located at the University of Florida (UF) and hosted by the UF College of Engineering.

<u>Toxic Roundup Days</u>: Organized disposal opportunities on specified dates and at preannounced locations, usually with no fee and no penalties for disposal. Examples of materials collected are: household chemicals, pesticides, paints, solvents, motor oil, antifreeze, batteries or other chemically active, corrosive or environmentally harmful household wastes.

Urban land: Land that is more than half within a city boundary.

DACS: Florida Department of Agriculture and Consumer Services

DEP: Florida Department of Environmental Protection

EPA: U.S. Environmental Protection Agency

<u>FBI</u>: Federal Bureau of Investigation

FFWCC: Florida Fish and Wildlife Conservation Commission

FLL: Florida Litter Law

FSRC: The Florida Survey Research Center, located at the University of Florida.

KAB: Keep America Beautiful

NCEDR: National Center for Environmental Decision-Making Research

NPS: National Park Service

NWFWMD: Northwest Florida Water Management District

SIC: Standard Industrial Classification Codes

SFWMD: South Florida Water Management District

SJRWMD: St. Johns River Water Management District

**SRWMD**: Suwannee River Water Management District

SWFWMD: Southwest Florida Water Management District

ULP: Urban Litter Partnership

USFWS: U.S. Fish and Wildlife Service

USFS: U.S. Forest Service

WMD: water management district

#### 1.1.8 How this report is organized

Section 2, "Methodology," describes the development of the survey methodology that was the basis of the project.

Section 3, "Results," presents a summary of the results of the surveys.

Section 4, "Discussion," compares, integrates, and discusses the results of the surveys.

Appendix A, "Florida Litter Law", contains the text of the Florida Litter Law.

Appendix B, "Survey Forms," contains a copy of each of the surveys developed and used as a part of this study.

Appendix C, "Water Management District Summaries," contains detailed reports, compiled by land use for each water management district, of survey findings.

Appendix D, "Illegal Dumping Photographs," contains photographs of illegal dumps taken during field surveys.

Appendix E, "Master Questionnaire," contains a copy of the phone survey questionnaire with the results in percentages for each question.

#### 1.2 Illegal Dumping Methodology

#### 1.2.1 Overview

The current study involved three phases to determine the status of Florida's illegal dumping problems on large, rural lands. The first phase, the pilot survey, focused the research team on the problem and became the basis for a field survey instrument for use in the second phase and a phone survey instrument for the third phase. Data obtained from the field and phone surveys are compiled and summarized in the Results and Discussion chapters of this text. Appendix B contains the survey instruments.

# 1.2.2 Pilot survey

The pilot survey was designed to obtain feedback on the issue and on the survey questions. Questions in the pilot survey were ones researchers considered pertinent in achieving the study's goals, based upon their review of the literature. Most of the questions were phrased in an openended format to elicit a variety of responses and to limit the impact of researcher bias in the answers. Responses to the pilot survey were then used to rephrase the questions and include multiple-choice categories. This refining process increased the efficiency and consistency of data acquisition.

# Pilot methodology

During the pilot phase, the researchers grouped large landholders and managers into the following categories of survey respondents, based on major land uses in Florida:

- Power companies
- Paper companies and timberlands
- Citrus lands
- Phosphate mines
- Cattle ranches
- Vegetable farms
- Transportation rights-of-way
- Prison lands
- DEP lands, including state parks, preserves, and other natural areas
- Water management districts
- City or county lands
- Federal lands, including national forests, preserves, and military holdings
- Theme parks
- Land companies and real estate

Researchers contacted and interviewed landowners and managers from the above land uses

statewide and completed pilot surveys by phone and fax. They then utilized the interviewees' comments in developing the final survey instrument. The 21 completed pilot surveys were with timberland managers, water management district land managers, national forest rangers, national park rangers, state park rangers, fruit orchard operators, vegetable farmers, cattle ranchers, and real estate agents.

#### Pilot results

As a result of the pilot survey, researchers recognized that the most efficient way to gather reliable data would be to conduct the main survey in two phases. The first phase would be a field survey using face-to-face interviews to complete the survey questionnaire. Researchers would be able to see and experience the magnitude of the problem in the context of actual field conditions and to gain anecdotal interview information to supplement the survey answers. The second phase would be a phone survey that would enable researchers to quickly and economically gather a large number of responses and would thereby provide an adequate sample size for statistical analyses. The pilot phase resulted in slightly modifying the survey instrument (such as adding or rewording some questions) and provided the scope needed to accomplish the study goals.

# 1.2.3 Field survey

Researchers focused on covering as much ground as possible to get a representative sample of Florida's acreage.

#### Survey respondent selection

Florida is a large and geographically diverse state. Common threads in its geography are its water resources and large proportion of land area contiguous to freshwater and saltwater bodies. Land use is intricately tied to the state's water resources. Florida's five water management districts provided a convenient means of dividing the state to examine illegal dumping and served as separate study areas for gathering information. At each water management district headquarters, researchers conducted a field survey and, in addition, requested contact information for landowners who represented the district's principal land uses. Most data at these headquarters came from district land managers. The goal was to obtain at least 10 completed field surveys from the major land uses in each district. In some instances, researchers could not obtain contact information from district headquarters for every land use, and they then turned to Internet research for leads.

Researchers selected field survey participants based on land usage and not on particular problems with illegal dumping. When owners or managers of targeted land uses were identified, researchers used the first contact person who agreed to participate. Thus, the field survey participants represent a random sample stratified by land use.

#### Conducting the field survey

Once researchers gathered the land use and contact information from district headquarters, they contacted the landowners or managers and established itineraries for completing field

surveys. Researchers personally interviewed the respondents and completed the field surveys. In most instances, researchers conducted the field surveys one-on-one. However, in a few cases, the researcher conducted the field survey interview with several respondents representing a property and recorded a consensus from the respondents. Respondents sometimes directed researchers to illegal dumpsites, and researchers also encountered random illegal dumpsites on their own. The researchers photographed these dumpsites whenever possible (Appendix C).

After all field surveys were completed for a water management district, researchers reviewed the field surveys by land use, wrote summaries of the anecdotal information and obvious trends in the responses and entered the data into a database.

#### **1.2.4** Phone survey

In addition to the field survey, researchers devised and commissioned a phone survey, in order to obtain a large enough sample to assure statistically valid data on the status of illegal dumping statewide. The Center contracted with the Florida Survey Research Center (FSRC) to develop the phone survey instrument, conduct the phone survey, and run basic statistics on the results.

# Phone Survey instrument development

The FSRC adapted the field survey to better fit a phone survey situation. This adaptation process included several phone survey versions. Center staff provided comments and guidance to FSRC staff. During this process, two screening questions were added to the beginning of the phone survey. The first was designed to ensure that the respondent owns or manages at least 100 acres of land. The second ensures that the respondent's land is in a rural location. The phone survey questions closely resemble the field survey questions. However, while restructuring the questions to work in a phone survey, it was possible to ask for more detailed responses to some questions. Appendix B contains a copy of the phone survey instrument.

#### Selection of businesses by Standard Industrial Classification Codes

Center staff considered the types of rural land uses in Florida according to the Standard Industrial Classification (SIC) code categories and selected 11 SIC categories to target for the phone survey. Staff selected the categories because their respective businesses would most likely own or manage large tracts of land. The Center purchased a database containing all Florida businesses in the selected SIC codes. Table 1-1 lists the selected categories and the number of companies in each.

Table 1-1 Phone Survey Target Respondent Categories

SIC	Industry Description	No. of
		Companies
6552-02	Real Estate Developers	1,698
0191-01	Farms	492
7996-01	Amusement Places	411
7999-99	Amusement & Recreation	239
4911-01	Electric Companies	172
0241-01	Dairies	159
5031-08	Timber & Timberland Companies	148
2621	Paper Mills	79
6552-01	Land Companies	45
1499-01	Mining Companies	26
1751-02	Livestock Breeders	25
	Total	3,494

After looking through the database at the types of businesses in each category, Center staff decided that most businesses in the Amusement & Recreation and Amusement Places categories were not likely to meet the acreage and rural screening criteria. Staff eliminated these two categories from the data set given to the FSRC for the phone survey. A database containing a total of 2,844 businesses and related data was given to FSRC for conducting the phone survey.

# Sample size and selection

A target sample size of 400 was selected to obtain a significant confidence level on the resulting statistics. FSRC randomly selected businesses from the final database. FSRC and the Center sought to maintain proportions of businesses in the SIC categories in the sample of 400 as were contained in the original data set.

#### Data collection and quality control

FSRC data quality assurance and quality control protocols were followed to ensure that phone calls were made in a consistent manner and the responses recorded accurately and captured in the database. FSRC trains its telephone interviewers prior to their making any phone calls. They called the businesses during the workday and made an effort to speak to the owner or a manager at each business contacted. Once the appropriate person was reached, the phone survey interviews averaged about 5 to 10 minutes, depending upon how the respondent answered the questions. Interviewers recorded responses on paper and gave the completed phone surveys to a supervisor who reviewed them, recorded response totals and entered the results into a database.

Obtaining completed phone surveys took longer than expected. To expedite completion, Center staff discontinued use of the second screening question, which asked if more than half the property was located within a municipal boundary. The question was left in the phone survey but no longer used to disqualify respondents; interviewers continued the interview regardless of the answer. Respondents who previously were disqualified because of this question were called again to obtain completed phone surveys. However, it still was not possible to reach the targeted sample size of 400, and only 292 phone surveys were completed. While maintaining the SIC code proportions of the original data set, every effort was made to achieve the target sample size. Many businesses were called back eight to 12 times to try to obtain a completed phone survey. (The FSRC's standard procedure is to call a single business back only four times).

#### 1.3 Illegal Dumping Results

#### 1.3.1 Overview

This chapter presents the results of the field surveys and the phone surveys. The field survey results were compiled and reported here by water management district; the phone survey results were compiled statewide.

#### 1.3.2 Field survey

Center staff conducted a total of 58 field surveys throughout the state. These field surveys cover approximately 6,679,993 acres, or 19% of the state's total land area. Table 1-2 summarizes the number of field surveys and acreage covered in each district.

Table 1-2. Field Survey Summary of Acreage Covered

WMD	Acreage	Acreage Surveyed	% of Acreage	No. of Surveys
			Surveyed	
South Florida	11,475,200	2,197,935	19%	12
St. Johns River	8,000,000	1,061,380	13%	11
Northwest Florida	7,235,200	1,816,000	25%	13
Southwest Florida	6,400,000	615,900	10%	11
Suwannee River	4,889,600	988,778	20%	11
Totals	38,000,000	6,679,993	19%*	58

<sup>\*</sup>The percentage of acreage covered statewide was calculated using 34.7 million acres as the total acreage for the state (converted from the dry land area of Florida in square miles, <a href="https://www.hammondelec.com/flvisit2.html">www.hammondelec.com/flvisit2.html</a>, March 3, 2000). The total acreage for the water districts exceeds 34.7 million acres because the water districts may have rounded up their actual acreages and/or used dry plus wetland acreages.

The total cost of dealing with illegal dumping reported by field survey respondents is \$964,048. Additionally, \$3 million was reported as the FFWCC's statewide budget for investigating environmental pollution including dumping. However, FFWCC could not estimate how much was spent statewide on illegal dumping only. The costs relating to illegal dumping are estimates only. Respondents often did not have actual expenditure figures readily available for each of three requested categories: patrol and surveillance, fencing and signs, cleanup and

tipping fees. If a respondent could not easily break out expenditures into categories, cost estimates were put into the "other" category. Respondents reported approximately 1,910 illegal dumpsites total in the past year, though in many cases they did not have actual numbers readily available and only estimated them. Table 1-3 summarizes the estimates of cost and number of illegal dumpsites.

Table 1-3. Field Survey Summary of Costs and Number of Illegal Dumpsites

Water Management District	Total Costs	No. of Illegal Dumpsites (n=58)
Suwannee River	\$ 67,250	703
St. Johns River	71,400	330
Northwest Florida	156,250	265
South Florida	389,500	251
Statewide Railroad	200,000	200
Southwest Florida	79,648	161
Totals	\$ 964,048	1,910

In the field survey sections, each water management district is summarized by the most common land uses occurring in it, with properties assigned to generic land use categories based upon their primary use. However, most lands in the field surveys were being used for multiple purposes. For example, the phosphate mine properties surveyed also had lands under timber management, and some of the timberland properties surveyed had lime-rock mines as well. Many of the cattle and vegetable farm properties also had small-scale timber operations. The land use categories are briefly explained below.

- State Wildlife Management Areas (FFWCC): FFWCC primarily manages wildlife and wildlife habitat, including enforcement of regulations to protect wildlife habitats. A law enforcement officer with the FFWCC was interviewed in each Water Management district.
- State Forests: The DACS manages several forests for recreation and timber.
- Federal Lands: These would include military bases, national forests, national parks, and national preserves.
- Railroads: A company manages 1,752 miles of track throughout the state.
- Private Timberlands: Several large-scale timber companies operate in Florida. Most of their lands are under multiple uses, such as recreation and mining, but these lands' primary function is timber production. This land use category includes PRIDE, a private, nonprofit organization that leases timberland from the state.
- Citrus Lands: Citrus growers sometimes manage parts of their land for vegetable production.
- Water Management District lands: These lands are set aside for wildlife habitat, aquifer recharge, wetlands, and groundwater protection, but are often open for certain recreational uses.
- Farming and Cattle Lands: These lands are privately owned and occupied in a variety of uses. Although agriculture and dairy cattle are their primary functions, timber management and mining also occur.

- Power Company Lands: These lands are primarily used as transmission corridors to facilitate power transmission throughout the state.
- State Parks: DEP manages several parks in the state primarily for recreation and preservation.
- Sugarcane Lands: About 425,000 acres in Florida are managed for sugarcane. Sugar growers also commonly grow corn and rice as secondary crops.
- Theme Parks: Theme parks are popular tourist attractions.
- Department of Transportation: DOT manages transportation rights-of-way throughout Florida.
- Mining Lands: Several forms of mining occur in Florida. Most mining operations also have other activities occurring, such as timber management and the production of fertilizer and/or concrete.
- County Lands: Counties manage large rural lands for a variety of purposes. Borrow pits and road rights-of-way are common county land uses.

#### NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

#### Introduction and land uses

The Northwest Florida Water Management District is comprised of 16 counties stretching from the St. Marks River Basin in Jefferson County to the Perdido River in Escambia County. It occupies 11 major drainage basins, and 1.1 million residents occupy the district's 11,305 square miles. The major population clusters are Panama City, Pensacola, and Tallahassee. Timber management occupies most of the land base in this district, followed by cattle, row crop farming, and urban development. The district has several state forests and parks and a national forest.

#### Interviews and acreage

Researchers completed 13 field surveys in this district. These surveys reflected illegal dumping patterns in 1.8 million of the district's 7.2 million acres (approximately 25%). In initial interviews, two land resource managers in the district office confirmed that timber operations dominate the district's landscape. Representatives of three large-scale (greater than 100,000 acres) timber operations were interviewed. Other land uses surveyed were as follows (also summarized in Table 1-4):

- Two field surveys were completed with a county land manager who also raised vegetables on his own land.
- Two other field surveys were completed with private farmers.
- A field survey was completed with a DOT manager.
- A deputy ranger for Apalachicola National Forest completed a survey.
- A law enforcement officer of FFWCC was interviewed.
- Field surveys were completed with two park rangers who manage state parks administered by DEP.

Table 1-4. Field Surveys and Land Use (NWFWMD)

Land Use	No. of Surveys
Private Farming (Cattle and Row Crops)	3
Private Timber	3
State Parks (DEP)	2
State Wildlife Management Areas (FFWCC)	1
County	1
Water Management and Conservation (WMD)	1
Department of Transportation	1
National Forest	1
Total	13

# Extent of illegal dumping and associated costs

Twelve of the 13 respondents reported finding at least one illegal dump on their properties each year. These field surveys showed that forests get the worst of this district's illegal dumping. Eight respondents reported some form of forest management on their properties. Forest roads provided secluded places and adequate cover for people to illegally dump. Household trash was the item most commonly dumped, followed by appliances and tires. Construction and roofing materials, yard waste, animal carcasses, toxic wastes, used medical supplies, automobiles, and even human bodies reportedly were found in illegal dumps in this district.

The Apalachicola National Forest had some of the heaviest and most widespread dumping that the field survey crew found statewide. The forest's deputy ranger reported that he dealt with at least 200 illegal dumps a year. Most of the forest is accessible by road. Several chronic dumpsites occurred, but random dumping reportedly occurs nearly everywhere in the Apalachicola National Forest. Table 1-5 depicts the extent of illegal dumping by land use.

Table 1-5. Extent of Illegal Dumping by Land Use (NWFWMD)

Land Use	No. of Dumps (n=13)
National Forest	200+
State Wildlife Management Areas (FFWCC)	50
Private Timber	5
Private Farming (Cattle and Row Crops)	3
State Parks (DEP)	3
Water Management & Conservation (WMD)	3
Department of Transportation	1
County	Unknown
Total	265

Questions about changes in frequency of illegal dumping over the previous five years turned up no definitive trend. Five respondents reported less dumping on their properties, four reported more dumping, and four reported no change.

Interviewees reported various deterrents: 10 of 13 reported using fences, gates, and signs; some patrol their lands; frequent cleanups take place at chronic dumpsites; Jackson County offers "amnesty days", opportunities for residents to dispose of excess quantities or types of waste at no additional cost; and, some lease land to hunt clubs that then restrict property access and thereby reduce dumping. All private forestry operations used hunt club leases that required the clubs to restrict access by others to the leased lands.

The respondents had a difficult time answering questions about costs they incurred from illegal dumping, largely because such costs are not line items in their budgets and get lumped into the properties' overhead costs. Many times the respondents had to give educated guesses to these questions. Table 1-6 reflects the respondents' best estimates of their total costs related to dumping problems. No dollar amount is given for patrolling because it was not a line item among respondents who do patrol and instead was included as an overhead cost. An FFWCC respondent reported that the commission allocates approximately \$3,000,000 statewide to investigate and enforce environmental pollution and illegal dumping laws. Researchers were unable to determine what portion of that is spent on illegal dumping enforcement in this water management district and so did not include any of that amount in this district's cost data. Lands with chronic dumping problems are more expensive for hunt clubs to clean up and cost more to fence and gate. Consequently, the hunt clubs pay less to lease those lands and the landowner loses money. A private timber company manager estimated losses of \$100,000 from leasing lands with existing illegal dumping on them.

Table 1-6. Illegal Dumping Costs (NWFWMD)

Activity	Cost (n=13)
Cleanup	\$101,300
Other (Overhead)	54,650
Fencing/Signs	300
Total	\$156,250

The field surveys showed that most landowners report illegal dumping incidents to law enforcement officers. This is usually the county sheriffs' office or the FFWCC. State park personnel report illegal dumping to the Florida Park Patrol, a division of DEP. In one field survey, the respondent stated they reported illegal dumping to the county code enforcement office.

Most interviewees reported that investigations ensued after they notified law enforcement and that dumps get cleaned up either at their own expense or by the dumpers, although the latter rarely face prosecution for their dumping violations.

The most common recommendation among the interviewees for reducing illegal dumping was more public education. Table 1-7 summarizes government activities that the field survey respondents said could reduce illegal dumping.

<u>Table 1-7. Recommendations to Reduce Illegal Dumping (NWFWMD)</u>

Government Activity	No. of Responses (n=13)
Public Education	10
More Legal Disposal Sites	7
Increase Enforcement/Prosecution Efforts	7
Decrease Tipping Fees	7
Increase Toxic Roundup Days	6
Increase Hours and Days of Disposal Site Operation	4

In addition, some respondents also suggested the following measures:

- Countywide mandatory trash collection.
- County enforcement requiring owners to cleanup illegal dumps.
- Better advertisement of "amnesty day" program dates.
- Additional county code officers assigned to illegal dumping investigation.
- Provide improved recycling and disposal options for appliances and toxic materials.
- Base disposal fees on household income or property value, on a sliding scale.

#### SUWANNEE RIVER WATER MANAGEMENT DISTRICT

#### Introduction and land uses

The Suwannee River Water Management District covers the smallest land area of Florida's five water management districts. It has 13 river basins, 285,000 people, 15 counties, and 7,640 square miles, mostly in rural timberlands. The district's most common land uses are timber production, cattle farming, phosphate mining, recreation, and row crop farming. It has numerous state parks and prisons as well. The greatest concentration of population surrounds and includes Lake City.

#### Interviews and acreage

Eleven field surveys were completed, covering about 1 million of the district's 4.9 million acres (20.2% coverage). The survey respondents were: the WMD land resource manager; a FFWCC law enforcement officer; a state park ranger; a DACS county forester and state forest ranger; three private timber company managers, one of whom also mines lime rock; a phosphate mining operator who also manages some timber lands; and, two farmers with cattle and row crops. Table 1-8 shows the number of field surveys completed for each major land use in this district.

Table 1-8. Field Surveys and Land Use (SRWMD)

Land Use	No. of Surveys
Private Timber	3
State Forests (DACS)	2
Private Farming (Cattle and Row Crops)	2
Water Management & Conservation (WMD)	1
Wildlife Management Areas (FFWCC)	1
State Parks (DEP)	1
Phosphate Mining	1
Total	11

#### Extent of illegal dumping and associated costs

Ten of the 11 field survey respondents reported some problems with illegal dumping. The FFWCC officer reported that more than 200 dumpsites are discovered and investigated in this district each year. The officer noted that rural dumping often occurs where a populated area borders undeveloped lands that are readily accessible by roads. The state forester, who covers an entire county, reported that at least one illegal dump occurs every day in that county. Nine of the 11 respondents reported that household appliances are commonly dumped. Eight respondents reported that tires are often dumped in large numbers. Yard waste and construction debris followed as the next most commonly dumped items. Interviewees also mentioned automobiles, industrial wastes, and animal carcasses. Table 1-9 illustrates the number of dumpsites found in the previous year for each major land use.

Table 1-9. The Extent of Illegal Dumping by Land Use (SRWMD)

Land Use	No. of Dumps (n=11)
State Forests (DACS)	367
State Wildlife Management Areas (FFWCC)	200+
Private Timber	125
State Parks (DEP)	4
Private Farming (Cattle and Row Crops)	4
Water Management and Conservation (WMD)	3
Phosphate Mining	0
Total	703+

Field survey responses varied concerning the change in frequency of illegal dumping during the previous five years. Four respondents reported less dumping, three reported more dumping, and four reported no change in illegal dumping.

As deterrents to illegal dumping, 10 of the 11 respondents reported using fencing or signs, 9 reported using patrols and surveillance, and 6 reported limiting motor vehicle access with gates.

Timber managers cited land leasing to hunt clubs as a successful deterrent strategy. Table 1-10 summarizes costs for each deterrent category. FFWCC did not report any costs.

Table 1-10. Illegal Dumping Costs (SRWMD)

Activity	Cost (n=11)
Patrol/Surveillance	\$56,700
Cleanup	5,500
Other (Overhead)	3,050
Fencing/Signs	2,000
Total	\$67,250

Law enforcement in this district is handled primarily by local sheriffs and by the FFWCC. Ten of the 11 respondents said they turn to some form of law enforcement officer when they encounter illegal dumping on their lands. Two said their county had a code enforcement officer who specialized in illegal dumping issues. FFWCC complaints received get forwarded to DEP. Most respondents reported that, after notifying the authorities, an investigation took place. However, even when an offender was identified and charged, he or she rarely faced prosecution. Sometimes an identified offender was persuaded to clean up the site, and otherwise, the landowner or manager cleaned up the sites.

All of the respondents recommended government actions to reduce illegal dumping. Table 1-11 summarizes their recommendations.

Table 1-11. Recommendations to Reduce Illegal Dumping (SRWMD)

Government Activity	No. of Responses (n=11)
Decrease Tipping Fees	10
Increase Hours and Days of Disposal Site Operation	9
Increase Toxic Roundup Days	9
Public Education	7
More Legal Disposal Sites	7
Increase Enforcement/Prosecution Efforts	7

Interviewees also recommended county mandatory garbage collection, additional funding in all counties for code enforcement officers assigned to illegal dumping investigations, and streamlining existing solid waste programs.

#### ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

#### Introduction and land uses

The St. Johns River Water Management District (SJRWMD) includes all or part of 19 counties in northeastern Florida. It encompasses about 8 million acres of land and a population of 3 million. The St. Johns River is the longest river in Florida, stretching 310 miles and fed by three drainage basins. Many creeks and rivers feed the upper, middle, and lower basins. The most common land uses in the district are timber production, urban development, and agriculture, including cattle and row crops. Several paper mills, military bases, state prisons, and mental hospitals are in this district, as well as state parks, state forests, and one national forest. Greater Jacksonville and Orlando are the district's major population concentrations, and its midsized population areas include Gainesville, Daytona Beach, and Melbourne.

#### Interviews and acreage

A total of 11 interviews were completed in this district, representing 1 million of the district's 8 million acres (12.5% coverage). Researchers obtained completed field surveys from the following lands and individuals:

- The water management district's land resource manager.
- Two FFWCC law enforcement officers.
- A state park ranger.
- Two large-scale timber companies' land managers.
- Two state forest rangers representing three state forests.
- A forest ranger representing the only national forest in this district.
- A large power company's environmental director.
- A railroad company official.
- A farm manager at a large cabbage farm

Table 1-12 shows the number of field surveys completed for each major land use in this district.

Table 1-12. Field Surveys and Land Use (SJRWMD)

Land Use	No. of Surveys
State Forests (DACS)	2
Private Timber	2
Water Management and Conservation (WMD)	1
State Wildlife Management Areas (FFWCC)	1
State Parks (DEP)	1
National Forest	1
Power Company	1
Railroad	1
Row Crops	1
Total	11

# Extent of illegal dumping and associated costs

The field surveys indicated that nine of the 11 respondents experienced illegal dumping on lands they managed. The Railroad Company, with headquarters in this district, reported 200 illegal dumps per year on its lands statewide. That number is not included in Table 1-13 since sites only in this district could not be separated out of the statewide figures. Tires were the item most commonly reported in the district, followed by household appliances, construction and demolition debris, yard waste, household trash, automobiles, boat hulls, vehicle batteries, and animal carcasses. Table 1-13 shows the extent of illegal dumping by land use in this district.

Table 1-13. Extent of Illegal Dumping by Land Use (SJRWMD)

Land Use	No. of Dumps (n=10)
State Wildlife Management Areas (FFWCC)	250
State Forests	28
National Forest	25
Water Management and Conservation (WMD)	12
Power Company	11
Private Timber	4
State Parks	0
Row Crops	0
Total (District)	330

When asked about the frequency of illegal dumping over the previous five years, five respondents reported less dumping and five reported no change. The only respondent who reported more dumping was the national forest ranger, who reported that dumping is worse during the spring of the year and that dumping along waterways is increasing in frequency. Most respondents said illegal dumping was widespread and not confined to specific locations.

The interviewees said the deterrents they used most often were surveillance, fencing, signs, and gates. Hunting club leases were successful deterrents on forest management lands, as the leases require the clubs to limit access to the leased properties and the limited access led to a noticeable drop in illegal dumping.

Illegal dumping costs large landowners and managers substantial sums of money in this district. The interviewees were asked to itemize their expenditures related to illegal dumping as best they could. Some gave educated guesses, but an idea of illegal dumping costs was obtained. Table 1-14 summarizes these cost estimates in the district.

Table 1-14. Illegal Dumping Costs (SJRWMD)

Activity	Cost (n=10)
Cleanup	\$43,900
Other (Overhead)	17,500
Fencing and Signs	6,500
Patrol and Surveillance	3,500
Total	\$71,400

Note: The railroad reported spending \$200,000 annually to clean up illegal dumps along railways The respondent for the company could not identify its costs separately for each of the five water management districts, so it does not appear in this table.

Most respondents said they report illegal dumping to some law enforcement agency. Most often that agency is the local sheriffs' department, but the FFWCC and code enforcement officers also sometimes receive reports. Respondents said that illegal dumps they reported were investigated and cleaned up. Four of the 11 respondents reported that prosecutions followed dumping arrests. They stated that it is difficult to identify and cite an offender and believe that prosecutors and judges place a low priority on dumping violations. Increased enforcement efforts was usually explained as the need to increase fines and prosecution rates. Table 1-15 summarizes the interviewees' recommendations.

Table 1-15. Recommendations to Reduce Illegal Dumping (SJRWMD)

Government Activity	No. of Responses (n=11)
More Legal Disposal Sites	8
Increase Enforcement Efforts	8
<b>Government Activity</b>	No. of Responses
Public Education	6
Lower Tipping Fees at Legal Disposal Sites	6
More Hours and Days of Disposal Site Operation	6
More Toxic Roundup Days	6

#### SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

#### Introduction and land uses

The Southwest Florida Water Management District (SWFWMD) includes all or part of 16 counties and covers about 10,000 square miles. It encompasses nine river basins and a population of about 3.8 million. Tampa, St. Petersburg, and Sarasota are located in this WMD. Some of the most productive agricultural land in Florida is in this district, where the largest land use is agriculture, at 31% of the district area. Urban land uses, including residential, commercial, and industrial, make up 23% of the district. Urban land uses are concentrated on the Gulf Coast, where the urban growth rate is high. Upland forest accounts for 17% of the district and wetlands for 18%. Most of the state's phosphate mining occurs in this district.

#### Interviews and acreage

Center staff completed 11 field surveys in this district. Of these, 10 interviews were conducted in person and one by phone. One interview was conducted with the Agricultural Crimes Unit of a county sheriff's office that responds to reports of illegal dumping countywide. Because the sheriff's office does not own or manage land, information from this survey is included anecdotally but not in any of the response counts. The field survey area covered approximately 615,900 acres, or 10% of the district's total 6.4 million acres. The field surveys covered various land uses, as summarized in Table 1-16.

Table 1-16. Field Surveys and Land Use (SWFWMD)

Land Use	No. of Surveys
Farming & Cattle	2
Citrus	2
State Park	1
Mining	1
State Forest	1
Power	1
Theme Park	1
State Wildlife Management Areas (FFWCC)	1
Water Management and Conservation (WMD)	1
Total	11

Field survey respondents in this district included: two park managers at Florida's largest state park; the director of environmental affairs at a phosphate mine; two employees of one of Florida's largest state forests; a facilities manager for a major power company; the chief horticulturist (who is also responsible for environmental issues) for a theme park; and the managers of two ranches. (These ranch lands also have uses other than farming and cattle, such as conservation, mining, citrus, timber, and land development. However, for the purpose of the table above, these land use activities were categorized as farming and cattle.) Interviewees included a manager and foreman of a citrus growers cooperative, an individual citrus grower and law enforcement officials from FFWCC and a county sheriff's Agricultural Crimes Unit.

# Extent of illegal dumping and associated costs

Respondents reported about 161 illegal dumpsites during the previous year, in addition to the 425 dumping violations reported to a county sheriff's office. Table 1-17 summarizes the number of illegal dumps found in the past year for each land use.

Table 1-17. Extent of Illegal Dumping by Land Use (SWFWMD)

Land Use	No. of Dumps
	(n=11)
State Forest	50
Citrus	31
Farming & Cattle	26
State Wildlife Management Areas (FFWCC)	19
Theme Park	12
Power	11
Water Management & Conservation (WMD)	8
State Park	4
Mining	0
Total	161

From about 50 sites in one district forest during the previous year, employees removed 118 tons of illegally dumped solid waste. All respondents reported finding household trash, and most said they often found tires, construction and demolition debris, household appliances, and plant debris. Half of them reported finding motor vehicles. They rarely reported finding toxic or industrial waste on their lands. Most respondents said dumping on their lands was widespread rather than confined to specific areas. Some noted that dumping seemed to occur most often along roads accessing their properties. The most common types of access were paved roads, unpaved roads, and gated roads. One respondent said once a chronic dumping site is cleaned up and steps are taken to prevent further dumping in that area, a new chronic dumpsite appears near the old one. Five respondents noted less dumping now than five years ago, while three saw no change, and three found more illegal dumps than five years ago.

The most common deterrents to dumping were patrol and surveillance, and fencing and signs. Half said they used cleanups to deter further illegal dumping. The state park respondent said mowing along roadways adjacent to the park helped deter dumping along the roadways. Another deterrent of particular note was an agreement between the sheriff's office's and many of that county's larger landholders. The agreement enabled the sheriff's office to arrest or cite trespassers on a landowner's property, even in the landowner's absence. When respondents found illegal dumps on their lands, most cleaned up the dumps. Many tried to identify the dumper and reported the dumpsites to authorities. Respondents most often report dumping to local law enforcement, usually the county sheriff's office. However, one land manager reported dumping to the landowner, and another landowner reported dumping to FFWCC. Once they reported dumpsites to authorities, respondents said investigation, cleanup and prosecution usually followed.

Table 1-18 summarizes costs to the landowners and state and local government representatives surveyed, by type of activity.

<u>Table 1-18. Illegal Dumping Costs (SWFWMD)</u>

Activity	Cost (n=11)
Cleanup and Tipping Fees	\$40,948
Patrol and Surveillance	20,000
Fencing and Signs	6,000
Other	5,200
Total Costs	\$72,148

If a respondent could not break out costs into the categories shown above, the total cost was listed as "other." The sheriff's office reported expenditures of nearly \$100,000 in the past year responding to and investigating illegal dumping reports. That amount is not included here because it is not a cost borne by a large, rural landholder. However, it gives an indication of what one county agency spends on enforcement.

To reduce illegal dumping, half the respondents said government should use public education, strengthen enforcement efforts, and increase the number of toxic roundup days, sites, and hours. Some recommended more legal disposal sites, lower tipping fees, and more hours and days of operation at legal disposal sites. Table 1-19 summarizes these results.

Table 1-19 Recommendations to Reduce Illegal Dumping (SWFWMD)

Government Activity	No. of Responses (n=11)
Increase enforcement efforts	7
Increase toxic roundup days	5
Public education	4
Increase hours and days that sites are open	4
More legal disposal sites	4
Decrease tipping fees	3

#### Respondents also suggested:

- a tire and large-item "amnesty day" for individuals (not businesses) to bring these items to the landfill free of charge;
- a tax to finance disposal costs, instead of charging a fee at the landfill;
- expanded ticketing power to include agencies and employees other than standard law enforcement officers and stiffer penalties;
- more public trash bins in rural areas; and
- a recycling fee or surcharge on frequently dumped items, especially tires, at point of sale and then used to pay a redemption fee when collected and turned in.

#### SOUTH FLORIDA WATER MANAGEMENT DISTRICT

#### Introduction and land uses

The South Florida Water Management District includes all or part of 16 counties, covering about 17,930 square miles. The district has a population of about 6 million and is highly urbanized along the "Gold Coast," which extends from West Palm Beach south to Coral Gables and includes Greater Miami, the district's largest population center. Fort Myers and Naples are also in this district, and it extends north up the center of the state to the Kissimmee area south and west of Orlando.

Land uses in the district include agriculture, water conservation, recreation and urban development. In the urban areas, the economy depends heavily on the tourist industry, service, and commerce. The Florida Keys, also part of this district, form a unique area and likewise depend heavily on recreation and tourism. Water conservation areas within the district include the Everglades and the Kissimmee River system. North of the Everglades, citrus fruits are the primary crops and large areas of land are used for cattle grazing. Around Lake Okeechobee and to the south, farmers grow mostly sugarcane, rice, nursery plants and vegetables.

The district encompasses an area of complex and integrated natural and constructed waterways that include the Kissimmee River, Lake Okeechobee, and numerous flood control dams and canals. Waters from these drain to the Atlantic Ocean primarily via canals and to the Gulf of Mexico via the Caloosahatchee River and the Everglades.

# Interviews and acreage

Center staff completed 12 field surveys in this district. Of these, nine interviews were conducted in person and three surveys were completed by fax. The field survey area is nearly 2.2 million acres, or 19% of the district's total 11.5 million acres. These field surveys covered various land uses, as summarized in Table 1-20.

Table 1-20. Field Surveys and Land Use (SFWMD)

Land Use	No. of Surveys (n=12)
Federal Land	3
State Forest	2
Farming	2
Power	1
Citrus	1
Theme Park	1
Land Use	No. of Surveys
State Wildlife Management Areas (FFWCC)	1
Water Management and Conservation (WMD)	1
Total	12

Field surveys for public lands in this district were completed by two rangers from different parts of Everglades National Park, a U.S. Fish and Wildlife Service officer at the Loxahatchee

National Wildlife Refuge, and two employees for different tracts of a state forest. In the agricultural land use category, field surveys were completed by a vice president, a manager, and a field foreman for a large sugarcane grower; the manager of a citrus grove; and, in the vegetable farming category, a district conservationist for the Natural Resources Conservation Service and a manager for a Soil and Water Conservation District. Others surveyed were: a facilities manager for a major power company; the supervisor of waste resources at a theme park; and, for the Wildlife Management category, a captain and two lieutenants of FFWCC.

### Extent of illegal dumping and associated costs

Respondents reported finding approximately 251 illegal dumpsites during the previous year. Table 1-21 summarizes the number of these dumps for each land use type.

Table 1-21. Extent of Illegal Dumping by Land Use (SFWMD)

Land Use	No. of Dumps (n=12)		
Federal Land	68		
State Wildlife Management Areas (FFWCC)	60		
Citrus	52		
Water Management & Conservation (WMD)	35		
Farming	20		
Power	12		
State Forest	4		
Theme Park	0		
Total	251		

The government conservationist, the conservation district water manager, and the theme park's solid waste manager said they received no reports of illegal dumping in the previous year. The other respondents reported finding household appliances, and most also found tires, construction and demolition debris, and household trash. About half reported finding motor vehicles and plant debris and a few found possibly toxic and industrial wastes at dumpsites. The most extensive illegal dumping among the land uses in the field survey was in the East Everglades District of Everglades National Park. Two respondents attributed some of the illegal dumping problems in South Florida to cultural differences in attitude toward waste disposal and the environment. Four respondents said dumping on their land was widespread, while four said it was confined to specific areas. Four noted that dumping seemed to occur most often along roads or at gates accessing their properties. The most common types of access to respondents' lands were paved roads, unpaved roads, and gated roads. Two of those responding to the field survey said they experienced less dumping now than five years ago, while six saw no change over the past five years, and three found more illegal dumps than five years ago.

The most commonly used methods of deterrence were patrol and surveillance, and fencing and signs. In the East Everglades, removing vegetation increased visibility and sight distance to make surveillance for illegal dumping more effective. Canals surrounding fields also effectively acted as barriers to prevent access for dumping. Some respondents said they used cleanups to deter further illegal dumping. When respondents found illegal dumps on their lands, most

cleaned them up, and many tried to identify the dumper and reported the dumpsites to authorities. Respondents said they most often reported dumping violations to local law enforcement, usually the county sheriff's office. Some respondents reported to codes enforcement and a few to FFWCC. Once a dumpsite was reported, respondents said, investigation, cleanup and prosecution usually followed.

Table 1-22 summarizes costs to the landowners and federal, state, and local government agencies responding to the field survey.

Table 1-22. Illegal Dumping Costs (SFWMD)

Activity	Cost (n=12)
Patrol and Surveillance	\$152,000
Fencing and Signs	134,500
Other	27,000
Cleanup and Tipping Fees	26,000
Total Costs	\$339,500

If a respondent could not break out costs into the categories shown above, the total cost was listed as "other." In particular, wages and vehicle costs for performing duties related to illegal dumping were listed as "other." Some costs that may not be incurred annually and did not occur last year were not included in the table. These could be substantial. For example, repair and replacement costs for irrigation canal water pumps blocked or damaged by debris sucked into intakes after being dumped into canals.

To reduce illegal dumping, most respondents recommended public education and increased enforcement efforts. Some said more legal disposal sites, lower tipping fees, longer operating hours and days at disposal sites, and more toxic roundup days, sites, and hours would help curtail illegal dumping. Table 1-23 summarizes these results.

Table 1-23 Recommendations to Reduce Illegal Dumping (SFWMD)

<b>Government Activity</b>	No. of Responses (n=12)
Public education	8
Increase enforcement efforts	7
More legal disposal sites	4
Decrease tipping fees	4
Increase hours and days that sites are open	4
Increase toxic roundup days	3

#### Respondents also suggested:

- radio and television broadcasts educating the public on the benefits of a clean environment;
- an additional county tax to offset landfill fees;

- more aggressive prosecution under the Florida Litter Law;
- a reward system for citizens who report illegal dumpers;
- advertisement of the East Everglades illegal dumping problem;
- multilingual education programs; and
- limiting access on public lands.

### **1.3.3** Phone survey results

## Overview

This section contains the results of the phone survey conducted by the Florida Survey Research Center on behalf of FCSHWM. The Master Questionnaire containing the results for each of the questions is in Appendix D. A total of 292 phone surveys were completed. Table 1-24 shows the number of phone surveys completed for each SIC code.

Table 1-24. Number of Phone Surveys Completed for Each SIC Code

SIC	Industry Description	Surveys
		Completed
6552-02	Real Estate Developers	158
0191-01	Farms	69
0241-01	Dairies	22
5031-08	Timber & Timberland Companies	21
6552-01	Land Companies	6
4911-01	Electric Companies	6
0751-02	Livestock Breeders	4
1499-01	Mining Companies	4
2621-	Paper Mills	2
	Total	292

Respondents to the phone survey owned or managed a total of 2.1 million acres in 61 of Florida's 67 counties. Respondents found a total of 5,592 dumpsites on their lands in the previous year. Most respondents (84%) owned or managed lands in rural areas. For the purpose of this survey, rural land is defined as land that has more than half of its total acreage outside of city boundaries. The total costs reported by respondents for all activities that related to illegal dumping in 1999 totaled \$913,568.

#### Extent

When asked how much of a problem illegal dumping on their property is, 17% of the respondents said it is a substantial problem, 34% said it is somewhat of a problem, and 48% said it is not a problem. Of those surveyed, 49% did not find any illegal dumps on their lands, and 3% said they did not know if anything was dumped on their property. The 48% who did find illegal dumps found anywhere from 1 to 365 sites. Respondents found dumps containing household trash, household appliances and furniture, and tires most often (Table 1-25). After finding illegal

dumps on their lands, some respondents reported the incidents, usually to local law enforcement. Respondents were most likely to report a dumpsite if it contained industrial waste or toxic waste. In many cases, dumping incidents reported to officials received follow-up investigation, which in turn sometimes resulted in a cleanup. Investigation and cleanup was more likely to occur than prosecution.

Table 1-25. Items Found in Illegal Dumps (Phone)

Items Found	% of Respondents (n=292)
Household trash	77.2%
Household appliances/furniture	62.9%
Tires	58.6%
Construction/demolition debris	50.7%
Plant debris	49.3%
Motor vehicles	24.3%
Other	14.3%
Industrial waste	6.5%
Toxic waste	4.4%

Most respondents cleaned up the illegal dumps themselves. Landowners and land managers were most likely to clean up household appliances and furniture. Only a few tried to identify the dumpers. Just over half of the respondents found no change in dumping frequency in the previous five years, while 19% said it increased and 22% said it decreased.

The most commonly used deterrents were putting up fencing and signs and cleaning up dumpsites when found. About half the respondents used these deterrents, and some respondents used patrol and surveillance and other deterrents.

Access to respondents' lands is typically by road: 93% have access by paved roads, 48% by public unpaved roads, 19% by forest roads, and 37% by gated roads. While some respondents' land is more than 15 miles or less than 5 miles from a solid waste disposal facility, most report a facility within 6 to 15 miles.

To reduce illegal dumping, half to slightly more than half of the respondents said all of the activities listed in Table 1-26 would be helpful.

Table 1-26. Government Activities to Reduce Illegal Dumping (Phone)

<b>Government Activity</b>	% of Respondents (n=292)
Increase toxic roundup days	59%
Increase hours and days that sites are open	59%
Decrease tipping fees	57%
More legal disposal sites	56%
Increase enforcement efforts	54%
Public education	49%

### Cost

Table 1-27 summarizes costs to the landowners and land managers surveyed.

Table 1-27. Costs Related to Illegal Dumping (Phone)

Activity	Cost (n=292)
Patrol and Surveillance	\$162,525
Fencing and Signs	433,320
Cleanup and Tipping Fees	277,811
Other	39,912
Total Costs	\$913,568

Note: The costs contained in this table are estimates.

# 1.4 Illegal Dumping Discussion

### 1.4.1 Overview

This section presents an analysis of dumping trends in different land uses and regions and their associated costs. It compares results of the phone survey and field survey results and discusses anecdotal discoveries the research team made concerning law enforcement, deterrents, and cleanup.

Before discussing the results, a few points need to be made about the data:

First, field surveys conducted with FFWCC primarily covered state wildlife management areas but to a limited extent may include all land uses, not just those surveyed for this study. Illegal dumping reports came to FFWCC from public and private landowners and managers regarding small or large landholdings. This should be kept in mind when reviewing tables showing the number of dumpsites found by FFWCC.

Second, the responses to both surveys represent self-reporting. In a few instances in the field

survey, the responses did not match the interviewer's field observations. For example, the researchers observed illegal dumping on premises where the land manager reported no illegal dumping. In a small sample size, this factor can negatively affect data quality.

Lastly, a small sample size also presents problems in observing and defining trends. Numbers reported as extremely high or low, compared to others in the database, distort statistical calculations and make it difficult to draw meaningful conclusions.

### 1.4.2 Field Survey

### Geographic trends with land use

Florida's geography allows for a wide variety of land uses and thus opens the possibility of conducting a study of illegal dumping in several ways. An overriding feature of the state is the extent of its coastline, totaling 1,350 miles, and the economic development associated with it (Funk and Wagnalls, 2000). Another important feature is the water resources in Florida's wetlands, streams, rivers, and lakes. These resources are divided by topography into five major drainage basins. A Water Management District board that governs water use issues manages each basin area. The five water management districts provide convenient geopolitical divisions of the state for study purposes, as they are approximately equivalent in size, and geography largely dictates the land uses within each district.

Urban development is common to all five districts. In addition, major land uses in the three northern districts (Northwest, Suwannee, and St. Johns) include timber management, cattle farming, and vegetable farming. North Florida's timber industry occupies about 15 million acres (ibid.), and most of Florida's state and national forests are in these districts as well.

In the southern water management districts (Southwest and South), public lands, farming, and phosphate mining are the most common rural land uses. Most Florida farmland is in the central and southeastern regions. The southern districts contain the state's largest urban areas as well as millions of undeveloped acres in the Everglades that are divided into various national preserves, refuges, and parks.

Other land uses and trends worth noting are:

- State parks are scattered throughout Florida.
- National parks and preserves are located mostly in the southern part of the state and along the shorelines.
- Phosphate mining is concentrated in the central section of the state, primarily Polk County (ibid.), although some phosphate mining occurs in the north-central area. Phosphate mining revenues account for more than half of all mineral and mining revenues in Florida.
- Tourism is concentrated along Florida's beaches and in theme parks in the central and southern areas.
- Agricultural practices encompass multiple land uses statewide and represent significant revenue within the state. Florida agriculture is the third most prosperous in the nation and generates the eighth largest gross income (ibid.). The state's 40,000 farms average about 300 acres each and the five most valuable agricultural commodities they produce are citrus,

greenhouse and nursery products, sugarcane, tomatoes, and dairy products (Farm Bureau, 2000).

# Extent of illegal dumping

This section examines land use trends with regard to illegal dumping, the types of items dumped, and changes in dumping over the past five years.

Land uses that experienced the worst illegal dumping problems included federal lands and forest areas. FFWCC, which manages state wildlife management areas, found the most illegal dumps during the previous year. In part, this large number is due to the inclusion of some dumps that other public land managers and some private landowners reported to FFWCC. Responses to field surveys indicate that forested lands experience the most illegal dumping. These included national forests, state forests, some wildlife management areas, and private timberlands, all of which appear in the top five land uses for illegal dumping in Table 1-28. Also during the field survey, researchers observed extensive illegal dumping in state and private forests.

The federal lands represented in the field surveys included the Everglades, rural lands in South Florida which are representative of that region's illegal dumping problems. The worst illegal dumpsites discovered during the field survey were in the East Everglades, managed by the National Park Service. Field researchers observed and photographed dumped tires, household garbage, and household appliances along the roads that access this area of the national park, as well as numerous burned automobiles and boat hulls. The second worst dumpsite encountered during the field survey was at Apalachicola National Forest, where illegal dumps lined many of the access roads. Field researchers observed and photographed tires, household garbage, household appliances, and construction and demolition debris along several of these roads.

Railroads were reported to be areas of chronic dumping. The 200 dumps reported along railroad rights-of-way included some through large, rural properties, but many were urban, as well. A railroad official that was interviewed could not distinguish urban dumping from rural dumping.

Several citrus growers in central and southern Florida reported a high incidence of illegal dumping. One citrus grower near the Everglades reported at least one dump per week. Most of those dumping instances involved materials from commercial enterprises (shingles from roofing companies and truckloads of tires), or very large items (e.g., mobile homes).

Though dumping on sugarcane farming lands represented only 1% of the dumping reported, only one field survey was conducted in this land use category. The one field survey from sugarcane lands showed more dumping than any other single field survey from the other agricultural land uses (farming and cattle). The three sugarcane farm managers interviewed for the field survey reported an increase in illegal dumping on their farm and significant costs associated both with cleanup and with efforts to deter the activity (see <u>Field survey summary</u> below).

Table 1-28 expresses illegal dumping problems relative to land uses across the state. The

table is ranked in descending order with respect to the percent of reported dumping.

Table 1-28. Illegal Dumping Trends with Land Use (Field survey)

Land Use	No. of Surveys	Percent of Completed Surveys	No. of Dumps per Year Reported	Percent of Reported Dumping	No. of Dumps per Survey
State Wildlife Management Areas (FFWCC)	5	9%	579	30%	115.80
State Forests	7	12%	449	24%	64.14
Federal Lands	5	9%	293	15%	58.60
Railroads	1	2%	200	11%	200.00
Private Timberlands	8	13%	134	7%	16.75
Citrus Lands	3	5%	83	4%	27.67
Water Management Districts	5	9%	61	3%	12.20
Farming & Cattle Lands	9	15%	33	2%	3.67
Power Company Lands	3	5%	34	2%	11.33
State Parks	5	9%	11	1%	3.67
Sugar Cane Lands	1	2%	20	1%	20.00
Theme Parks	2	3%	12	<1%	6.00
Department of Transportation	1	2%	1	<1%	1.00
Mining Lands	2	3%	0	0%	0.00
County Lands	1	2%	-?-	NA	NA
Total	58	100%	1,910	100%	NA

When searching for the factors that most inhibit illegal dumping, a few obvious circumstances surface. Rural areas nearest urban areas are more prone to illegal dumping than other rural areas. Rural lands with tall crops, trees or other vegetative cover are more prone to illegal dumping, as are those with isolated back roads.

Areas with all or some of these factors are even more likely to experience chronic illegal dumping problems. The East Everglades and Apalachicola National Forest are representative of such lands. The East Everglades lie between the rest of the Everglades and the "Gold Coast."

Most road access from the adjoining urban area to the east terminates near the East Everglades park and the tall sawgrass and other subtropical vegetation that grow there make adequate cover for illegal dumping. The Apalachicola National Forest is very different geographically and ecologically than the Everglades but has similar dumping problems. That national forest is less than 30 minutes south of Tallahassee, one of the largest population clusters of northwestern Florida. The Apalachicola National Forest has numerous remote roads accessible to the public. The forest canopy provides screening for the activities and the materials associated with illegal dumping.

Among agricultural land users, perhaps the reason citrus and sugarcane growers reported more illegal dumping than other farmers was because their crops grow high enough to hide the activities of illegal dumpers.

Some South Florida Park rangers and farm managers cited cultural influences as a factor contributing to illegal dumping there. They suggested that some recent immigrants might not have adopted prevailing U.S. cultural standards concerning solid waste disposal and possible environmental hazards.

Table 1-29. Illegally Dumped Items (Field survey)

Items Dumped	No. of Reports	Percentage of Respondents (n=58)
Household Trash	46	79%
Household Appliances	43	74%
Tires	40	69%
Construction/Demolition Debris	37	64%
Yard Waste	30	52%
Vehicles and/or Boats	25	43%
Industrial Waste	15	26%
Animal Carcasses	11	19%
Miscellaneous Toxic Waste	6	10%
Medical Waste	3	5%

Table 1-29 shows the most commonly dumped items. Among respondents to the field survey, 79% reported household trash dumped on their lands, and 74% reported dumping of household appliances. It should be noted that most of the respondents who reported tires as commonly dumped items considered tires to be their worst problem. The commercial dumping of tires and construction debris is apparently a significant problem throughout the state. Many respondents did not know that yard waste (vegetative debris) counted as an illegally dumped item.

Some respondents reported that vehicles get dumped for two main reasons: auto theft chop shops often leave auto or boat remains, and owners often burn and leave their automobiles in remote places to stage a theft for insurance fraud. This happens frequently in the East Everglades but also occurs in other parts of the state. Automobiles contain a variety of substances that are toxic to the environment and have the potential to leak out onto and into the soil.

No apparent pattern of industrial waste dumping emerged in the small sample size of the field survey. Industrial wastes reported include oil drums, used timbers, chemical containers, and other similar items of industrial origin and frequently contain substances potentially hazardous to the environment. Miscellaneous potentially hazardous substances reported included cleaning supplies, batteries, and pesticides. Medical waste was reported only a few times. Animal carcasses were a commonly reported item.

Table 1-30 shows the change in frequency of illegal dumping for the previous five years for each land use. Most respondents, including all five FFWCC districts, reported no change in illegal dumping during the previous five years, while others reported more or less illegal dumping during that period. Although respondents for forested areas reported some of the most severe illegal dumping problems, many reported a decrease in the frequency of illegal dumping over the previous five years. The Apalachicola National Forest could not report for this frequency variable because the deputy ranger interviewed had only been there for two years.

Respondents largely attributed decreases in illegal dumping in forest areas to hunting club leases and road closures. Hunting club leases require the clubs to restrict access to the leased property. If leased areas have chronic dumping problems, the property owners or managers often forgo revenue from the lease in exchange for contract language committing the club to clean up the land. Respondents, primarily those from private timber companies, reported hunt club leases as an effective deterrent to illegal dumping. State forest managers reported that road closures helped reduce the frequency of illegal dumping during the previous five years.

Most reports of increased dumping came from farming and cattle land uses. No one cause surfaced for this. A few farmers blamed changes in county ordinances, while others offered no explanation. The <u>Deterrents</u> subsection, under 1.4.3 Integrated Discussion below, further elaborates on all the deterrents the respondents reported using and the effectiveness of those deterrents.

<u>Table 1-30.</u> Change in Frequency of Illegal Dumping over the Previous Five Years (Field survey)

Land Use	No. of Surveys	More Dumping	Less Dumping	No Change
State Wildlife Management Areas (FFWCC)	5	0	0	5
State Forests	7	2	4	1
Federal Lands	5*	1	1	2
Railroads	1	0	1	0
Private Timber Lands	8	1	6	1
Citrus Lands	3	2	0	1
Water Management Districts	5	0	1	4
Farming & Cattle Lands	9	4	1	4
Power Company Lands	3	2	0	1
State Parks	5	0	2	3
Sugarcane Lands	1	0	0	1
Theme Parks	2*	0	1	0
Department of Transportation	1	0	1	0
Mining Lands	2	0	1	1
County Lands	1	1	0	0
Totals	58*	13	19	24

<sup>\*</sup>Two field survey respondents were not familiar with the property in question for the entire five years prior to the survey.

#### Cost trends

Costs associated with illegal dumping can be analyzed from several perspectives. Statewide, all respondents reported spending a total of \$964,048 on activities related to illegal dumping. FFWCC incurred additional costs that it could not identify separately. FFWCC's annual statewide budget for law enforcement activities relating to environmental pollution is \$3 million. However, the agency does not track how much of this goes toward illegal dumping-related activities. Two FFWCC districts estimated their local expenditures, but the other three could not. This is not uncommon. In several field surveys, respondents could not estimate the amount of money spent to prevent or clean up illegal dumping. Therefore, the totals presented here do not

include those costs and are therefore underestimates of the actual costs. In addition to those instances, the railroad respondent to the field survey reported statewide costs of \$200,000 for overhead related to illegal dumping.

Table 1-31 shows costs to large landholders for illegal dumping, broken out by the water management district in which the land is located. Expenditures are split among the cost categories, the highest being patrol and surveillance, and cleanup. Most expenditures in the "other" category are overhead costs or costs related to dumping that are difficult to break out.

Table 1-31. Illegal Dumping Costs by Water Management District (Field surveys)

WMD	# of dumps	Patrol	Fencing	Cleanup	Other	Totals
SFWMD	251	\$152,000	\$134,500	\$ 26,000	\$77,000	\$389,500
NWFWMD	265	0	300	101,300	54,650	156,250
SWFWMD	161	27,500	6,000	40,948	5,200	79,648
SJRWMD	330	3,500	6,500	43,900	17,500	71,400
SRWMD	703	56,700	2,000	5,500	3,050	67,250
Totals	1710	\$239,700	149,300	217,648	157,400	\$764,048

Note: N=57. The totals listed in this table do not include costs incurred by the railroad statewide, nor do they include the dumpsites reported in the railroad field survey.

Table 1-31 shows that the landholders in the South Florida WMD reported the most spending, in large part because it spent significant amounts on patrol, surveillance, fencing, and signs for its own lands. Landholders in the Northwest Florida WMD reported the second highest costs, most of it (\$100,000) to clean up a single county's rights-of-way and lands. Landholders in the Suwannee River WMD reported spending the least, yet finding the most illegal dumpsites. Perhaps the relatively low spending on activities including deterrents at least partly contributed to illegal dumping. However, it does not necessarily follow that the WMDs whose landholders spend the most on illegal dumping find the fewest dumpsites. The South Florida WMD landholders reported the least number of dumpsites.

Table 1-32 shows that the WMDs reported spending the most on illegal dumping in the previous year. Land uses that spent the most included those with easy public access, such as water management districts, railroad rights-of-way, county rights-of-way, state forests, federal lands, and wildlife management areas. State parks, mining lands, and theme parks were the land uses that spent the least on activities related to illegal dumping. Most of these land uses were well secured with fences, gates, and security guards who in many cases patrolled to deter trespassing. Timberlands also reported spending relatively little on illegal dumping. To a large degree, this may have been because many timber landowners and managers lease land to hunt clubs, which act as deterrents and keep dumping-related costs low.

Table 1-32. Illegal Dumping Costs by Land Use (Field survey)

Land Use	No. of Surveys	No. of Dumpsites	Total Cost	Cost per Survey
Water Management & Conservation (WMD)	5	61	\$322,700	\$64,540
Railroads	1	200	200,000	200,000
County Lands	1	?	100,000	100,000
State Forests	7	449	86,368	12,338
Federal Lands	5	293	78,500	15,700
State Wildlife Management Areas (FFWCC)	5	579	57,500	11,500
Power Company Lands	3	34	29,500	9,833
Farming & Cattle Lands	9	33	22,900	2,544
Sugar Cane Lands	1	20	18,500	18,500
Citrus Lands	3	83	15,800	5,267
Private Timber Lands	8	134	14,750	1,844
State Parks	5	11	13,680	2,736
Mining Lands	2	0	2,650	1,325
Theme Parks	2	12	900	450
Department of Transportation	1	1	300	300
Total	58	1,910	\$964,048	NA

Table 1-33 shows that of the various landowners and land managers in the field survey, state agencies spent the most on illegal dumping-related activities. The combined expenditures of the state agencies represented in the field survey was \$480,548, most of it among the WMDs. Private landowners and land managers spent the second largest sum on illegal dumping, followed by a single county government and a couple of federal government agencies.

Table 1-33. Illegal Dumping Costs by Land Manager Affiliation (Field survey)

<b>Land Manager Affiliation</b>	No. of Surveys	<b>Total Cost</b>
State	23	480,548
Private	29	305,000
County	1	100,000
Federal	5	78,500
Total	58	\$964,048

Table 1-34, Illegal Dumping by Land holding Size, shows a direct correlation between the size of a land holding, the number of dumpsites, and the total spent: larger land holdings had more sites and greater costs. Almost 2/3 of the field survey lands exceeded 10,000 acres. Those lands had more than 12 times more dumpsites as lands under 10,000 acres and the large landholders' costs were almost 5 times greater. No cost per dumpsite could be inferred from the

data, in part because the field survey did not quantify dumps by size or volume. Dumpsites vary greatly in the volume of material they contain, so cleanup costs per site also vary. Also, since not all reported dumpsites are cleaned up, some have no associated costs. Therefore, costs to landowners vary with the nature and extent of their response to the dumping.

Table 1-34. Illegal Dumping Costs by Land holding Size (Field survey)

Acreage	No. of Surveys	No. of Sites	Cost
<100	1	2	\$ 0
101-1,000	10	58	32,900
1,001-10,000	10	86	128,300
10,001- 100,000	15	274	272,930
>100,000	22	1,490	529,918
Total	58	1,910	\$964,048

# Field survey summary

Illegal dumping on public and private lands alike is widespread throughout Florida and is accompanied by significant costs. From the 58 field surveys completed from all five WMDs, 83% of the landholders reported illegal dumping on their land during the previous year. Respondents found a total of 1,910 illegal dumpsites and reported spending \$964,048 on illegal dumping-related activities. Field survey respondents spent the most on patrol and surveillance, and cleanup, in roughly equal amounts. State agencies spent the most on illegal dumping-related activities in the previous year and most of that money was spent to patrol, prevent and clean up dumping on Water Management District lands. Landowners in the Suwannee River WMD spent the least on illegal dumping and reported the most illegal dumps. FFWCC spent \$3 million on all environmental crimes, including illegal dumping.

Illegal dumping on large rural lands seemed closely related to three factors: rural lands nearest population clusters, such as Tallahassee and Miami; rural lands with road access; and, rural lands with adequate vegetative cover to hide illegal dumping activities. Tree crops are an example of a land use that provides cover for dumping while row crop farmers with shorter crops did not have as severe of a problem. Federal lands and forested areas, both public and private, were most prone to illegal dumping. Landowners and land managers of these lands found a total of 876 illegal dumps, or approximately half of all illegal dumps found on all types of land in the field survey.

Respondents to the field survey most commonly found household trash, appliances and furniture, tires, construction and demolition debris and yard waste at illegal dumps on their lands. About one half of the respondents said they saw no change in the amount of illegal dumping on their lands over the previous five years. The remaining respondents' observations were split between seeing an increase and seeing a decrease, with few real trends. State forest and private timberland managers observed less dumping in the previous five years. Private timberland managers credited hunt club leases and road closures for this decrease.

## 1.4.3 Phone survey

This section discusses the extent of dumping and related costs that large landholders and managers incurred, according to data obtained during the phone survey of 292 landowners.

# Extent of illegal dumping

Just under half (48%) of phone survey respondents found at least one illegal dump on their properties in the previous year, and among them, half reported the dumping to be a significant problem. Table 1-35 shows the amount of dumping the respondents reported for all of the businesses polled in the phone survey. The table is ranked in decreasing order, showing the businesses reporting the most dumpsites at the top and those with the least at the bottom. Respondents managing farmlands reported the most illegal dumping, with real estate developers reporting slightly less. These two land uses completed the most phone surveys. Livestock breeders and timberland managers also reported a large number of dumpsites. However, livestock breeders reported the most dumpsites per phone survey, followed by farmers and paper mill land managers.

Table 1-35. Illegal Dumping Trends with Land Use (Phone)

Industry Description	No. of Surveys	Percent of Completed Surveys	No. of Dumps per Year Reported	Percent of Reported Dumping	No. of Dumps per Survey
Farms	69	23.6%	2568	45.9%	37.22
Real Estate Developers	158	54.1%	2367	42.3%	14.98
Livestock Breeders	4	1.4%	356	6.4%	89.00
Timber & Timberland Companies	21	7.2%	141	2.5%	6.71
Paper Mills	2	0.7%	63	1.1%	31.50
Land Companies	6	2.1%	49	0.9%	8.17
Electric Companies	6	2.1%	45	0.8%	7.50
Mining Companies	4	1.4%	2	0.0%	0.50
Dairies	22	7.5%	1	0.0%	0.05
Total	292	100.0%	5592	100.0%	NA

Illegal dumping appeared to be a problem for large landowners and managers in rural and urban areas alike. Almost three times as many rural landowners (73.3% vs. 26.4%) completed phone surveys as those that owned or managed urban lands. This is because the minimum required acreage to participate in the survey was 100 acres and larger landholders are more likely

to have land in rural areas. About 29% of those who reported dumping on their lands found between 1 and 20 dumpsites in the past year, while 4.8% found between 21 and 50 - about 2 to 4 instances per month - and just over 7% found more than 50 dumpsites - one or more per week. Seven of the 292 respondents said they found about one dump a day on their lands.

As shown in Table 1-25 of the phone survey results (page 28), the items most frequently found at illegal dumpsites were, in decreasing order: household trash, household appliances and furniture, tires, construction demolition debris, and plant debris. This can also be seen in Figure 1, which shows the number of responses for each category of items on the survey. Many of the 292 phone survey respondents reported finding more than one type of waste, for a total of 488 responses.

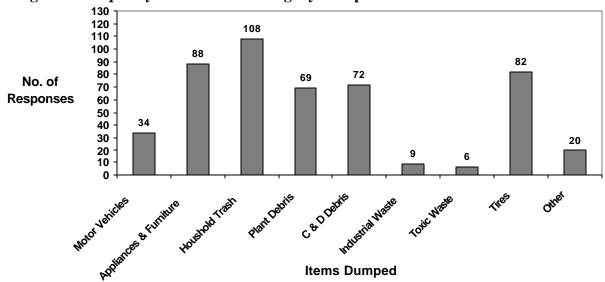


Figure 1. Frequency Distribution of Illegally Dumped Items

#### Cost trends

Table 1-36 summarizes the expenditures the landowners or land managers made for each of the surveyed business types. The phone survey results showed that in the previous year, real estate developers spent the most on activities related to illegal dumping. Their expenditures were 77% of the total for all land uses in the phone survey. The number of phone surveys of real estate developers was in approximate proportion to the number of real estate developers in Florida. That is a large number and added significantly to the total amount spent. Most of the money they spent on dumping was on cleanup, fencing, and signs. Farmers and timber-related companies also spent a significant amount, with the greatest expenses for both groups being fencing and signs. Paper mill land managers had the highest cost per phone survey, but this is skewed by the fact that only two responded and one of them had high costs. Real estate developers, timberland managers, and farmers also had relatively high costs per survey in the phone survey. None of the four livestock breeders or of the four limerock mining companies surveyed reported spending any money on illegal dumping.

Table 1-36. Illegal Dumping Costs by Land Use (Phone survey)

<b>Industry Description</b>	No. of Surveys	No. of Sites	Cost	Cost per survey
Real Estate Developers	158	2,367	\$708,916	\$4,487
Farms	69	2,568	91,392	1,325
Timber & Timberland Companies	21	141	64,500	3,071
Paper Mills	2	63	40,800	20,400
Dairies	22	1	5,960	271
Land Companies	6	49	1,500	250
Electric Companies	6	45	500	83
Livestock Breeders	4	356	0	0
Mining Companies	4	2	0	0
Total	292	5,592	\$913,568	NA

Note: The costs contained in this table are estimates provided by the respondents.

Urban landowners and managers reported spending \$312,052 in the previous year on activities related to illegal dumping, and their rural counterparts reported spending \$601,516. Respondents for urban lands represented 26% of the total surveyed by phone but accounted for 34% of the total reported for spending on illegal dumping.

### 1.4.4 Integrated Discussion

This section brings together the results from the field and phone surveys for discussion. Information on the extent and costs associated with illegal dumping, deterrents, law enforcement, cleanup, and respondent recommendations are integrated into this section.

#### Extent and costs

Combining the field and phone surveys, a total of 350 large landholders were surveyed. These landholders managed a total of 8,784,363 acres, or approximately 25% of Florida's dry land acreage. Surveyed landholders found a total of 7,502 dumpsites on their properties and spent at least \$1,877,616 on illegal dumping in the previous year.

When comparing the results of the two surveys, some interesting points surface. Respondents from farming and cattle operations completed the most field surveys from one land use type. In these nine field surveys, the respondents reported 33 illegal dumps. From the phone survey, farming had the second most responses, behind real estate developers. Farms combined with

livestock breeders and dairies represented 95 of the 292 completed phone surveys and reported a total of 2,925 illegal dumps. This equates to 3.7 dumps per survey from the field results and 30.8 dumps per survey from the phone results. The greatly expanded sample size of the phone survey statistically yields more valid data, thus, the number of dumps reported in the phone survey is likely a better representation of the dumping problems faced by those landowners overall. Applying the dump-per-survey ratio reveals differences with private timberlands between the two surveys. Field survey results showed 16.8 dumps per survey, while phone survey results showed 6.7 dumps per survey. Power companies found 11.3 dumps per survey in the field survey and 7.5 dumps per survey in the phone survey. Mining companies found very few, if any, dumpsites in the previous year in either survey.

From a cost perspective, the results showed an obvious difference in the two surveys regarding money spent on illegal dumping. Again, the phone survey results came solely from the private sector. In the field survey, government agencies managing public lands spent more than the private sector. In the 292 phone responses, spending of \$913,568 was reported. No public land respondents completed the phone survey. Real estate companies, farms, and timber companies were the largest of these spenders. In the 58 field responses, spending of \$964,048 was reported. Water management districts, railroads, county lands, and state forests were the largest spenders in the field survey. Note that with the exception of railroads, these are all public land uses.

Although fewer responses were obtained with the field survey, it covered the entire state with representatives from most major land uses. The phone survey covered 60 of Florida's 67 counties. More than half the phone surveys came from real estate developers. Other land uses might not be equally represented. Despite differences in results between the two surveys, they were consistent in reporting that illegal dumping was a serious and expensive problem in Florida.

#### Deterrents

The field surveys revealed a variety of deterrents to illegal dumping. Signs, fencing and gates, patrols and surveillance, and frequent cleanups were the deterrents respondents most commonly reported. In both surveys, respondents most often said they used fences and signs: 76% from the field survey and 56% from the phone survey. In the field survey, respondents reported patrol and surveillance as the second most commonly used deterrent. In the phone survey, respondents reported frequent cleanups as the second most commonly used deterrent. Half the field survey respondents were public agencies that might be more likely to spend money on patrol and surveillance. Private landholders using land for their business might be more likely to spend limited money on cleanups instead of the more expensive measures of patrol and surveillance. Respondents reported several other deterrents that they used less frequently, and these will be described briefly later in this section.

Many respondents reported using "No Dumping" signs as deterrents but did not necessarily agree on the signs' effectiveness. Some considered signs costly and generally ineffective, while others found them useful. On several occasions, the field survey team saw illegal dumping near "No Dumping" signs.

Many respondents reported that limiting access through the use of fencing and gates deterred

dumping. However, those measures are expensive to install and maintain and are frequently vandalized. When a gate is installed at a chronic dumpsite, the dumping activities sometimes continue just outside the new gate. Even so, some respondents reported that the gate did help reduce the problem in such instances because the dumping was concentrated just outside the gate, making cleanup easier and less expensive.

Respondents reported surveillance as an effective but expensive deterrent. Keeping people on watch around the clock and over the extent of the property can cost quite a lot, but patrols make it possible to catch illegal dumpers in the act, which in turn makes prosecution more feasible.

Six of the eight private timberland managers in the field survey reported hunt clubs to be very effective at reducing illegal dumping. When hunt clubs contract with large rural landowners for hunting privileges, they are required to secure the land and keep it clean. Often the clubs include local residents. Membership involves them in the stewardship of the land and they will watch for activities such as dumping. Also, dues of club members go partly to cleanup and prevention activities. Hunt clubs also generate alternative revenues for timberland managers. Most respondents who used hunt clubs as a deterrent said illegal dumping stopped being a problem once the clubs established control over the land.

Respondents found that frequent cleanups at chronic dumpsites deterred some illegal dumping. When landowners and managers kept problem areas clean, the dumping typically subsided or ceased.

A few respondents reported using the following additional deterrents:

- offering rewards to people who reported illegal dumping
- amnesty days at disposal facilities
- mowing
- providing roll-off trash bins where chronic dumping problems occurred
- using earthen barriers and vegetation to close roads

Some respondents reported that county dumping laws make it easier for sheriffs' deputies to arrest offenders.

#### Enforcement

Responses varied as to whether landholders reported illegal dumping to some type of enforcement authority. In the field survey, 72% of respondents said they reported illegal dumping on their lands, but anecdotally they said they reported only some of those dumping incidents. Those respondents said they are more likely to report larger or chronic dumps. Phone survey respondents also reported to authorities only some of the dumps they found. Depending upon what items they found, between 22% and 67% contacted enforcement authorities to report the dumping. Those who found plant debris were the least likely to report it (21.7%) while those most likely to report it were those who found toxic waste (66.7%), industrial waste (44.4%), and motor vehicles (41.2%).

Field surveys revealed numerous law enforcement agencies in Florida that investigate and/or enforce litter laws on dry land. The agency charged with enforcement varies with the nature of the dumping and whether it is on public or private lands. One-half (29 of 58) of the field surveys covered public lands, in part because large, rural landholdings included many public lands and in part because of methodology that targeted diverse land uses and intentionally included a variety of public lands. The agencies that administer public lands usually patrol them and often have formal policies for reporting and cleaning up illegal dumps. This adds to the complexity of enforcement efforts and may contribute to overlap and duplication of services or to fragmented enforcement efforts. The task force approach is one possible solution to these shortcomings. Some localities have organized task forces to enhance communication and cooperation among the agencies that address illegal dumping at different levels of government. Researchers learned of this and other cooperative efforts in Alachua, Putnam, Polk, Duval, and Dade counties. A case study of Putnam County's task force is presented at the end of this section.

At the federal level, the U.S. Forest Service (USFS), the U.S. Fish and Wildlife Service (USFWS), and the National Park Service (NPS) have officers to enforce state and federal litter laws. The Federal Bureau of Investigations (FBI) and the Environmental Protection Agency (EPA) have law enforcement officers who sometimes investigate illegal dumping.

At the state level, the Department of Agriculture and Consumer Services (DACS), the Florida Fish and Wildlife Conservation Commission (FFWCC), and the Department of Environmental Protection (DEP) enforce the Florida Litter Law.

At the county level, sheriffs' departments and county code enforcement divisions enforce the Florida Litter Law and/or local litter codes and ordinances. Field survey respondents most often mentioned law enforcement agencies and FFWCC as the ones to receive and investigate reports of dumping. In most cases, respondents who listed "law enforcement" referred to a deputy of the county sheriff's office. The following sections describe each agency's role in more detail.

<u>Local law enforcement-</u> Among field survey respondents for rural areas, 81% of those who reported illegal dumping made their report to local law enforcement (usually the sheriff's office) and 88% of those who made a report said an investigation followed. Of the phone survey respondents who reported illegal dumping, 29% reported to law enforcement. Some field survey respondents stated anecdotally that, while many sheriffs' offices did investigate illegal dumping for local landowners and managers experiencing problems, some gave these complaints a low priority.

When investigation by either the landowner or a deputy identified a dumper, the complaint was often handled informally by convincing the dumper to clean up the waste. Cleanups followed a report in 85.7% of the cases reported. Anecdotal comments made by several respondents indicated a perception that the court system assigns a low priority to this type of violation. While fully two-thirds (67%) of the field survey respondents reported some type of prosecution following the reporting of dumping instances, phone survey respondents were only aware of prosecutions in between 11.1% and 22% of the cases, depending upon what agency or individual received the report. Law enforcement was perceived as the most effective (22%) at following up with prosecution, while codes enforcement officers were among the least (11.8%).

Some of the more populous counties employ code enforcement officers who are assigned primarily to illegal dumping investigations. About 12% of the respondents in both surveys reported cases to these agencies.

Florida Fish and Wildlife Conservation Commission- In the past, the state Fish and Game Commission enforced Florida litter laws on most rural lands. When it was reorganized into the FFWCC, litter law enforcement shifted primarily to the DEP. FFWCC manages wildlife refuge areas of several types, including those on both publicly and privately owned lands. These include large tracts of rural land and wildlife officers investigate illegal dumping on those lands. The agency exercises wildlife enforcement powers over a third land type referred to as "open lands" that may include highway rights-of-way as well as private property. Enforcement on this third category of lands is primarily for wildlife protection laws, so illegal dumping instances are usually referred to the DEP.

The field survey showed that FFWCC is the second most likely agency to get reports of illegal dumping violations. Among field survey respondents, 38% reported to FFWCC, perhaps because one-half of the field surveys covered public lands and FFWCC's predecessor was the primary agency to receive such reports until the reorganization. In contrast, only 3.6% of phone respondents, all of whom represented businesses on private lands, reported dumping instances to FFWCC.

Illegal dumping is classified as environmental pollution. That category also includes littering violations. The FFWCC enforcement office reported an annual average of 432 environmental violations from 1995-1998. The agency spent approximately \$435,000 in 1998 on enforcement related to environmental pollution. Because researchers could not ascertain what portion of that sum the agency spent addressing illegal dumping, it is not included in cost totals. However, FFWCC has five districts statewide that closely approximate the geographic boundaries of the water management districts. Five field surveys were completed for wildlife lands, and all five estimated the number of dumps found, for a total of 579 dumps. Only two could give cost estimates, which totaled \$57,500. That total is included in cost estimates but is certainly significantly low because three FFWCC districts gave no estimates.

FFWCC organizes several cleanups a year with community groups such as hunt clubs, youth groups, or Keep America Beautiful affiliates. The organizers offer free sodas and T-shirts as incentives to recruit volunteers on cleanup days.

<u>Department of Environmental Protection- The</u> DEP has a Division of Law Enforcement that enforces the Florida Litter Law using three sub-divisions. The Florida Park Patrol enforces the Florida Litter Law in state parks and the Bureau of Environmental Investigations and the Bureau of Emergency Response work together to enforce the Florida Litter Law statewide.

DEP encourages citizens to report illegal dumping first to their local law enforcement agencies because DEP has fewer officers than local agencies have. When DEP does get called to investigate an illegal dumping incident, the Bureau of Emergency Response discerns the level of hazard the dump presents, and the Bureau of Environmental Investigations initiates a criminal

investigation. The Bureau of Emergency Response may require a landowner to pay for emergency contract cleanup when dumping poses an immediate environmental threat.

Comments from private landowners in the field survey indicated that they hesitate to report illegal dumping to DEP because they fear they will be fined and required to clean up the dumpsites.

<u>U.S. Forest Service-</u> There are three national forests in Florida: the Apalachicola National Forest, the Osceola National Forest, and the Ocala National Forest. Researchers visited the Apalachicola National Forest and the Ocala National Forest to complete field surveys. Each had two full-time law enforcement officers. Osceola National Forest has one full-time law enforcement officer, but researchers did not include this forest in the study.

Illegal dumping was a serious, widespread problem in the two Florida national forests included in the field survey. With only a few officers to deal with the problem and other crimes to investigate, the officers often did not have time to investigate all the illegal dumping activities in their jurisdictions.

<u>National Park Service-</u> There are about a dozen national parks in Florida. The rangers who staff them have full authority to enforce any law on national parklands, which include monuments, memorials, seashores, preserves, and parks. In emergency situations or if asked, the rangers have enforcement authority on national forest lands, Bureau of Land Management lands, and USFWS refuge lands. Rangers in two districts of Everglades National Park completed field surveys. The East Everglades area had some of the worst dumping that researchers saw.

<u>U.S. Fish and Wildlife Service</u>- The USFWS manages several refuges in Florida and has its own law enforcement division to deal with illegal dumping on those lands. Nationwide, USFWS manages 520 refuges covering 92 million acres. The agency has two law enforcement divisions: refuge officers and special agents. The special agents have jurisdiction on all lands, but only with laws that deal with migratory birds and endangered species. The refuge officers have jurisdiction only on refuge lands but enforce all state and federal laws, including Florida's Litter Law. One wildlife refuge officer completed the field survey.

<u>Department of Agriculture and Consumer Services</u>- This agency employs personnel who are responsible for enforcing laws on lands owned or managed by the DACS. State forests, agricultural research stations, and DACS office complexes are the primary land types covered by this agency. The land managers who work these lands use this "in house" law enforcement as the need arises. Seven field surveys were conducted for state forest lands.

Other Federal Agencies- The EPA employs undercover investigators to examine violations of federal environmental laws. They respond when requested by another federal agency, such as NPS, for especially severe illegal dumps.

Occasionally, the FBI or DEA are involved with illegal dumping investigations. This occurs when illegal drug-manufacturing equipment is discovered or when an area experiences chronic dumping of environmentally hazardous or toxic materials. A national park ranger outside of

Miami reported that he often found marijuana potting and growing materials and irrigation piping dumped in remote locations.

Case study: The Putnam County Task Force on Illegal Dumping-Putnam County, led by Keep Putnam Beautiful, Inc., launched a coordinated effort to address illegal dumping and litter by creating a task force of representatives from the many agencies responsible for public health and safety and other involved citizens. Task force members represent local and state government agencies as well as the private sector and non-governmental organizations, all with an active role or interest in deterring illegal dumping. City of Palatka participants include the codes office and police. Participating county offices are the sanitation department, sheriff's office, codes office, health department, and department of public safety. State agencies on the task force include the State Attorney's Office, the Florida Highway Patrol, FFWCC, DOT, the Division of Forestry, the DEP, and the St. Johns Water Management District. Participation from the private sector includes Georgia-Pacific and Waste Management of Putnam County.

The task force meets monthly to discuss current issues relating to illegal dumping and litter. Center researchers attended a task force meeting where several participants explained their roles in curtailing dumping and littering. For example, sheriff's deputies regularly patrol areas where they will likely encounter uncovered loads and issue citations and make arrests as warranted. Deputies also investigate dumpsites reported to the sheriff's office. When they can determine a dumper's identity, they often tell the violator to clean up the site or face citation or arrest. FFWCC also receives dumping reports and investigates dumpsites. Like the sheriff's office, FFWCC tries to get the dumper to clean up the site, and its officers can issue citations and make arrests as necessary. The Highway Patrol is on the lookout for uncovered loads and sometimes patrol for this on roads leading to the landfill. The amount of time the Highway Patrol spends on this type of activity depends on the current priorities of the local command office. Keep Putnam Beautiful, Inc. hires off-duty deputies as part-time environmental enforcement officers. (The litter grant was amended to include funds for public education and these officers additionally perform that service). This coordination and communication among task force members can result in more effective controls over dumping and littering.

### Cleanup

Cleaning up illegal dumps can be dangerous as well as costly, but the alternative – not cleaning them up – can be far worse. The physical composition of dumps, which may contain old batteries, broken glass, containers of unknown substances, and environmentally hazardous materials, gives cause for great care during cleanup. The following discussion briefly describes methods commonly used to handle illegal dumps.

Landowners and managers often clean up illegal dumpsites themselves or hire independent contractors to clean them up. Most respondents to the phone survey (66%-88%) said they did the cleanups themselves, depending on what types of items were dumped. Some had the labor and heavy equipment needed to clean up large dumps of tires, appliances, automobiles, and construction and demolition debris. However, property owners and managers often paid contractors with large trucks, backhoes, and a labor force to clean up the worst dumps. Timberland owners who lease lands to hunt clubs may require the hunt clubs to clean up any

illegal dumpsites during the term of the lease.

Community organizations can be effective at cleaning up roadsides and chronic dumpsites. Scouts, AmeriCorps, and Keep America Beautiful (KAB) are examples of organizations that use members and interested volunteers to conduct cleanups. These groups often have their own project areas but also coordinate with other organizations to conduct periodic large scale cleanups. FFWCC, USFS, and KAB facilitate cleanups of large, rural lands with volunteer labor, sometimes offering T-shirts and sodas as incentives. Volunteers provide momentum that in turn can motivate businesses and other organizations to get involved. Frequently, city and county contracts with solid waste haulers require them to provide a specified number of yearly pickups of material collected in volunteer cleanups.

Prison and county jail inmate labor is often used to clean up illegal dumps. Most local governments offer community service programs that require people found guilty of minor crimes to pick up litter on roadsides. People caught illegally dumping may be offered the opportunity to clean up their dumps and others to avoid prosecution or may have to clean up dumps as part of their punishment.

Many illegal dumps are not cleaned up, some because they are too remote to be considered problematic, others because they are too big, chronic, or expensive to manage. Dumped appliances often contain Freon that can leak into the atmosphere, and harmful substances in numerous dumped items can leach into the groundwater. Motor oil, battery acids, and heavy metals are among toxic substances left to seep from illegal dumps into groundwater. Ignoring or tolerating illegal dumps can potentially cause harm to people and the environment.

### Respondent Recommendations

As part of both the field and phone surveys, interviewees were asked their opinions concerning action government could take to reduce illegal dumping. During the phone survey, the respondents were first asked this question in an open-ended manner to elicit a variety of responses. Next, the respondents were asked how they felt about the following six categories: public education, more disposal sites, increased law enforcement, decreased tipping fees, increased hours of landfill operation, and more toxic waste roundup days. Some respondents offered opinions about the categories before they were asked. During the field survey, the respondents were simply asked how they felt about the categories and if they would like to offer any other recommendations.

Table 1-37 summarizes the responses from both surveys and presents a ranking of each category. The field survey percentages represented 58 respondents, and the phone survey percentages represented 292 respondents.

Table 1-37. Interviewee Recommendations

Recommendation	Field	Phone (Open- Ended)	Phone (When Asked)	Rank
Increased Enforcement Efforts	58.6%	25.0%	53.8%	1
More Disposal Sites	50.0%	14.1%	55.5%	2
Smaller Tipping Fees at Landfill	51.7%	12.7%	57.2%	3
Public Education	62.1%	5.2%	48.6%	4
More Toxic Waste Roundup Days	50.0%	4.1%	58.6%	5
Increased Hours of Operation at Landfill	46.5%	5.8%	59.3%	6

When asked, most respondents agreed with the six recommendations. Starting with the last ranked category and working in ascending order, each category will be briefly explained and other responses received during both surveys will be discussed.

Most respondents said increased hours and days of operation at landfills and toxic disposal sites would be helpful. When phone respondents were given the six choices, these two measures were recommended the most. With the field surveys, these responses usually were associated with more disposal sites and smaller tipping fees, the number two and three recommendations overall. When discussing the provision of more disposal sites, one frequent suggestion was to provide locally available collection sites throughout rural areas.

Public education programs were the next to last solution to come to mind independently for phone respondents and also the least accepted when asked about it. Conversely, field survey respondents chose this solution the most. Many field survey respondents felt that education is most effective when it is made available to children and young people and thus may decrease dumping in the future. They were more pessimistic about education as a measure to change adult behavior. For adult offenders, respondents said that stricter enforcement, including higher fines and more severe punishments, would be more effective.

Increased law enforcement was the most popular measure overall. Enforcement seemed to mean different things to different respondents. In national and state forests, the respondents (many of whom were patrol officers themselves) said more officers were needed in the field. The most common response to this category was that there needs to be more follow through with prosecution and conviction once offenders are identified and cited. Prosecution can be difficult unless the dumper is caught in the act and a law enforcement officer is on the scene to make the arrest. Several respondents related experiences in which a dumper was identified but did not get prosecuted. They suggested that civil service employees whose duties include patrol and management of rural lands be empowered to issue citations for violations of the Florida Litter Law.

Besides the above-mentioned recommendations, other suggestions surfaced during both surveys. The most common suggestion was to invest money in advertisements that promote the need for a clean environment and discourage illegal dumping. Several respondents remembered the Keep America Beautiful television commercial featuring Iron Eyes Cody as a Native

American with a tear on his cheek viewing a littered landscape. They considered that very effective. Other recommendations included: mandatory trash collection by the counties, better recycling services, more toxic waste disposal sites, codes enforcement officers whose primary function would be policing litter and dumping, and substituting county taxes for landfill fees. Interestingly, this last recommendation came with the same explanation each time it was given. They reasoned that a primary motivation for people to engage in illegal dumping is to avoid landfill fees. If people knew that they were paying taxes for the service already and they did not have to pay each time they made a trip to the dump, they would be more likely to use the landfill. Respondents did not recommend this service for commercial use of the landfills.

Recommendations made only once or twice were:

- county-mandated cleanups of illegal dumps
- sliding-scale disposal fees based on user income
- giving value to commonly dumped items such as appliances and tires
- establishing a reward system for identifying illegal dumpers
- education programs targeting immigrants
- limiting access on public lands.

## 1.5 Illegal Dumping Conclusions

Illegal dumping is a common and costly problem for large landholders throughout Florida, as evidenced by the 83% of field survey respondents and 48% of phone survey respondents who said dumping occurred on their properties in the previous year. These included phone survey respondents in 60 of Florida's 67 counties and field survey respondents in all five water management districts. The 350 landowners and land managers who completed one or the other of the surveys owned or managed a total of 8.8 million acres, or 25% of Florida's dry land acreage. They reported finding a total of 7,500 illegal dumps and spending a total of \$1.8 million on illegal dumping-related activities in the previous year.

The surveys employed in this study led to the following characterization of illegal dumping in Florida:

- The items most often found at dumpsites were household trash, appliances and furniture, tires
  and construction and demolition debris, followed closely in both surveys by yard waste or
  plant debris.
- According to the field survey, public lands, both state and federal, experienced the most illegal dumping. To a lesser degree, railroads, private timber, farming, and cattle lands experienced a significant amount of dumping. According to the phone survey, real estate developers and farmers experienced the most illegal dumping, and to a lesser degree, timber and paper mill lands experienced a significant amount of dumping.
- Of the field survey respondents, state agencies, particularly FFWCC and the WMDs combined, spent the most money on illegal dumping-related activities in the previous year. Of the phone survey respondents, real estate developers spent the most money on illegal

- dumping-related activities.
- Illegal dumping occurred most commonly where road access was available, along roads and at gates.
- Among respondents to one or the other of the surveys who experienced illegal dumping, about 15% (17.6% in the phone survey) estimated that they found one or more dumpsites per week and around 10% (11.8% in the phone survey) reported finding 2 to 4 dumpsites per month. Five respondents to the phone survey reported an average of one illegal dump per day.
- In general, respondents to both surveys indicated that the amount of illegal dumping had not changed in the previous five years. Exceptions were timberlands and state forests, which reported a decrease in dumping frequency.
- The most frequently used illegal dumping deterrents were fences and signs, according to both surveys. Field survey respondents frequently said they used gates and fences to limit access to their land.
- According to both surveys, landowners and land managers usually, but not always, reported illegal dumping incidents to authorities. In the field survey, 72% of respondents reported dumpsites found on their land. The number of phone survey respondents reporting dumpsites to authorities depended upon the type of items dumped and varied from 22% (those finding plant debris) to 67% (those finding toxic waste). Stated in the reverse, one third of those in the phone survey who found toxic waste did not report it. Anecdotal comments from some respondents in the field survey indicated that they may not always report environmentally hazardous material for fear of being fined themselves or being forced to bear expensive cleanup costs. This may partially account for the lack of reporting seen in the data from the phone survey.
- When landowners and land managers reported illegal dumping incidents, they usually reported them to law enforcement agencies (81% in the field survey), most likely the local sheriff's office.
- Officials to whom illegal dumping was reported often investigated the reports but did not always prosecute. In the field survey, 72% of the respondents reported dumpsites to some official agency and 88% of those reported were investigated. Prosecutions followed in two-thirds (67%) of the cases reported to officials. Of the phone survey respondents who reported dumpsites, a little over one-half of those reports were investigated when reported to local law enforcement (58.5%) or to a codes enforcement officer (58.8%). However, prosecutions of offenders occurred in only 22% of the cases reported to local law enforcement and in only 11.8% of those cases reported to codes enforcement officers. The percentages gained in the phone survey are probably more reliable because of the larger number of surveys and a questionnaire altered to elicit more detailed information on some questions.
- Many large landowners and land managers said that increased enforcement, including increased prosecution, and stricter fines and penalties would reduce the amount of illegal

dumping. Over one-half of all respondents (53.8% in the phone survey) made this recommendation. However, about one-half of the respondents in both surveys recommended more convenient disposal sites and a decrease in landfill tipping fees as measures likely to reduce illegal dumping. In the phone survey, 55.5% recommended more disposal sites and 59.3% felt an increase in the number of hours and days that disposal sites are open to the public would help to reduce illegal dumping. Also in the phone survey, 57.2% felt that decreased fees for the public at disposal sites would tend to reduce illegal dumping.

Finally, it is potentially useful to an understanding of the results of this study to describe some of the difficulties encountered in conducting the phone survey. The initial methodology contemplated a database of 400 completed surveys in order to obtain a validity of plus or minus 95%. Researchers believed that 400 responses could be obtained from the database of 2844 Florida industries (the original database of 3494 was reduced to only businesses likely to have large, rural land holdings) in a period of 2-3 weeks. An evening phone survey of 400 households could normally be completed in 7-10 days. Because these were businesses and would therefore be mostly available during the daytime, extra time was allotted with an outside window of completion of 4 weeks.

Approximately 3 weeks after beginning the phone survey there were only about 49 completed surveys and after 5 weeks there were only 86 completed surveys. Many potential respondents didn't qualify because they owned less than 100 acres (the arbitrary minimum acreage defined as a large landholder for this study) or because their lands were primarily in urban boundaries. It was difficult to get an owner or manager on the phone to complete the survey and many callbacks were necessary. Some numbers in the database were wrong numbers and some people refused to participate in the survey. After discussing the situation, the research staff decided to drop the urban boundary question as a screening question in order to secure more respondents from the database. In addition, the FSRC agreed to put more callers on the survey. After 10 weeks FSRC had completed 292 surveys and determined that the target margin of error of plus or minus .05 had been reached, after adjusting for things such as the final population size and sample stratification. The data from those surveys was analyzed and is presented in the findings of this report.

### 2. CITY COSTS

## **2.1 City Costs Introduction**

Every city has to manage litter and illegal dumping. Often, one department in a city bears much of the cost for litter control, while other departments may incur some litter-related costs in the course of their primary functions. Most cities' budgets are organized by department, and when several departments have litter-related expenses, the true cost of managing litter and illegal dumping is difficult to establish. This report presents the results of a study to determine the comprehensive costs of managing litter in three Florida cities.

#### 2.1.1 Overview

Gainesville, Jacksonville, and St. Petersburg were chosen for this study. To obtain a comprehensive estimate of litter-related costs in these three cities, Center researchers focused on three main categories of possible expenditures: cleanup, law enforcement, and prevention/education. Staff organized the information it obtained for each city by expense categories in the Results section of this report. The findings varied widely among the three cities, as reviewed in the Discussion section.

#### 2.1.2 Previous research

The Center conducted two previous studies that in part addressed the costs to local governments of managing litter.

As described in The Florida Litter Study: 1998 (FCSHWM, 1998), the Center surveyed Florida counties to learn about programs and costs for managing litter at the county level. Researchers conducted that survey by phone, fax and letter with numerous follow up contacts to secure and verify the information. The Center received responses from 43 of Florida's 67 counties, for a 66% response rate. Even with this good response rate, some of the information was incomplete. Often it appeared that the survey respondent did not have access to all of the requested information or the time and other resources necessary to secure complete and accurate responses. In some cases, the person who filled out the survey for one county office was unaware of litter activities and costs in other county offices. One finding of that study was that a field survey using personal interviews would most likely yield more complete information.

During research for the report titled <u>The Florida Litter Study: Economic Impacts of Litter on Florida's Businesses</u> (FCSHWM, 1999), researchers surveyed solid waste management staff of 10 Florida cities regarding their cities' litter management practices, including the costs associated with providing those services. That survey was conducted by personal interviews in the ten largest Florida cities. It was associated with the primary study of litter costs incurred by businesses and was designed to follow up on the previous study by using face-to-face interviews. Once again researchers faced obstacles to obtaining complete and accurate litter cost figures. Just as litter is a complex solid waste issue, the city and county

programs designed to abate litter are complex. Researchers surveyed some city and some county solid waste officials and found that programs and contracts are interwoven such that costs for programs and services in a finite city area are often estimates of larger contracts, at best. City staff members often included litter costs with other solid waste or beautification costs, making specific litter costs difficult to break out. When available, costs for city services that were indirectly or only partially related to litter abatement were rough estimates. Researchers also learned that although various departments within cities had litter-related costs, none kept track of total litter-related expenditures. As a result, one of the conclusions of that study was that it would be necessary to interview individuals in several city departments, identify all litter-related services and request cost figures for each. Since that type of study would take greater time and effort, Center staff proposed a follow up study that focused in greater depth and detail on only three cities.

### 2.1.3 Objectives

The objectives of this study were to determine which departments in selected cities spent money on programs and activities to manage litter and illegal dumping and to determine comprehensive costs for each city to manage litter and illegal dumping.

## 2.1.4 Definitions and acronyms

The following are definitions for terms and acronyms used in this report:

The Center or FCSHWM: The Florida Center for Solid and Hazardous Waste Management

Illegal Dumping: The intentional, unauthorized, and inappropriate disposal of solid waste

FY: Fiscal Year

Litter: Misplaced solid waste

<u>Litter-free event</u>: Public event that uses education, signs, advertising, disposal and recycling containers and other proven methods to reduce litter and manage the waste generated by the event.

#### 2.2 City Costs Methodology

St. Petersburg, Jacksonville, and Gainesville were chosen for this study of annual costs associated with prevention and cleanup of litter and illegal dumping. Those three cities were selected because they represent large urban service areas, yet they also represent somewhat different types of cities in Florida and each is easily accessible from Gainesville. Three researchers surveyed one city each and then reviewed, discussed and compiled the results to form the Integrated Discussion and Summary.

Center researchers studied the city government organization in the three cities to identify all departments that would potentially administer programs and services and therefore spend money to prevent or abate litter and illegal dumping. Researchers identified potential interviewees through previous studies, the Internet, and phone calls to city departments such as Public Works, Solid Waste, and Sanitation. Researchers then chose interviewees based on their knowledge of the city programs and costs related to preventing and cleaning up litter and illegal dumping, availability, and willingness to participate in the survey.

Once contacted, interviewees were asked the following questions:

- What programs does your department have for preventing or cleaning up litter and illegal dumps?
- How much does each program cost?
- What exactly do the costs cover (for example, salary, disposal fees, and overhead)?

Researchers obtained data by mail, email, telephone, fax, and in-person interviews. Initially, a survey sheet containing projected cost categories was faxed to respondents to give them an idea of the types of programs for which the Center was requesting cost information (Appendix F). In most cases, researchers met with a representative of the city department after they had received the survey sheet and had time to compile the relevant cost information. Researchers then conducted follow up calls to further clarify expenditures and to verify the associated activities.

Only money spent from the cities' budgets during the fiscal year October 1, 1998 through September 30, 1999 (FY99) was included in this study. If substantial changes from that fiscal year were made for the current year (FY00), this report notes those changes anecdotally. Every effort was made to limit litter cost figures for Gainesville and St. Petersburg to those programs and services provided only to the areas within the city limits. In Jacksonville, however, county and city expenditures are unified since Duval County and the City of Jacksonville are consolidated into a single governmental unit. Although not all services are provided at equal levels throughout Duval County, researchers viewed this example of a city/county unified structure as an opportunity to gain even more accurate cost figures. Typically, some solid waste and other litter-related services involve intergovernmental agreements wherein the county contracts to provide some services within city boundaries. That arrangement sometimes makes it necessary to estimate what costs apply only to areas within the city. Researchers expected that the unified Jacksonville/Duval county government would reduce the necessity to cut out certain costs and make estimates.

Researchers divided costs into the three program components of cleanup, enforcement, and education and prevention. These were the categories of costs examined in the Center's '97-'98 study (FCSHWM, 1998) and researchers planned to continue the cost studies with a consistent approach. Litter and illegal dumping programs and activities were listed in sub-categories of these three components and their costs were totaled for each city. Litter removal is incidental to many programs, for example where grounds staff perform mowing, trimming and various other tasks that may include litter pick up and removal. In these circumstances, respondents were asked to provide or calculate a percentage of the program's expenditures based upon the amount of time and other resources spent only or primarily on litter and illegal dumping-related activities.

Again, any study of the costs of litter and illegal dumping is complicated by the fact that litter related activities are often only a small part of the major responsibilities undertaken by city Public Works, Parks and other departments. While Center researchers decided in advance to include <u>all</u> activities related to litter or illegal dumping, there are specific services that require explanation and clarification. Every effort was made to secure costs for only the litter portion of services. All city services related to trashcans in public places were considered directly related to litter abatement efforts and the costs were included in this study. However, it was less clear how to approach costs of activities related to street sweeping, storm drain cleaning and solid waste collection. Following is a more detailed explanation of those cost areas.

Center researchers discussed and debated whether or not to include street sweeping costs in this study. In consultations with DEP officials, researchers were encouraged to include such costs because they are known to be substantial and of particular interest and impact when considering urban environmental issues. Many members of the general community may regard street sweeping as a litter cleanup activity since litter is collected in the process. However, recent studies funded through the Center and conducted in Tampa, Florida (Brinkman, Ryan et al, 1999) have analyzed the composition of street sweeping materials and determined that litter is a minor component of street sweepings. The primary goal of street sweeping is actually to improve air (pick up potential wind blown dust and dirt) and water (remove potential storm water sediments) quality by collecting the major ingredients such as natural mineral sediment ("dirt"), dust and organic materials (leaves, etc.) and some potential pollutants such as oil, grease, and herbicides. Though litter cleanup is generally incidental to street sweeping, the presence of litter in the sweepings renders them unusable for many other purposes without extensive processing and further expense. This makes the litter far more influential in the total process than its percentage of occurrence in the collected sweepings would at first seem to indicate. After considering all of these factors, researchers included the costs for street sweeping in this study. The costs of street sweeping activities are high because it is a continuous, city-wide process utilizing costly equipment and because handling and disposal of the sweeping material is costly. This tends to inflate the overall costs to cities for litter control reported here and should be taken into account when examining the totals.

Ascertaining costs for cleaning litter from storm drains presents a similar dilemma. Dirt and plant materials are also reportedly a high percentage of the materials removed from drainage systems when crews clean them out, especially in undeveloped areas. However, almost every ditch and drain-cleaning task involves some amount of litter and trash removal and that can be a significant amount in urban areas. It often involves removing, transporting and disposing of vast quantities of large household items such as furniture, appliances, construction and demolition debris and tires. When possible, city personnel gave ditch cleaning cost figures for only the litter and trash removal aspect of their overall drainage ditch-cleaning task. Actual cost figures were given when available but some cost figures are based upon percentage estimates of the task as it relates to the total budget. City drainage supervisors in St. Petersburg acknowledged that litter and illegal dumping cleanup constitutes part of the costs of cleaning storm drainage systems but were unable to arrive at a cost figure for that part of their program or service and provided no cost figure.

Costs for litter cleanup associated with routine recycling and solid waste curbside pickup could not be documented and so were not included in the final totals. Center researchers have previously observed some connections between the methods, efforts and efficiency employed to dispose of the waste stream and the quantity and composition of waste that ultimately finds its way onto the landscape as litter and illegal dumping (FCSHWM, 1999). As an example, researchers postulated that missed trash pickups could result in additional cleanup costs because they are more apt to result in overflowing and overturned containers. Especially where cans are placed at curbside, full containers left for extended periods are more subject to animal foraging, vandalism and accidental overturn. However, the sample cities in this study did not report this as a significant problem or a cost that could be determined separately from regular solid waste pickup costs. Solid waste pickup contractors included missed pickup service in their route costs since drivers were normally required to go back later for missed pickups. Sometimes a supervisor would return later for isolated misses. In either case, litter pickup was not provided if the contents were spilled, or, no cost could be calculated if later pickup did include cleaning up spills. Since contractors could conclude that it reflects poorly on the quality of their services to report litter pickup costs as a negative outcome of their services, this is an area that may merit separate independent study.

Finally, while graffiti cleanup is a community beautification effort often carried out in conjunction with litter cleanup programs, it is not the focus of this study and those costs were excluded.

### 2.3 City Costs Results

### 2.3.1 Overview

The cost results below are separated by city. For each city, a table lists activities related to litter and illegal dumping and a breakout of costs for each activity; notes follow each table to give more detailed explanations of the costs. The costs cover FY99 and are rounded to the nearest \$100.

#### 2.3.2 Jacksonville results

The City of Jacksonville spent at least \$3,324,600 during FY99 on programs and activities related to litter and illegal dumping. The total comes from various divisions of seven city departments: Public Works; Solid Waste and Resource Management; Parks, Recreation, and Entertainment; Neighborhoods; Jacksonville Sheriff's Office; Jacksonville Transportation Authority; and Regulatory and Environmental Services. Table 2-1 lists target activities and a breakdown of their costs. Further descriptions of the activities and costs listed follow the table.

Table 2-1. Jacksonville Costs Associated with Litter and Illegal Dumping

1. Cleanup		
i Til		
a. Litter pickup on city-owned property – rights-of-way,	PW, Bldgs. &	\$ 90,000
areas around public buildings	Landscape Maint.	
	PW, Streets &	134,000
	Drainage	
b. Litter and illegal dumping pickup	SW & RM	130,000
c. Special events litter management	Parks, Rec. & Ent.	37,200
d. Street-sweeping	SW & RM	988,900
	PW, Streets &	360,000
	Drainage	
e. Storm drain cleanout	PW, Streets &	429,000
	Drainage	
f. Trash can and litter pickup at bus stops	JTA	41,500
g. Litter and illegal dumping pickup by county jail inmate	JSO, Montgomery	15,700
crews	Corrections Center	
	PW, Streets &	346,000
	Drainage	
h. Disposal from volunteer cleanups, time, supervision	SW & RM	50,000
i. Clean It Up, Green It Up litter-related programs	Neighborhoods,	86,000
	CIU,GIU	
j. Litter pickup by contracted crews	Neighborhoods,	79,400
	CIU,GIU	
	Subtotal	\$2,787,700
2. Enforcement		
a. Abandoned Junk Car Unit – vehicles abandoned on city	Jacksonville	30,000
rights-of-way	Sheriff's Office	
b. Illegal dumping and litter investigation & enforcement	Interagency	227,500
	Special Invest.	
c. Illegally dumped hazardous materials initial	Regulatory &	6,200
investigation (staff salary only)	Environ. Services	
	Subtotal	263,700
3. Education and Prevention		
a. "No Littering" or "No Dumping" signs	PW, Traffic Eng.	5,000
b. Trash cans in city parks	Parks, Rec. & Ent.	268,200
	Subtotal	273,200
Total Costs		\$3,324,600

Acronyms: CIU, GIU – Clean It Up, Green It Up; SW&RM – Solid Waste and Resource Management; PW – Public Works; JTA – Jacksonville Transportation Authority; JSO – Jacksonville Sheriff's Office

#### 1. Cleanup

- a. Public Buildings & Landscape Maintenance estimated spending \$80,000 to \$100,000 on salary, equipment, and maintenance for a four-person crew to pick up litter in the city core. Streets & Drainage spent \$134,000 on a contract for litter pickup on city rights-of-way; it had some in-house costs for litter pickup on city rights-of-way but could not break out those costs.
- b. Litter and illegal dumping pickup costs were actual expenditures covering disposal fees only for litter and illegally dumped waste in the city core. This \$130,000 did not include the associated labor and transportation costs.
- c. Special events litter management costs were estimated at \$37,200 for labor and disposal of litter from two major and six minor special events.
- d. Solid Waste & Resource Management spent \$988,900 on street-sweeping in the city core. These costs included labor and equipment. Streets & Drainage spent \$360,000 on a contract for street-sweeping of county roads and outlying residential streets. Total costs for street-sweeping were \$1,348,900.
- e. Streets and Drainage spent \$429,000 on cleaning litter, household trash, furniture and appliances, etc. from storm drains along county roads and outlying residential streets. This figure included salary, benefits, and equipment costs.
- f. Jacksonville Transportation Authority estimated spending \$41,500 in FY99 to empty trash cans and pick up litter at bus stops. This figure included money to fund "Downtown Rangers" and contracts to maintain bus stops in the rest of the city. This figure assumes 50% of contractor time (and therefore cost) was spent on mowing, and it included wages for a part-time inmate crew supervisor.
- g. The Jacksonville Sheriff's Office, through the Montgomery Corrections Center, spent an estimated \$15,700 on salary for inmate crew supervision. This estimate includes supervision for a litter control, a chain gang that did some cleanup in Intensive Care Neighborhoods, and crews that helped with Clean It Up, Green It Up cleanups. Some vehicle costs also were included. Streets & Drainage spent \$346,000 on salary and benefits for staff supervision of six inmate crews and vehicle costs. This amount did not include any costs for Jacksonville Sheriff's officers who are responsible for the inmates.
- h. Solid Waste & Resource Management estimated it spent \$50,000 in FY99 on costs related to volunteer cleanups. This figure included costs of litter disposal, staff time, and supervision.
- i. Clean It Up, Green It Up spent \$86,000 on staff salaries for community litter-related programs.
- j. During FY99, Clean It Up, Green It Up contracted litter pickup crews for three projects that cost a total of \$79,400: the Springfield Alleyway cleanup, Intensive Care Neighborhood cleanups, and lot clearance.

#### 2. Enforcement

a. The Jacksonville Sheriff's Office Abandoned Junk Car Unit, which handles vehicles abandoned on city rights-of-way, had an estimated cost of \$30,000 in FY99 for officers' salaries and benefits. Officers responded to and posted notices on each abandoned vehicle, which incurred significant city vehicle maintenance and fuel costs, but these could not be estimated.

- b. Illegal dumping and litter investigation and enforcement were handled by Interagency Special Investigations. FY99 costs of \$227,500 were estimated by applying the percentage of total cases having to do with litter and illegal dumping to total costs. These costs covered salaries, benefits, and some supplies but not costs for vehicles, computers, phones, or radios.
- c. Jacksonville Regulatory and Environmental Services conducts an initial joint investigation with FDEP when hazardous materials are illegally dumped. This \$6,200 cost estimate covered staff salary only and not supplies, equipment, or vehicle costs for initial investigations.

#### 3. Education and Prevention

- a. The Traffic Engineering Division of Public Works spent \$5,000 for litter and dumping signs during FY99.
- b. The Park Maintenance Division spent \$268,200 for trash crews to empty trash cans at city parks. This figure included wages and benefits for the trash crews, disposal costs, and vehicle costs. It did not include trash can replacement costs, which were estimated to be minimal.

Jacksonville budgeted money for new programs related to litter and illegal dumping in the current fiscal year (FY00). These include \$500,000 for an anti-litter advertising campaign handled through the Clean It Up, Green It Up division. Another \$150,000 will go toward contracting litter pickup crews as necessary for neighborhoods. Funding for these activities may continue in future budgets, but not necessarily at the same levels.

### 2.3.3 Gainesville results

During FY99, the City of Gainesville spent at least \$602,000 on activities related to litter and illegal dumping. These tasks are handled primarily by four city departments: Public Works, Recreation and Parks, Police and Safety, and Community Development. Most of the funds went to Public Works' Operations and Solid Waste divisions and to the Parks division of Recreation and Parks. Table 2-2 and the detailed explanations of each category following the table list the expenditures.

Table 2-2. Gainesville Costs Associated with Litter and Illegal Dumping

Activity or Program	Department	Cost
1. Cleanup		
a. Litter pickup on city-owned property	Parks	\$117,900
b. Illegal dumping cleanup on city-owned	Solid Waste	12,400
property		
c. Identification of littered areas and illegal	Solid Waste	3,400
dump sites		
d. Special events litter cleanup	Solid Waste	3,600
	Parks	7,800
	Operations	3,000
e. Mechanical street-sweeping	Operations	337,200
f. Storm drain cleanout of litter	Operations	5,800
g. Litter pickup crews, residential streets	Operations	7,100
h. Litter pickup at bus stops	Solid Waste	9,200
i. Litter pickup by state prison road crews	Operations	18,100
	Parks	4,600
j. Organized volunteer cleanup support services	Parks	1,000
	SW contractor	21,100
	Police	8,900
	Subtotal	\$561,100
2. Enforcement		
a. Litter and illegal dumping officer	Police	1,900
	Subtotal	\$ 1,900
3. Prevention		
a. "No Dumping" signs	Transportation	300
b. Trash cans in public places	Solid Waste	20,000
c. Bus stop trash cans	Regional Transit	14,400
d. City utility properties	Regional	4,300
	Utilities	
	Subtotal	\$ 39,000
Total Costs		\$602,000

Because cost figures could not be obtained for some known litter-related activities, researchers can confidently assert that the actual costs to manage litter in Gainesville exceed the total reported in the table above. However, the figure shown is the best available dollar figure after a concerted research effort. No figures were available for some additional dumpster service by a solid waste contract hauler. Also, the Regional Transit and Transportation divisions under the Public Works department and Gainesville Regional Utilities (GRU) reported some litter-related activities for which they have no breakout on costs. Researchers inquired about some activities for which no expenditure appeared and learned that the city included the activity under another expense category, did not fund the activity, or could not break out the cost for the activity. The Code Enforcement division of Community Development, for example, did not track litter and dumping reports separately and thus could not estimate associated investigation costs. The following explanatory notes are keyed to the activities and costs reported in Table 2-2.

# 1. Cleanup

- a. These costs include: parks, athletic fields, tot lots, ditches, rights-of-way, and areas around city buildings; a percentage of vehicle and other equipment and supply costs; and supervision and supply costs for an inmate crew that could not be included under 1.i and did not include the value of 2,496 hours of inmate labor.
- b. The total for illegal dumping was \$12,400. This figure included some undetermined investigation costs not separately listed under 1.c, disposal fees of \$600 for a park trash container, ditch-cleaning, and \$1,500 for roll-off containers for roadside cleanups. Organized cleanup efforts accounted for \$10,300 of the total: three Adopt-a-Street cleanups, 18 neighborhood cleanups, and the Great American Cleanup. The total also included city costs associated with a sheriff's community work service crew. Not included here were some investigation costs included instead under 1.c, cleanups on GRU transmission rights-of-way included instead under 3.d, and tipping fees that the county waived.
- c. This \$3,400 was figured at 7% of one employee's time to investigate litter and dumping reports.
- d. This totals \$14,400 for special events cleanup and includes costs of additional trash cans, signs, materials transfer, and tipping fees for six events during the year plus three annual litter-free events. It included litter crews and street-sweeping after the University of Florida homecoming parade and cleanups after UF home football games (five or six each season).
- e. This \$337,200 included residential and arterial street sweeping by machines, tipping fees, and transfer handling costs of sweepings. It included annual repair costs of \$65,400 for four machines and fuel costs of \$8,000. (The cost of a new machine is \$126,000 to \$136,000).
- f. This \$5,800 included labor and equipment to clean litter from main watercourses (costs for disposal are included under 1.b). Costs were not available for clean outs of two underground storm water collector systems. Those were installed specifically to collect sediments and floating debris. They are cleaned three to four times a year.
- g. This \$7,100 includes labor and equipment for residential street crews. (Prison inmate crew costs are included under 1.i).

- h. The Solid Waste department handled only the disposal tasks and costs at bus stops. Public Works crews cleaned bus stops as part of streets and rights-of-way (1.a and 1.g). Bus stop trashcan installation and maintenance costs are listed in row 3.c.
- i. This \$22,700 cost estimate included a supervisor and equipment for an inmate clean up crew. Cleanup prior to mowing rights-of-way and ditches also included supervision, equipment, and supplies for state prison inmate crews, but not the value of their labor. This total includes \$15,500 to remove posters from 278 utility poles. Inmate crew costs to clean parks and landscaped areas are under 1.a.
- j. This \$31,000 included \$1,000 in labor, but not equipment, costs to the Parks division for the Great American Cleanup and labor and equipment costs to the SW contract hauler for 18 neighborhood cleanups. (Other costs to the Solid Waste division are under 1.b). This total included labor costs for police officers that assist with between seven and ten annual neighborhood cleanups.

#### 2. Enforcement

This \$1900 included costs for a police officer's hours spent on the Keep Alachua County Beautiful board and the State Attorney's illegal dumping task force. Costs to the department included some overhead in addition to salary. The department used a standard hourly rate of \$49.48 to arrive at these costs. That is the cost figure used to calculate court ordered restitution and it is supposed to include all costs. The cost of towing abandoned and junked vehicles was not available and is not included.

#### 3. Education and Prevention:

- a. This \$300 includes only the cost of materials (not labor to fabricate and install) for 21 "No Dumping" signs.
- b. This \$20,000 was the cost to purchase, install and maintain trash cans along University Avenue and in parks.
- c. This \$14,400 includes installation, materials, equipment, transportation, labor and maintenance costs for trashcans. The per-can cost was \$200 for one type of can placed at bus stops.
- d. This \$4300 includes cost estimates for installing and maintaining gates to forestall dumping on transmission rights-of-way. It also includes cleanup costs for illegal dumping on utility properties.

# 2.3.4 St. Petersburg results

St. Petersburg reported \$1,573,000 spent during FY99 on most city activities related to litter and illegal dumping. The departments that deal with litter and illegal dumping in St. Petersburg are Sanitation, Engineering and Stormwater, Parks, and Transportation. Table 2-3 and the descriptive notes following it detail the programs for cleanup and prevention, the participating departments, and the associated costs.

Table 2-3. St. Petersburg Costs Associated with Litter and Illegal Dumping

Activity or Program	Department	Cost
1. Cleanup		
a. Street-sweeping	Engineering & Stormwater	\$ 705,000
	Parks	8,300
Activity or Program	Department	Cost
h Litter pielan en eity eyyned property	Parks	588,500
b. Litter pickup on city-owned property	Sanitation	39,100
c. Illegal dumping pickup on city-owned property	Parks	12,100
or mean damping premap on only of mean property	Sanitation	24,100
	Parks	34,500
d. Litter pickup for special events	Sanitation	4,600
e. Litter pickup by county jail work crews	Parks	72,000
f. Litter pickup by state prison crews	Parks	22,000
g. Litter pickup by volunteers	Parks	1,000
h. Snipe sign removal	Sanitation	53,800
	Subtotal	\$1,565,000
2. Prevention		
a. "No Litter" signs	Transportation	1,000
	Parks	1,000
b. Trash cans	Parks	6,000
	Subtotal	\$ 8,000
Total Costs		\$1,573,000

City departments reported no costs for enforcing litter laws or codes. Codes Enforcement reported that Sanitation deals with all codes violations pertaining to litter and dumping. Sanitation reported that it included enforcement costs with cleanup figures and had no way to break them out.

### 1. Cleanup

- a. Street-sweeping was handled primarily by the Engineering and Stormwater Department, which used heavy equipment to keep roads clean of litter and debris. The Parks Department spent money to keep park sidewalks and streets clean but did not operate the heavy equipment normally associated with street-sweeping. The total for keeping roads clean in St. Petersburg was \$713,300.
- b. The Parks Department had crews that routinely removed litter from park lands. The Sanitation Department removed litter per request of other departments or citizens. The total expenditure for removing litter from city property was \$627,600.
- c. Illegally dumped items were removed by the Parks Department from park lands and by the Sanitation Department from all other city lands. Sanitation had a crew whose responsibilities included cleanup of illegal dumps. These cleanup activities totaled \$36,200
- d. The Parks and Sanitation departments cleaned up special events such as concerts, athletic activities, and fairs. These cleanup activities cost \$39,100.
- e. The Parks Department contracted with county jails for inmate labor to remove litter from park lands, at a cost of \$22,000.
- f. The Parks Department also contracted with the Florida Department of Corrections for inmate labor to remove litter from park lands at an annual cost to the city of \$22,000.
- g. The Parks Department organized volunteer cleanup events at a cost of \$1,000.
- h. The Sanitation Department had a "snipe sign" program to remove flyers, posters, notices, and so forth posted on city property, at a cost of \$53,800. The program director itemized the expenses into salaries, vehicle costs, tipping fees, and uniforms.

#### 2. Prevention and Education

- a. The Transportation and Parks departments posted and maintained signs with anti-littering slogans, at a cost of \$1,000 apiece.
- b. Trash cans in parks deterred littering on park lands, at a cost of \$6,000 annually.

The city had other programs associated with litter and illegal dumping cleanup but no cost estimates for them. For example, Engineering and Stormwater Department crews maintained drainage ditches, catch basins, pipes, ponds, and lakes, but the department manager could not break out specific cleanup costs for the illegally dumped items and litter the crews removed.

### **2.3.5 Summary**

Table 2-4 summarizes the costs identified in this study for each city in FY99. Jacksonville had the most costs, followed by St. Petersburg, and then Gainesville. All three cities spent significantly more on cleanup than on enforcement or prevention.

Table 2-4 Summary of City Costs Associated with Litter and Illegal Dumping

Activity	Jacksonville	Gainesville	St. Petersburg
Cleanup	\$2,787,700	\$561,100	\$1,565,000
Enforcement	263,700	1,900	0
Prevention	273,200	39,000	8,000
Total Costs	\$3,324,600	\$602,000	\$1,573,000

# **2.4 City Costs Discussion**

#### 2.4.1 Overview

Litter and illegal dumping abatement programs exist at several levels of government. At the county and city levels, solid waste issues often overlap and are intertwined. Counties frequently support city cleanup functions as part of solid waste management services the counties provide to the cities through contractual arrangements. A county sheriff's office may supply inmate crews for cleanups in the city and charge the city only the cost of supervising the work and, perhaps, equipment and transportation. The state Department of Transportation (FDOT) may clean state and interstate highways running through the city at no cost to the city.

Only the direct costs to the cities are included in this study, even though the total actual cleanup costs may include expenditures by other governmental units. Also, many litter costs are incidental to other services provided by the city. This required that departments estimate the percentage of time crews spent on litter control and extract that figure from the budget. Researchers sought the most complete cost information, while limiting the scope of the study to costs incurred by the cities.

St. Petersburg and Gainesville have graffiti-removal programs closely associated with tasks to reduce litter and illegal dumping. However, researchers defined the graffiti removal programs as beautification rather than litter abatement programs and thus did not include the graffiti program costs into this study.

The methodology likewise excluded costs associated with routine solid waste collection and recycling programs. However, researchers initially postulated that missed curbside pickups frequently contribute to litter through accidental overturn, vandalism, animal foraging, and the like. Accordingly, the initial survey requested these costs. In all three cities, it was not possible to break out costs for missed pickups. Solid waste managers explained that drivers are required to go back for missed pickups. The times and distances involved, and therefore the costs, were not tracked separately. In Gainesville, return trips must be done on the same day as the scheduled pickup or a supervisor must make the pickup. Further, the contract hauler asserted that missed pickups are not a contributing factor to litter.

#### 2.4.2 Jacksonville

Jacksonville's government is unique in Florida. Duval County and the City of Jacksonville consolidated their governments to form the current governmental structure. As a result, the City of Jacksonville has a downtown city core with a significant amount of outlying suburban area and some rural areas. Jacksonville is Florida's largest city, both in terms of population and area. In total, Jacksonville covers about 800 square miles and has approximately 694,000 inhabitants. Its large area is probably the biggest reason for its relatively high costs of managing litter and illegal dumping.

The following are comments regarding costs related to litter and illegal dumping that researchers targeted in this study but did not obtain for Jacksonville.

- Jacksonville had no designated team to identify littered areas and illegal dump sites. Various divisions identified these areas during their normal duties and referred them to the Clean It Up, Green It Up division for action. Jacksonville did not recycle materials collected in litter or illegal dumping cleanups.
- Jacksonville had no dedicated missed-pickup crew. The regular crews returned for missed pickups, but the cost of their doing so could not be determined.
- Center researchers could not determine costs associated with litter pickup as part of court-ordered community service work.
- The city bore no cost for litter pickup by state prison road crews, as state agencies bore all costs for this activity.
- Jacksonville Code Enforcement appeared to spend minimal time on activities related to litter and illegal dumping, so researchers obtained no costs there.
- The city spent nothing on litter and dumping ad campaigns in FY99. (See the Results section for a brief description of anti-littering ad campaign budgeted for FY00.)
- Jacksonville did not hold any litter-free events during FY99.

Street-sweeping costs were included in this study although litter pickup is incidental to street-sweeping. However, street-sweeping is an expensive activity and one related to litter management. Jacksonville spent \$1,348,900 on street-sweeping in FY99: \$988,900 for the city core and \$360,000 in outlying areas. This constituted more than one-third of the total costs of all litter-related activities obtained for Jacksonville.

The costs for Jacksonville presented in the Results section are underestimates. In most cases, city representatives' estimated costs were not all-inclusive and included only the easiest costs to break out, such as staff salaries and benefits. They often did not include more difficult costs to break out, such as equipment or vehicle use. In fact, one interviewee predicted estimated costs to be at least 15% low. Costs for some targeted activities in this study could not be broken out easily because they constituted only a small portion of employees' duties.

#### 2.4.3 Gainesville

Gainesville city government operates under a commission-manager arrangement. The city has a population of approximately 100,000 and covers an area of 45.52 square miles. Several city departments are involved with cleanup:

The Public Works department had a total budget of \$14.5 million for FY99 and three principal divisions with litter cleanup functions: Operations, Solid Waste, and Transportation. The Regional Transit System, administered by the Public Works Director, maintains trash receptacles throughout the city at bus stops. The combined cost of all litter tasks in Public Works was at least \$455,600, by far the majority of the total city litter costs obtained of \$602,000. The Operations division has Heavy Equipment and Drainage sections. Heavy Equipment includes street-sweepers, and Drainage cleans water courses clogged with trash and other debris. Street-sweeping was the costliest activity, at \$337,200, but litter removal was a small part of street-sweeping volume. The Solid Waste division coordinates most cleanup activities, in addition to normal solid waste pickup and recycling. The Signs section of Transportation makes signs to post in problem dumping areas and public spaces.

The Recreation and Parks department conducts litter cleanup activities through the Parks division. One crew focuses mainly on parks and landscaped areas, and another cleans rights-of-way and the banks above ditches and retention basins. Some special events cleanups follow events such as outdoor concerts organized and sponsored by the Cultural Affairs department. The Parks division is responsible for cleanup after those events and included any money received from Cultural Affairs for this purpose under special events activities costs.

The Community Development department includes the Code Enforcement division. This division investigates unsafe and unsanitary conditions that often include litter and illegal dumping. Violations frequently fall under a "hazardous lands" designation that may include overgrown lots, illegally stored goods, and unsafe structures. When Codes identifies cases of illegal dumping they are referred to the Solid Waste division. Codes doesn't record these referrals and Solid Waste doesn't identify which dumping reports come from the Codes division. Consequently, no costs could be broken out for investigations conducted by the Codes division that included illegal dumping. However, the Code Enforcement division incurred expenditures for personnel time, travel costs and administrative expenses.

The Gainesville Police Department (GPD) assigned a detective to coordinate dumping and litter issues with other agencies. In addition, officers in the Community-Oriented Policing program were on hand for organized cleanups, and GPD provided an estimate of that cost.

Gainesville Regional Utilities (GRU) is a separate entity under the City Commission. Its cost figures included cleaning up dumping instances and maintaining gates to limit access to utility transmission properties, a frequent location of illegal dumping.

Cleanup, enforcement, and prevention activities citywide involved complex costs. This is especially true of costs and activities that do not appear in the table. The following comments serve to explain some of those more complicated cost issues.

- Inmate and court-ordered community service labor saved the city considerable money. In the Parks division alone, seven inmates worked 2,496 hours in FY99, out of a total of 11,403 hours expended on litter tasks. Costs for supervising an inmate were about \$3.40 per hour, while the next least expensive alternative worker is a temporary laborer who typically cost the city \$9.42 per hour. A city maintenance worker cost about \$13 per hour. The savings of using inmate labor in FY99 was about \$24,000, and the supervisors estimated total savings to the city by using inmate labor at as much as \$120,000.
- Alachua County usually waives tipping fees for organized cleanups. There were 18 cleanups in the city in FY99 with an average tipping fee for a full roll-off container of about \$154. (The landfill tipping fee was \$37.40 per ton). The city thus saved about \$3,000 in FY99 on tipping fees from 18 cleanups.
- When some materials collected in cleanup activities are recycled, there are additional labor and handling costs incurred by the Solid Waste department. Those costs could not be separated out from illegal dumping cleanup costs as a whole.
- Gainesville held three litter-free events under the Special Events budget. Solid Waste reported costs for containers, signs, and material pickup for these events. Not included were additional public agency funding from the county and from civic support.
- No city costs could be found that related directly to anti-littering advertising or educational programs. However, the city Solid Waste office cooperates with the county to promote recycling. For example, the county advertises "Big Blue" recycling bins on the city's Regional Transit System buses.
- Gainesville costs in this study did not include those for managing litter on the University of Florida campus or other state properties or facilities within city limits. With a 2,000-acre campus and a student body of more than 43,000, UF has a large presence in the city. While the city may save substantially by having UF responsible for cleaning up a large parcel of land within the city, it also incurs additional costs related to home football games, the homecoming parade, and other university-related events and characteristics. For example, much of the cost of removing posters from utility poles (\$15,500 for 278 poles) is incurred in areas near the university and around student-oriented businesses and housing areas.

Some departments or divisions reported the best available cost figures that included all related costs. Street sweeping is a good example - it included the costs of equipment, operations, and disposal. However, street sweeping was a whole budgeted task and thus simple to calculate.

In other activities, researchers based estimates on the percentage of litter-related activities in a department's budgeted tasks, relying on the department's experience and expertise to make those estimates. Departments could not always determine costs for things such as administrative staff costs (including employee benefits), transportation, and equipment when those costs were primarily due to other departmental tasks. Accordingly, after several discussions and upward revisions to include additional costs, a parks division supervisor acknowledged that actual costs

were probably higher than the figures given. A Drainage supervisor summed up this dilemma when he said that, in his division, "Litter is part of everything you do. You're always dealing with trash."

## 2.4.4 St. Petersburg

St. Petersburg's population of 241,413 makes it the fourth largest city in Florida. The city covers 58 square miles and has 234 miles of shoreline. St. Petersburg's government is organized under the strong mayor system, which combines the political leadership of the mayor with an elected city council.

The St. Petersburg costs gathered and totaled in this study are underestimates of the total actual costs of efforts in the city to abate litter and illegal dumping, for some of the same reasons that costs for the cities of Gainesville and Jacksonville are underestimates. For example, litter removal is a cost in ditch cleaning tasks but no cost estimate for this part of the task was given. In St. Petersburg, the mayor instituted a "Keep It Clean" policy. The Sanitation Department reports that this policy is implemented with an approach that amounts to "clean it up and ask questions later." Where the trash came from and who gets charged for the removal is secondary to speedy removal by the city. Sanitation implemented this approach in part by providing oversized containers in 90 and 300-gallon sizes throughout the city. An automated collection system also facilitated the use of these heavier and bulkier containers. Most of the city was designed with alleyways running through the middle of each block, behind each property. This layout also allows for easy access to the containers for pick ups and eliminates the need for residents to move the containers to the front curb for pick up day as is done in many other cities. The 300 gallon containers look like small, round dumpsters and are often shared by several residences. This provides an adequate disposal volume for most customers, with capacity to spare. Most material that might otherwise be illegally dumped is placed in these containers, and Sanitation absorbs the related expenses into its budget for routine residential collection. That approach raises the costs of providing routine solid waste collection. The Department cannot estimate the costs incurred as a result of this policy, but believes it effectively diverts a large part of the waste stream into established collection procedures. Therefore, it would be interesting to also compare what amounts different cities spend per capita on normal solid waste collection. However, that figure was not included in this study. Researchers noticed during field studies that the city of St. Petersburg as a whole looks relatively clean when compared subjectively with other large Florida cities. The "clean it up and ask questions later" commitment may result in a cleaner appearance when implemented through a variety of waste handling and clean up programs. However, additional services to accomplish that can be expected to entail additional costs. Table 2-5 below shows that St. Petersburg has the highest cost per person of the three cities for services targeting litter and illegal dumping.

Engineering and Stormwater's yearly expenditures accounted for nearly half the reported expenses, mainly for street sweeping. Again, although litter is reportedly a minor component of the sweepings, this study included those costs as a litter-related activity. The Department had other hidden, and therefore unreported, clean up costs in maintaining drainage ditches, pipes, catch basins, ponds, and lakes. The Transportation department reported costs for "No Littering" signs. Sanitation did most of the work keeping the city clean, but most costs directly related to

those tasks were included under budgetary items that paid for a wide array of services and could not be easily separated out. The Parks department, responsible for all parklands as well as rights-of-way and medians throughout the city, conducts litter cleanup and reported associated costs.

# **2.4.5 Integrated Discussion**

Because only three cities were surveyed for this study, observations and conclusions based upon the information obtained are necessarily anecdotal in nature. The primary goal of this study was to describe the various departments, programs and costs sample Florida cities devote to litter and illegal dumping abatement. Therefore, researchers caution that any discussion comparing the cities has no statistical validity and is highly speculative. There are many differences in the character of the three cities and any combination of those factors could account for differences in the costs of litter programs. Other cities in Florida possessing similar characteristics may be somewhat comparable in their programs and costs but this study cannot predict any such correlation because there are too many variables based upon things such as location, population and land use.

This study describes programs and costs actually reported in three cities and demonstrates that there are similarities as well as differences in practices. Therefore, table 2-5 offers some size and cost figures for the three cities, from the smallest to the largest in costs, population and land area. However, this is more for descriptive purposes than for comparison to each other or for analyses. For example, the cost per person is highest in St. Petersburg where the number of residents per square mile (4,069) and the costs per square mile (\$27,120) are also the highest of the three. St. Petersburg has just over twice as many residents per square mile (4,069) as Gainesville (2,014) while Jacksonville has less than half as many people per square mile (867) as Gainesville. One piece of anecdotal evidence gathered that might explain the higher costs per person in St. Petersburg is the report that the mayor of St. Petersburg made a clean city a high budgetary priority.

Table 2-5. City Costs and Population

City	<b>Total Cost</b>	*Population	Square Miles	Cost per Person
Gainesville	\$ 602,000	92,648	46	\$6.50
St. Petersburg	\$1,573,000	236,029	58	\$6.66
Jacksonville	\$3,324,600	693,630	800	\$4.79

<sup>\*</sup> Source: Population Estimates Program, Population Division, U.S. Census Bureau, Washington, DC 20233, Estimated Population 7/1/98.

### **2.4.6 Summary**

This report presents case studies of program costs to manage litter and illegal dumping in three Florida cities. An important factor in describing the costs involved is that the cities vary somewhat in the departments, programs and services utilized to handle litter and illegal dumping. Some of these differences stem from things such as the size and layout of the city. This report describes which city departments provide what services and the associated costs. Other cities may experience higher or lower costs based upon their governmental structures, locations, or other characteristics. Other characteristics could include population density, geographic size and economic base.

Another very important finding is that the costs associated with litter and illegal dumping cleanup often are included in the costs of larger budgeted city services. Since city departments do not always account for litter-related costs separately, city department managers were sometimes unable to determine those costs. Therefore, the results presented in this report underestimate the actual expenses related to litter and illegal dumping. In other instances the managers made estimates based upon their knowledge and experience. Usually these estimates were derived from an assessment of the percentage of time or other resources required to handle litter tasks. Although researchers could not assess all of the associated costs, they did find that the three target cities in this study incurred significant annual expenses, from more than \$600,000 to well over \$3 million from litter and illegal dumping.

## 3. KEEP AMERICA BEAUTIFUL LITTER INDEX REVIEW

### 3.1 Litter Index Introduction

Why measure litter? The Keep America Beautiful (KAB) organization utilizes litter measurement to direct resource allocation for cleanups and other litter abatement activities and to measure litter control progress. Measurement also can provide the basis for funding requests and accountability for funds expended. States, counties, cities, volunteer organizations, and others may find a measurement tool useful for similar reasons. This report presents the results of a study designed to field test the Keep America Beautiful Litter Index (KAB-LI) in six Florida cities.

## 3.1.1 Background

In September of 1998, the president of KAB appointed a committee to explore the development of a new litter measurement methodology, with the goal of developing recommendations to revise or replace the Photometric Index (PI) (Porter, 1999). Dr. J. Winston Porter of the Waste Policy Center in Washington, D.C. was hired as the Project Manager for this effort. He and his staff began by defining the problem, assessing KAB's existing measurement tools, researching known alternative methods, and proposing a test model that would meet KAB's needs. The committee held meetings beginning in early 1999 to discuss and develop the proposed new measurement index. KAB and other organizations were engaged in an urban litter demonstration project under the title of the Urban Litter Partnership (ULP) in Houston. As part of that effort, KAB first conducted field trials in Houston and later in several other cities around the United States. At this writing in mid-2000, the Keep America Beautiful Litter Index (KAB-LI) is being released for use by KAB affiliates nationwide.

#### 3.1.2 Overview

As part of the 1998-1999 Florida Litter Study, the Center participated in the ULP's national effort to advance effective litter control strategies. The Center joined in this with the U. S. Conference of Mayors (USCOM), KAB, and a number of interested corporate and academic sponsors. KAB invited the Center, as a participating sponsor of the ULP, to serve on the new Litter Measurement Instrument Development Committee.

To facilitate their work on the KAB Litter Index Committee, Center researchers submitted a proposal to the DEP to conduct field trials of the KAB-LI in Florida. This task was accepted as part of the 1999-2000 Florida Litter Study. Preparation for field trials of the Index facilitated participation on the committee by enabling researchers to develop a working knowledge of the proposed index and generated additional recommendations to the committee for the further development of the index.

The Center first received funding for a two-month interim study, which it conducted in July and August 1999 and reported on at the end of that period (FCSHWM, 1999). As background investigation researchers first examined a similar visual measurement index formerly used in St.

Petersburg, Florida. The Center then conducted a field trial of the KAB-LI in Jacksonville, using the latest available model from KAB.

As preparation for conducting further field trials, two Center researchers attended further training and participated on a KAB field trial team in Gwinnett County, Georgia. The Center then used the latest version of the training materials to conduct a similar training session with KAB affiliate members in Jacksonville and Brevard County, Florida. Researchers reviewed and discussed with the survey teams their experiences following the field ratings as part of those trials. After Center researchers evaluated the results, they incorporated that information and additional committee refinements into a modified methodology. Researchers then conducted additional field trials in St. Petersburg, Tallahassee, West Palm Beach, and Fort Lauderdale.

### 3.1.3 Review of previous research

Dr. Porter initially presented the KAB litter index committee with a report reviewing the methods in use by KAB and summarizing a cross-section of the literature concerning some of the most widely used litter measurement methods. The committee reviewed and discussed these methods.

For years, the KAB relied on the PI and the Windshield Survey methods. The PI involved analyzing photographs taken at random sites in a sample area by overlaying a grid and counting the number of grids containing litter. During the years KAB used the PI, however, it found the PI to be costly, time-consuming, and complex. PI results often contradicted visual observations, and the index often failed to determine if litter had increased or decreased in an area.

The Windshield Survey method involved visiting representative areas of a community and visually categorizing the litter status of the different land uses in them. The KAB-LI closely resembles the Windshield method in that it employs a four-stage visual scale, from excellent to poor, to categorize litter status. The main problem with the Windshield method was the lack of clear definitions for the categories, which gave rise to inconsistent results.

Other approaches reviewed by Dr. Porter included study methodologies by Daniel B. Syrek, the Florida Center, the state of Nebraska, the Tidy Britain Group, Keep Australia Beautiful, New York City, and the Center for Marine Conservation (Porter, 1999).

# 3.1.4 Objectives

The goal of this study was to field test the KAB-LI in several Florida cities and to assist KAB in further developing the Litter Index into an instrument that produced consistent, realistic results, worked in a variety of rural and urban settings, and was easy to use.

### 3.1.5 Definitions and acronyms

The Center: The Florida Center for Solid and Hazardous Waste Management

FCSHWM: The Florida Center for Solid and Hazardous Waste Management

KAB: Keep America Beautiful

KAB-LI: KAB Litter Index

KFB: Keep Florida Beautiful

Litter: Misplaced solid waste.

PI: Photometric Index

ULP: The Urban Litter Partnership

USCOM: The U. S. Conference of Mayors

# 3.2 Litter Index Methodology

### 3.2.1 Description of the Litter Index

The KAB-LI uses a 4-point Likert-type ordinal scale to give a score of 1, 2, 3, or 4 to defined sub-areas of a larger community. The KAB-LI was designed for use primarily by local KAB affiliates to direct litter-abatement activities and to measure litter control progress during selected time periods (KAB, 2000). Development criteria specified that it be

- relatively easy and inexpensive to use,
- useful in many different locations and for multiple purposes (in its baseline evaluations as well as its follow up),
- valid, reliable, and believable, and
- repeatable and accurate (KAB, 2000).

Detailed description of categories removed at the request of KAB.

# 3.2.2 Training

The KAB-LI includes a training packet with literature, photographs, and a video. The packet explains the KAB-LI, defines the four categories of the rating scale, and provides video and photographic examples of the litter categories. In this respect, the KAB-LI more clearly defines litter categories than the Windshield method does. Before KAB affiliate raters use the index for the first time, KAB recommends that an experienced trainer review the materials with them and lead a training scoring session in three to five sub-areas to show and discuss how to score them.

Center researchers used the most current version of the training packet when conducting these studies. (No videotape was included in the materials at that time.) The Project Manager trained two additional researchers in the KAB method before beginning these field trials. Staff then practiced with the instrument in several sub-areas and became comfortable using the rating scale. The goal was to test the functionality of the KAB-LI as presented in the training packet under actual field conditions in several Florida cities and to make recommendations based upon the resulting experience.

### 3.2.3 Rating area and sub-areas

Removed at the request of KAB.

# 3.2.4 Scoring

Removed at the request of KAB.

### 3.2.5 KAB pilot test, Gwinnett County, Georgia

Two Center researchers traveled to Georgia to accompany the KAB litter index pilot test team, receive training in using the litter index, and offer suggestions for developing the measurement system further. The goals were to learn firsthand how the measurement instrument had been applied in earlier tests, to confer with the KAB staff and their consultant over the latest modifications, and to try it out under supervised test conditions.

The team consisted of nine raters and a driver, all in one van. A consultant briefly described the system and handed out written materials, which contained photos to illustrate the four litter conditions, scoring sheets, and descriptive explanations. After several test ratings, the team visited 38 pre-selected sites and recorded scores for each site. Of the original 48 sites selected for rating, the team eliminated 10 due to weather and time constraints.

The local affiliate director selected the sites ahead of time from various land use categories, county commission districts, and geographically diverse areas of the county. Sub-areas varied in size and shape. Some were several miles along both sides of a roadway; others were a school, park, mall, and office or industrial park. Several sites had been subjects of a previous PI rating and cleanup efforts. Others were newly completed projects. The public schools or parks had their

own maintenance staffs, and at two sites, workers were picking up litter during the rating. The team saw but did not rate several littered areas. In practical terms, this meant that most sites received scores of 1 or 2 and scorers had little opportunity to test the instrument in rating heavy litter situations.

Center researchers later examined the scores to determine the statistical validity of the training and the instrument. Researchers posed and considered two questions: (1) How does each rater's score compare to the mean score for a given site? (2) Is there a correlation between how different raters rated different sites? The Center used the answers to these questions to determine if the litter index could produce consistent results. Statistical analysis indicated raters' scores did not differ significantly from the mean score, and that scores among raters' correlated closely at each site. In simple terms, the raters gave similar ratings for each site, which confirmed the validity of the instrument and of the training.

#### 3.3 Litter Index Results

### 3.3.1 Overview

This section highlights the evolution of these field trials of the KAB-LI through area ratings in six Florida cities and the methods used to accomplish this project's objectives. A final methodology was developed and used in the last four cities surveyed.

### 3.3.2 City surveys

### Jacksonville and Brevard County

KAB requested Center researchers to involve local affiliates in field studies of the index. Local KAB affiliates in Jacksonville and in Brevard County assembled the rating teams for those surveys, and Center researchers trained and led the teams. KAB staff chose sub-areas to rate based upon their knowledge of the area. Considerations included known "hot spots," previous cleanup locations, opportunities to view both clean and littered sub-areas, a geographic sampling of the city or county, and a rating period of approximately two hours. Site size varied from one city block to several blocks to a mile or two of limited-access freeway. The methods used for these surveys varied little from those used in the pilot survey in Georgia. Some effort was made to standardize the size of sub-areas by using block faces as sub-area boundaries. This method was not used in all cases, though, partly because block faces were not always present and also partly because they were not always regular in shape and size. In some sub-areas, the team rated several blocks together because the neighborhood boundaries or some other geographic or land use feature presented a plausible consistent unit. This was true of the limited-access freeways rated where mile markers or some other feature presented a plausible rating unit.

### St. Petersburg, West Palm Beach, Fort Lauderdale, and Tallahassee

A third variation of the methodology was applied in rating the final series of four cities. Keep Florida Beautiful (KFB) advised that the new Governor's centerpiece of state beautification and

cleanup efforts in blighted inner city areas would be a new program called Front Porch Neighborhoods. Several Florida cities had such areas of special interest. KFB requested that the new rating system be applied in several of these areas, if possible. The research team added Front Porch designated neighborhoods as a qualifying criterion for study areas in the last four rating trials.

In St. Petersburg, Fort Lauderdale, and West Palm Beach researchers chose areas by city council or commission districts. Further, the city council district containing a Front Porch neighborhood was selected as the designated rating area. Tallahassee does not have city commission districts designated as separate areas of the city, so Center staff delineated an area around the city core with assistance from a KAB local affiliate staff member. The rectangular area thus delineated is bounded on each side by a major roadway and also contains a Front Porch neighborhood.

To aid in the validity of comparing sub-area scores, Center researchers standardized sub-area size in the last four cities. In St. Petersburg, sub-areas were unconnected half-mile segments. In Fort Lauderdale, West Palm Beach, and Tallahassee, four half-mile segments were strung together to form a two-mile route, with a separate rating given at the end of each half mile. These longer routes were chosen in part because they more closely resembled the KAB sub-area map shown in training materials and also those used in the pilot test in Gwinnett County, Georgia. Using a city map, identifiable urban land uses (schools, parks, shopping centers) within the area were selected for rating. Sub-areas were chosen throughout the geographic extent of the area in order to obtain a representative sampling of the area as a whole.

KAB materials indicate that the sub-areas rated should comprise between 20% and 100% of the total area. Further, area coverage can be determined by using either the street mileage or the square footage contained in the area. Center researchers first experimented with plotting subareas for ratings based upon the total land area of the chosen district. Since the land area of subareas rated should equal at least 20% of the total, it was necessary to determine how large of an area was being rated as researchers traveled a pre-determined route. To do this, staff examined the issue of the width of area coverage that scorers could see and rate on a route. Informal discussions with KAB staff suggested that previous field trials based area coverage figures on an assumption that raters can view a distance of 250 feet (approximately 0.05 miles) on each side of the vehicle for a total width of coverage along the chosen route of approximately one city block. Before traveling to any of the final four cities, researchers conducted field tests of this in Gainesville. Researchers determined on the basis of those tests that they could only fully see and accurately rate a distance of 100 feet (0.02 miles) from either side of the car in an urban setting. This was because the standard city lot's depth as well as fences, buildings, and other obstructions limited raters' line-of-sight distance. When side streets or open areas do allow for a greater viewing distance, it is difficult to see small litter at distances greater than 100 feet in either direction while moving forward along a travel route.

In St. Petersburg, two scorers were used, one of whom also navigated, while a third person drove. In Fort Lauderdale and West Palm Beach, three scorers were used, one of whom was also the driver. One scorer recorded both her own scores and the driver's scores by asking the driver for his score at the end of each scoring sub-area. A KAB affiliate director accompanied Center

researchers as an additional rater in Tallahassee. Appendix A presents an example of a city survey and a map of the selected council district marked with six two-mile routes, and the three raters' data sheets.

## 3.3.3 Field Trial Adaptations of the KAB-LI

Center researchers discussed and experimented with methods of standardizing the sub-area size and also for calculating the area coverage obtained by ratings of the sub-areas. This process involved deciding upon the length of the sub-area rating routes and determining what number of feet to use in calculating the viewing width of the route. For determining area coverage in this study, researchers used the total of the widths times the lengths of all sub-areas in a given area. This section describes this process in greater detail.

In St. Petersburg, Center staff first conducted practice ratings in four trial sub-areas, one that was one mile long, and three that were one-half mile long. The one mile route seemed too long to accurately depict a consistent sub-area because it incorporated two distinctly different neighborhoods. A sub-area of one half mile (approximately 5 city blocks) seemed less apt to change drastically within the rating sub-area, thus the resulting score seemed more accurate as a representation of the sub-area. Also, raters found it easier to maintain their focus and attention and to make mental decisions regarding the litter score observed along this shorter route.

Starting with the field trials in St. Petersburg, center staff followed KAB recommendations for area coverage as closely as possible. Center researchers calculated the city commission district chosen for rating in St. Petersburg to be approximately seven square miles (7 mi²), once the approximate acreage of a large lake in the area was deducted from the total. Twenty percent of 7 mi² is 1.4 mi². Assuming a scorer could see a distance of 100 feet (0.02 miles) from either side of the car, scorers would have to drive a total of 35 miles to cover 1.4 mi² or 20% of the area. Driving and scoring 35 miles in such a highly urban area would take longer than the KAB suggested two hours for rating all sub-areas. It also appeared that it would require driving through more than 20% of the area streets since larger parcels of land containing parks, lakes, schools and shopping centers did not always permit driving through for rating purposes.

Since KAB had suggested that scorers could see 0.05 mile from either side of the car, area coverage was recalculated using 0.05 miles as the route width. This new calculation indicated that 14 miles of driving distance would cover 20% of the area. This was found to be a more realistic distance to drive and score in approximately two hours in that urban setting. Center researchers chose a variety of land uses identified on the map to serve as rating sub-areas. These included schools, shopping centers and parks. In two hours, the rating team was able to score 24 half-mile long sub-areas for a total of 12 miles of driving distance. Using KAB's assumption for scorer sight distance to calculate the width of the rating route, Center staff covered 1.2 mi<sup>2</sup>, just short of the 1.4 mi<sup>2</sup> needed to cover 20% of the area.

Using the experience gained in St. Petersburg, Center staff adapted the same approach for use in Fort Lauderdale and West Palm Beach. In Fort Lauderdale, staff scored a total of 24 sub-areas, each with a driving distance of one-half mile, in a two-hour period. However, instead of separate half-mile sub-areas, as was done for St. Petersburg, staff scored six sets of four adjacent half-

mile sub-areas. This way, a KAB affiliate could look at a combined two-mile route or at each half-mile sub-area separately. The connected two-mile routes also appeared to more closely resemble KAB examples of sub-areas in the KAB-LI instructional materials. In West Palm Beach, Center staff drove and scored three two-mile routes for a total of 12 half-mile sub-areas. This took about one hour and adequately covered 20% of this small district. Combining sets of four half-mile sub-areas seemed to effectively capture accurate ratings for individual neighborhoods while producing a composite score for a larger sub-area. In Tallahassee, the same methodology was used for a rectangular section in the center of the city because Tallahassee does not have city council voting districts. Six two-mile routes or 24 half-mile sub-areas were scored. The data sheet by scorer 1 in Appendix F shows how a two-mile route contains scores from four half-mile sub-areas.

### 3.4 Litter Index Discussion

Because areas can be scored quickly from a vehicle, this instrument is easy to use in many urban settings. However, some safety precautions need to be observed while performing this survey from a moving vehicle. Heavy traffic and high-speed roads are conditions less suitable for this method because other vehicles can present obstructions to the viewing area and keeping up with the traffic flow may make viewing difficult. In the downtown cores of some cities, driving may be very difficult, and a team of scorers may choose to walk the sub-area. If the initial rating is conducted while on foot, the sub-area should be walked every time it is rated. Researchers saw much more litter when they walked a section of grassy shoulder that had just been rated from a vehicle. Therefore, it is assumed that a scorer likely will see more litter when walking than when riding in a vehicle. Consequently, ratings done on foot will not be comparable to ratings done from a vehicle. This research experience suggests that it may be safer and yield more accurate scores in congested city areas to conduct the ratings while walking. That method of conducting the ratings was not explored in this study enough to comment upon it in any detail. Researchers observed that a familiarity with the roads in the rating area eases the driving and navigation tasks. It may also contribute to greater safety and accuracy.

Weather extremes also affect the scoring process. In Gwinnett County, rain severely limited visibility and eventually caused the cancellation of the scoring session. Weather and traffic should be considered when planning to conduct ratings. Score sheets should include the date, time, and notes concerning any unusual weather, traffic, or other conditions. That information may be useful in planning future rating sessions.

The KAB recommendation for three to six raters in addition to the scoring leader and the driver is a good one and should be followed when possible. Center staff experienced difficulties in conducting ratings with a total of only three persons in the vehicle. The safety of the scoring team depends upon the driver giving full attention to the traffic, road conditions, route and traffic signs and signals. In these trials, the driver and the navigator frequently missed seeing some of the litter conditions when their attention was diverted. Center staff recommends a non-scoring driver and a minimum of three other full-time scorers. Ideally, the rating process should have the full attention of four or more individuals. Center staff also recommends that at least one KAB person accustomed to organizing cleanups be part of the scoring team as well as someone who is

new to the rating system. This will provide different and potentially valuable perspectives to the scoring process.

An unresolved issue for Center researchers at the time of these field trials was whether area coverage figures were to be calculated on the total land area of the area, as attempted by Center researchers, on the number of road miles within the area, or by some other method. While conducting ratings in St. Petersburg, Center researchers reconfirmed that they could not adequately view and score an area extending 0.05 miles (264 feet) from either side of the car in many areas. However, using a narrower route width-of-viewing figure to calculate area coverage made it difficult to drive enough streets to obtain the recommended area coverage. This is partly because land uses such as schools, parks or commercial developments often contain large areas that cannot be viewed well enough from a vehicle to be rated and they also reduce the number of streets available to drive for rating as compared to standard neighborhood configurations. In the chosen district of St. Petersburg researchers drove many of the available streets in order to obtain what was calculated to be, at most, just under 20% coverage based upon the land area of the district. At the same time, the subjective appraisal by the team was unanimous that they had driven through more than 20% of the area by the time sub-area ratings were completed.

The other method that was suggested in KAB instructional materials to achieve adequate area coverage is to determine the total number of road or street miles in the area and then conduct ratings on 20% or more of that mileage. Since scoring from a vehicle depends upon road access, it seems reasonable that calculations of area coverage should be based upon the available road miles in the area. Local affiliate directors may be able to determine road mileages for their community and base area coverages on those. In this study, researchers did not attempt to determine the number of miles of streets and roadways in the city council districts chosen for rating. If the number of road miles in an area are readily available from some source or can be easily calculated, KAB affiliates will have an easier task of calculating how many miles of subarea ratings to conduct to achieve adequate area coverage.

Some difficulty may be experienced in rating an otherwise clean area that has a few large litter items or an illegal dump. For a number of sub-areas, one or two sizeable, random litter items were seen in an otherwise consistent sub-area. For example, shopping carts seemed to be in many sub-areas that Center staff rated. Several sub-areas that would otherwise be scored as a 1 or a 2 often included a shopping cart or two somewhere in the sub-area. In these cases, Center staff gave the sub-area the lower score but noted in the comments section of the scoring form that a shopping cart or two was seen in the sub-area. This type of comment could be useful to the KAB affiliate in organizing a cleanup in the area. Questionable curbside set-outs were also problematic. Sometimes it was not apparent if a set-out was legal and would be picked up. For example, plant debris was often seen near the street in piles. Some of it was obviously old but some was newer and could have been awaiting a scheduled pickup. KAB affiliate members familiar with the waste handling schedules and practices of the area could better judge those situations.

The KAB affiliate director who participated in the Tallahassee rating anticipated some differences between rating highly urbanized areas and the small-town, largely rural area in her program area. However, some of her suggestions would apply equally in either type of setting.

She would select half-mile sub-areas for rating in the towns within her area and two-mile sub-areas along linking roads between towns. If she were applying the Litter Index in her KAB affiliate area, she recommended using as many as eight scorers traveling in a school bus for the scoring. Members of the affiliates' board of directors could conduct the ratings as an alternative to a regularly scheduled meeting. Using a larger team would allow modifications to the rating process, which may improve the accuracy of the scoring. The affiliate director recommended that half the scorers sit on one side of the bus and half on the other, scoring only what they can see from their respective side of the bus. In that way, they would not have to divert their attention from side to side and they could possibly give separate scores for different land use types. One suggestion was to allow raters to give separate scores for public and private land use categories. Such a double rating system would give one score for private property (such as house yards, vacant lots, and business fronts) and another score for public property (such as rights-of-way and parks). Some cities in particular treat public and private lands differently in planning cleanups and enforcing ordinances so separate scores for a sub-area could be helpful.

These insights and suggestions demonstrate some types of modifications that local affiliates might find useful in order to adapt the rating instrument to their communities' specific needs. However, on a cautionary note, any modifications to the rating process need to be consistent if the data is to be compared to future surveys. Users of the index also need to remember that any variation in the method also reduces the validity of score comparisons from one community to another. If Litter Index scores reported to KAB are to yield valid national scores and be compared from area to area or state to state, it is important that the ratings be conducted with as much consistency and uniformity as possible. Accordingly, any questions concerning the applicability or adaptations of the Litter Index as developed by KAB should be directed to that organization.

The data analysis of the pilot test in Gwinnett County showed that with proper training realistic and consistent results are attainable. The detailed instructions given in the training packet contribute to consistent ratings. However, Center researchers recommend standardization of sub-area size in order to produce data suitable for future comparisons, such as in monitoring cleanup efforts or comparing one community's scores to another. Overall, Center researchers found the KAB-LI to be a practical and effective instrument for ascertaining urban litter levels.