

Florida Department of Environmental Protection

## **Wekiva Residential Fertilizer Practices**

March 31, 2009



*Photo: Matt Bledsoe*



FDEP Contract# G0078

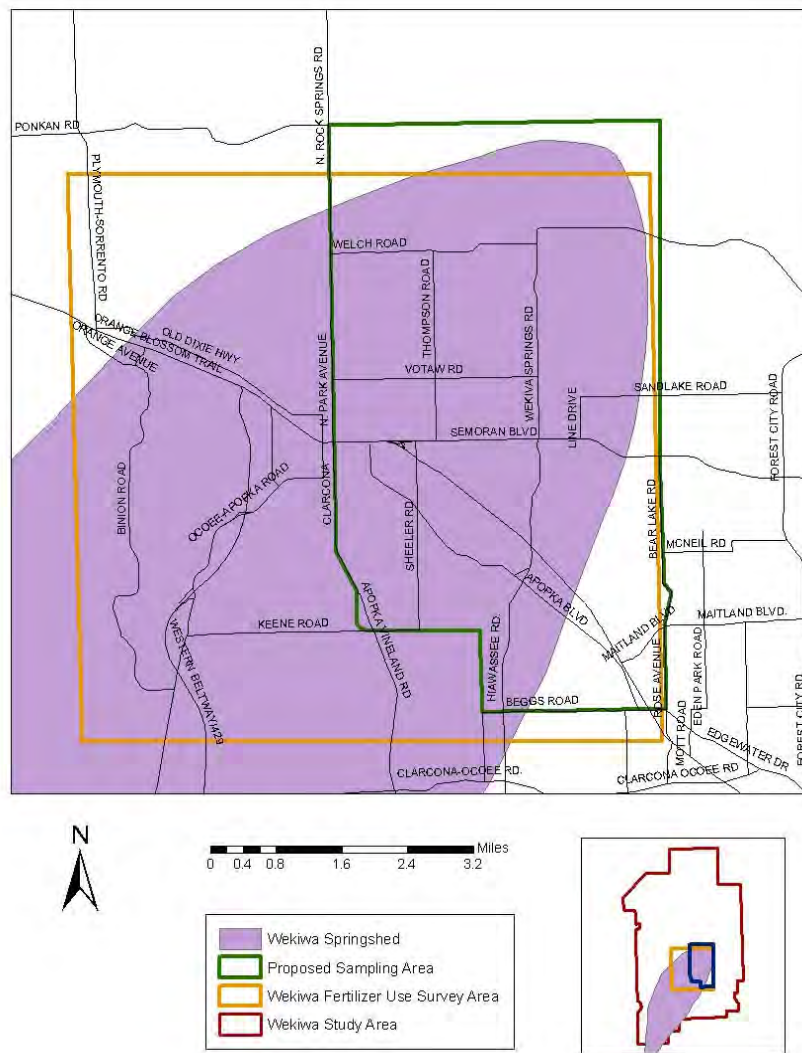
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**Figure 1: Wekiwa Study Area Map**



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## Executive Summary

This study, the Wekiva Residential Fertilizer Practices, was conducted in a 36 square mile Wekiva Survey Area (WSA) from January – August 2008 to better understand the application of fertilizer from residential landscape practices in that area. Using social research methods, information about homeowner fertilizer and irrigation was collected to clarify the accuracy of previous assumptions about fertilizer application rates that were made in the Phase I Wekiva River Basin Nitrate Sourcing Study by MACTEC for FDEP and SJRWMD in 2007. This report contains representative telephone survey data collected among homeowners in the Wekiva Survey Area (Figure 1) in April 2008, as well as observational, interview, and literature review evidence to support recommendations for further research and management practices. The comprehensive research approach supports final recommendations and provides data helpful in overcoming the barriers to more sustainable landscape maintenance practices. Seven hundred and forty respondents completed the telephone survey (n=740) designed to address three goals:

- 1) To understand the extent that homeowner fertilizer practices contribute to groundwater nutrient loading;
- 2) To identify locations for well installation by recruiting homeowners interested in participating in the ground water monitoring study; and
- 3) To understand homeowner behaviors and motivators for fertilizing and irrigating their lawn.

The telephone survey results are summarized in pie charts throughout this report and the descriptive responses are provided in Appendix A. A market segmentation analysis was conducted to distinguish unique homeowner fertilizer practices and characteristics.

The Phase I report by MACTEC estimated residential fertilizer nitrogen loads based on assumptions that 25% of residents are not fertilizing, 50% are using the recommended application rates, and 25% are overfertilizing. Our data show that eighty-four percent (84%) of Wekiva residents apply fertilizer to their lawn, which is higher than the Phase I estimated 75%.

The percentages of persons who apply according to recommended rates and who overfertilize are confounded by several factors. One is that only the homeowners who fertilize the yard themselves (59%) know what and how much fertilizer is being applied. Those who hire a company do not appear to know what is being applied to their lawn. Of the internal fertilizers, nearly three-quarters follow the bag directions when deciding when and how to fertilize, making up approximately 33% of residents. So this study can address the first assumption and part of the second, but not the third unless information from the lawn care services clarifies application rates.

- Phase I assumption: 25% of residents are not fertilizing - Actual: 16% are not fertilizing
- Phase I assumption: 50% are using the recommended application rates - Actual: 55% of residents reported applying fertilizer according to store recommendations (1%), bag directions (45%); Expert Advice (2%) or they calculate the correct amount according to lawn size (6%).
- Phase I assumption: 25% are overfertilizing – Actual – Hard to conclude based solely on self-reported homeowner data, as 41% of homeowners do not apply fertilizer themselves. More information on this is provided in the following paragraphs.
- Phase I assumption: Use of reclaimed water for irrigation is assumed to replace/reduce fertilizer use – Actual: Residents irrigated by reclaimed water have the second highest annual fertilization frequency (4.56 times/year).

The representative telephone survey data do demonstrate some interesting differences in the frequency that fertilizers are applied. On average, fertilizer is applied 3.53 times/year by homeowners in the Wekiva study area, however different homeowner groups apply fertilizer at different annual frequencies. Persons who hire someone to apply fertilizer (referred to here as external fertilizers) have their yard fertilized 4.76 times per year. This is consistent with other research, which demonstrated that “The average application rate of fertilizer on a lawn area basis reported by professional lawn care companies is higher compared to that calculated for homeowners,” (Law et al, 2008). Those who live in homes irrigated by reclaimed water have the next highest annual fertilization application frequency (4.56 times/year). Most Wekiva residents

(59%) apply fertilizer to the lawn themselves. These (internal fertilizers) homeowners represent the group with the lowest fertilization frequency (2.88 times/year).

Although external fertilizer homeowners' yards are fertilized more frequently than those who apply fertilizer themselves, they do not appear to know how much or what type of fertilizer is applied and therefore it is impossible to calculate the potential contribution of nitrogen from this population based on their accounts. The amount of nitrogen applied by external fertilizers is unknown and the amount applied by internal fertilizers is suspect because few homeowners were able to provide the size of the fertilizer bag they typically purchase or the three numbers on the bag that indicate nutrient content.

Homeowners who apply fertilizer to the yard themselves appear to be applying it at a rate consistent with IFAS recommendations, but this calculation is based on self-reported response data and relies on broad assumptions about average lot size and validity of fertilizer knowledge. Based on averages, the rate of nitrogen fertilizer applied by internal fertilizer homeowners is about 0.5 lbs of nitrogen per 1000 sq/ft about 3 times a year. This estimate assumes that the lot sizes given are representative of most, that the bag sizes are accurate, and that people accurately remember the three numbers on the bag. Many respondents answered that they didn't know the answers to these questions and the accuracy of those who responded is suspect. Therefore, this calculation has a large margin of error and should be interpreted cautiously.

A market segmentation analysis was conducted to differentiate those who apply fertilizers themselves and those who hire outside assistance. Persons who hire someone to apply fertilizer (external fertilizers) are less in touch with their yard's landscape maintenance including both fertilization and irrigation. They are more likely to schedule their yard maintenance into a systematic pattern of watering and fertilization and then leave it alone. They do not do the majority of their landscaping activities and they defer to their lawn service when making landscaping decisions.

External fertilizer homeowners are more likely to live in a community with a homeowner's association, more likely to be serviced by sanitary sewer, and less likely to interact with

neighbors when making landscaping-type decisions. They are more educated, more likely older or retired, more likely female, and have lived in Florida for a shorter length of time than internal fertilizers (Wekiva Fertilizer Telephone Survey, T-test,  $p < 0.05$ .)

These behavioral and attitudinal differences demonstrate that fertilizing homeowners will require different types of management practices. A more targeted and evaluable program can be designed for the Wekiva population, understanding that the “general public” is not as general as frequently assumed. For example, one may require mandates such as covenants or restrictions to encourage management practices whereas others may be encouraged through facilitative strategies. Or it may be that the homeowners’ associations should be targeted instead of individual homeowners. Specific populations require specific strategies.

Although surveys provide volumes of information about population dynamics and permits statistical analysis, interviews provide the qualitative information needed to explain why and how people make decisions. Therefore, forty-two homeowners were interviewed from June - August 2008 in order to clarify these questions as well as recruit homeowners for well installation. We found that people perceive different visual or seasonal cues for determining when fertilizer is needed. Homeowners who use seasonal cues tend to apply fertilizer most during the spring “growing” season and least during the winter when they perceive grass to be dormant. An equal number responded that they fertilized most in the summer because it is growing as those that responded that they fertilized least in the summer because it is too wet. This anecdotal evidence can not be extrapolated to the population at large, but can help understand individual motivation and rational.

An observational study was conducted to help identify neighborhoods for monitoring that had a uniformity in lawn fertilization practices so that the groundwater concentrations could be roughly linked to the general fertilization practices immediately above on the surface. From January – March 2008, the research team conducted a windshield study of neighborhoods recording yard color gradient and block uniformity. Dry, sparse and typically brown lawns were expected due to lack of rain and normal lawn dormancy. A neighborhood was considered uniform if all houses had similar colored lawns (i.e., bright green, light green, or brown). We found that the

longer established or lower income areas of town appeared to be more uniform in the practice of applying little to no fertilizer to the yard. Newer, gated, elaborately landscaped communities and those adjacent to golf courses appeared most uniform in using much fertilizer and were the most likely bright green candidates. The appearance of the subdivision entranceway appeared to set the standard for the houses within, which is often reinforced by the homeowner's association covenants.

The majority of WSA residents (68%) live in communities managed by a Homeowner's Association (HOA). Although few of these HOAs (3%) are responsible for maintaining the landscapes themselves, the rules and covenants they enforce are a strong influence on homeowner behaviors. Our research examined Homeowner Association Covenants and deed restriction documents that affect landscaping design and maintenance criteria to determine the extent they overlap with the University of Florida's Conservation Clinic and the Levin College of Law model "Conservation Restrictive Covenants Language. We found that the Wekiva area HOA covenants with the greatest similarity overlapped the UF model language by only 11% and the least overlap between the two was 2%. The most common feature from the model found in existing covenants was that they had a committee to review landscape changes.

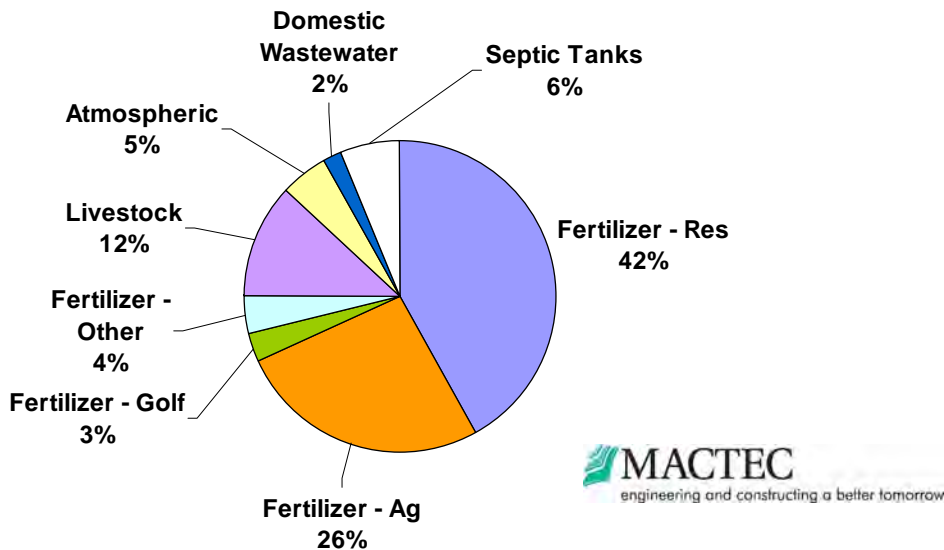
This report provides a great deal of information about residential landscaping practices, opinions, and attitudes for persons living in the Wekiva Survey Area. This information should be utilized to better target appropriate management actions, design appropriate messages, and extend the body of knowledge about the impacts that fertilizer and fertilization practices have on the Wekiva River Basin. There are many things to consider when deciding to invest in a management practice, and this report clarifies existing practices and illuminates potential barriers and motivators to changing behavior. We demonstrate significant differences existing between fertilizing populations that may require different types of management practices. General recommendations for further investigation are presented based on the evidence in this research report.

# Introduction

The Florida Department of Environmental Protection (FDEP) and the St. Johns River Water Management District (SJRWMD) have initiated a study to determine sources and loads of nitrate to surface and ground waters in the Wekiva River system. A “Phase I” study was conducted for SJRWMD by MACTEC Engineering and Consulting which consisted of a review of available data on sources of nitrate to the Wekiva River and Floridan aquifer system, preliminary identification of relative nitrate contributions to water resources in the area, and an identification of data gaps. Their contract outlined a series of tasks detailed in their report:

- Obtain, review, and integrate existing data and models
- Conduct “desk-top” inventory of potential sources of nitrate loading to surface and ground waters
- Review and summarize literature on nitrate loading to surface and ground waters from land uses in the Wekiva basin
- Develop preliminary nitrate budget for the basin (Chart 1)
- Develop preliminary recommendations for nitrate load reduction strategies

**Chart 1: Nitrogen Inputs by source: 9,400 Metric Tons/Year**



The Phase I report summarized nitrogen inputs and loads by source and land use types. Recommendations suggested the need for finer scale investigations of the impacts of residential landscape fertilization to better understand the contribution of this nonpoint source of nitrogen and its impact on the Wekiva basin. Understanding the individual populations clarifies the measurable link between land use activities and water quality integral to estimating load reductions from social activities. This report, Wekiva Residential Fertilizer Practices, presents valuable information about the impact of residential landscaping actions and attitudes on nitrogen loads in the Wekiva basin.

The University of Central Florida Stormwater Management Academy was contracted by the FDEP to conduct social research on homeowner landscape practices, particularly in the areas of lawn fertilization and irrigation. The purpose of this research is to gain a solid understanding of common landscape practices in the Wekiva Survey Area (WSA) and use that information to estimate residential fertilizer input rates for the entire basin. The objectives of the social research were to contribute to Wekiva Phase II by focusing on the following:

- 1) Collect salient information about residential landscape perceptions and lawn maintenance practices focusing on lawn fertilization and irrigation practices in the Wekiva Survey Area from January – September 2008 from a representative sample of the population.
- 2) Recruit 30-40 homeowners or homeowner associations to participate in the research by permitting a well to be installed on their property and monitored for water quality (to be conducted by a contractor for SJRWMD).

The Wekiva Study Area was identified for the research because it is an area that is known to be within the recharge of Wekiva Springs and where land use practices are most likely to affect spring water quality. None of the results of this study can be applied to any other population other than residents living within the Wekiva Study Area.

This research provides input on previous assumptions posed in the MACTEC Report. The Phase I report by MACTEC estimated residential fertilizer nitrogen loads based on assumptions that

25% of residents are not fertilizing, 50% are using the recommended application rates, and 25% are overfertilizing. Our data show that eighty-four percent (84%) of Wekiva residents apply fertilizer to their lawn, which is higher than the Phase I estimated 75%. The percentages of persons who apply according to recommended rates and who overfertilize are confounded by several factors. For example, homeowners who fertilize the yard themselves (59%) know what they purchase and how much fertilizer they apply, but they are uncertain how frequently they apply it, often saying “as needed.” Those who hire a company do not appear to know what is being applied to their lawn, but they know how frequently it is applied because it is part of a negotiated contract. Of the internal fertilizers, nearly three-quarters follow the bag directions when deciding when and how to fertilize, making up approximately 33% of residents. So this study can address the first assumption and part of the second, but not the third unless information from the lawn care services clarifies application rates.

A secondary goal is to identify appropriate strategies to encourage residential landscaping practices that will decrease nitrogen loads to the Wekiva watershed by understanding current practices and motivations. This study asks important landscape behavioral questions such as:

What fertilizers are homeowners applying?

How are they applying fertilizer?

When are they applying fertilizer?

Why are they applying fertilizer to their lawn?

This study focuses primarily on residential landscape practices because the impacts of residential fertilization practices are the least understood source of nitrate in the Wekiva Basin. A separate study (conducted by contractor for SJRWMD) is investigating the potential for nitrate loading from residential fertilizer application by conducting field studies of nitrate concentrations in shallow ground water aquifers in residential areas while the present study is collecting information on residential lawn management activities. The other nitrate sources identified in Phase I include septic tanks, domestic wastewater, livestock and agriculture. These are not included in the Phase II research because the body of scientific evidence describing nitrate loading from these sources is more extensive and conclusive.

## **Methodology**

To understand the complexity of human activities associated with lawn maintenance, a multi-mode approach to the social research was used: An observational study, followed by a telephone survey of homeowners in the Wekiva Survey Area and thereafter, homeowner and stakeholder interviews. The goal was to collect information about landscape maintenance responsibilities, fertilization and irrigation frequency, decision-making influences, and motivators for landscape maintenance decisions. Observations were used to understand yard uniformity of “greenness” so that locations for monitoring well installation could be selected. A telephone survey provides statistically valid representative information, but fails to explain “why” and “how” people do what they do. To better understand motivating and influencing factors, face-to-face interviews with homeowners collect valuable qualitative information while recruiting homeowners to participate in the groundwater monitoring portion of the study.

### ***I. Observational Study of Front Yard Uniformity***

Research shows that parcel lawn greenness and lot size can predict household fertilization practices (Zhaou et al, 2008). Observational studies were conducted from January to March, 2008 to assess the uniformity of lawn greenness as an indication of fertilization practices in the Wekiva Survey Area. Researchers drove through neighborhoods and ranked uniformity based on the variation of lawn greenness among homeowner landscapes at the block level and neighborhood wide. During the period of the observational study, dry, less green and typically brown lawns were expected due to lack of rain and normal lawn dormancy season.

Neighborhood uniformity was therefore apparent as bright green lawns for all or none of the residences. Two measures of uniformity gauged neighborhoods from uniformly less green to uniformly bright green with one measure in the middle for non-uniform neighborhoods defined as those with varying uniformity in their lawn appearance.

### ***II. Telephone Survey Research***

A fifteen-minute long telephone survey of homeowners in the Wekiva Survey Area was conducted from April 18 – May 7, 2008 to collect information on lawn fertilizing and irrigation practices as well as landscape attitudes and influences. A survey sampling frame of 7,000

telephone numbers was procured based on a list of census tracts that geographically overlapped the study areas by 70% and those whose major population centers were within the study area even though the entire tract was not. Although accurate, the survey sampling frame extends slightly beyond the Wekiva Survey Area. Telephone numbers were randomly called between the hours of 3:00 pm and 9:00 pm during weekdays and 12:00 pm and 9:00 pm on weekends.

UCF Institute for Social and Behavioral Science (ISBS) researchers used Computer Assisted Interviewing Techniques (CATI) to conduct the telephone interviews. The CATI system provides automated scripting and response coding that is more efficient to use, has greater reliability, and reduces coding error. All telephone interviewers were trained in advance and received IRB certification. A total of 740 telephone surveys was completed.

#### *Survey Objectives*

- Use social data to better understand the extent that homeowner fertilizer practices contribute to groundwater nutrient loading.
- Collect data on variables associated with Wekiva Study well installation site selection, including landscape stability and mandates, whether on septic or city sewage, and use of reclaimed water for irrigation.
- Identify homeowners that may be interested in participating in the research study by having an interviewer come to their house to learn more.
- Understand homeowner behaviors and motivators for fertilizing and irrigating their lawn.

The telephone survey questionnaire was loosely based on the sample survey provided at [www.lakeaccess.org/lakedata/lawnfertilizer/lawnsurvey/htm](http://www.lakeaccess.org/lakedata/lawnfertilizer/lawnsurvey/htm). The survey collected general information on homeowners fertilizing and irrigating behaviors and screened respondents for the criteria that will be used for well installation. A copy of the survey topline report of response frequencies is provided in **Appendix A**.

### ***III. Homeowner Recruiting and Interviews***

The third part of the social research builds on the survey data by actively engaging homeowners as research participants. The main objective of the homeowner interviews is to recruit homeowners for well installation and to collect the salient data that was collected of telephone respondents. Participant selection criteria include:

- Must own the residence
- Must live in the proposed sampling area (See Figure 1 on pg. 2)
- Must have lived in the home for at least five years
- Lawn must be well established and stable for five years
- Must be on central sewer for at least ten years
- Must not irrigate with reclaimed water
- Prefer neighborhoods with uniform lawn management practices

Recruiting for well installation was initiated during the telephone survey, which ended with the interviewer asking whether the respondent would be willing to participate further in the research. Those who agreed were asked for their home address and four additional questions to help clarify whether they met selection criteria. After the telephone survey was completed, interviewers personally visited potential participants to recruit them for the well installation project. During the telephone survey, 239 persons indicated that they would be willing to participate further in the research, but of these, only 76 would provide a home address and of these, twenty-nine registered for well installation. Potential participants who were not at home were left a recruiting and registration brochure that can be easily completed and mailed back with postage paid. However, no registration forms were received through the mail.

Research team members also approached local environmental and civic groups to recruit homeowners in the Wekiva Survey Area research. A map of the study area and accompanying recruiting brochure was presented to the group and if permitted, a short PowerPoint presentation on landscaping was conducted. Three people were recruited through civic group presentations; two others were ineligible because they lived outside of the project boundary.

The last method for recruiting homeowners to participate involves visiting targeted neighborhoods in the Wekiva Survey Area to contact homeowners. Ideal selection criteria for neighborhoods were those uniform in their fertilizing practices, serviced by city water, and not irrigated with reclaimed. Homes were randomly selected within a neighborhood and homeowners were initially screened to ensure they were eighteen years of age that their home was not on a septic tank. Teams of two to three researchers canvass neighborhoods on foot and bicycles, knocking on doors and leaving brochures in visible locations for residents to pick up. People willing to have the well installed were asked to complete a homeowner interview. Two similar but slightly modified face-to-face homeowner survey questionnaires based on the telephone survey questionnaire. The interview screening and consent language is included in **Appendix B**.

## Results

### *I. Observational Study of Front Yard Uniformity*

#### *Yard Uniformity*

Observed neighborhoods were divided into those where houses appeared to uniformly apply little fertilizer (light green), those that appeared to uniformly apply much fertilizer (bright green) and those that appeared to have both (not uniform). Observations were mapped and recorded to assist the well installation team select neighborhoods with uniform practices.

**Image 1: Lawn with no fertilizer**



The older, lower income and longer established areas of town appeared to be more uniform in the practice of applying little fertilizer to the yard. Newer, gated, elaborately landscaped communities and those adjacent to golf courses appeared most uniform in using much fertilizer. The landscaping at the entrance of the subdivision appeared to cue homeowners to the appropriate expectation of manicured landscaping within.

**Image 2: Lawn with much fertilizer**



Non-uniform neighborhoods that have some houses that appear to use much fertilizer and some that do not are primarily located within the transitional areas between golf course communities and in the subdivisions that abut natural areas or agricultural fields. During the time period of the study, people were initiating yard maintenance and some of these may eventually become uniform fertilizers as one neighbor follows the others example.

## II. Telephone Survey Findings

### *Sample population characteristics*

Table 1 summarizes the demographic characteristics of the 740 people who responded to the Wekiva Telephone Survey. The majority of telephone respondents are middle aged (mean=53 years); white (83%); female (60%); year-round residents (98%); who have lived in Florida an average of thirteen years. They are highly educated, with a majority (82%) completing some college or above and most with college degrees (33%). Only two percent (2%) of the survey population did not graduate from high school which is low compared to 20% of Floridians (2000 Census.)

<b>Table 1: Respondent Characteristics</b>			
	<b>Percentage</b>	<b>Average</b>	<b>Range</b>
Female	60%		
Caucasian	83%		
Average age		53 years	18-94
Higher Education (Beyond High School)	82%		
Employed	59%		
Lived in Florida		29 years	1-84
Have a Homeowners Association	68%		
Have sanitary sewer	61%		
Years in current residence		13 years	1-60
Full-time residents	98%		
Fertilize their lawn	84%		
Irrigate their lawn	92%		
Irrigate with reclaimed (who irrigate)	10%		
Lot size (Square feet)		22,025 ft <sup>2</sup>	780-8712
Lawn percentage	58%		
Proportion of lot that is lawn (Square feet)		12,907 ft <sup>2</sup>	
Owner occupied housing units	80%		

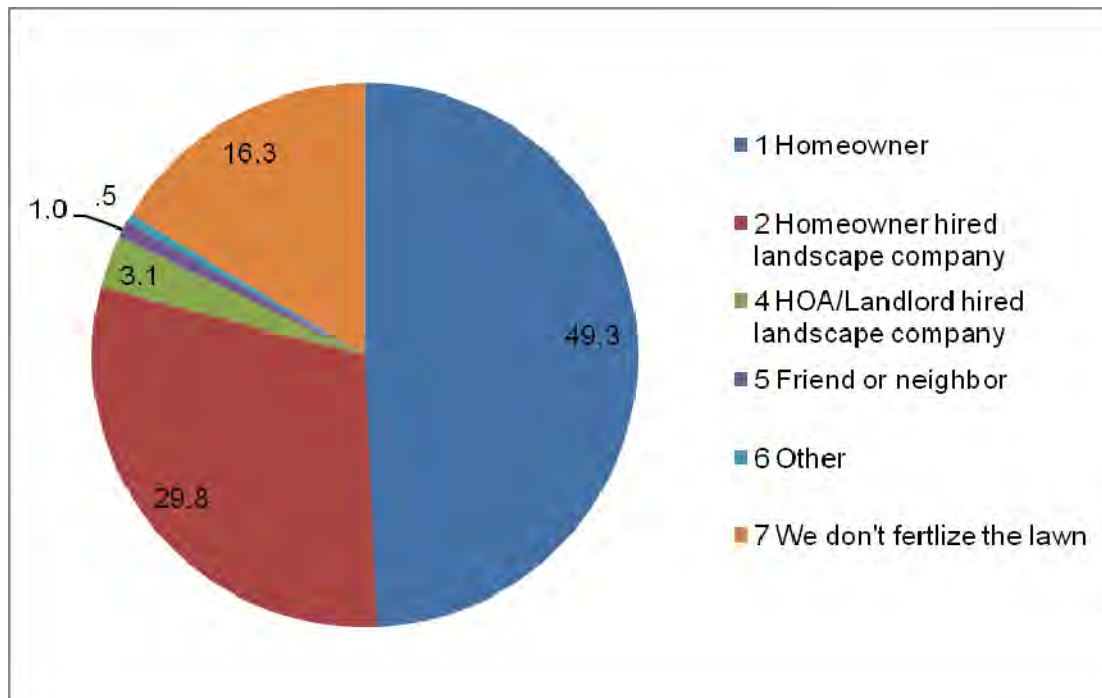
Slightly half (59%) of survey respondents indicated that they were employed, twenty-five percent (25%) are retired, and seven percent (7%) are not employed. Respondents volunteered alternate responses to the status of employment including five percent (5%) housewife or house husband, two (2%) percent disabled, and two percent (2%) a full-time student.

### ***Yard characteristics and general maintenance***

All respondents live in a single-family home, with sixty-one percent (61%) reporting being serviced by sanitary sewer. Forty-four percent (44%) of survey respondents said they had to replace or modify their landscape in the past five years. The average reported lot size is about ½ acre (22,025 ft<sup>2</sup>) and the average reported lawn percentage is 58%.

Sixty-eight percent (68%) of respondents live in a community that has a Homeowner’s Association (HOA), however only three percent (3%) indicated that the HOA or landlord was responsible for maintaining the landscape. Of those with HOAs, seventy-three percent (73%) indicate they never or seldom interact with the HOA and six percent (6%) replied that their HOA had changed landscaping rules recently.

**Chart 2: Who Fertilizes the Lawn?**

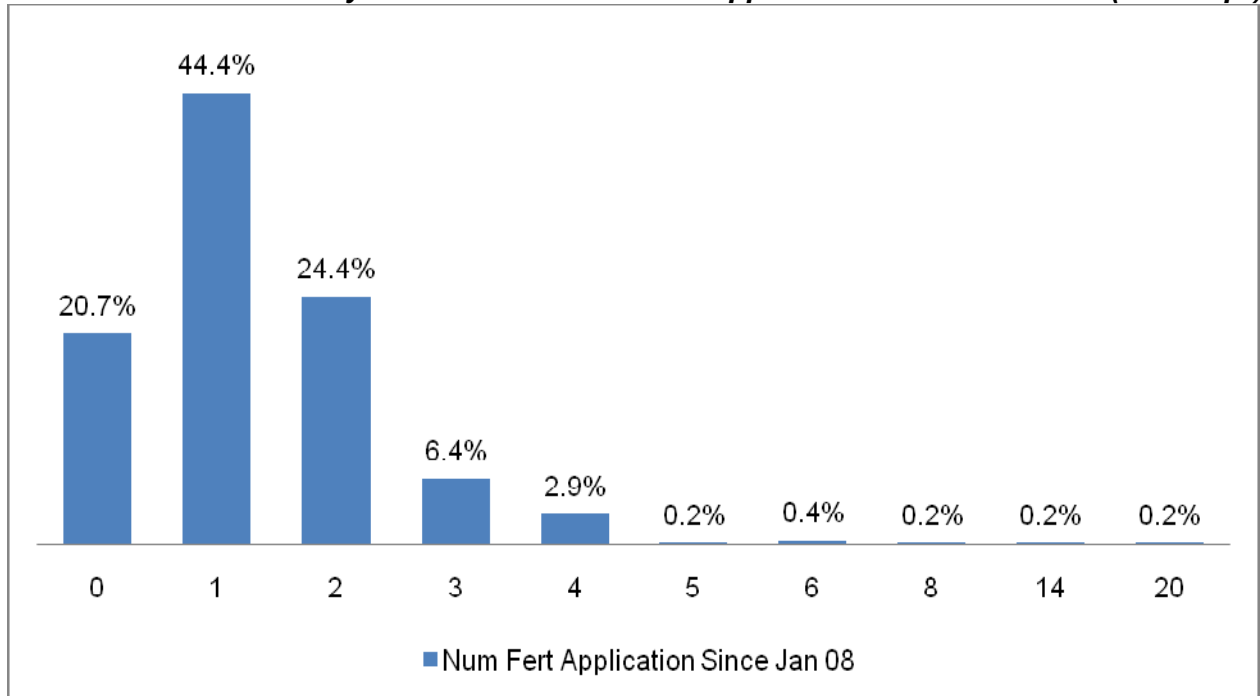


n=735

Nearly three-quarters (71%) of surveyed residents do the majority of the home’s landscaping activities themselves. Those who hire a landscape maintenance company (23%) vary greatly in the extent that they direct the company’s practices. Twenty-two percent (22%) indicated that they did not direct the landscaping practices at all, thirty-one (31%) said they directed them a

little bit, twenty-two percent (22%), said they directed them somewhat and twenty-five percent direct their landscape company a lot. We suggest that the people who hire landscape companies (external residences) and those who do their own landscaping (internal residences) are two different audiences.

**Chart 3: About how many times has fertilizer been applied to the lawn in 2008? (Jan – Apr)**



*n=545; Average = 1.4 (asked only of those who fertilized their yard)*

### ***Fertilization practices***

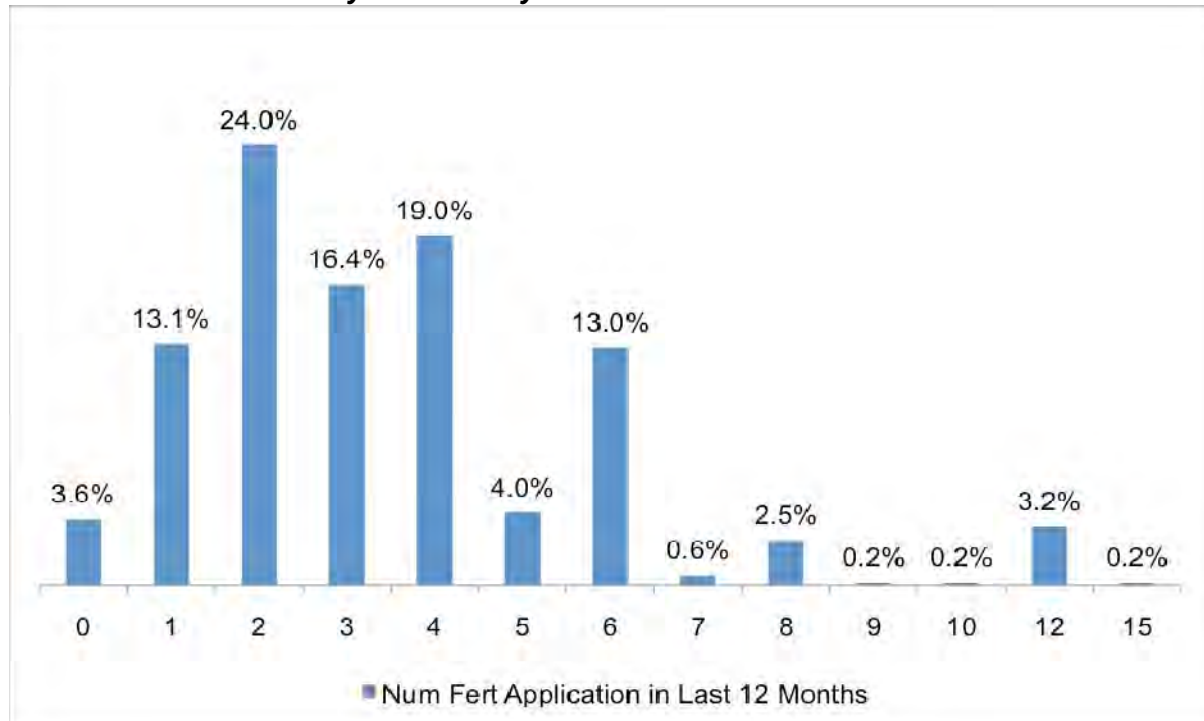
Eighty-four percent (84%) of respondents indicate that fertilizer is applied to their lawn. Of those, over half (59%) apply it themselves, another third (36%) hire a landscape company themselves, four percent (4%) have a HOA or landlord that hires a landscape company and less than two percent indicated that a friend, neighbor, or other applied the fertilizer. About half (51%) applies fertilizer on a regular schedule while the other applies fertilizer as needed.

To better understand the amount and frequency of lawn fertilization, a series of questions was asked to capture information about recent and annual fertilization frequency, type of fertilizer applied, bag size, and number of bags applied.

### ***Lawn fertilization rates***

Typically when people answer a question about frequency of activity over time, they go through a contemplative process of assigning a number of times they did it over a shorter period and using that as a point of reference to extrapolate over the long term. In this research, we provide a series of questions to facilitate this process, asking the number of times fertilizer was applied since the beginning of the year and over the last twelve months. We recognize that fertilizer sales are high in the spring and surveying during March and April should have captured additional people who may only fertilize once a year. Respondents indicated that the lawn was fertilized an average number of 1.4 times during the period of time from January to April, 2008 with a range from 0-20 times (Chart 3 on previous page). If this rate was constant, the annual expected average fertilization frequency would be 4.2 times/year. The annual average rate of fertilizer application is slightly less than the four month application average amount (Chart 4).

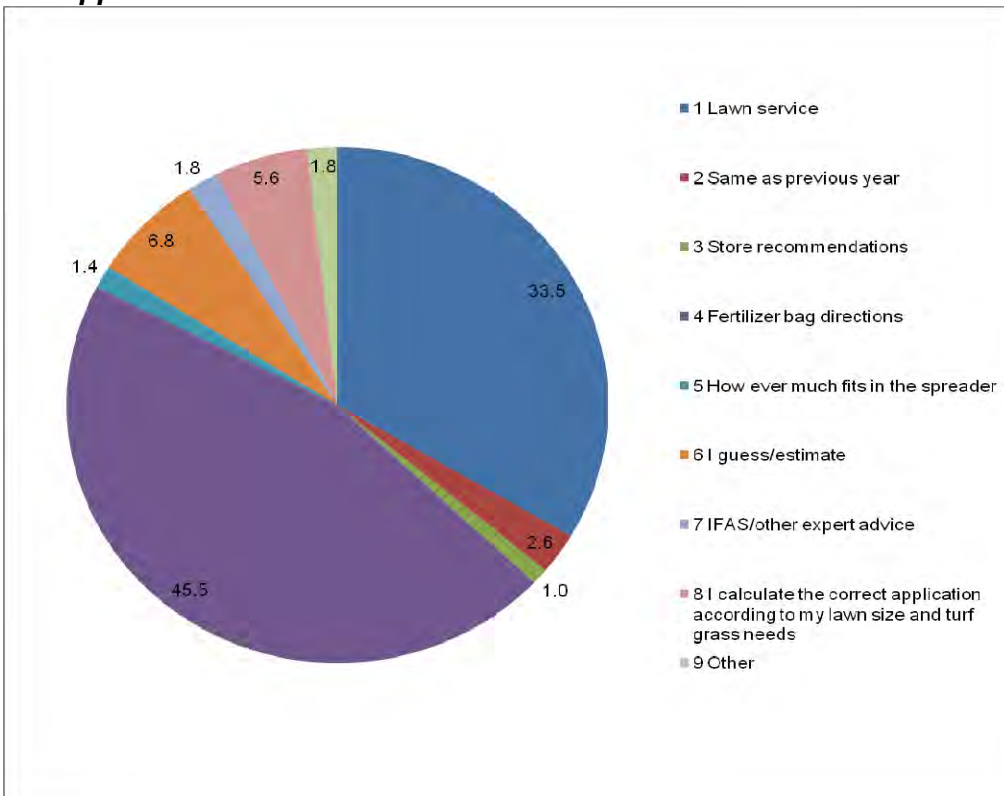
**Chart 4: About how many times was your lawn fertilized over the last twelve months?**



*n = 529, Average = 3.76 (asked only of those who fertilized their yard)*

Reported fertilization rates ranged from 0-80 times per year, but for the purposes of averaging fertilization frequency, the two highest (outlier) data were removed from the data set as suggested by reviewers. With these outliers removed, the average number of times that fertilizer is applied to residential yards is 3.53 times/year in the Wekiva Study Area. We found that different homeowner groups apply fertilizer at different annual frequencies. Persons who hire someone to apply fertilizer (referred to here as external fertilizers) have their yard fertilized 4.76 times per year. This is consistent with other research, which suggests that the application rate of fertilizer on a lawn area basis reported by professional lawn care companies is higher compared to that calculated for homeowners, (Law et al, 2008). Those who live in homes irrigated by reclaimed water have the next highest annual fertilization application frequency (4.56 times/year). Most Wekiva residents (59%) apply fertilizer to the lawn themselves. These (internal fertilizers) homeowners represent the group with the lowest fertilization frequency (2.88 times/year).

**Chart 5: How do you decide how much fertilizer to apply to the lawn at one application?**

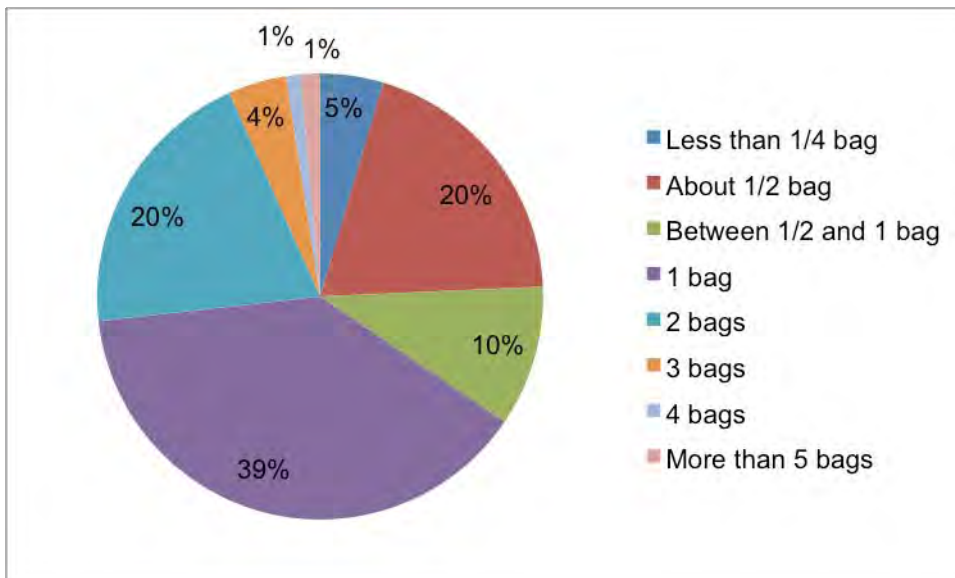


*n= 499; (Asked of those who report fertilizing their lawn).*

The majority of respondents indicate that their lawn is fertilized twice a year (24%). The next most popular response was four times a year (19%); followed by three times a year (16%); and the frequencies of once a year and six times a year were equally reported (13%). Almost the same number of respondents indicated that they did not fertilize at all (3.6%), as did those who fertilized twelve times over the previous year (3.2%).

When asked how they decide the amount of fertilizer per application, the majority of respondents were divided between those who said they followed the fertilizer bag directions (45%) and those who rely on the lawn service (33%). The former are respondents who apply fertilizer themselves (internal) and the latter those who rely on outside assistance (external). This is one of many significant differences between these two segments of the audience that would require different management practices to encourage best management practices (Wekiva Fertilizer Practices Telephone Survey,  $p = .05$ ).

**Chart 6: How many bags of fertilizer applied to the lawn at each application**



$n = 285$  (Asked of those who apply fertilizer themselves (internal); Avg. 1.21 bags)

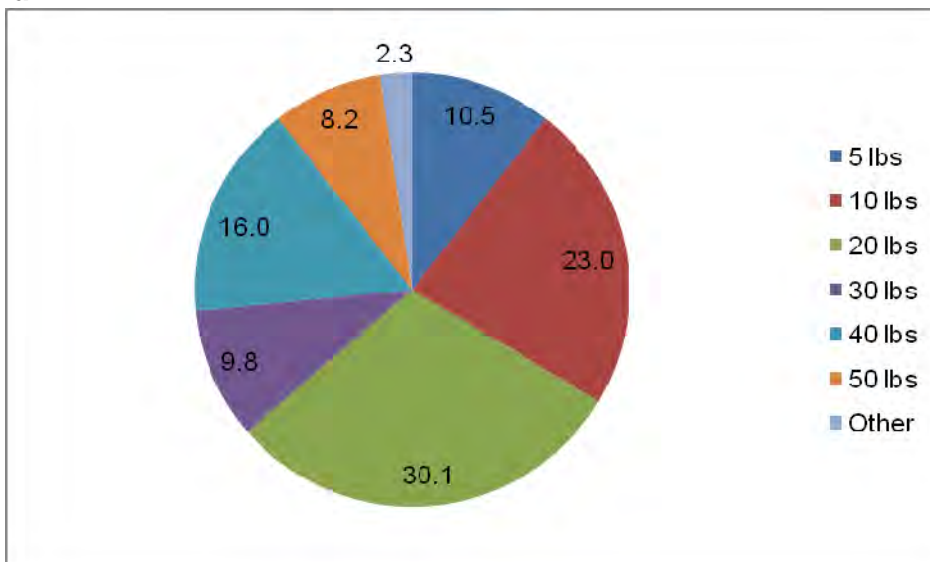
Other ways that respondents decided how much fertilizer to apply in a single application include: guess or estimate (7%); calculate based on lawn size and turf grass needs (6%); apply same as

previous time (3%); and IFAS/other expert advice/store recommendations (3%). A small number of respondents (1%) apply the amount that fills up their fertilizer spreader.

To estimate the amount of fertilizer applied, we asked those who responded that they applied fertilizer themselves (internal) the number of fertilizer bags applied at one time and the size of bags typically purchased. Sixty-five percent (65%) apply one or more bags of fertilizer at each application. The largest percentage of internal fertilizers (39%) applies one bag of fertilizer at each application. The next most frequent response is two bags per application (20%) followed closely by about ½ bag per application (20%). Ten percent (10%) of respondents applies between ½ - 1 bag per application, five percent (5%) applies less than ¼ bag, four percent (4%) applies three bags each time they fertilize and a little over two percent (2.5%) applies four or more bags or fertilizer each time they fertilize their lawn. The average number of bags applied at one time is 1.21 bags.

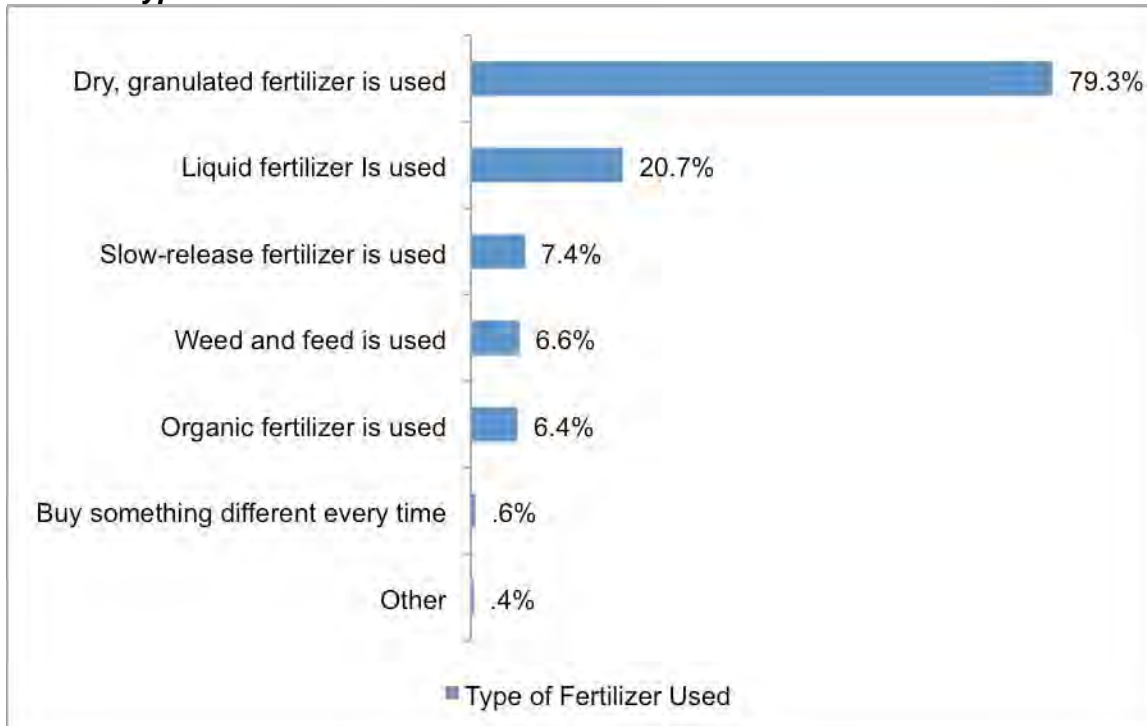
The size of the bags that respondents typically purchased varied greatly, with the average size bag reported at 22.82 pounds. About 1/3 of respondents (33%) purchase fertilizer in bags that are ten pounds or less, another third (30%) purchase twenty pound bags and another third (34%) purchase bags that are thirty pounds or larger. A small number (2%) purchase bags that are some other size. Because we must rely on the accuracy of their memory, the validity of these numbers is questionable. Chart 7 summarizes the data on most commonly used fertilizer bag sizes.

**Chart 7: How large are the bags of fertilizer that you purchase for the lawn?**



*n=256. (Asked of those who apply fertilizer themselves; Average 22.82 lbs)*

**Chart 8: Type of fertilizer used**



*n=574; (Asked of those who report fertilizing their lawn)*

The type of fertilizer that was typically applied was asked of those who fertilize the lawn themselves and those who rely on outside assistance. Respondents were able to select more than one response. The most popular fertilizer type reported is dry, granulated fertilizer (67%) followed by liquid fertilizer (18%), weed and feed (6%), and organic fertilizer (5%). Six percent (6%) of the respondents use slow-release fertilizer. Because we asked this question of all households who fertilize, the high response of don't knows ( $n=87$ , 15%) is expected from those who hire outside companies. It is possible that the low reporting of the use of "Weed & Feed" indicates that people don't know what they are purchasing, they don't know that "weed and feed" is considered fertilizer, or this population isn't typical of others where weed and feed is more popularly used. The validity of homeowners' knowledge on these specific questions is always in question, especially among those who have outside assistance to apply fertilizer. Likewise, homeowners who fertilize the yard themselves and only fertilize "as needed" may not remember from one year to the next what they purchase. A more accurate picture of what fertilizer is being used in the Wekiva Study Area may be attained by interviewing local hardware and gardening centers, landscape companies, and fertilizer applicators.

**Table 2: Reported fertilizer content**

N#	P#	K#	Frequency	Percent
29	03	04	7	10%
29	03	06	1	1%
29	03	08	1	1%
29	06	09	1	1%
29	02	16	1	1%
29	03	05	1	1%
27	03	08	1	1%
27	03	12	1	1%
27	06	03	1	1%
27	03	05	1	1%
26	02	13	2	3%
26	02	09	1	1%
26	03	11	1	1%
26	11	02	1	1%
25	00	08	1	1%
24	08	24	1	1%
23	05	10	1	1%
23	10	10	1	1%
23	04	03	1	1%
22	00	03	1	1%
20	06	06	1	1%
20	20	20	1	1%
18	09	06	1	1%
18	06	12	1	1%
17	02	11	1	1%
17	03	11	1	1%
17	05	11	1	1%
16	04	08	1	1%
16	02	12	1	1%
15	07	11	1	1%
15	00	15	1	1%
13	06	06	2	3%
10	10	10	3	4%
10	04	08	1	1%
10	00	11	1	1%
10	20	30	1	1%
09	00	24	1	1%
08	08	08	1	1%
08	12	08	1	1%
06	06	06	19	27%
06	00	06	1	1%
06	02	00	1	1%

By far, one of the most challenging questions and hence the one with the largest percentage of error is the question asking the telephone respondents to list the three numbers indicative of the nutrient content in the fertilizer most frequently applied to their lawn. Only seventy-two people (n = 72) were able to answer the question, making the accuracy of the responses dubious. There is a great deal of variance in the list of fertilizer content numbers outlined in Table 2 on the following page.

Twenty-seven percent (27%) of respondents answered 06 06 06, which is the most frequently reported fertilizer composition. The second most popular formula is 29 03 04 (10% of respondents answered). Four percent (4%) answered 10 10 10; three percent (3%) answered 13 06 06 and three percent (3%) answered 26 02 13.

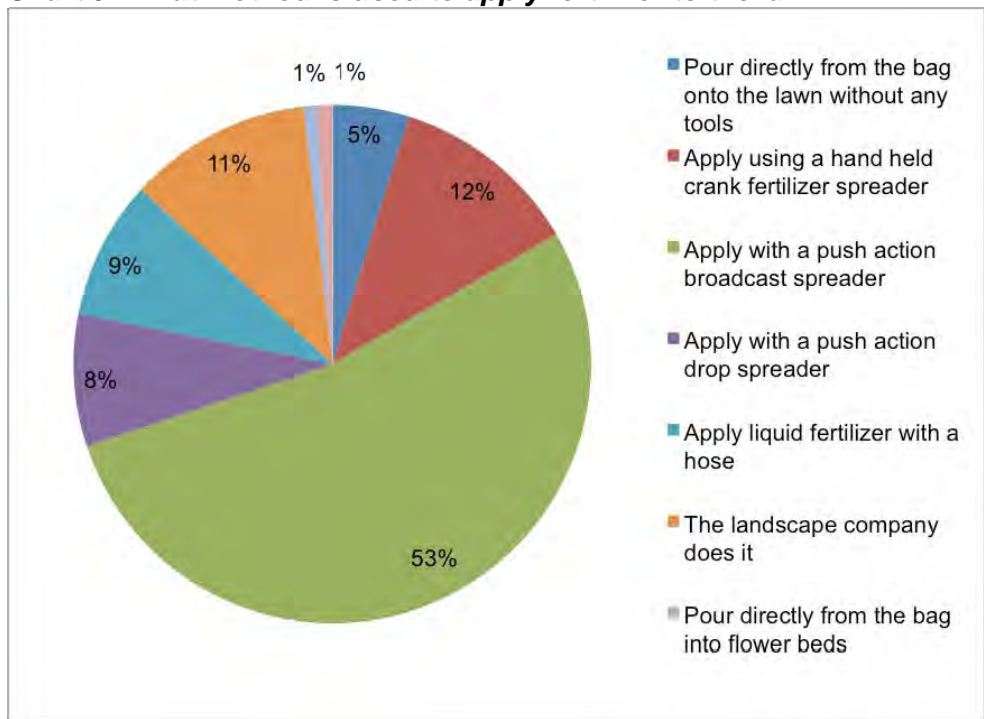
Table 2 also clarifies the individual nutrient concentrations most frequently reported in the fertilizer formula. The red numbers are the most popular number reported for each of the three nutrients in the formula. The first number represents the nitrogen concentration, the second number represents the phosphate concentration and the third number is the potash or potassium concentration.

One third (33%) of respondents regularly apply fertilizer containing 20% nitrogen content or more. Another third (32%) apply between 6-9% nitrogen per application, many purchase the most popular reported formula (06 06 06). The average reported nitrogen content is 19%. The most popular phosphate concentration (second number in the series) was the number 3 (13% reported) and the most popular potash concentration reported was 8 (10% of the respondents).

***Fertilizer application methods***

To understand fertilizer application methods, we asked those who fertilized their yards (both internal and external applicators) how they applied fertilizer. In Chart 9, the responses of both internal and external applicators are combined. Over half (53%) of homeowners reported that a push action broadcast fertilizer spreader was used to apply lawn fertilizer. Twelve percent (12%) use a hand crank fertilizer spreader that is likely used for spot fertilizing.

**Chart 9: What method is used to apply fertilizer to the lawn?**

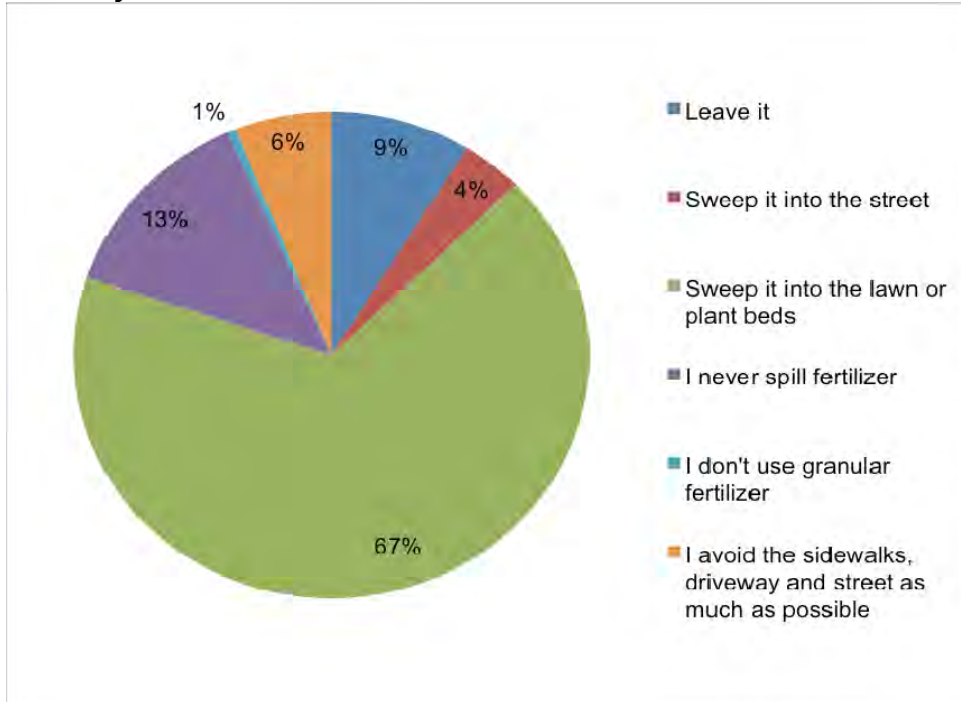


n=502

Eight percent (8%) say fertilizer is applied with a push action drop spreader and 8% apply liquid fertilizer with a hose. A small number (5%) pour directly from the bag onto the lawn or into

flower beds and even fewer (1%) measure and pour onto beds from the measuring cup. Twelve percent of respondents don't know what method is used because a landscape company does it.

**Chart 10: What do you do if granular fertilizer is spilled on the sidewalk, driveway or street?**



*n = 365; (Asked of those who fertilize their lawn - internal)*

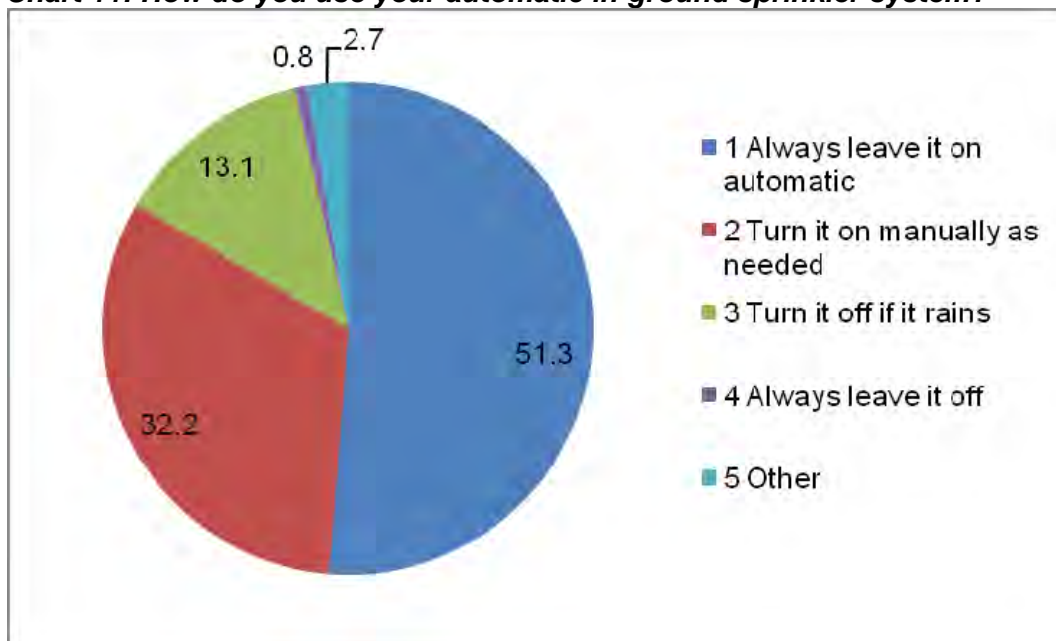
In reference to spill cleanup, we asked respondents what they do if granular fertilizer is spilled on the sidewalk, driveway, and street. The results are summarized in Chart 10 on the following page.

Most respondents indicated that they have spilled fertilizer and responded by sweeping it into the lawn or plant beds (68%). Thirteen percent (13%) of homeowners indicate that they leave the fertilizer there or they sweep it into the street, both of which would be problematic for stormwater management. Another thirteen percent (13%) indicate they have never spilled fertilizer and 6% indicate that they avoid sidewalks, driveways and streets as much as possible, both of which demonstrate good best management practices.

### *Irrigation practices*

Irrigation provides a conduit for fertilizer absorption by plants as well as runoff into stormwater systems. To better understand how and when people apply irrigation, the survey asked a series of questions about irrigation practices, maintenance, and scheduling. Ninety-two percent (92%) of respondents irrigate their yard. Nearly every one of them (99%) reported that they are responsible for watering the lawn themselves. The others have a HOA or landlord responsible for watering their lawn, hire a landscape company, or have some other external assistance to irrigate their yard.

**Chart 11: How do you use your automatic in-ground sprinkler system?**



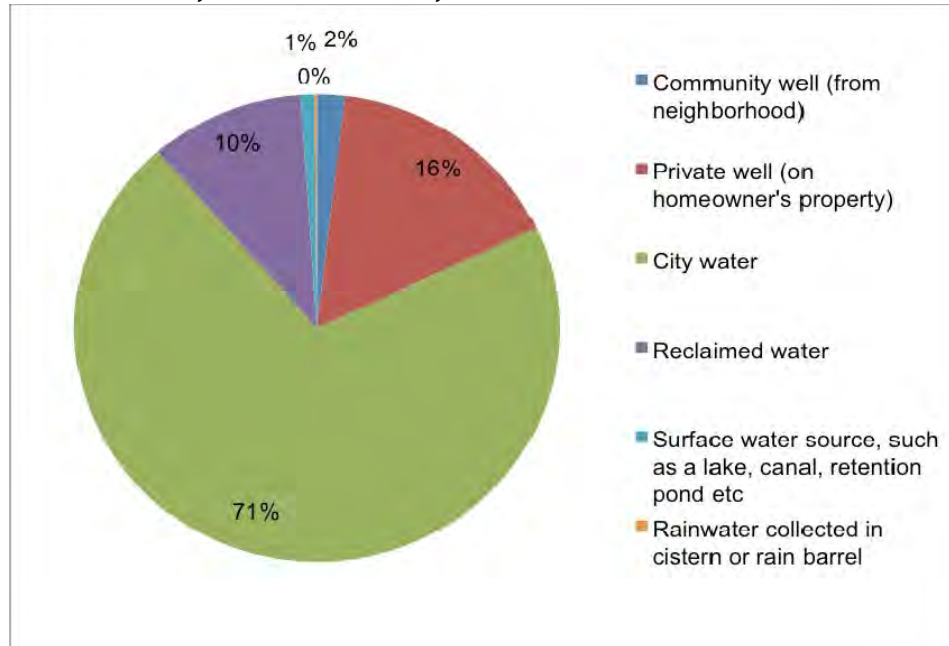
*n=519 (Asked of those with an in ground, automatic sprinkler system)*

Most respondents (78%) use an in-ground, automatic irrigation system as their primary method for lawn irrigation. Ten percent (10%) set an above ground sprinkler out by hand and ten percent (10%) use a hose to water by hand. Only a slight number (<1%) said they use drip irrigation from hoses at the surface and two percent (2%) use other methods.

When asked how those with in-ground, automatic irrigation systems used their sprinkler system, the majority either always leave it on automatic (51%) or turn on the sprinkler system manually as needed (32%). This difference in behavior corresponds with whether the respondent is an

external fertilizer or an internal fertilizer. External fertilizers are more likely to leave it on automatically, and internal fertilizers are more likely to manually turn their irrigation system on as needed. Thirteen percent of respondents turn off the sprinkler when it rains (13%) and a small number (1%) always leave it off.

**Chart 12: Is your landscape irrigated with well water, city water, surface water, reclaimed water, or some other source?**



*n = 641; (Asked of those who irrigate their lawn)*

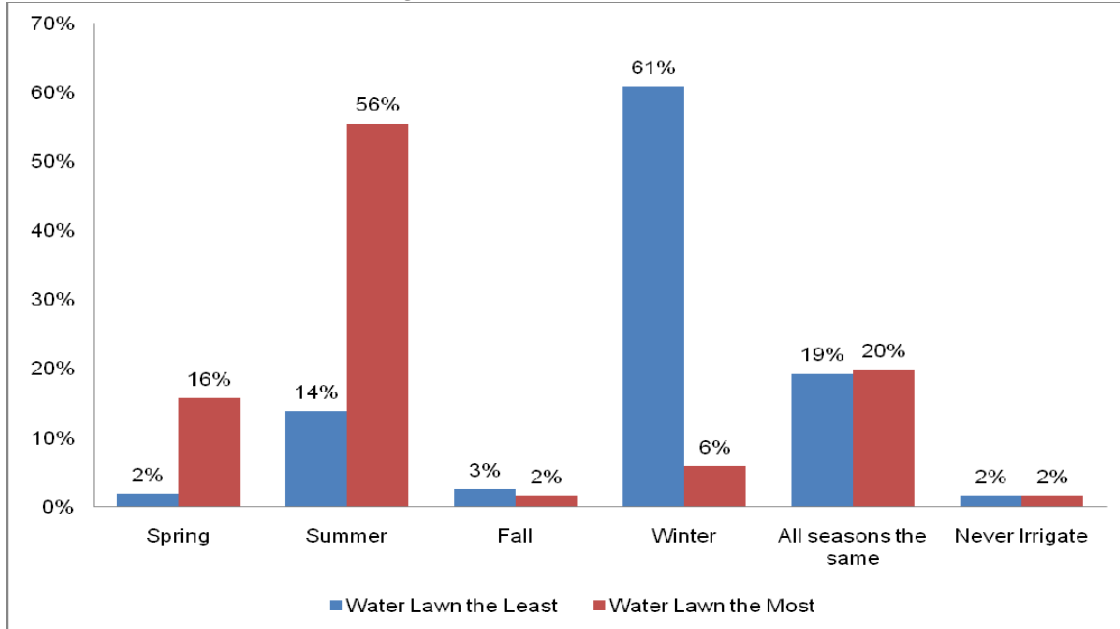
Of those residents who irrigate their landscape, seventy-one percent (71%) said that the source of irrigation is city water. Additional irrigation sources included a private well on homeowner’s property (16%), community well from the neighborhood (2%), surface water source such as a lake, canal, retention pond, etc. (1%), and rainwater collected in a cistern or rain barrel (<1%). Ten percent (10%) responded that they had reclaimed water for irrigation.

***Irrigation frequency***

The project area is located with the St. Johns’ River Water Management District and they have had a long-standing public education and regulatory program encouraging people to water not more than twice a week. It is encouraging to see from the response set that people are for the most part adhering to this policy. By far, the majority of respondents (92%) indicate that they

are watering one or two days a week. Three days a week was the next most popular response (7%), with a small number watering more than four days a week (< 2%).

**Chart 13: Seasonal Lawn Irrigation Habits**



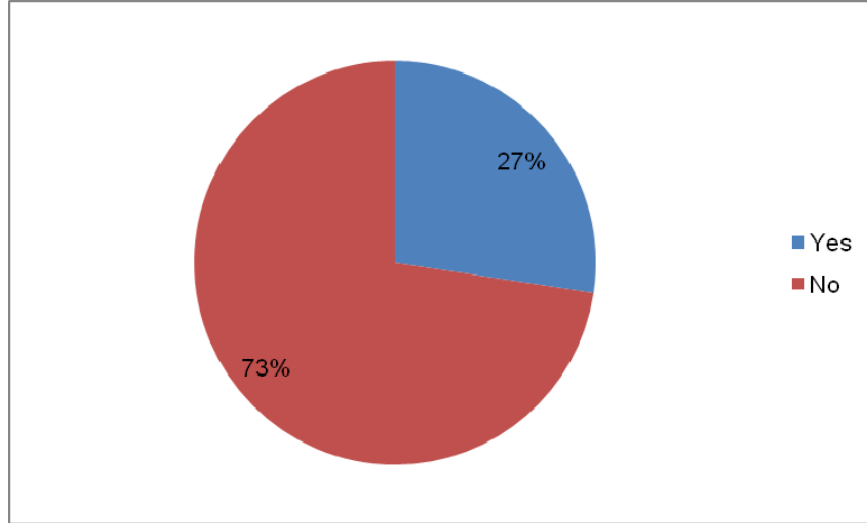
*n=634,636; (Asked of those who report watering their lawn)*

We also asked about seasonal variation to better understand when people apply water the most. Respondents indicate that they watered most in the summer (55%), followed by spring (16%), winter (6%), and fall (2%) and that the least amount of watering occurs in the winter (61%), followed by summer (14%), with fall and spring each accounting for about two percent (2%). Roughly twenty percent (20%) indicated that all seasons are irrigated the same while about two percent (2%) never irrigated their lawn.

***Irrigation system maintenance***

Twenty-seven percent (27%) of respondents said that they utilized a professional service for maintenance of their irrigation system. Almost half (49%) responded that their irrigation system had a rain sensor on it and of these most, (84%) indicated that it seemed to work correctly.

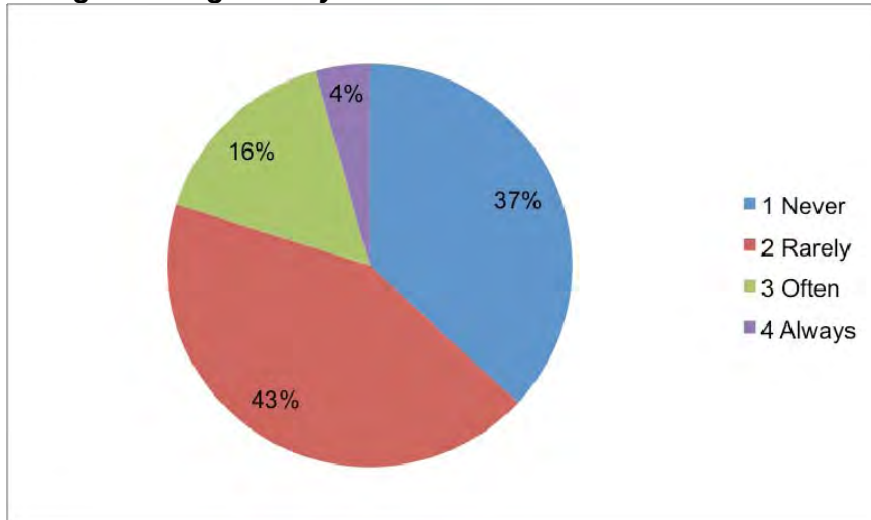
**Chart 14: Is your irrigation system maintained by a professional service?**



*n = 515, (Asked of those who have an automatic irrigation system)*

Over three quarters (80%) of those who have an automatic in-ground irrigation system rarely or never change the timer. Sixteen percent (16%) often change it and a small number (4%) of persons indicate that they always change the irrigation times. This is further indication of the tendency to program yard maintenance and leave it alone.

**Chart 15: How frequently do you or your professional service change the irrigation system timer?**

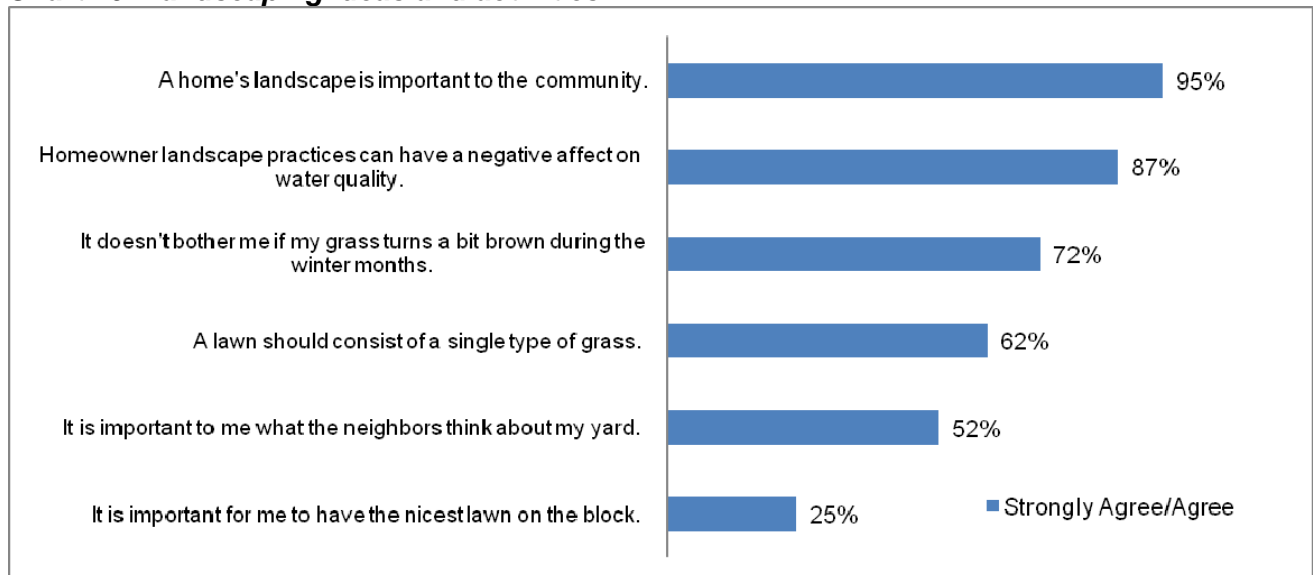


*n = 515; (Asked of those who have an automatic irrigation system)*

### *Landscape attitudes and sources of knowledge*

Several interesting characteristics about the landscaping attitudes and perceptions of residents in the Wekiva Basin study area were also indicated by the survey. We suspect that neighborhood values and behaviors influence the individuals within them with normative as well as mandatory reinforcement of appropriate landscape appearance. A series of questions about landscaping attitudes and beliefs clarifies the extent and types of influencing community norms and personal values.

**Chart 16: Landscaping ideas and activities**



n=660-735

The attitudinal data suggest an interesting paradigm as described in the literature (Yabiku et al 2008). The paradigm as reported by Yabiku et al is that strong environmental concern does not necessarily lead individuals to adopt resource efficient landscaping practices. The Yabiku et al research shows that even though people acknowledge that lush, green lawns can use a lot of water (in the referenced case, the study was a desert environment), they still have a lush, green lawn. An understanding of the environmental impact alone did not correspond to a change in landscape practices. We suspect a similar dynamic in our study, where nearly ninety percent (87%) agreed strongly/agreed with the statement, “Homeowner landscape practices can have a negative affect on water quality,” and over ninety percent (95%) agree or agree strongly with the statement, “A home’s landscape is important to the community.” It may be that in some cases, homeowners’ values are at odds with each other. Although the homeowner believes that

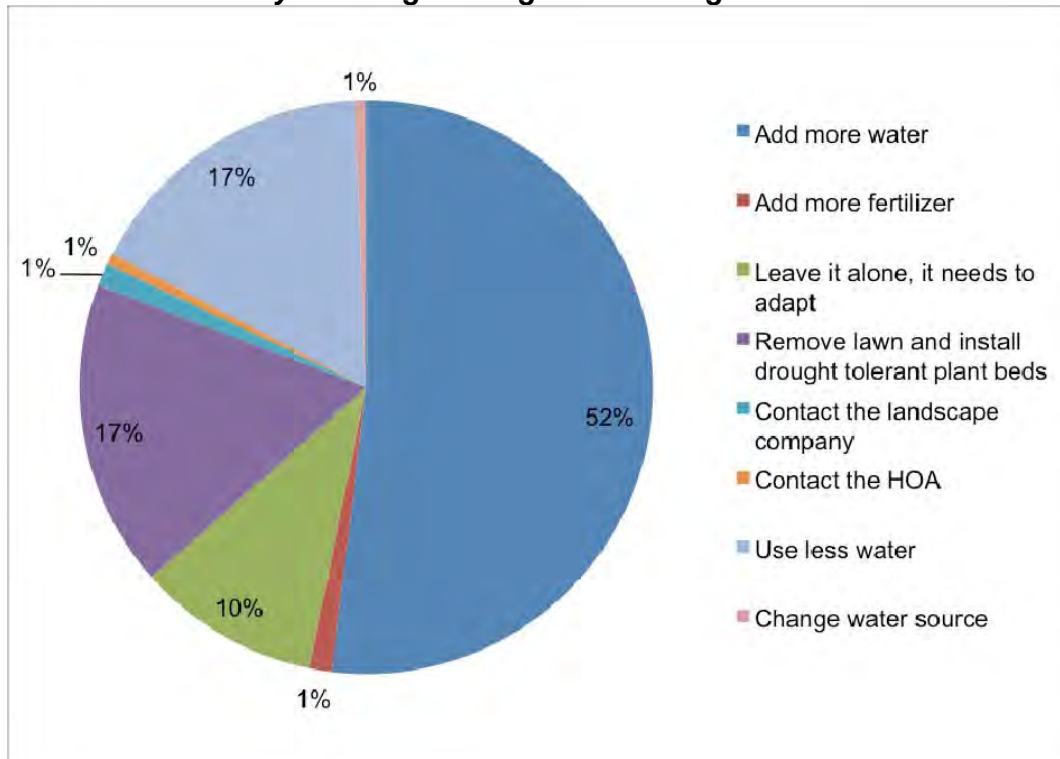
landscaping practices can negatively affect water quality, the pressure of community conformity may be more relevant to the individual who must also comply with the covenant mandates enforced by the neighborhood. When deciding between immediate conformity, satisfaction and pride in opposition to potentially polluting water, the homeowner folds to the pressure to maintain the yard at a level of cultivation and maintenance that satisfies their neighborhood.

Interestingly, this pressure appears greatest at the community level than it does at the neighbor or block level, where fewer respondents agree/strongly agree. Roughly half (52%) of respondents agree strongly or agree with the statement, “It is important to me what the neighbors think of my yard” and fewer (25%) agree strongly/agree that, “It is important to have the nicest lawn on the block.” Nonetheless, 27% responded that their neighbor’s yard influences what they do in their own yard. Clearly, individual yard appearance and maintenance activities are influenced by the community.

Along these lines, we investigated other influences to landscape maintenance. The perception of appropriate appearance of lawn cover was investigated. Most residents (61%) agree/strongly agree that “a lawn should consist of a single type of grass” which may be an indication of weed and feed use, or other herbicide treatments applied to maintain a monoculture. However, in response to the statement, “It doesn’t bother me if my grass turns brown during the winter months,” seventy-one percent (71%) agreed or strongly agreed, indicating an understanding of grass dormancy and tolerance of color change. This may indicate a tendency to reduce lawn maintenance in the winter months, but not if the color change happened at another time of year.

When asked what they do if their lawn changes color in general, seventy-one percent (71%) consider it a sign that they need to change something about their landscape maintenance. Most indicated that they would add water (30%) if the lawn changes color and eight percent (8%) said they would add fertilizer. Most respondents said that their actions depend on other conditions and considerations.

**Chart 17: What did you change during recent drought?**



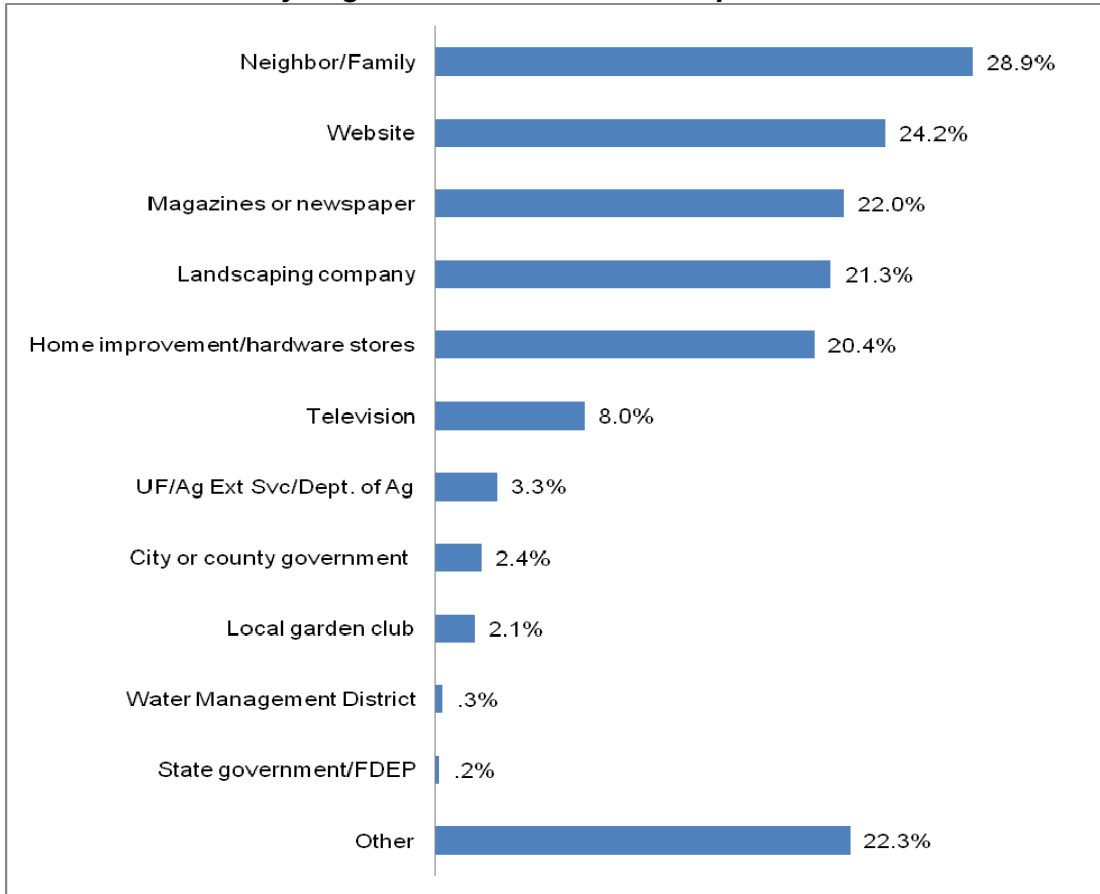
*n = 259; (Asked among those who say their yard habits changed due to the recent drought - 37%).*

When asked specifically about the current drought situation (Chart 17), the two most popular responses were surprisingly contradictory. First of all, nearly two-thirds (63%) indicated that the current drought situation had not caused them to change anything about their yard maintenance. But those who did change landscape practices indicated that they either added water (52%) or they decreased the amount of water they put on their lawn (17%). Another seventeen percent (17%) removed lawn area and installed drought tolerant plants. Reducing water use and installing drought tolerant plants may have been a response to mandatory reductions in irrigation scheduling from two days a week to one day a week.

Understanding where people receive information will clarify avenues for accessing the target audience through the channels they rely on for legitimate information. Respondents receive information on landscaping from a variety of sources. The most frequently reported sources were friends and neighbors (29%) and from unspecified websites (24%). If people are equally using neighbors and the web for their landscaping information, than Florida landscaping websites such as the UF/IFAS Florida Yards and Neighborhoods site should be evaluated and

updated regularly to meet homeowners’ needs. Twenty-one (21%) rely on their landscaping company to provide information, representing a segment of the population most reliant on outside vendors. Other sources are detailed in Chart 18.

**Chart 18: Where do you get information on landscape maintenance?**



n=719

### **III. Homeowner Interviews**

Forty-two homeowners were interviewed from June-August 2008. The homeowner interviews were conducted in concert with recruitment and the evidence is not representative to any population. The discussion herein is completely anecdotal and should not be considered indicative of any single population. We were interested in collecting important data needed to select homeowners for well installation, and followed up with questions that are impossible to collect via telephone survey methods. These include questions such as “Why do you fertilize when you do?”

Of the forty-two homeowners interviewed, four homeowners do not fertilize, twelve of them hire an outside company to apply fertilizer and the remainder apply fertilizer themselves. This sample is too small to conclude anything about the population in general, but the sample is interestingly similar to the population at large in the percentage of those who don't fertilize (10% vs. 16% at large), hire external assistance (28% vs. 23% at large) and those who apply fertilizer themselves (62% vs 67% at large.) Also, like the representative telephone survey, about half of the interviewed homeowners indicated that they fertilized on a regular schedule and the other half only as needed.

We asked a series of questions to better understand when and why people decide to add fertilizer to their lawn. Open ended responses were organized into two general categories, those that look to the lawn to determine whether it needs fertilizing and those that fertilized based on some seasonal or information prescription on the bag or company directions. The “other” category includes people who fertilize when they feel like or indicate there is no schedule. Table 3 outlines the breakdown of the interviewed resident’s responses categorized as visual or seasonal indicators.

**Table 3: Indicators that the yard needs to be fertilized (n=21)**

	<b>N</b>
Visual indicator (looks bad or change in color)	8
Seasonal indicator (from bag directions or previous habits)	10
Other	3

Visual indicators were reported like signs of stress, grass turning brown, leaves folding up, presence of unwanted weeds, and other visual signs that the lawn appeared unhealthy. Seasonal tendencies varied more, and they are depicted in Table 4 according to when people tend to fertilize the most and the least.

***Seasonal tendencies in fertilization: (see Table 4)***

We found that when deciding if fertilizer is needed, people perceive different visual or seasonal cues. Most interviewed homeowners said that they apply fertilizer during the spring “growing” season. The least number applies fertilizer during the winter, when they perceive grass to be

dormant. Interestingly, an equal number responded that they fertilize most in the summer because grass is growing as the number that fertilize least in the summer because it is too wet. Changing fertilizer behavior in the summer may require two different messages or management practices to reach these two unique segments of the audience.

- Fertilize *Most*
  - Nine respondents report fertilizing most during the springtime because their yard needed a growth “boost” during, what these respondents saw as, the “growing season”.
  - Three respondents report fertilizing most during the summer to increase turf growth or because they understand seasonal rain trends.
- Fertilize *Least*
  - Six respondents report fertilizing least during the winter months because of turf dormancy or a lack of irrigation.
  - Four respondents report fertilizing least during the summertime because of the season’s increase in temperature and natural rainfall.

**Table 4: Seasonal tendencies in fertilization (from homeowner interviews)**

	<b>Season (#)</b>	<b>Why that season?</b>
Fertilize Most (n=12)	Summer (3)	<ul style="list-style-type: none"> <li>• Growing season</li> <li>• When it rains</li> <li>• Needs to grow</li> </ul>
	Spring (9)	<ul style="list-style-type: none"> <li>• Get grass to grow</li> <li>• Growing season</li> <li>• It needs it according to Scotts</li> <li>• Just emerging give a boost</li> <li>• Looks bad</li> <li>• Temp is cooler</li> </ul>
Fertilize Least (n=10)	Winter (6)	<ul style="list-style-type: none"> <li>• Dormant</li> <li>• Irrigation not available</li> <li>• Not growing</li> </ul>
	Summer (4)	<ul style="list-style-type: none"> <li>• Already growing don’t want to cut</li> <li>• Summer heat</li> <li>• Too hot</li> <li>• Too wet</li> </ul>

The important information to take away from these interviews is not a definitive representative conclusion about how all people decide when to fertilize, but an awareness that people differ in what motivates them to apply fertilizer to the lawn. Telephone surveys typically can not collect adequate variation in responses to open ended questions like “Why do you fertilize at that time?”

nor are they the appropriate mode to use for that purpose. Interviews provide a better venue to collect this type of qualitative, open ended information however, it is impossible to extrapolate these interview responses to the population at large. Only representative survey data like those reported in the previous section demonstrate population level evidence.

***Seasonal tendencies in irrigation: (Table 5)***

In addition to asking people about the reasons for fertilizing, we also asked those who change their irrigation timer if there was any seasonal influence associated with their decision to irrigate more or less frequently. We were surprised that the most interviewed homeowners indicated that they irrigated the yard the most in the summer because it is hotter, drier and “more stressful to the lawn.” Their response seems to suggest that if it doesn’t rain, they water more in the summer, but this can’t be concluded from the evidence collected. If they set an automatic irrigation system timer and never change it, it is likely that the frequency they decide is needed at the “most stressful” period of time will be the default amount used throughout the year.

- Irrigate *Most*
  - The majority of person interviewed irrigate most during the summer months. They report that it is a hotter, dryer, and a more stressful time for their lawns.
  - A smaller number (n=7) indicate that they water most during the springtime because there is less rain but a good season to stimulate their lawn’s growth.
  - Five homeowners irrigate most during the winter because less rain makes it a dryer season.
  - Two homeowners irrigate most during the fall because they find it to be the driest time of the year.
  
- Irrigate *Least*
  - Most of the interviewed homeowners (n=24) irrigate least during the winter months. These respondents find that irrigation is less needed due to colder temperatures and turf dormancy. Another reported deterrent to irrigating in the winter is that the homeowner does not want to stand outside with the hose when it is cold.
  - Three interview respondents irrigate least during the summertime because there is so much natural rainfall.

Among interviewed homeowners, we found a difference between the seasonal cues used to trigger the need for fertilizer and the need for irrigation. Although many apply water during the summer because of the heat, they tend to not apply fertilizer during the summer for the same reason, stating things like “too hot” and “too wet.” Another homeowner stated that the grass already grew too fast in the summer and they already cut it too frequently, why would they want to cut it more? These seasonal responses are important in that they provide clues to appropriate educational messaging that will appeal to certain segments of the population.

**Table 5: Seasonal irrigation tendencies (from homeowner interviews)**

	Season (#)	Why that season?
Irrigate Most (n=37)	Summer (20)	<ul style="list-style-type: none"> <li>• Because it is the driest time</li> <li>• Dry , Dryer, Dried up and brown</li> <li>• Grass curls from heat</li> <li>• Growing season</li> <li>• Heat, Hot</li> <li>• Burns yard</li> <li>• Late summer because its dry</li> <li>• Need for water, color</li> </ul>
	Spring (7)	<ul style="list-style-type: none"> <li>• Dry</li> <li>• Lack of rain; Less rain</li> <li>• Spot seeding as needed</li> <li>• To make it grow</li> </ul>
	Winter (5)	<ul style="list-style-type: none"> <li>• Because it is dryer, Dry</li> <li>• Less rain, No rain</li> </ul>
	Fall (2)	<ul style="list-style-type: none"> <li>• Driest time of the year</li> </ul>
Irrigate Least (n=33)	Winter (24)	<ul style="list-style-type: none"> <li>• Cold, less heat</li> <li>• Dead anyway</li> <li>• Doesn't grow; Doesn't need it</li> <li>• Cold; don't want to stand outside</li> <li>• Grass is dormant, not growing</li> <li>• Not needed rainy season</li> </ul>
	Summer (9)	<ul style="list-style-type: none"> <li>• Because of rain</li> <li>• Because of rain freq, seasonal duration change</li> <li>• Cause it is raining</li> <li>• More rain, if its raining, rainy</li> </ul>

Seasonal answers detailed in Table 5 on the following page reflect the variance associated with individuals perceptions of seasons. We did not indicate specific dates, or ask respondents to clarify what “dates” they meant when they mentioned seasons. Understand that with these results, individuals are likely thinking more in terms of “growing” and “dormant” gardening seasons than they are specific dates and times of year. People tended to explain that they irrigate more when it is dry and than select the season based on its tendency for dryness. Again, these qualitative responses are anecdotal and provide a glimpse into individual decision-making processes and are not representative of any population. As such, number of homeowners that

mentioned these seasons is reported instead of percentages to reduce the potential for interpretation at a population level.

In the representative telephone survey of WSA residents, eighty percent of respondents rarely or never change their irrigation timer. Targeting a management practice that asks them to irrigate less frequently would require an understanding of what prompts the small population that is likely to change their timer to do so. The other eighty percent will likely require more active management actions to change or have their landscape company change the irrigation timer. The management action would have to consider the scheduling ability of the timer, as some timers can not be programmed for complicated scheduling variations.

## Audience Segmentation

The survey and interview evidence begins to reveal variations in residential landscape practices that are worthy of further investigation. This research found significant differences in internal and external fertilizer applicators on a number of variables and we continue investigating the differences in these two populations for several reasons. For one reason, differences in the barriers and motivators to behavior change become evident. Another is that the population can be segmented into audiences based on their likelihood to change behavior, ranging from those unlikely to change to those likely to change. Appropriate management practices can be prescribed based on scientific predications. Likewise, longitudinal research and evaluation can more readily show a change in behavior among a targeted population than from the population at large (including those not specifically targeted).

In this section, we characterize residents based on whether fertilizing the lawn is primarily done in-house (internal) or by someone outside the house (external). This is because the decision-making authority and thus motive rationale for how and when fertilizer is applied differs among these two groups of lawn fertilizers. One is a homeowner, applying fertilizer based on their own knowledge, using methods that best suit them, and those they perceive result in greatest benefit at the least trouble. The other is the lawn care professionals, who may be either small or large companies that provide lawn maintenance services. In this study, we focus on the homeowner audience, segmenting them into those who do their own landscaping and like to work in their garden and those that hire a company to maintain and fertilize their landscape. Focusing on yard fertilization as one maintenance activity, we demonstrate that significant differences exist between homeowners who fertilize their own yards (internal) and those who hire outside fertilizer applicators (external) to clarify the likelihood for over-fertilizing and better target management practices.

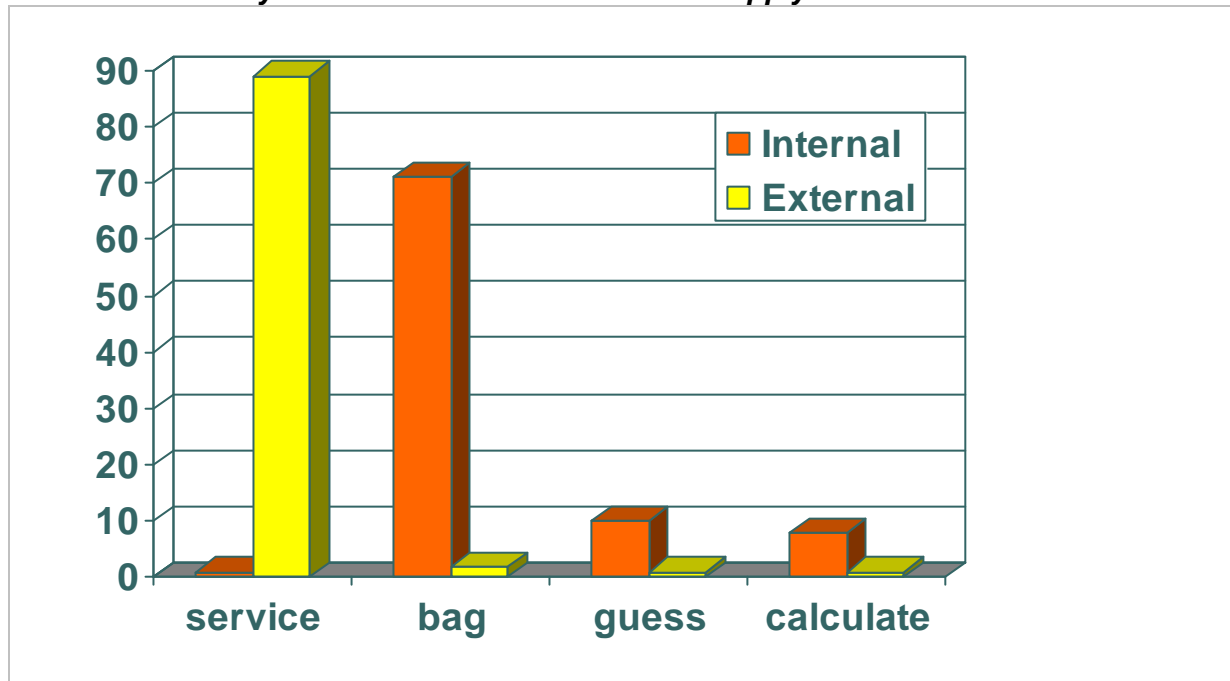
Significance tests were conducted to compare internal vs. external fertilizers using a simple t-test at  $\alpha = 0.05$  (95% confidence). The margin of error associated with the calculated proportions for internal and external fertilizers is  $\pm 5.1\%$  and  $\pm 6.2\%$ , respectively. This means that 95% of the time, when calculated in this fashion, proportions for these groups would be

within +/-5.1% and +/-6.2% of the stated proportion used for the statistical test. In all instances where we indicate “significant differences were found,” the variances fell within these parameters.

### ***Internal and external fertilizers***

Forty-one percent (41%) of the WSA population are external fertilizers that hire a landscape company, have an HOA who maintains their yard, or have some other external assistance with lawn fertilizer application. In general, external fertilizer persons are less in touch with their yard’s landscape maintenance including both fertilization and irrigation. They are more likely to set their yard maintenance into a systematic pattern of watering and fertilization scheduling and then leave it alone. They do not do the majority of their landscaping activities and they tend to fertilize and water on a regular schedule.

**Chart 19: How do you decide how much fertilizer to apply?**



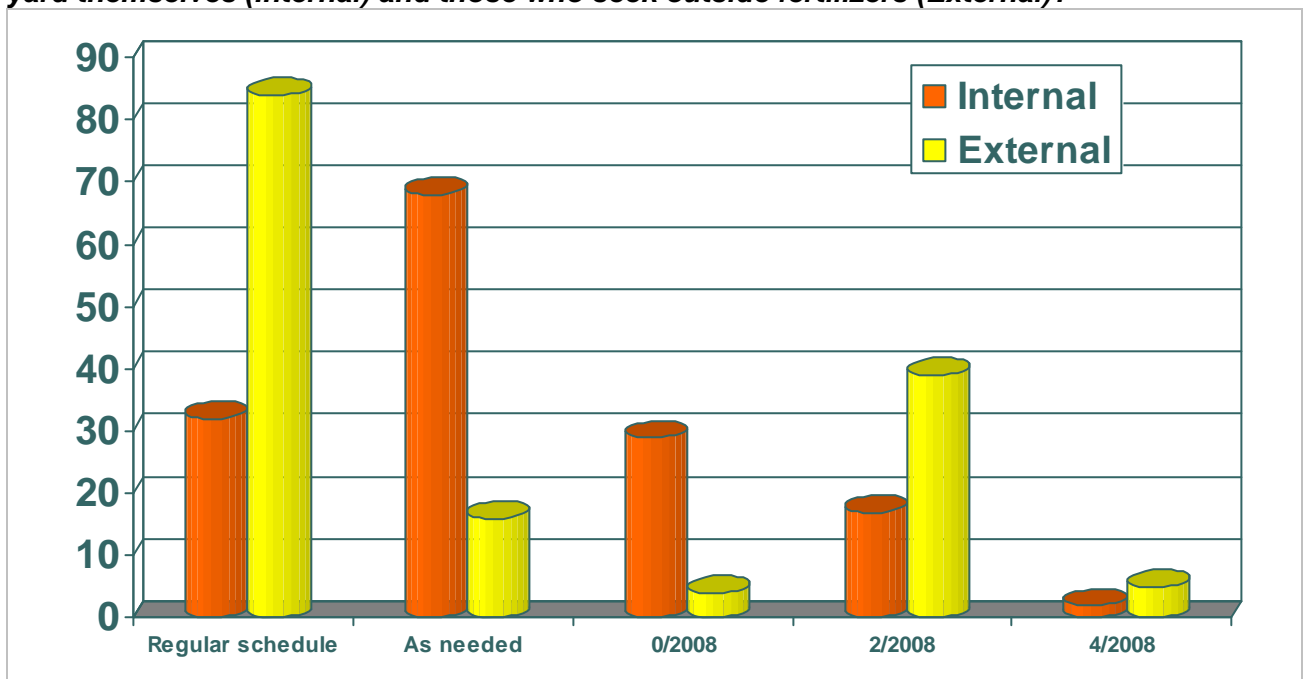
n= 312, 180 (internal, external)

External fertilizers defer to their lawn service when deciding how much fertilizer to apply to the lawn at one application. They are more likely to live in a community with a homeowner’s association, are serviced by sanitary sewer, and do not interact with neighbors when making

landscaping-type decisions. They are more educated, more likely older or retired, female, and have lived in Florida for a shorter length of time. There are significant differences in how external and internal fertilizers maintain their yards.

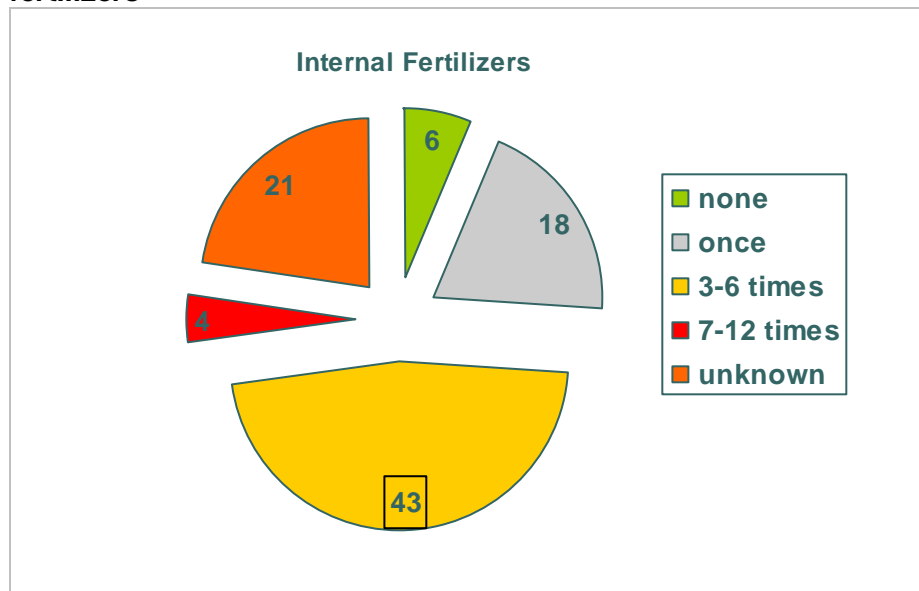
During the first four months of 2008, external fertilizers were much more likely to have applied fertilizer to their lawn two or more times. When asked when fertilizer will be applied again, 47% of external fertilizers say next month, compared to 29% of internal fertilizers. Chart 20 depicts differences in fertilizer application frequencies between internal and external homeowners. Internal fertilizers are more likely to do the majority of their home’s landscaping activities (90%), more likely to apply fertilizer to their lawn only as needed, and more likely to say they had not yet applied fertilizer to their lawn in 2008.

**Chart 20: Frequency of fertilizer application by homeowners who fertilize the yard themselves (Internal) and those who seek outside fertilizers (External)?**



*n=355,208 (internal, external)*

**Chart 21: Annual fertilizer application frequency among internal fertilizers**



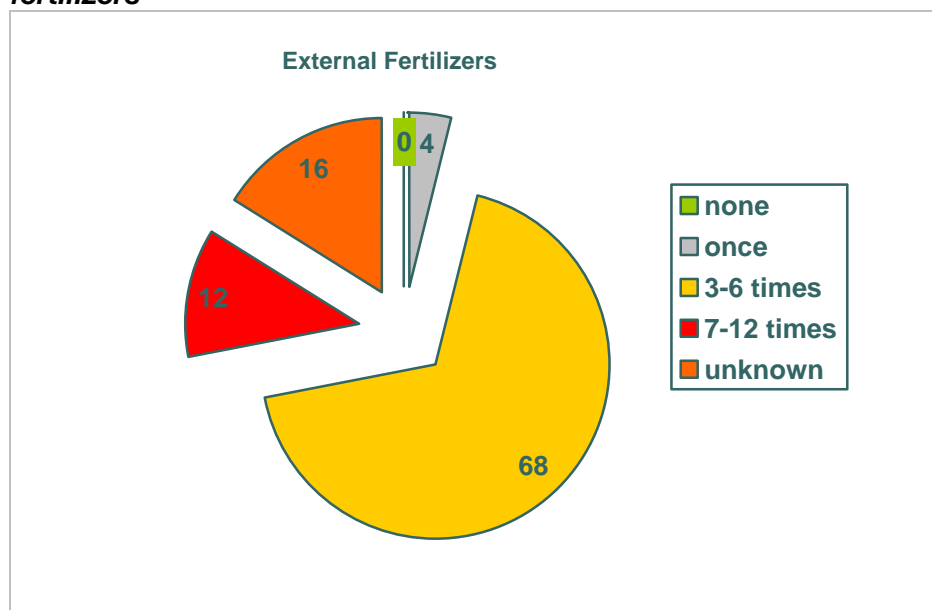
n=350

External fertilizers are more likely to fertilize their lawn 3-6 times or 7-12 times over the past 12 months while internal fertilizers are more likely to say zero times or once. Internal fertilizers are more likely to say they will next fertilize in the fall or whenever it needs it.

Effecting a change in fertilizer frequency will vary between these two segments. Those who only fertilize “as needed” may not fertilize very frequently and thus are likely to seek guidance or reminders when they decide to fertilize. Those who apply on a schedule are likely to be established in a routine that is more challenging to change.

When deciding how much fertilizer to apply to their lawn in a single application, internal

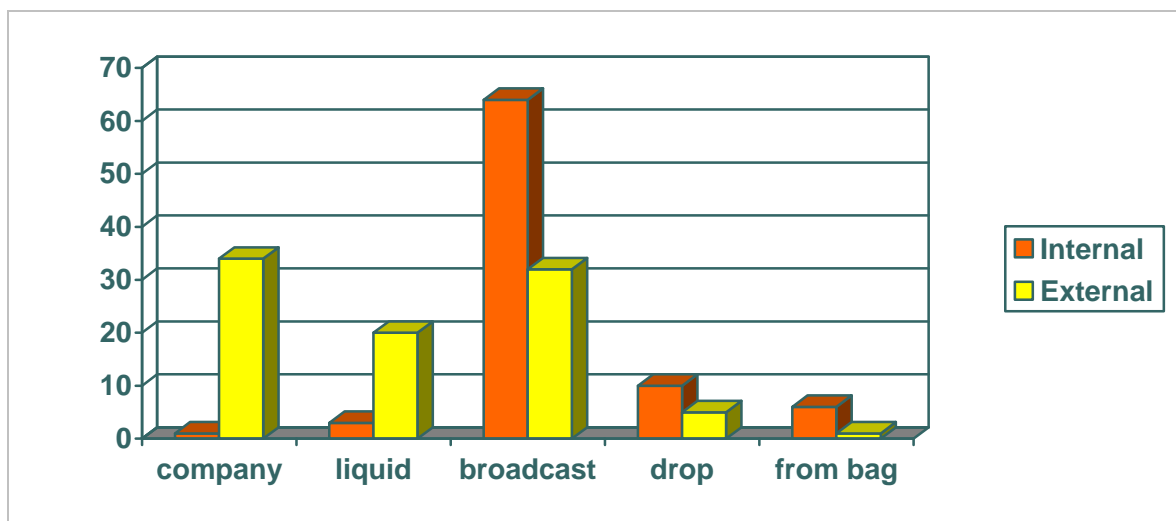
**Chart 22: Annual fertilizer application frequency among external fertilizers**



n=189

fertilizers use a variety of methods. The majority of them (71%) refer to the fertilizer bag directions. The remainder guesses or estimates the amount (10%), calculates the correct application according to lawn size and turf grass needs (8%), or uses the same as the previous year (4%). Internal fertilizers are more likely to apply lawn fertilizer with a push action broadcast spreader, a push action drop spreader, or by pouring directly from the bag onto lawn. External fertilizers say the landscape company does it and that they typically apply liquid fertilizer with a hose or use a broadcast spreader for dry fertilizer.

**Chart 23: Fertilization methods among internal and external fertilizers.**

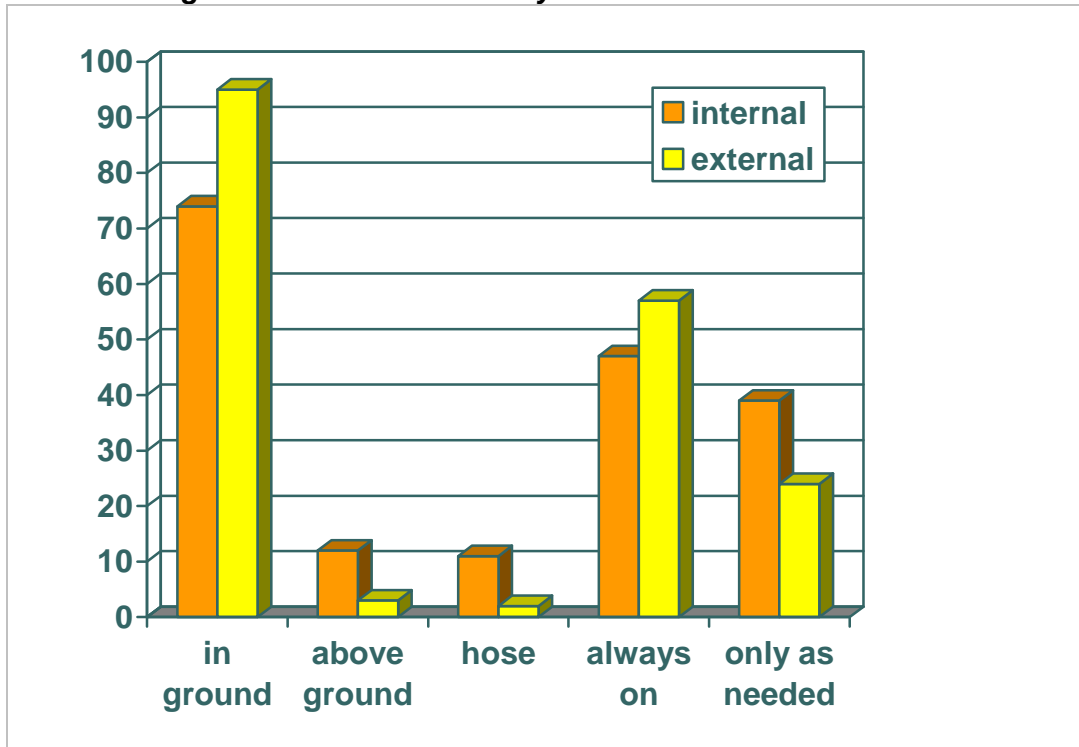


*n* = 327,167 (internal, external)

There are also significant differences in the ways that internal and external fertilizers irrigate the yard. For example, ninety-five percent (95%) of external fertilizers use an in-ground, automatic irrigation system as their primary method for lawn watering—compared to seventy-four percent (74%) of internal fertilizers. Internal fertilizers are more likely to set an above ground sprinkler out by hand or hand water using a hose. When asked how they use their sprinkler system, more than half (57%) of external fertilizers report that they always leave it on automatic, compared to 47% of internal fertilizers.

Thirty-nine percent (39%) of internal fertilizers say they turn the sprinkler system on manually as needed, compared to 24% of external fertilizers. External fertilizers are more likely to report having a rain sensor on their irrigation system and are more likely to say their irrigation system is maintained by a professional service.

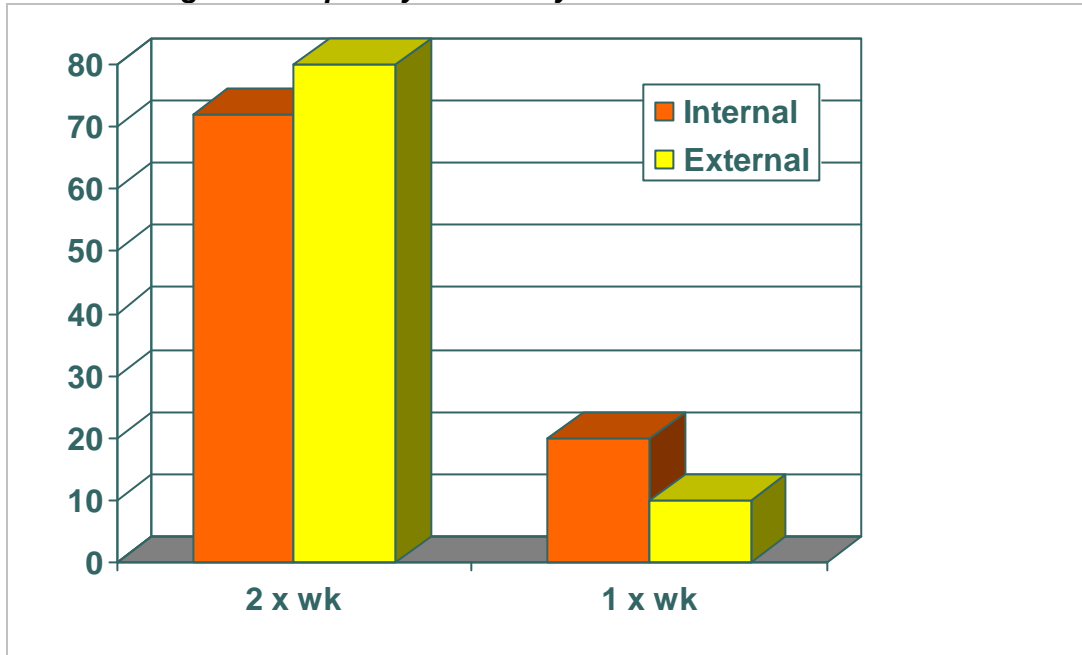
**Chart 24: Irrigation methods divided by internal and external fertilizers**



*n=346,235 (internal, external)*

Eighty percent (80%) of external fertilizers irrigate twice a week compared to seventy-two (72%) of internal fertilizers (Chart 25). In contrast, twenty percent (20%) of internal fertilizers report watering their lawn once per week, compared to 10% of external fertilizers. Among those who feel that lawn color changes indicate the need to change something about their landscaping maintenance procedures, internal fertilizers say they would add water while external fertilizers are more likely to contact the landscape company.

**Chart 25: Irrigation frequency divided by internal and external fertilizers**



*n=317,230 (internal, external)*

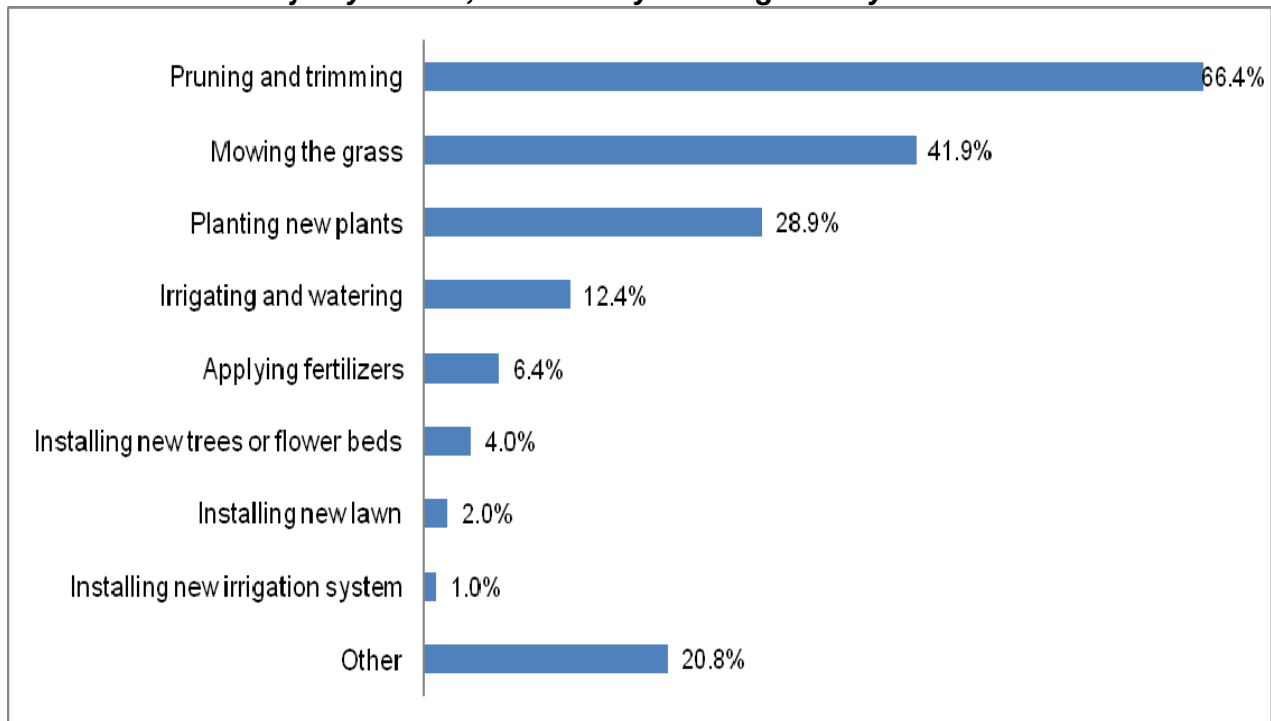
Significant differences were discovered in the attitudes and values of internal and external fertilizers. In general, internal fertilizers are less concerned with the public perception of their lawn/landscape. For example, they are OK with their grass turning a bit brown in the winter, they don't worry about what others think about their yard, they don't feel strongly that a lawn should be of a single type of grass, and they don't feel as strongly that their landscape is important to the community as external fertilizers.

Based on the representative telephone survey data of WSA residents, external fertilizers are more likely to agree strongly with the statement "a home's landscape is important to the community" and are more likely to agree with the statement "it is important to me what the neighbors think about my yard." This indicates a strong social conformity influence among this population. Although concerned about their landscaping, external fertilizers spend little time working in their yard.

Twenty-five percent (25%) of external fertilizers didn't work in their yard at all and among those who did, only 2% worked in the yard 20-29 days during the month compared to 7% of internal fertilizers (Chart 26). Respondents spent an average of 6.3 days working in the yard, ranging

from one day or less (26%) to 29 days or more (4%). About half of the respondents (47%) spent four days or less working in the garden or lawn over the past month. The largest number of homeowners (66%) indicated they were pruning and trimming, followed by the second most popular landscaping activity, mowing the lawn (42%). This survey was conducted prior to regular rainfall occurring and lawns were not growing as quickly as they do in the summer. We would expect the frequency of these activities to change throughout the year.

**Chart 26: For the majority of time, what were you doing in the yard?**



n = 550

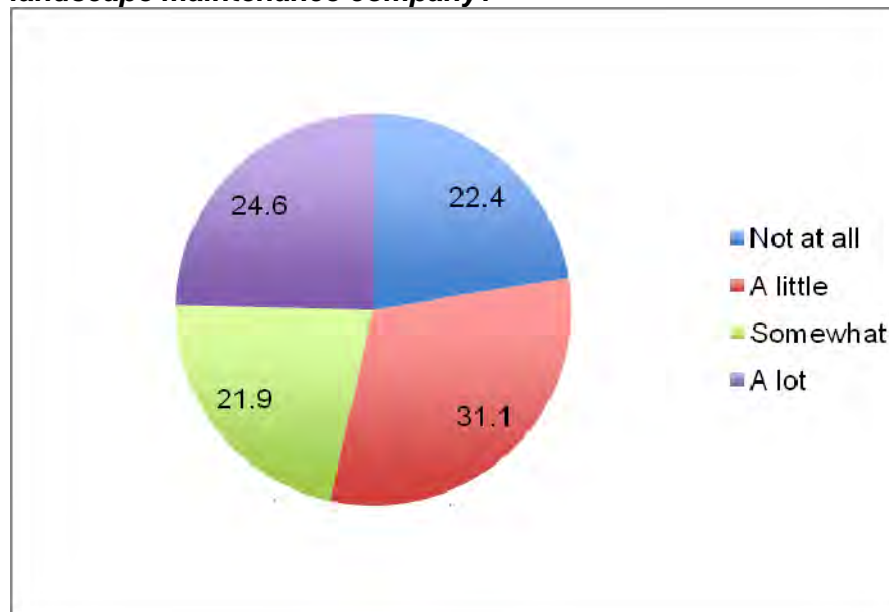
The ability and desire to work in the yard is an interesting area for further investigation. We suspect there are “gardeners” and “landscape maintainers” and are trying to understand which of these homeowner types should be first targeted with lawn care best management practices. In this study, we assume that if a person fertilizes their own yard they are likely to be a “gardener” type while one that hires most of their landscaping out, including the fertilizing activities, would tend to be the type to put their landscape on auto-pilot and rely on someone else to maintain it. This may be an erroneous assumption. It may be the case that the yard consists for a garden and a lawn, each area maintained separately. The person or persons making the decisions about lawn health, maintenance requirements, fertilizer formulas, application rates and amounts are the

ones that should be targeted with an appropriate management practice. The challenge is to select who they are, where they live, how to reach them, and what the management action should be.

### ***Fertilizer companies***

External fertilizers depend on someone else to make their landscaping decisions. Homeowners were interviewed to better understand how they interact with their landscaping and fertilizing companies. People who hired outside companies to apply fertilizers and pesticides to their yards did not know much about what was being applied. Although they tended to know the frequency that fertilizer was applied, since they paid a bill contingent upon visitation, few homeowners knew what the fertilizer contained.

**Chart 27: To what extent do you direct the practices of the landscape maintenance company?**



n=183

To clarify, homeowners were asked to contact a new fertilizer company to request assistance. A series of questions was asked to six local fertilizer companies in an attempt to understand the type of information a typical homeowner would receive if they contacted a fertilizer company to request new service. Generally, fertilizer companies did not share specific content information about what they would be applying to the lawn.

Without even visiting the yard, some companies demonstrated hard selling techniques of a full-service package that included insect treatment, lawn fertilizer, and tree and shrub fertilizer

application six to twelve times a year. Others did visit the house before making recommendations. When asked for specific information about the content, the homeowner was told that the person who applied it would tell them, that it changed throughout the year, or that it could consist of both liquid and granular materials. Only one company called back to provide an exact fertilizer formula (24-2-11). Another company representative explained that the homeowner “need not worry, there is no phosphorous in it.” Generally, companies were hesitant to share the content of the fertilizers, herbicides, and pesticides used during the sales call.

### *Homeowners associations*

A majority of Wekiva Survey Area residents (68%) live in communities managed by a Homeowner’s Association (HOA). Although few of these HOAs (3%) are responsible for maintaining the landscapes themselves, the rules and covenants they enforce are a strong influence on homeowner behaviors (Martin et al 2002). We examined thirty-one (31) different HOA covenants and deed restriction documents that affect landscaping design and maintenance criteria for residential lots within the Wekiva Survey Area.

Using the recommended model of conservation restrictive covenants language created by the University of Florida’s Conservation Clinic and the Levin College of Law, the research team compared the existing HOA language along qualitative and quantitative measures. The presence or absence of key covenant sections and specific language content from eighteen randomly selected covenants is presented in Table 6. Variables compared include whether the HOA requires general maintenance, that landscape changes be approved by an Architectural Review Board (ARB), whether specific sod, tree or shrub types are required, approval to remove trees or plants is required, or whether a central irrigation system is required. Table 6 includes the name of the subdivision, the year the covenants were recorded ranging from 1979 to 2003 (if provided), and the jurisdiction in which the subdivision resides. The columns indicate the key language specifications appropriate to landscaping and turf grass maintenance as recommended by the UF language. The results of this research indicate that most HOAs have general maintenance requirements and have an Architectural Review Board (ARB). Few have a sod requirement, require specific types of vegetation, or state anything about the irrigation system. Understandably, many of these subdivisions were built prior to the model language coming out.

**Table 6: Wekiva fertilizer study covenants and deed restriction comparison**

	Require General Maintenance	ARB Review	Specific Grass Required	Percent Sod Required	Trees and Shrubs Required	Tree Removal Permit	Irrigation System Required
<b>The Palms (1983), Orange</b>	Yes	Yes	Not stated	All sides of lot	Must have shrubs on front and side yards	Not stated	Not stated
<b>Bent Oaks (1979), Orange</b>	Yes	Yes	Not stated	All sides of lot	Not stated	Not stated	Not stated
<b>Wekiva Ridge Oaks (2001), Orange</b>	Yes	Yes	St. Augustine Floratam and Bahia	Not stated	3 trees required in front ; list of trees provided	Prohibited tree list included	100% coverage of all open areas
<b>Surrey Park (1990), Apopka</b>	Yes	Yes	No artificial sod or plants	Not stated	Local municipality rules	Not stated	Not stated
<b>Piedmont Park (1988), Apopka</b>	Yes	Yes	"Long lived" ground cover, sod, shrubs, & trees	Not stated	Not stated	Remove dead and dying trees	Not stated
<b>Stonewood Reserve (2005), Apopka</b>	Yes	Yes	Not stated	Not stated	Not stated	Trees > 8" diameter must be replaced	Not stated
<b>Sheeler Oaks (1983), Apopka</b>	Yes/no-conflicted wording	Yes	Preserve value and harmony among structures and vegetation	Not stated	Not stated	Not stated	Not stated
<b>Wekiva Hunt Club (1984), Orange/ Seminole</b>	Yes	Yes	Bahia, St. Augustine or Bermuda- no higher than 6"	50% covered in turf grass	Trimming and size limits required	ARB approval	Not stated
<b>Wekiva Preserve, Apopka</b>	Yes	Yes	Not stated	Not stated	Not stated	ARB & City of Apopka	Not stated
<b>Sweetwater Country Club (1982), Orange</b>	Yes	Yes	St. Augustine	All sides of lot	Not stated	Not stated	Not stated
<b>Wekiva Run (2002), Apopka</b>	Yes	Yes	Not stated	Not stated	Not stated	Not stated	Not stated
<b>Country Landing, Orange</b>	Yes	Yes	Not stated	Not stated	Not stated	Not stated	Not stated
<b>Carol Woods, Orange</b>	Yes	Yes	Not stated	Not stated	Not stated	Not stated	Not stated
<b>Wekiva Ridge Oaks (2001), Orange</b>	Yes	Yes	St. Augustine, Floratam, and Bahia	Not stated	3 planted trees; 5 species preferred, 4 prohibited	ARB approval	Must provide 100% coverage
<b>Wekiva Cove (1993), Seminole</b>	Yes	Yes	Not stated	Not stated	Not stated	ARB approval	Not stated
<b>Sunset View, Orange</b>	Yes	Yes	Not stated	All sides of lot	At least 2 trees	Not stated	Not stated
<b>Misty Woods, Orange</b>	Yes	Yes	Not stated	Not stated	Not stated	ARB approval	Not stated
<b>Heather Glen, Orange</b>	Yes	Yes	Not stated	Not stated	Not stated	ARB approval	Not stated

A more detailed quantitative analysis was completed to measure the extent that existing HOA covenants overlap with the UF/Conservation Clinic and Levin College Model Language. The analysis required that the UF Conservation Covenant model language be organized into twenty-two different indicators associated with specific language points. These were scored according to the number of different attributes contained within the statement and a weight was applied as a subjective measure of the importance of that particular attribute to fertilizer practices. Each covenant was graded by seeking each of the twenty two prescribed indicators and rating them from 1-10 based on how relevant the covenant language met the model language criteria. For each question, the number rated was multiplied by the scaled factor and then summed across all questions for each subdivision to give a total percentage that the existing covenant language overlaps with the conservation language model. The research demonstrates that there is little overlap between the existing covenants in the Wekiva Survey Area and the UF model conservation covenant language.

The Wekiva Survey Area HOA covenants with the greatest similarity overlapped the model language by about 11% and the least overlap was 2.2% between existing homeowner's association covenant language and the UF Conservation Clinic model covenant language. Table 7 on the following page details the outcomes of this analysis, with the name of the subdivision listed in the left column and the scoring that they received on each of twenty-two indicators across the top. More details of the indicators and how they were evaluated are included in Appendix C.

**Table 7: Homeowners association covenant language overlap analysis**

Subdivision Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total Overlap (% Similar to Model)	
Factor	2.5	1.1	2.2	2.2	2.2	2.4	7.2	2.4	7.2	3.6	2.5	2.5	2.5	2.5	1.4	1.2	1.8	3.6	5.1	3.6	3.6	2.5		
Sheeler Oaks	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Deer Lake Run	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
The Oaks of Wekiva	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Terra Oaks	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Votaw Manor	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Riverside Cove	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Country Landing	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Brook Hollow	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Pines of Wekiva	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Errol Estates	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Northwoods	0	2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10.9
Autumn Chase	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Wekiva Club Estates	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
The Palms	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Fisherman Paradise	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Forest Lakes	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Teawood Cove	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Liberty Heights	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9.8
Rose Bay	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.4
Bear Lake	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	8.7
Sable Point	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.3
Sweet Water	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3.6
Emerald Cove	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3.6
Peidmont Park	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3.6
Arrow Estates	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3.6
Oaks of Wekiva	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2.5
Willow Creek	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2.5
Piedmont Lakes	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2.5
Woodsea Oaks	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2.5
Sweetwater Ctry Club	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2
Crow S Ranch	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2

Since this research was conducted, a revised “Florida Friendly Guidance Models for Ordinances, Covenants, and Restrictions” document was released. This manual, a joint Florida-Friendly Landscape document from FDEP and the University of Florida, contains two ordinance models addressing nonpoint sources of pollution from landscapes, one of which is more comprehensive and includes water conservation and other issues, and one of which only addresses fertilizer application. Both are reflective of the findings of the 2007 Consumer Fertilizer Task Force. In addition, model Covenants, Conditions and Restrictions, prepared by the UF College of Law for the Florida Friendly Landscape program, are included to provide guidance for private developers, homeowners associations, and others. The document can be downloaded from <http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf>.

## Conclusion

One of the primary reasons for this research is to examine the assumptions of the Phase I Wekiva Research Report to determine whether they differ from representative residential fertilizer and irrigation self-reported behaviors. Findings from this Phase II research suggest that the assumptions used in Phase I to calculate the amount of residential fertilizer may be underestimating the actual contribution.

The Phase I report by MACTEC estimated residential fertilizer nitrogen loads based on assumptions that 25% of residents are not fertilizing, 50% are using the recommended application rates, and 25% are overfertilizing. Our data show that eighty-four percent (84%) of Wekiva residents apply fertilizer to their lawn, which is higher than the Phase I estimated 75%. The percentages of persons who apply according to recommended rates and who overfertilize are confounded by several factors. One is that only the homeowners who fertilize the yard themselves (59%) know what and how much fertilizer is being applied. Those who hire a company do not appear to know what is being applied to their lawn. Of the internal fertilizers, nearly three-quarters follow the bag directions when deciding when and how to fertilize, making up approximately 33% of residents. So this study can address the first assumption and part of the second, but not the third unless information from the lawn care services clarifies application rates.

- Phase I assumption: 25% of residents are not fertilizing - Actual: 16% are not fertilizing
- Phase I assumption: 50% are using the recommended application rates - Actual: 55% of residents reported applying fertilizer according to store recommendations (1%), bag directions (45%); Expert Advice (2%) or they calculate the correct amount according to lawn size (6%).
- Phase I assumption: 25% are overfertilizing – Actual – Hard to conclude based solely on self-reported homeowner data, as 41% of homeowners do not apply fertilizer themselves. More information on this is provided in the following paragraphs.
- Phase I assumption: Use of reclaimed water for irrigation is assumed to replace/reduce fertilizer use – Actual: Residents irrigated by reclaimed water have the second highest annual fertilization frequency (4.56 times/year).

We used average responses from internal fertilizers to estimate the amount of nitrogen applied per year per 1000 square feet of turf grass. Internal homeowners apply an average of 1.22 bags of fertilizer per application, containing an average of 19% nitrogen. The average size of the bag typically purchased is 22.82 lbs, indicating that about 28 pound of fertilizer (5.32 lbs of nitrogen) is applied per application. Considering that average reported landscaped lot size is 11,118 sq ft, internal fertilizers apply an estimated 0.48 pounds of nitrogen/1000 sq ft three times per year. The string of assumptions makes this calculation highly suspect and is only pertinent to homeowners who apply fertilizer themselves and remember what they apply. There are other groups of homeowners for which calculating rate and amount would be impossible.

About half of Wekiva homeowners apply fertilizer only as needed and we are unsure exactly how frequently they determine it is needed. We do know that those who fertilize only as needed were less likely to have fertilized during the first four months of 2008 and are less likely to know how many times a year they fertilize. This may indicate that “as needed” is infrequently and may be less than the average. From our interviews, homeowners determine fertilizer is needed based on seasonal and visual evidence.

Furthermore, an accurate calculation of fertilizer can not be made due to the missing data associated with the external fertilizers. Forty-one percent of Wekiva Survey Area yards are fertilized by a lawn fertilizer company. We have little understanding of what these companies are applying to yards with each visit. Although homeowners who hired a company were more likely to know their fertilizer schedule, they were less likely to know what was applied and how much was put down at one time. Follow-up interviews confirmed that fertilizer company technicians typically do not tell homeowners the content of the fertilizer during the sales call.

The IFAS recommended application rates for St. Augustine grass is ½ lb of Nitrogen per 1,000 square feet 2-5 times per year (Table 7). In the past, it was customary to recommend the application of 1 pound of actual nitrogen per 1000 square feet of turfgrass. In light of potential environmental concerns it is now recommended that no more than one half (0.5) pound of the nitrogen in the application be in the soluble form. Our calculation demonstrates that internal homeowners are applying fertilizer according to IFAS recommendations.

**Table 7: Recommended fertility rates for St. Augustine grass in Central Florida**

Location					N Fertility Guideline <sub>1</sub>						
Central Florida					2-5						
Maintenance Level <sub>2</sub>	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov
Basic			C				Fe		C		
Moderate			C		SRN		Fe	SRN	C	C	
High		C		N	SRN		Fe	SRN		C	

C=complete fertilizer application (NPK); N=nitrogen application only; SRN=nitrogen only in a slow-release form; Fe=iron application only.

1. Fact Sheet ENH5, a series of the Environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. First published: May, 1991. Revised: October, 2000; June, 2006. Downloaded from EDIS website at <http://edis.ifas.ufl.edu>.

2. L.E. Trenholm, Associate Professor, Turfgrass Specialist, Department of Environmental Horticulture, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL 32611, J.B. Unruh, Associate Professor, Turfgrass Specialist, West Florida Research and Education Center, Institute of Food and Agricultural Sciences, Jay, FL 32565, and J.L. Cisar, Professor, Turfgrass Specialist, Ft. Lauderdale Research and Education Center, Institute of Food and Agricultural Sciences, University of Florida, Ft. Lauderdale, FL 33314.

Another area of investigation was the extent that homeowners whose yards are irrigated with reclaimed water are applying fertilizers. The Phase I report suggests that “Use of reclaimed water for irrigation is assumed to replace/reduce fertilizer use.” Our self-reported data indicate that this is not the case and that people who reported having reclaimed water for irrigation on average applied fertilizer more than those not irrigated with reclaimed (4.56 times/year vs. 3.72 times/year). A breakdown of average annual fertilization frequency by homeowner group is presented in Table 8.

Population Segment	Average Annual Fertilizer Application Rate	(n)
All (Overall average)	3.53	(525)
Internal fertilizers	2.88	(341)
External fertilizers	4.76	(183)
Homes using reclaimed water	4.56	(50)

This report provides a great deal of information about residential landscaping practices, opinions, and attitudes. We found significant differences in populations of homeowners that are motivated differently. We found that homeowners associations can influence landscaping norms through covenant requirements and that landscaping companies become the arbiters of landscape compliance, insuring lawns will meet the prescribed community expectations. Persons who rely on landscaping companies have less knowledge of what is applied and are less likely to be involved in yard work of any kind, putting their home's landscape on "autopilot." Persons who apply fertilizer themselves are more like the gardener type who can be influenced to change their yard practices.

This information should be utilized to better target appropriate management actions, design appropriate messages, and extend the body of knowledge about the impacts that fertilization practices have on the Wekiva River Basin. There are many things to consider when deciding to invest in an management practice, and this report clarifies existing practices and illuminates potential barriers and motivators to changing behavior. We demonstrate significant differences existing between fertilizing populations that may require different types of management practices. In the next section of the report, some general recommendations for further investigation are presented based on the evidence in this research report.

## Recommendations

- Management practices may target homeowner audiences based on whether they are the type to set their yard on autopilot and let someone else deal with it or whether they prefer to take care of the yard themselves. These two audiences require different management practices, the former may be managed through covenants, conditions, or restrictions, while the latter may be motivated through education or other beneficial incentives. Further investigation should examine how and why people decide that the lawn “needs” fertilizer. There are likely differences in what motivates internal and external fertilizers to apply fertilizer to their lawn.
- Encourage the adoption of the conservation clinic covenant language among homeowners associations in the Wekiva area. Target homeowners associations with information about sustainable landscape design and recommended fertilizer rates. Recognize that barriers to adoption may exist, such as fears of property devaluation, uncertainty of community acceptance, and neighborhood market resale. Presenting them with designs, images, evidence of cost savings, and resale values may help convince those most challenged by this change. Remind them that the state encourages more sustainable landscape practices and reinforces the language suggested by the model covenant. The revised “Florida Friendly Guidance Models for Ordinances, Covenants, and Restrictions” document can be downloaded from <http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/ffl-mo-ccr-1-09.pdf>.
- Target management practices in the neighborhoods that receive reclaimed water for irrigation. First, confirm that yards irrigated with reclaimed water do not need fertilizer. If proven to be the case, this provides a positive message and motivator for eliminating fertilizer use among this population. Mapping fertilizer frequency and reclaimed water use can help illustrate neighborhoods to target with this management practice.
- Target management practices to homeowners who apply their own fertilizer (internal). First identify them by their locations and numbers. Use their own words such as “it’s resting,” and “why make it grow even faster” as pertinent reasons for recommending the most suitable

fertilizer application time that will reduce runoff. Map internal fertilizers and target the neighborhoods or perhaps the civic groups in proximity to populations of internal fertilizers.

- Encourage homeowners who rely on external assistance to save money by reducing the visits from their fertilizer company. Encourage them to ask their fertilizer company to provide a written statement explaining what they are applying and when. Consumers demand to know what is done to their car at maintenance time, and this level of follow-up should be encouraged from their landscape maintenance company as well. Use money savings as an incentive, perhaps asking if they know what they are paying for (what are they getting for that) and what they are paying with (Wekiva impacts). Another avenue would be to encourage fertilizer companies to disclose the amount of nitrogen applied per application.
  
- Encourage more sustainable landscape designs. Continue to research resource efficient plant materials and turf grasses that require little fertilizer and water inputs. Demonstrate resource efficient (Florida-Friendly) landscape designs and encourage their adoption among the most motivated gardener audiences as well as new developers. Homeowners who purchase a house with an existing landscape and maintain the landscape on autopilot are going to be the most challenging audience to change. They are unlikely to install a new landscape design unless something goes drastically wrong with the old one and they are unlikely to change their habit of “hands-off” maintenance.

# Appendix A

## Telephone Survey Topline Report

Wekiva Survey Topline Report  
Telephone Survey Completed April 18 – May 7, 2008

Q1a: Have we reached a home or business?	(n=740)
	<u>%</u>
Home	100.0
Q1b: We are seeking people who live in a single family house, do you live in a house or an apartment?	(n=740)
	<u>%</u>
House	100.0
Q2: About how long have you lived in the house you are currently living in? (Raw Data)	(n=738)
	%
1	3.3
2	4.1
3	6.5
4	3.7
5	8.8
6	5.3
7	4.1
8	7.0
9	2.6
10	8.0
11	1.6
12	4.3
13	2.4
14	2.3
15	3.1
16	2.6
17	1.2
18	2.4
19	1.4
20	6.0
21	1.2
22	1.5
23	0.5
24	0.8
25	2.6
26	0.9
27	0.4
28	0.4
29	0.3
30	3.7

31	0.8
32	0.4
33	0.1
34	0.3
35	0.7
36	0.1
37	0.3
38	0.4
39	0.3
40	0.5
41	0.1
42	0.1
43	0.3
44	0.1
45	0.4
46	0.3
47	0.3
50	0.5
51	0.7
58	0.1
60	0.1

Q2\_recode: About how long have you lived in the house you are currently living in? (Categorical Recode)

	(n=738)
	<u>%</u>
Less than 5 years	17.5
5 to less than 10 years	27.8
10 to less than 15 years	18.7
15 to less than 20 years	10.7
20 years or longer	25.3

Q3\_coded: What is the name of the subdivision that you live in? (Coded)

	(n=214)
	<u>%</u>
Arbor Ridge	0.5
Arrow Estates	1.4
Arrow Place Circle	0.5
Audobon Village	0.9
Autumn Chase	0.5
Bear Lake	0.9
Bear Lake Manor	0.5
Bear Lake Woods	0.9
Belair Hills	1.4
Bent Oak	1.9

Bentley Woods	0.5
Bit Mount Lakes Development	0.5
Breezy Heights	0.9
Brook Hollow	0.9
Buckingham	0.5
Camp Woods Common	0.5
Carol Woods	0.5
Chelsea Park	0.9
Citrus Cove	0.5
Cobblefield	0.9
Cotaw Village	0.5
Country Address	0.9
Country Crossing	0.9
Country Landing	0.5
Country Side Hights	0.5
Crow S Ranch	0.5
Deer Lake	0.5
Deer Lake Run	0.9
Dicks Landing	0.5
Dove Hill	0.5
Dumbridge	0.5
Earl Estate	0.5
Emerald Cove	0.5
Errol Estates	3.3
Fisherman's Paradise	0.5
Forest Lakes	0.5
Forest Park Estates	0.5
Forrest Trail	0.5
Forrest brook	0.5
Foxboro Farms	0.9
Gunner's Point	0.5
Holly Brook Homes	0.5
Lake Doe Estates	0.5
Lake Hammer	0.5
Lake Harriet	0.5
Lake Harriet Estates	0.5
Lake Jewel Heights	0.5
Lake Jewels Estates	0.5
Lake McCoy Oaks	0.5
Lawn Lake	0.5
Liberty Heights	0.5
Lynwood	0.9
Magnolia Estates	0.5
Magnolia Hills	0.5
McCormick Woods	0.5

North Crest	1.4
Northwoods	0.5
Oak Hills	0.5
The Oaks of Wekiva	1.4
Palm Parks	0.5
Palmetto Red Circle	0.5
The Palms	2.8
Paradise Point	0.5
Park Side at Arrow Estate	0.5
Piedmont Park	0.9
Piedmont Lakes	0.9
Pines of Wekiva	1.4
Riverside	0.5
Riverside Acres	0.9
Riverside Cove	0.5
Riverside Park Estates	0.9
Rolling Rocks	0.5
Rose Bay	1.4
Rosepoint	0.5
Royal Oak Estates	0.9
Sable Point	2.3
Shady Grove	0.5
Sheeler Oaks	2.3
Spring Ridge	0.5
Stockbridge	0.5
Stoney Wood	0.5
Sweet Water	3.3
Sweetwater Country Club	3.3
Sweet Water Island	0.5
Sweet Water Oaks	5.6
Sweet Water Rocks	0.5
Teawood Cove	0.9
Terra Oaks	1.4
Terrel Estates	0.5
Tuckaway Terrace	0.5
Villa Brantley	0.5
Vista Hill	0.5
Votaw Manor	0.5
Wekiva Woods	0.5
Wekiva	7.5
Wekiva Club	0.5
Wekiva Club Estates	0.9
Wekiva Cove	0.9
Wekiva Estates	0.9
Wekiva Hills	1.9

Wekiva Hunt Club	0.9
Wekiva Landing	0.5
Wekiva Manor	0.5
Wekiva Preserve	0.5
Wekiva Ridge Oaks	0.5
Wekiva Run	0.9
Wekiva Springs	0.5
Wekiva Springs Reserves	0.5
Wekiva Terrace	0.9
Westlake	0.9
Willow Creek	0.5
Willow Springs	0.5

Q4: Do you have a Homeowner's Association in your community?	(n=732)
	<u>%</u>
Y	68.3
N	31.7

Q5: How frequently do you interact with your Homeowner's Association? (Among those who report having an HOA in Q4)	(n=496)
	<u>%</u>
Never	22.0
Seldom	50.8
Often	12.3
Regularly	14.9

Q6: Has your HOA changed any landscaping rules recently? (Among those who report having an HOA in Q4)	(n=444)
	<u>%</u>
Y	5.9
N	94.1

Q7: Do you have central sewer service at your house or do you have a septic tank?	(n=729)
	<u>%</u>
Y	61.5
N	38.5

Q8: What is the square footage of your house? (Raw Data)	(n=636)
	<u>%</u>
200	0.3
600	0.2

700	0.5
800	0.2
850	0.3
888	0.3
900	0.5
910	0.2
980	0.2
1000	0.8
1070	0.2
1100	1.1
1148	0.2
1186	0.2
1190	0.2
1200	3.6
1238	0.2
1250	0.5
1300	2.0
1308	0.2
1350	0.3
1400	1.6
1438	0.2
1440	0.2
1500	5.7
1546	0.2
1550	0.2
1560	0.3
1600	3.1
1610	0.2
1650	0.3
1660	0.2
1665	0.3
1700	3.3
1722	0.2
1727	0.2
1750	0.6
1765	0.2
1780	0.2
1785	0.2
1800	7.4
1836	0.2
1850	0.6
1875	0.2
1900	2.7
1915	0.2
1937	0.2

1950	0.6
1979	0.2
1992	0.2
1999	0.2
2000	10.4
2016	0.2
2100	4.1
2150	0.2
2200	6.8
2203	0.2
2250	0.2
2268	0.2
2270	0.2
2300	4.7
2305	0.2
2340	0.2
2350	0.2
2398	0.2
2400	4.9
2425	0.2
2500	4.1
2510	0.2
2600	2.7
2650	0.2
2700	1.4
2800	2.8
2843	0.2
2900	0.5
2930	0.2
3000	5.8
3100	1.1
3200	0.5
3300	1.1
3400	0.3
3500	1.7
3542	0.2
3557	0.2
3600	0.2
3700	0.5
4000	1.1
4200	0.3
4237	0.2
4500	0.2
4700	0.2
5200	0.3

5300	0.2
5400	0.2
6000	0.2

Q8_rc: What is the square footage of your house? (Categorical Recode)	(n=636)
	<u>%</u>
Less than 1000 sqft	2.5
1000 to less than 1500 sqft	11.2
1500 to less than 2000 sqft	27.5
2000 to less than 2500 sqft	32.5
2500 to less than 3000 sqft	12.1
3000 sqft or larger	14.2

Q9: What is the size of the lot that your house sits on? (Raw Data in SQFT)	(n=181)
	<u>%</u>
1312	0.6
1400	0.6
3750	0.6
4000	0.6
4800	0.6
5000	0.6
5445	1.1
5500	0.6
5950	0.6
6000	1.1
6500	0.6
7500	2.8
7800	0.6
8000	0.6
8250	0.6
8775	0.6
9000	1.7
9375	0.6
10000	0.6
10800	0.6
10890	32.6
12000	1.1
14400	0.6
14520	8.3
18000	0.6
19040	0.6
21780	10.5
21875	0.6
22500	0.6
25200	0.6

26136	1.1
27000	0.6
29040	0.6
32670	3.9
39449	1.1
39451	7.2
43560	8.3
47916	1.1
65340	1.7
76275	0.6
87120	2.8

Q9_rc: What is the size of the lot that your house sits on? (Categorical Recode)	(n=181)
	<u>%</u>
Less than 5,000 sqft	2.8
5,000 to less than 10,000 sqft	11.6
10,000 to less than 15,000 sqft	43.6
15,000 to less than 20,000 sqft	1.1
20,000 to less than 25,000 sqft	11.6
25,000 to less than 30,000 sqft	2.8
30,000 sqft or larger	26.5

Q10: About what percentage of your home's landscape is lawn?	(n=684)
	<u>%</u>
0	0.6
1	0.1
2	0.6
5	0.7
8	0.1
10	1.8
12	0.3
15	1.8
20	2.5
25	6.6
28	0.1
30	5.1
33	3.5
35	1.2
40	3.5
45	1.6
50	18.0
51	0.3
55	0.4
60	7.9
65	0.6

66	1.2
67	0.1
70	4.7
75	8.8
78	0.3
80	11.0
85	1.9
88	0.3
90	7.5
91	0.1
95	2.3
98	0.3
99	0.4
100	3.8

Q10_rc: About what percentage of your home's landscape is lawn? (Categorical Recode)	(n=684)
	<u>%</u>
25 percent or less	15.1
More than 25 percent to 50 percent	33.0
More than 50 percent to 75 percent	24.0
More than 75 percent to 100 percent	27.9

Q11: Who does the majority of your home's landscaping activities?	(n=739)
	<u>%</u>
Homeowner (or homeowner's family)	70.6
Homeowner hires a landscape company	22.6
HOA/Landlord does it themselves	0.4
HOA/Landlord hires a landscape company	2.6
Friend or neighbor	3.1
Other	0.7

Q12: What is the name of the landscape company that you or your homeowners association hires to assist with landscape maintenance? (Of those who hire a landscape company)	(n=41)
	<u>%</u>
An independent individual	29.3
A3	2.4
Affordable Lawn	2.4
All American	2.4
American Signature Landscape	2.4
Down to Earth	2.4
FL Lawn Care	2.4
Focal Point	2.4
Free Time Landscape	2.4

Grasshopper Lawn Service	2.4
Green with Envy	2.4
Harmony Landscaping	2.4
Juarez Landscaping	2.4
Likeart	2.4
Procut	2.4
Quality Landscape	2.4
Roca Landscaping	2.4
Royal Landscaping	2.4
Sapphire Landscaping	4.9
Sharper Image	2.4
Sure Cuts	7.3
Sylvia Landscape	2.4
Ted Sam's Co.	2.4
Tim and Chris Landscapers	2.4
Tim's Lawnmowing	2.4
Tom Roach Agriculture	2.4
Trouble Fee	2.4

Q13: To what extent do you direct the practices of the landscape maintenance company? (Of those who hire a landscape company)

	(n=178)
	<u>%</u>
Not at all	23.0
A little	31.5
Somewhat	21.3
A lot	24.2

Q14: Who fertilizes the lawn? (n=735)

	<u>%</u>
Homeowner (or homeowner's family)	49.3
Homeowner hired landscape company	29.8
HOA/landlord hired landscape company	3.1
Friend or neighbor	1.0
Other	0.5
We don't fertilize the lawn	16.3

Q15: Is the fertilizer applied to the lawn on a regular schedule or only as needed? (of those who fertilize their lawns)

	(n=569)
	<u>%</u>
Regular schedule	51.3
Only as needed	48.7

Q16: About how many times has fertilizer been applied to the lawn in 2008? (of those who fertilize their lawns)

	(n=542)
	<u>%</u>
0	20.7
1	44.6
2	24.4
3	6.3
4	3.0
5	0.2
6	0.4
8	0.2
14	0.2
20	0.2

Q17: When will fertilizer be applied again? (of those who fertilize their lawns) (n=460)

	<u>%</u>
Next week	7.4
Next month	35.2
Next spring	1.3
Quarterly	6.1
Summer	19.1
Fall	13.0
Winter	1.7
Whenever it needs it	16.1

Q18: About how many times was your lawn fertilized over the last twelve months? (of those who fertilize their lawns)

	(n=527)
	<u>%</u>
0	3.6
1	13.1
2	23.9
3	16.3
4	19.0
5	4.0
6	12.9
7	0.6
8	2.5
9	0.2
10	0.2
12	3.2
15	0.2
50	0.2
80	0.2

Q19: What type of fertilizer do you typically purchase for your lawn? (of those who fertilize their lawns)	(n=587)
	<u>%</u>
Liquid fertilizer	20.5
Dry, granulated fertilizer	79.3
Weed and feed	6.6
Organic fertilizer	6.4
Slow-release fertilizer	7.4
Other	0.4
Buy something different every time	0.6

Q20: What method is used to apply fertilizer to the lawn? (of those who fertilize their lawns)	(n=498)
	<u>%</u>
Pour directly from the bag onto the lawn without any tools	4.8
Apply using a hand held crank fertilizer spreader	11.8
Apply with a push action broadcast spreader	53.2
Apply with a push action drop spreader	8.2
Apply liquid fertilizer with a hose	8.6
The landscape company does it	11.4
Pour directly from the bag into flower beds	0.8
Measure fertilizer and pour onto beds from measuring cup	1.0

Q21: What do you do if you do if granular fertilizer is spilled on the sidewalk, driveway or street? (of those who fertilize their lawns)	(n=363)
	<u>%</u>
Leave it	8.8
Sweep it into the street	3.9
Sweep it into the lawn or plant beds	67.5
I never spill fertilizer	12.4
I don't use granular fertilizer	0.6
I use granular fertilizer, but that has not happened to me	0.8
I avoid the sidewalks, driveway and street as much as possible	6.1

Q22: How do you decide how much fertilizer to apply to the lawn at one application? (of those who fertilize their lawns)	(n=496)
	<u>%</u>
Lawn service	33.5
Same as previous year	2.6
Store recommendations	1.0
Fertilizer bag directions	45.4

How ever much fits in the spreader	1.4
I guess/estimate	6.9
IFAS/other expert advice	1.8
I calculate the correct application according to my lawn size and turf grass needs	5.6
Other	1.8

Q23: How many bags of fertilizer are applied to the lawn at each application? (of those who fertilize their lawns)

	(n=284)
	<u>%</u>
Less than 1/4 bag	4.6
About 1/2 bag	19.7
Between 1/2 and 1 bag	10.2
1 bag	38.7
2 bags	20.1
3 bags	4.2
4 bags	1.1
More than 5 bags	1.4

Q24: How large are the bags of fertilizer that your purchase for the lawn? (of those who fertilize their lawns)

	(n=255)
	<u>%</u>
5 lbs	10.6
10 lbs	23.1
20 lbs	30.2
30 lbs	9.4
40 lbs	16.1
50 lbs	8.2
Other	2.4

Q25: List the 3 numbers that indicate the nutrient content of the fertilizer used most frequently on the lawn? (of those who fertilize their lawns)

	(n=71)
	<u>%</u>
22003	1.4
60006	1.4
60200	1.4
60606	25.4
80808	1.4
81208	1.4
90024	1.4

100011	1.4
100408	1.4
101010	4.2
102030	1.4
128888	1.4
130606	2.8
150015	1.4
150711	1.4
160212	1.4
160408	1.4
170211	1.4
170311	1.4
170511	1.4
180612	1.4
180906	1.4
200606	1.4
202020	1.4
230403	1.4
230510	1.4
231010	1.4
240824	1.4
250008	1.4
260209	1.4
260213	2.8
260311	1.4
261102	1.4
270305	1.4
270308	1.4
270312	1.4
270603	1.4
290216	1.4
290304	9.9
290305	1.4
290306	1.4
290308	1.4
290609	1.4
666666	1.4

Q26: Are there any other things about fertilizing practices that we didn't cover that you'd like to include in this study?

Because we're in the lake basin, so we're real sticklers about fertilizer not getting into the water.

Don't even do the backyard

Fertilizer only goes on certain parts of lawn, only st. augustine grass

Fertilizing company fertilizes the lawn and flower beds as well.  
 Flower beds, uses a 6-6-6 on those  
 For plants in garden, she uses compose garbage  
 He fertilizes about 3 times/year  
 He would like a fertilizing company to do it for him, but can't afford it.  
 How often do you cut grass?

I don't fertilize the back of my lawn where the lake is. The soil is so poor that I've had it re-sodded twice. The part of the lawn that I fertilize is facing the street.

I use Scott's Turf Builder  
 I would like to have more guidance on what type of fertilize is most environmentally-friendly.

The lawn company changes the types of fertilizer, throughout the year  
 The organic stuff is way too expensive. When we plant our fruit trees we'll stop using fertilizer there

Sometimes i put ironite  
 Sometimes its the dry kind other times its the hose kind of fertilizer  
 Use Scott's Bonus S Turf Builder  
 We don't fertilize the backyard

Q27: Who is responsible for watering your lawn?	(n=739)
	<u>%</u>
Homeowner (or homeowner's family)	90.4
Homeowner hires a landscape company	0.5
HOA/landlord does it themselves	0.3
HOA/landlord hires a landscape company	0.1
Friend or neighbor	0.1
Other	0.7
We never water the lawn	7.8

Q28: What is the primary method used to water your lawn? (Of those who water their lawn)	(n=670)
	<u>%</u>
In-ground, automatic irrigation system	77.8
Hand water using a hose	9.7
Set an above ground sprinkler out by hand	10.1
Drip irrigation from hoses at surface	0.6
Other	1.8

Q29: Which of the following best describes how you use your sprinkler system? (Of those who water their lawn)

	(n=519)
	<u>%</u>
Always leave it on automatic	51.3
Turn it on manually as needed	32.2
Turn it off when it rains	13.1
Always leave it off	0.8
Other	2.7

Q30: Does your irrigation system have a rain sensor on it? (Of those who water their lawn with an in-ground irrigation system)

	(n=493)
	<u>%</u>
Y	49.3
N	50.7

Q31: Does the rain sensor seem to work correctly? (Of those who water their lawn with an in-ground irrigation system)

	(n=225)
	<u>%</u>
Y	84.4
N	15.6

Q32: Is your irrigation system maintained by a professional service? (Of those who water their lawn with an in-ground irrigation system)

	(n=515)
	<u>%</u>
Y	27.4
N	72.6

Q33: How frequently do you or your professional service change the irrigation system timer? (Of those who water their lawn with an in-ground irrigation system)

	(n=463)
	<u>%</u>
Never	36.9
Rarely	43.0
Often	15.8
Always	4.3

Q34: Does the watering schedule for your lawn vary throughout the year or stay pretty much the same?  
(Of those who water their lawn)

	(n=657)
	<u>%</u>
Varies	51.8
Stays pretty much the same	48.2

Q35: On average, about how many days a week is your lawn watered? (Of those who water their lawn)

	(n=621)
	<u>%</u>
1	17.6
2	73.1
3	7.4
4	0.3
5	0.3
7	1.3

Q36: During what season do you typically irrigate the lawn the most (Of those who water their lawn)

	(n=636)
	<u>%</u>
Spring	15.7
Summer	55.5
Fall	1.6
Winter	5.8
All seasons are irrigated the same	19.8
I never irrigate the lawn	1.6

Q37: During what season do you typically irrigate the lawn the least (Of those who water their lawn)

	(n=634)
	<u>%</u>
Spring	1.9
Summer	13.9
Fall	2.5
Winter	60.9
All seasons are irrigated the same	19.2
I never irrigate the lawn	1.6

Q38: Is your landscape irrigated with well water, city water, surface water, reclaimed water, or some other source? (Of those who water their lawn)

	(n=641)
	<u>%</u>
Community well	1.9
Private well	16.1
City water	70.7

Reclaimed water	10.3
Surface water source, such as a lake, canal, retention pond, etc.	0.9
Rainwater collected in cistern or rain barrel	0.2

Q39: A home's landscape is important to the community	(n=733)
	<u>%</u>
Disagree strongly	1.1
Disagree	3.5
Agree	48.0
Agree strongly	47.3

Q40: A lawn should consist of a single type of grass	(n=664)
	<u>%</u>
Disagree strongly	8.3
Disagree	30.1
Agree	43.4
Agree strongly	18.2

Q41: Homeowner landscape practices can have a negative affect on water quality	(n=660)
	<u>%</u>
Disagree strongly	2.4
Disagree	10.8
Agree	50.9
Agree strongly	35.9

Q42: It doesn't bother me if my grass turns a bit brown during the winter months	(n=735)
	<u>%</u>
Disagree strongly	9.4
Disagree	18.8
Agree	50.6
Agree strongly	21.2

Q43: It is important for me to have the nicest lawn on the block	(n=727)
	<u>%</u>
Disagree strongly	25.7
Disagree	49.5
Agree	18.4
Agree strongly	6.3

Q44: It is important to me what the neighbors think about my yard	(n=722)
	<u>%</u>
Disagree strongly	15.9
Disagree	31.9
Agree	42.4
Agree strongly	9.8

Q45: In the last month or so, how many days have you spent working in your garden or lawn?	(n=715)
	<u>%</u>
0	17.2
1	8.4
2	11.7
3	9.7
4	14.0
5	7.1
6	5.0
7	2.4
8	4.1
9	0.3
10	3.1
12	1.8
13	0.7
14	0.7
15	4.2
16	0.4
18	0.1
20	2.5
21	0.3
24	0.7
25	1.4
28	0.1
29	0.4
30	2.2
31	1.4

Q46: What were you doing in the yard?	(n=596)
	<u>%</u>
Planting new plants	0.3
Mowing the grass	0.4
Pruning and trimming	0.7
Irrigating and watering	0.1
Applying fertilizers	0.1
Installing new lawn	0.0
Installing new trees or flower beds	0.0

Installing new irrigation system 0.0

Q47: If you were planning to be out of town or leaving for the summer, would that influence your irrigation schedule?

	(n=700)
	<u>%</u>
Y	30.9
N	69.1

Q48: If your lawn changes color, do you consider it a sign that you need to change something about your landscape maintenance procedures?

	(n=702)
	<u>%</u>
Y	70.8
N	29.2

Q49: If yes, what would you change? (Of those who would change procedure due to changes in lawn color)

	(n=466)
	<u>%</u>
Add water	30.7
Add fertilizer	8.4
Leave it alone	1.1
Rip it out and consider a replacement grass	2.1
Contact the landscape company	18.0
Contact the HOA	0.4
Other	29.8
Do multiple things	1.5
Check for insects	0.9
Depends on the circumstances	7.1

Q50: Has the current drought situation caused you to change what you do in your yard?

	(n=716)
	<u>%</u>
Y	37.3
N	62.7

Q51: If yes, what did you change? (Of those who changed what they do in their yard due to recent drought)

	(n=258)
	<u>%</u>
Add more water	31.4
Add more fertilizer	.8
Leave it alone, it needs to adapt	6.2
Remove lawn and install drought tolerant plant beds	10.5

Contact the landscape company	.8
Contact the HOA	.4
Other	39.5
Use less water	10.1
Change water source	.4

Q52: Does the look of your neighbor's yard influence what you do in your yard?	(n=732)
	<u>%</u>
Y	27.2
N	72.8

Q53: Where do you get information on landscape maintenance?	(n=678)
	<u>%</u>
Neighbor/family member	18.1
Home improvement centers/hardware stores	12.8
Landscaping company	13.3
Magazines or newspaper	13.8
Television	5.0
Website	15.2
Univ of FL/Ag Extension Service/Dept of Ag	2.1
City or county government	1.5
State government/FDEP	0.1
Water Management District	0.2
Local garden club	1.3
Other	16.5

Q54: How much formal schooling have you had?	(n=726)
	<u>%</u>
Less than high school	2.1
High school or equivalent (including GED)	16.3
Some college	32.2
College graduate	33.3
Graduate or professional degree	16.1

Q55: How long have you lived in Florida?	(n=725)
	<u>%</u>
1	0.4
2	0.6
3	0.6
4	1.4
5	1.7
6	0.8
7	1.0
8	2.1
9	0.8

10	4.1
11	1.4
12	2.2
13	2.3
14	1.9
15	2.9
16	1.0
17	1.7
18	2.5
19	1.8
20	5.4
21	1.7
22	1.9
23	1.8
24	1.2
25	4.6
26	1.9
27	1.2
28	2.2
29	0.6
30	5.9
31	1.8
32	1.9
33	0.8
34	1.0
35	4.1
36	1.0
37	1.0
38	1.7
39	0.7
40	4.6
41	0.6
42	1.5
43	1.2
44	0.1
45	1.9
46	0.4
47	0.8
48	0.7
49	0.8
50	3.0
51	1.5
52	1.5
53	0.7
54	0.4

55	0.8
56	0.4
57	0.4
58	0.3
59	0.1
60	0.6
61	0.7
62	0.1
63	0.3
64	0.1
65	0.6
66	0.1
69	0.1
70	0.1
71	0.1
72	0.3
73	0.1
76	0.1
78	0.7
79	0.1
80	0.3
84	0.1

Q56: Do you live in Florida year-round or just part of the year?	(n=734)
	<u>%</u>
Year round resident	97.8
Part time resident	2.2

Q57: What is your current employment status?	(n=726)
	<u>%</u>
Employed full-time	43.3
Employed part-time	7.3
Self-employed	8.1
Retired	25.5
Not employed	7.0
Disabled	2.1
Full-time student	1.9
Housewife or house-bound husband	4.8

Q58: Which of the following do you consider as your racial or ethnic group?	(n=719)
	<u>%</u>
White	82.9
Black/African-American	6.1
Hispanic	4.5

Asian/Pacific Islander	0.8
Native-American	1.1
Multi-racial or multi-ethnic	2.8
Other	1.8

Q59: What year were you born?	(n=702)
	<u>%</u>
1914	0.1
1917	0.1
1921	0.1
1922	0.6
1923	0.4
1924	0.4
1925	0.3
1926	1.0
1927	1.3
1928	0.9
1929	1.1
1930	1.7
1931	0.9
1932	1.1
1934	0.7
1935	0.9
1936	1.6
1937	1.6
1938	1.1
1939	1.7
1940	1.7
1941	1.1
1942	2.0
1943	1.9
1944	1.0
1945	2.1
1946	2.4
1947	2.7
1948	1.9
1949	1.6
1950	2.6
1951	2.0
1952	3.3
1953	2.7
1954	2.0
1955	3.1
1956	2.4
1957	3.4

1958	1.4
1959	2.8
1960	2.1
1961	2.3
1962	2.0
1963	2.4
1964	3.0
1965	3.0
1966	2.4
1967	1.7
1968	2.3
1969	1.6
1970	1.4
1971	0.7
1972	1.1
1973	0.6
1974	1.0
1975	1.1
1976	1.4
1977	0.7
1978	0.7
1979	1.1
1980	0.6
1981	0.7
1982	0.4
1983	0.3
1984	0.1
1985	0.3
1986	0.7
1987	0.6
1988	0.3
1989	1.0
1990	0.4

Q59: What year were you born? (Categorical Recode)	(n=702)
	<u>%</u>
18-44 years	29.3
45-64 years	46.3
65 years or older	24.4

Q60: What is your five-digit zip code?	(n=716)
	<u>%</u>
32010	0.1
32465	0.1
32702	0.1

32703	28.2
32707	0.1
32712	28.6
32714	3.1
32736	0.1
32768	0.1
32779	21.4
32781	0.3
32792	0.1
32801	0.1
32807	0.1
32810	13.5
32818	1.1
32827	0.1
33703	0.1
34761	1.8
35280	0.1
37302	0.1
39772	0.1

Q61: Gender (recorded if known)	(n=740)
	<u>%</u>
F	59.9
M	40.1

# Appendix B

## Homeowner Recruiting and Interviewing Documents

**Wekiva Landscaping Interview Questionnaire  
Screening and Consent**

**A) Introduce self, screen for appropriate and most knowledgeable person.**

**We are seeking homeowners to participate in the research project by allowing us to collect some information on their landscaping practices and also by allowing the research team to collect water quality data from their yard.**

**Hi! My name is <name> and I'm a student at <working with> the University of Central Florida and we're conducting research on lawn fertilizing practices here in the Wekiva area. Can I speak to you or whoever is responsible for landscaping at your house? I can only interview people who are at least 18 years of age. Thank you.**

**1) Are you at least 18?**

- 1 Yes Continue
- 2 No Is there someone home who is at least 18? If no, abort.

**2) Do you own or rent your home?**

- 1 Own - Continue
- 2 Rent - Abort

**3) Who does the majority of your home's landscaping activities?**

- 1 Homeowner (or homeowner's family) [Use Quex 1](#)
- 2 Homeowner hires a landscape company [Use Quex 2](#)
- 3 HOA/landlord does it themselves [Use Quex 2](#)
- 4 HOA/landlord hires a landscape company [Use Quex 2](#)
- 5 Friend or neighbor [Use Quex 2](#)
- 6 Other – record open ended
- 8 Don't know
- 9 All other missing –

**4) Do you have a septic tank?**

**B) Go through the consent form and get their signature to survey.**

Before we go any further I must go through the consent process. The University of Central Florida has an Institutional Review Board whose purpose is to protect the subjects of research. This Board requires that we complete a formal written consent process during which you will sign that you agree to participate in the survey which will take us about 15-20 minutes. I will record your answers to about 40 questions on these pages and then talk to you about the next phase of the research, which includes allowing a research team to collect groundwater samples from your yard. [<Read consent form and get signature>](#)

## Appendix C

Homeowner Covenant Rule Comparison with UF Conservation Covenant Model Language  
(November 2006)  
Evaluation Legend

### Homeowners Association Covenant Evaluation Matrix

#	Text	Answer Scale	Wt	Scale
1	<b>Environmental Landscape Review Committee:</b> "ELRC shall carefully monitor all pesticide applications, lawn and landscaping services, and fertilizer applications performed in the Common Areas and in the Managed Areas to ensure that Florida Green Industries' BMPs are followed."	2	7	5.1
2	<b>Landscape Changes:</b> "The committee shall not approve any proposed (homeowner) design change that fails to conform to the development's design concept. No approval shall be required for design changes involving the planting of annuals, planting of pre-approved plants or trees, or for the removal of deceased or diseased trees."	2	3	2.2
3	<b>Irrigation Plan:</b> "The irrigation plan shall meet or exceed state and local water regulations".	1	3	2.2
4	<b>Irrigation Preventative Maintenance Program:</b> "For common areas and managed areas, the committee shall implement a preventative maintenance program."	1	3	2.2
5	<b>Pesticide Records:</b> "Committee shall obtain . . . Pesticide application records, including records for any restricted use pesticides used in the common areas and managed areas . . . Maintain these pesticide records for 2 years from the application date."	1	3	2.2
6	<b>Certification Requirements:</b> "Only those employees of landscaping, fertilizing, or pesticide application companies who have a current certificate of completion of training in Florida Green Industries: BMP's . . . Demonstrate that the company's principles follow these BMP's. Committee shall maintain an updated list of certified professionals . . . update every 6 months. Homeowners not using list shall obtain written prior permission."	3	10	7.2
7	<b>Florida-Friendly Landscaping:</b> "The association may not prohibit any homeowner from implementing FFL or Xeriscape on the homeowner's private property."	1	10	7.2
8	<b>Pre-Landscape Installation:</b> "Before landscape installation starts . . . The Developer shall, after final grade, obtain soil analysis information from a reputable soil testing lab or U-F IFAS Coop Extension facility."	1	10	7.2
9	<b>Plant/Turf Selection and Design:</b> "In accordance with the most current version of the UF IFAS Florida Yards & Neighborhoods Plant List or the Water Management District's Water Wise Guide, the developer shall select turf grass and landscape plants suited to the soil and other site characteristics".	1	10	7.2
10	<b>Plant Installation:</b> "All plant installations shall be conducted in accordance with the most current version of the Florida Green Industries BMP's handbook guidelines".	1	5	3.6
11	<b>Mulching:</b> "All mulching shall be conducted in accordance with the most current version of the Florida Green Industries BMP's handbook guidelines. . . . Organic mulch and recycled mulch including leaves, pine needles, grass, and shrub clippings are recommended. The use of cypress mulch is prohibited."	2	7	5.1

12	<b>Fertilizer Use:</b> "Homeowners are strongly encouraged to follow the fertilizing recommendations of the most current version of the FYN guide to FFL. All fertilizing companies hired to service a homeowners lawn shall follow FGI BMP's and have a valid certification. Fertilizers and pesticides may not be applied within 10 ft. of the edge of any water body."	2	7	5.1
13	<b>Mowing:</b> "Mowing in common areas and managed areas shall be done in accordance with the most current version of the FGI BMP's handbook. . . . Homeowners are strongly encouraged to follow the suggested mowing recommendations in the most current version of the FYN guide to FFL."	2	7	5.1
14	<b>Turf Clippings:</b> "Unless the turf is diseased, turf clippings shall be left on turf areas or composted on-site to recycle nutrients. Any clippings or landscape materials that fall on impervious surfaces such as sidewalks, driveways, or roads shall be swept onto turf areas or composted. Turf clipping or landscape material shall not be deposited in any swales or water bodies."	2	7	5.1
15	<b>Composting:</b> "The committee shall not prohibit any homeowner from installing compost bins on the homeowner's private property."	1	2	1.4
16	<b>Irrigation System Design:</b> "All irrigation systems in the development shall be installed according to the state standards for landscape irrigation in Florida and shall meet or exceed all state and local regulations. . . . The irrigation system shall be designed so as to not overlap with water coverage zones, not to water impervious areas, and not to irrigate within 3 feet of the building foundation. The irrigation systems shall separate turf irrigation areas from landscape bed irrigation areas."	3	5	3.6
17	<b>Irrigation System Maintenance:</b> "Irrigation systems shall be continuously maintained in working order so that the application rate of water to landscape and grass does not exceed the ability of the soil to absorb and retain water applied during one application. . . . If a homeowner's irrigation system does not function properly, the committee may correct the problem."	2	5	3.6
18	<b>Rain Shut-off or Soil Moisture Sensors:</b> Are they mentioned?	1	5	3.6
19	<b>Homeowner Education:</b> "The association shall create a FFL educational package."	1	7	5.1
20	<b>Pesticide Application:</b> "Preventative blanket applications of pesticides are prohibited, except for termite prevention. All pesticide applications in common areas shall be done by a certified professional and in accordance with the most current version of the FGI BMP's handbook. Homeowners are strongly encouraged to use alternative methods for controlling pest problems and to follow the most current version of the FYN guide to FFL."	2	10	7.2
21	<b>Stormwater Reserve:</b> "_% of the initial working capital fund shall be set aside for maintenance and any future repair of the stormwater management system."	1	5	3.6
22	<b>Stormwater Runoff:</b> "The developer shall not divert roof or structure runoff to drain onto impervious surfaces. Homeowners shall not alter roof or structure drainage in any manner that channels runoff onto impervious surfaces."	2	7	5.1
Total			138	100

# Appendix D

## References

## References

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