

# Lake Lawne Hydrologic/Nutrient Budgets and Management Plan

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Orange County  
Environmental Protection Division

Prepared By:



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## SECTION 1

### INTRODUCTION

#### 1.1 General Description

This report provides a summary of work efforts performed by Environmental Research & Design, Inc. (ERD) for the Orange County Environmental Protection Division (OCEPD) to develop hydrologic and nutrient budgets and a water quality management plan for Lake Lawne. Lake Lawne is a 144-acre urban lake located in central Orange County with watershed areas located within both the City of Orlando and unincorporated Orange County. A general location map for Lake Lawne is given on Figure 1-1, with a local vicinity map given on Figure 1-2.

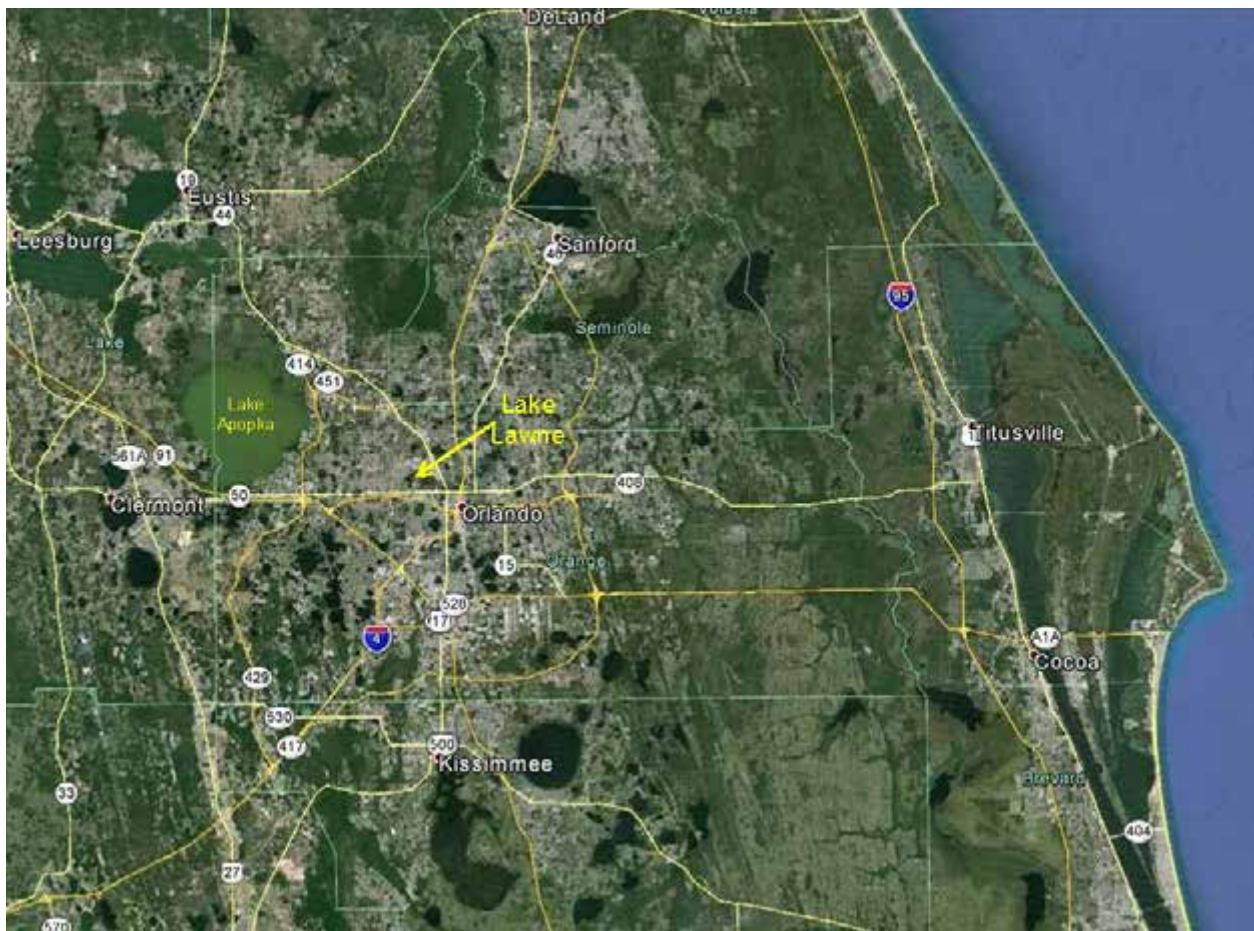


Figure 1-1. Location Map for Lake Lawne.

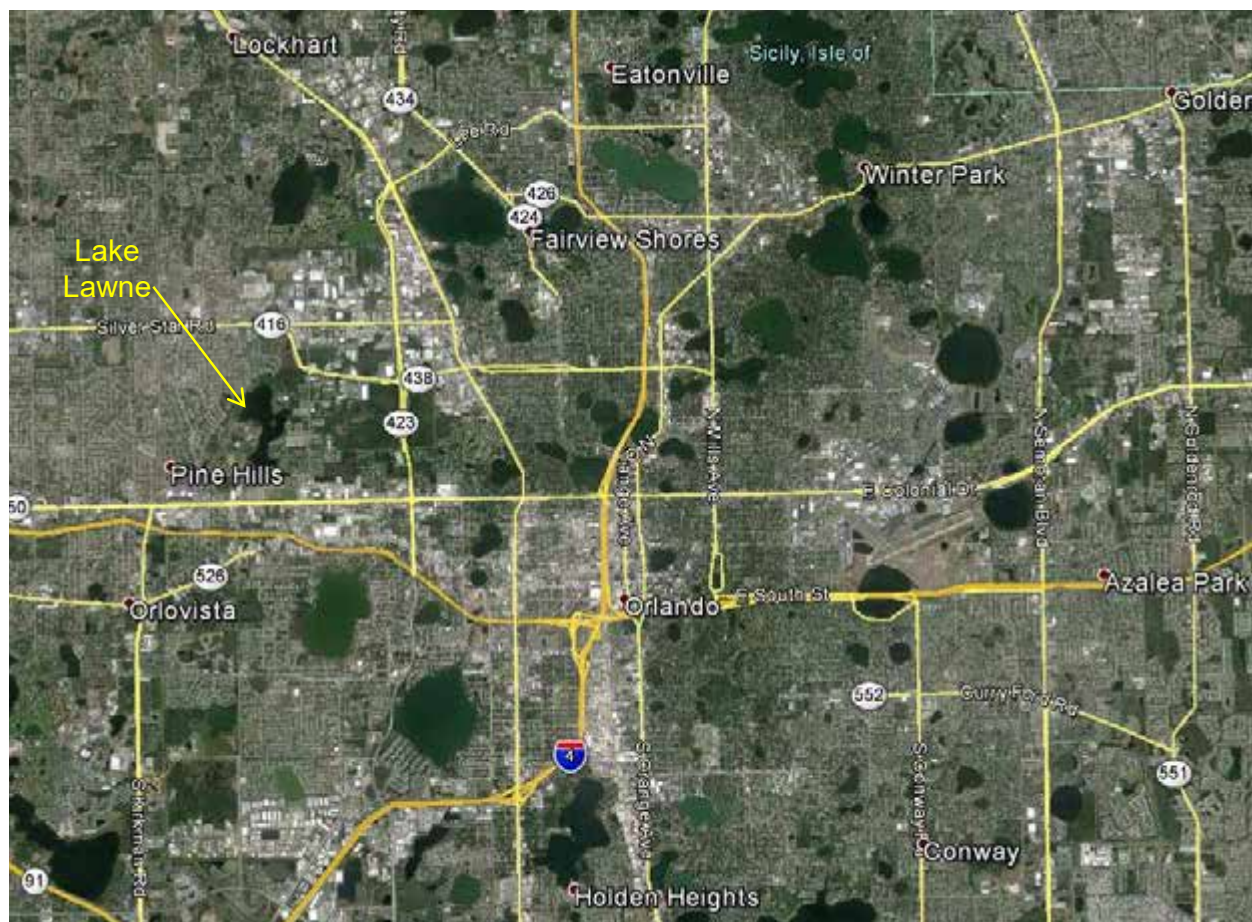


Figure 1-2. Local Vicinity Map for Lake Lawne.

An overview of Lake Lawne is given on Figure 1-3. Lake Lawne has a highly irregular shape and contains a small island which is used extensively by a variety of bird species. Lake Lawne is bounded on the east by Mercy Drive, on the north by Silver Star Road, on the west by Pine Hills Road, and on the south by Colonial Drive (S.R. 50). Discharges from Lake Lawne occur through an outfall canal with a water level control structure and ultimately enter the southwest side of Lake Orlando. Lake Lawne is located in the Little Wekiva Watershed, which discharges to the Wekiva River and ultimately to the St. Johns River.

As indicated on Figure 1-3, watershed areas surrounding Lake Lawne are highly developed, with a mixture of residential, commercial, industrial, and professional office land use activities. Much of the existing development was constructed prior to implementation of regulations requiring stormwater treatment and many areas discharge untreated runoff directly into the lake. Historical water quality within Lake Lawne has been highly variable, with elevated concentrations of nutrients and chlorophyll-a, and Tropic State Index (TSI) values indicating mesotrophic to eutrophic conditions.





Figure 1-3. Overview of Lake Lawne.

## 1.2 Impaired Waters Designation

Section 303(d) of the Clean Water Act (CWA) requires states to submit lists of surface waterbodies that do not meet applicable water quality standards. These waterbodies are defined as “impaired waters” and Total Maximum Daily Loads (TMDLs) must be established for these waters on a prioritized schedule. The Florida Department of Environmental Protection (FDEP) has established a series of guidelines to identify impaired waters which may require the establishment of TMDLs. Waterbodies within the State of Florida have been divided into five separate groups for planning purposes, with Lake Lawne located in the Wekiva River Hydrologic Unit of the Middle St. Johns River Basin in Group 2.

Lake Lawne was listed as an impaired water on the 2004 Cycle 1 State Verified List of impaired water segments in Orange County. Lake Lawne (WBID 3004C) was listed as impaired for nutrients based upon a mean TSI value exceeding 60 during 1991-1994, 1996, and 1997. Total phosphorus is stated to be the limiting nutrient within the lake. A nutrient TMDL was developed for Lake Lawne by FDEP during 2007, with final adoption on June 8, 2008. Since a TMDL was developed and adopted for Lake Lawne, the lake was delisted from the Cycle 1 State Verified List. However, this delisting does not mean that Lake Lawne is no longer considered to be impaired – it has simply been removed from the list of waterbodies requiring TMDLs.

### 1.3 Current Conditions

Development within the Lake Lawne drainage basin began during the early-1900s and began to expand significantly during the 1950s and 1960s. At that time, Lake Lawne was known for clear water and good fishing. Currently, virtually all available parcels within the drainage basin have been developed with single-family, commercial, industrial, and office uses. Since the 1970s, Lake Lawne has experienced periodic problems with surface algal blooms and has exhibited highly variable water quality characteristics.

### 1.4 Previous Studies

Two previous studies were identified by ERD which address either water quality or stormwater management for Lake Lawne. A brief discussion of each of the two studies is given below:

1. **Report on Lawn Lake, Orange County, Florida, EPA Region IV, Working Paper No. 262 (December 1997):** This report was prepared by the U.S. EPA with cooperation from the Florida Department of Environmental Regulation (now called the Florida Department of Environmental Protection) and the Florida National Guard and includes a very basic analysis of water quality characteristics and potential nutrient loading sources to the lake. The report includes a brief discussion of morphometric characteristics of the lake, along with a summary and discussion of surface water monitoring conducted on three separate occasions during 1973. Nutrient loads to the lake are estimated based upon a very limited database and multiple assumptions. The report concludes that the estimated loadings to Lake Lawne substantially exceed the “permissible” loadings recommended by Vollenweider to maintain oligotrophic or mesotrophic conditions.
2. **Preliminary Engineering Study – Lake Lawne Water Quality Improvement Project – Final Report, Prepared by BPC-TEK Joint Venture (Oct. 30, 2009):** This report provides a discussion and evaluation of three stormwater improvement projects associated with the use of the Princeton Village Property. The evaluated alternatives include: (1) wet detention pond; (2) alum/chemical treatment; and (3) an algal turf scrubber system. The report also includes an overview of the Lake Lawne drainage basin and existing characteristics, an analysis of current water quality characteristics and estimated annual pollutant loading analyses, and an analysis of each of the three evaluated alternatives. Information is provided on life-cycle costs per mass of pollutant removed and anticipated construction and O&M costs.

### **1.5 Work Efforts Performed by ERD**

Work efforts were initiated on this project by ERD during March 2011. The primary objectives of this project are to define current and historical water quality characteristics of Lake Lawne, quantify and rank hydrologic and pollutant loadings, and develop recommendations for water quality improvement. A field monitoring program was conducted by ERD from March 2011-March 2012 to collect hydrologic and water quality data for use in developing hydrologic and nutrient budgets for the lake. The hydrologic budget includes estimated inputs from precipitation, stormwater runoff, inflow from interconnected lakes, and groundwater seepage. The nutrient budget includes inputs from bulk precipitation, stormwater runoff, inflow from interconnected lakes, groundwater seepage, and internal recycling. A detailed evaluation of sediment characteristics in Lake Lawne was also conducted which included physical and chemical characterization of surficial sediments and evaluation of internal phosphorus recycling.

This report has been divided into 8 separate sections for presentation of the work efforts performed by ERD. Section 1 contains an introduction to the report and provides a general overview of the work efforts performed by ERD. Current characteristics of Lake Lawne are discussed in Section 2, including lake bathymetry, sediment accumulation and characteristics, and historical and current water quality. A discussion of the drainage basin area is given in Section 3, and the hydrologic budget is presented in Section 4. A nutrient budget, which includes inputs from total nitrogen, total phosphorus, and TSS, is given in Section 5. The calibrated water quality model is discussed in Section 6. A discussion of water quality management and improvement projects is given in Section 7 with cited references listed in Section 8. Appendices are also attached which contain technical data and analyses used to support the information contained within the report.



## SECTION 2

### PHYSICAL AND CHEMICAL CHARACTERISTICS OF LAKE LAWNE

#### 2.1 Physical Characteristics

A hydrographic survey of Lake Lawne was conducted by ERD on August 30, 2011 to evaluate water column depth as well as thickness of unconsolidated sediments within the lake. Measurements of water depth and sediment thickness were conducted at 295 individual sites in the lake. Probing locations used for the bathymetric study are indicated on Figure 2-1. Each of the data collection sites was identified in the field by longitude and latitude coordinates using a portable GPS device. The water level elevation in Lake Lawne on August 30, 2011 was approximately 86.4 ft NAVD 88), based upon the staff gauge maintained by Orange County on the east side of the east lobe, which is slightly higher than the water control elevation of 86.14 ft.

Water depth at each of the sites was determined by lowering a 20-cm diameter Secchi disk attached to a graduated line until resistance from the sediment layer was encountered. The depth on the graduated line corresponding to the water surface was recorded in the field and is defined as the water depth at each site. After measurement of the water depth at each site, a 1.5-inch graduated aluminum pole was then lowered into the water column and forced into the sediments until a firm bottom material, typically sand or clay, was encountered. The depth corresponding to the water surface is defined as the depth to the firm lake bottom. The difference between the depth to the firm lake bottom and the water depth at each site is defined as the depth of unconsolidated sediments.

The generated field data was converted into bathymetric maps for both water depth and unconsolidated sediment depth in Lake Lawne using AutoCAD 2007. Estimates of water volume and unconsolidated sediment volume within Lake Lawne were generated using the Autodesk Land Desktop 2007 Module.

A water depth contour map for Lake Lawne, based upon the field monitoring program performed by ERD, is given in Figure 2-2. For discussion purposes, Lake Lawne is assumed to consist of three separate lobes, referred to as the northern, southern, and middle lobes. Approximate boundaries for the north, middle, and south lobes are indicated on Figure 2-1, although the distinction between the lobes is loosely defined.

The northern lobe is characterized by relatively mild side slopes which extend to a central area with water depths ranging from approximately 6-12 ft. The presence of two deeper pockets, extending to 10 and 12 ft deep, suggests an origin as small sinkhole features in the north lobe. The western lobe is characterized by steep side slopes, with a relatively uniform bottom depth of approximately 6 ft. The southern lobe is characterized by a deep hole with steep side slopes and a water depth of 22 ft, suggesting more significant sinkhole activity in this area. The water surface elevation in Lake Lawne at the time of the bathymetric survey conducted by ERD was approximately 86.4 ft (NAVD 88) obtained from the Orange County staff gauge located in the C-1 Canal on the east side of the lake. The approximate location of the staff gauge is indicated on Figure 2-1.

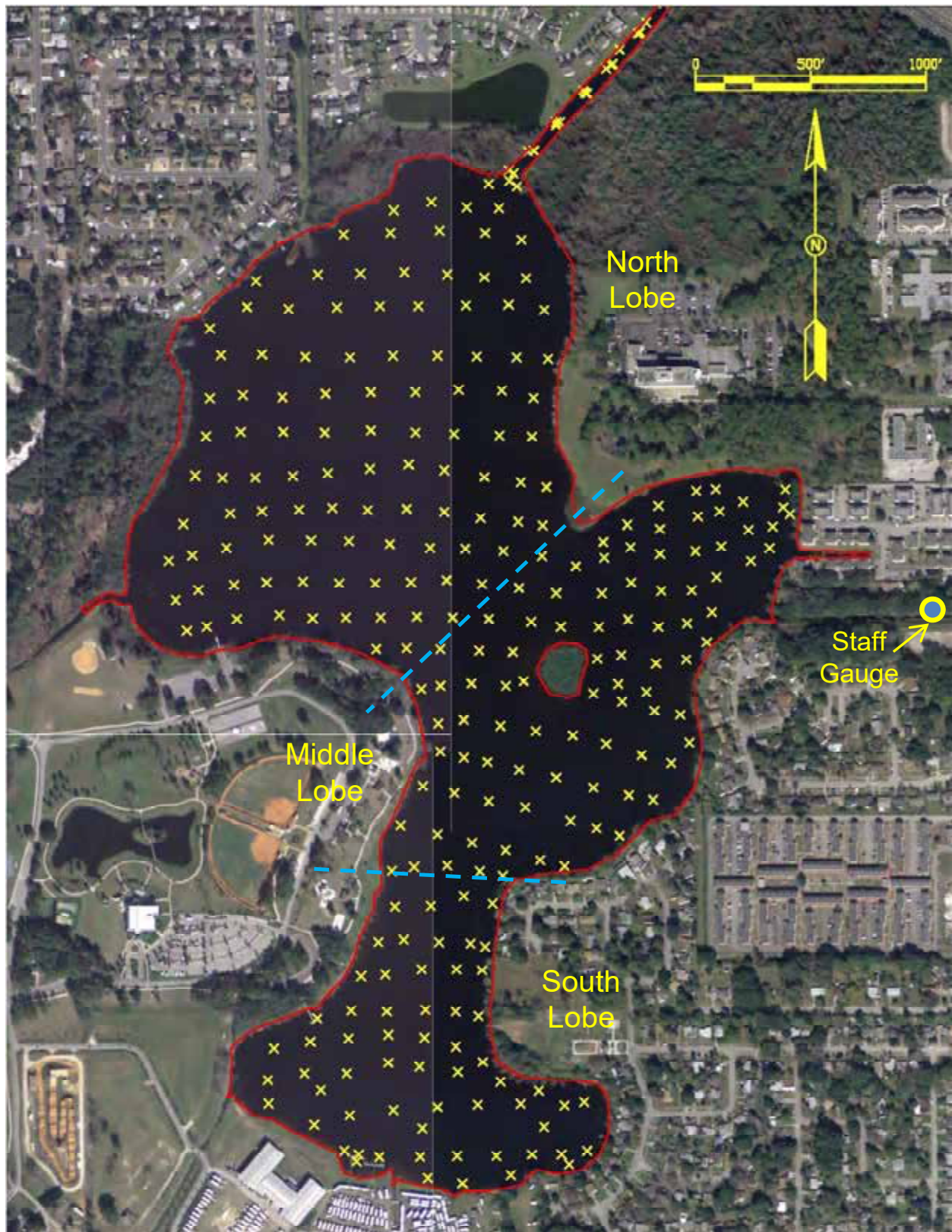


Figure 2-1. Probing Locations for Water and Muck Depth in Lake Lawne (August 30, 2011).



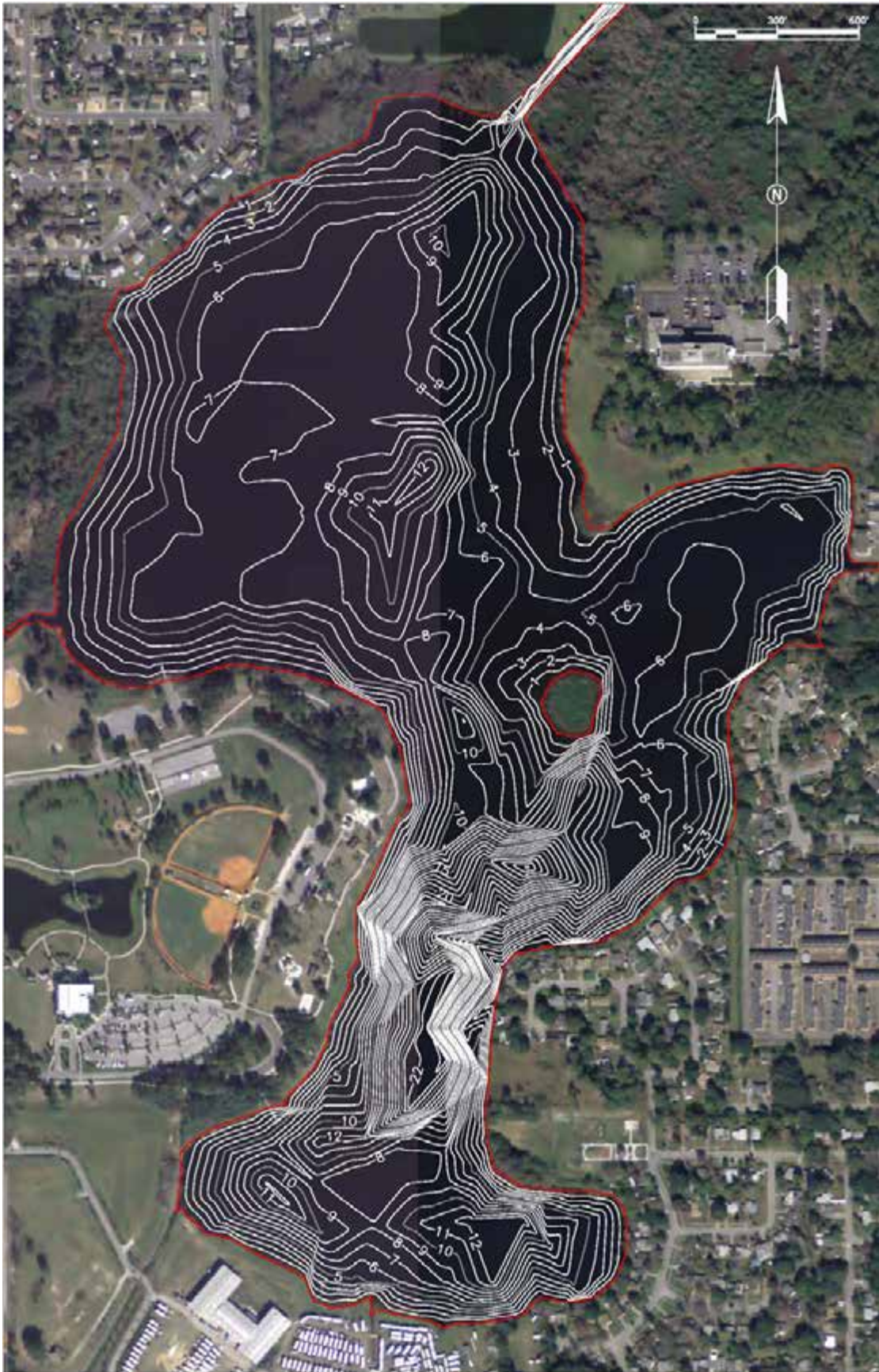


Figure 2-2. Water Depth Contours (ft) for Lake Lawne on August 30, 2011.  
(Water Elevation = 86.4 ft, NAVD 88)

Stage-area-volume relationships for Lake Lawne are summarized in Table 2-1 based on the bathymetric survey performed by ERD. At the water surface elevation of 86.4 ft (NAVD 88) present on August 30, 2011, the surface area of the lake was approximately 148.0 acres which includes Lake Lawne and the outfall canal to the water control structure. The lake volume at this elevation is 932 ac-ft which corresponds to a mean water depth of 6.3 ft. The calculated mean depth of 6.3 ft is relatively shallow for a Central Florida lake. A summary of bathymetric characteristics of Lake Lawne is given in Table 2-2.

**TABLE 2-1**  
**DEPTH-AREA-VOLUME RELATIONSHIPS FOR LAKE LAWNE**  
**(Elev. 86.4 ft, NAVD 88)**

| DEPTH<br>(ft) | SURFACE<br>AREA<br>(acres) | CUMULATIVE<br>VOLUME<br>(ac-ft) | DEPTH<br>(ft)                | SURFACE<br>AREA<br>(acres) | CUMULATIVE<br>VOLUME<br>(ac-ft) |
|---------------|----------------------------|---------------------------------|------------------------------|----------------------------|---------------------------------|
| 0             | 148.0                      | 932                             | 13                           | 8.9                        | 42.5                            |
| 1             | 138.4                      | 789                             | 14                           | 7.8                        | 34.1                            |
| 2             | 128.8                      | 656                             | 15                           | 6.8                        | 26.8                            |
| 3             | 117.6                      | 532                             | 16                           | 5.9                        | 20.5                            |
| 4             | 105.7                      | 421                             | 17                           | 5.0                        | 15.0                            |
| 5             | 92.0                       | 322                             | 18                           | 4.2                        | 10.4                            |
| 6             | 74.4                       | 239                             | 19                           | 3.3                        | 6.7                             |
| 7             | 52.4                       | 175                             | 20                           | 2.4                        | 3.8                             |
| 8             | 34.5                       | 132                             | 21                           | 1.6                        | 1.8                             |
| 9             | 25.2                       | 102                             | 22                           | 0.9                        | 0.5                             |
| 10            | 17.9                       | 80.5                            | 23                           | 0.1                        | 0.1                             |
| 11            | 13.7                       | 64.7                            | 24                           | 0.0                        | 0.0                             |
| 12            | 10.9                       | 52.4                            | <b>Mean Depth (ft) = 6.3</b> |                            |                                 |

Information on shoreline length or lake perimeter is also provided in Table 2-2. This value is used to calculate the shoreline development index which is a measure of the regularity of the lake shoreline. The shoreline development index is a ratio of the perimeter of the lake to the perimeter of a lake with the same area that is a perfect circle. Lakes which exhibit a high degree of irregularity in the shoreline provide a higher degree of habitat for aquatic organisms and often display a higher degree of diversity in the aquatic community. Shoreline development indices of approximately 2 or more are often considered to provide a high degree of habitat.

As indicated on Table 2-2, the shoreline development index for Lake Lawne is 1.83, indicating a somewhat irregular shoreline area. Based upon the shoreline development index, Lake Lawne would be expected to provide a higher degree of habitat compared with a lake with a regular circular shoreline.

**TABLE 2-2**  
**BATHYMETRIC CHARACTERISTICS**  
**OF LAKE LAWNE**

| BATHYMETRIC<br>PARAMETER <sup>1</sup> | UNITS | VALUE               |
|---------------------------------------|-------|---------------------|
| Surface Area                          | acres | 148.0               |
| Total Volume                          | ac-ft | 932                 |
| Mean Depth                            | ft    | 6.3                 |
| Maximum Depth                         | ft    | > 4                 |
| Shoreline Length                      | ft    | 16,490 <sup>2</sup> |
| Shoreline Development                 | --    | 1.83                |

1. Based upon a water surface elevation of 86.4 ft (NAVD 88) on August 30, 2011
2. Excluding the outfall canal

A bathymetric contour map of the depth of unconsolidated organic sediments in Lake Lawne is given in Figure 2-3. Deep pockets of organic muck are apparent in central portions of the north lobe and throughout the west and south lobes, with muck depths ranging from 0-10 ft in the north lobe, 0-6 ft in the west lobe, and 0-10 ft in the south lobe. The deeper accumulations of organic muck are likely associated with the historic sinkhole features which have partially filled-in with muck.

Estimates of area-volume relationships for organic muck accumulations in Lake Lawne are given in Table 2-3. Approximately 84.0 acres (57%) of the lake have existing muck accumulations ranging from 0-1 ft in depth, with 12% of the lake covered by muck accumulations ranging from 1-2 ft in depth and 10% covered by muck accumulations ranging from 2-3 ft in depth. Overall, the lake contains approximately 373 ac-ft (601,773 yd<sup>3</sup>) of unconsolidated organic sediments. The volume of unconsolidated sediments in Lake Lawne is sufficient to cover the entire bottom of the lake to a depth of approximately 2.5 ft. The mean muck depth in Lake Lawne is greater than the mean muck depth of 1.97 ft measured by ERD in Lake Pineloch during 2008.



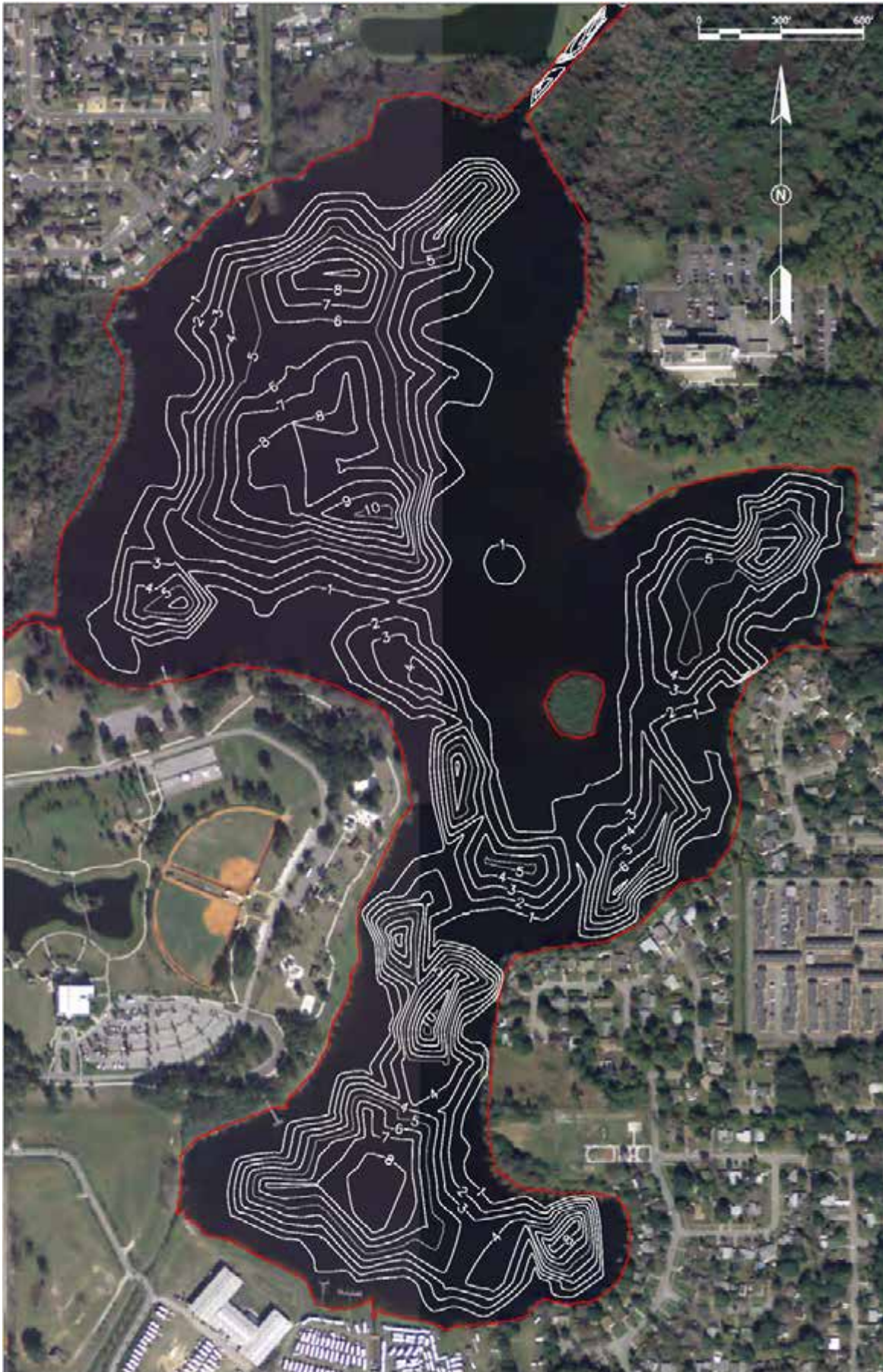


Figure 2-3. Muck Depth Contours in Lake Lawne on August 30, 2011.

TABLE 2-3

**DEPTH-AREA-VOLUME RELATIONSHIPS  
FOR ORGANIC MUCK IN LAKE LAWNE**

| MUCK DEPTH (ft) | SURFACE AREA (acres) | CUMULATIVE VOLUME (ac-ft) | MUCK DEPTH (ft)       | SURFACE AREA (acres) | CUMULATIVE VOLUME (ac-ft) |
|-----------------|----------------------|---------------------------|-----------------------|----------------------|---------------------------|
| 0               | 148.0                | 373                       | 6                     | 17.7                 | 25.2                      |
| 1               | 84.0                 | 257                       | 7                     | 11.1                 | 10.8                      |
| 2               | 65.6                 | 183                       | 8                     | 4.5                  | 3.0                       |
| 3               | 51.0                 | 124                       | 9                     | 0.7                  | 0.4                       |
| 4               | 38.0                 | 79.7                      | 10                    | 0.1                  | 0.0                       |
| 5               | 26.7                 | 47.4                      | Mean Depth (ft) = 2.5 |                      |                           |

## **2.2 Sediment Characteristics**

Sediment core samples were collected in Lake Lawne by ERD to evaluate the characteristics of existing sediments and potential impacts on water quality within the lake. Sediment core samples were collected at 42 separate locations within the lake during August 2011 by ERD personnel. Locations of sediment sampling sites in Lake Lawne are illustrated on Figure 2-4. Based on a surface area of 148 acres, sediment samples were collected at a rate of one sample for every 3.5 acres of lake area.

### **2.2.1 Sampling Techniques**

Sediment samples were collected at each of the 42 monitoring sites using a stainless steel split-spoon core device, which was penetrated into the sediments at each location to a minimum distance of approximately 0.5 m. After retrieval of the sediment sample, any overlying water was carefully decanted before the split-spoon device was opened to expose the collected sample. Visual characteristics of each sediment core sample were recorded, and the 0-10 cm layer was carefully sectioned off and placed into a polyethylene container for transport to the ERD laboratory. Duplicate core samples were collected at each site, and the 0-10 cm layers were combined together to form a single composite sample for each of the 42 monitoring sites where core samples were collected. The polyethylene containers utilized for storage of the collected samples were filled completely to minimize air space in the storage container above the composite sediment sample. Each of the collected samples was stored on ice and returned to the ERD laboratory for physical and chemical characterization.



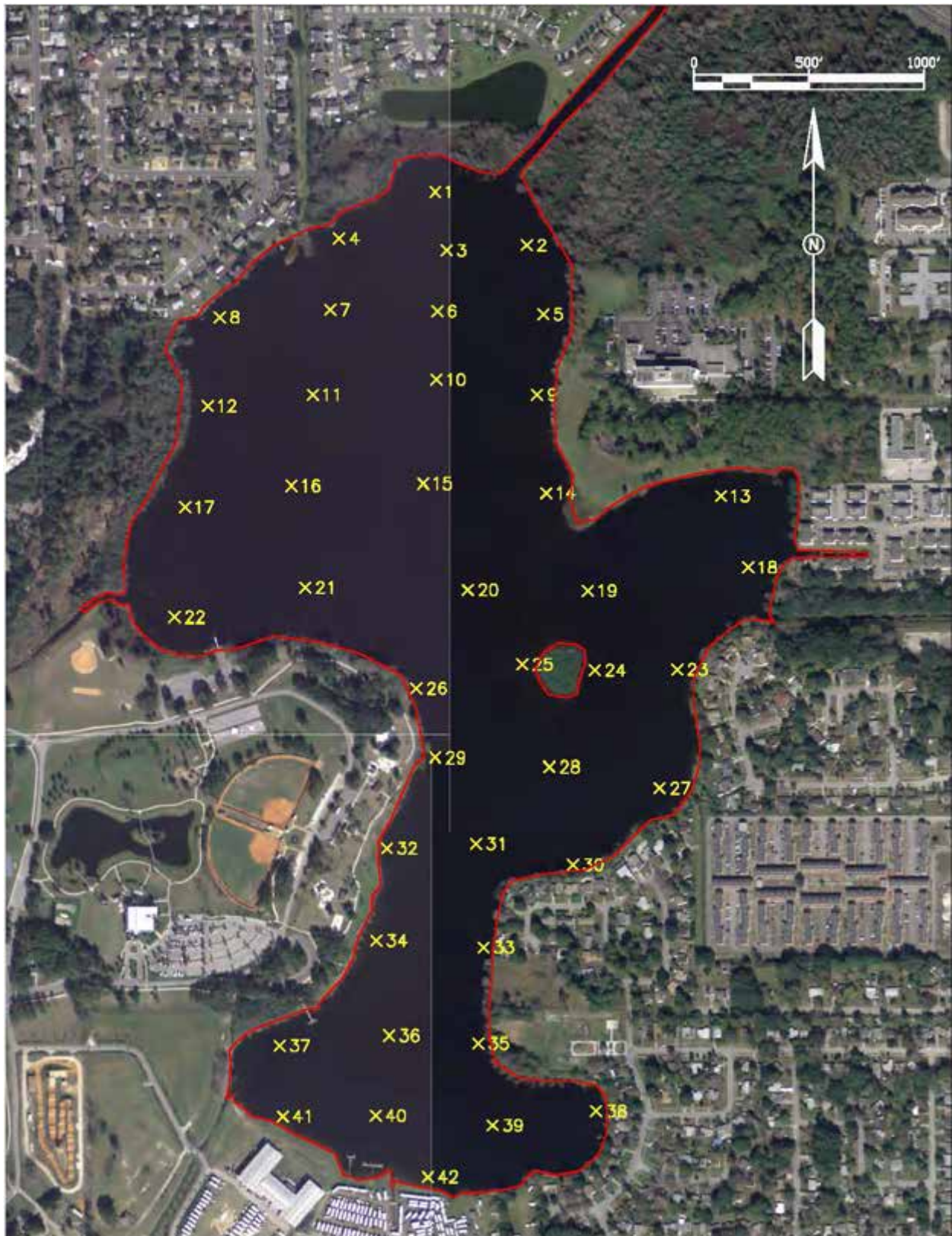


Figure 2-4. Location of Sediment Monitoring Sites in Lake Lawne.



## 2.2.2 Sediment Characterization and Speciation Techniques

Each of the 42 collected sediment core samples was analyzed for a variety of general parameters, including moisture content, organic content, sediment density, total nitrogen, and total phosphorus. Methodologies utilized for preparation and analysis of the sediment samples for these parameters are outlined in Table 2-4.

**TABLE 2-4**

### **ANALYTICAL METHODS FOR SEDIMENT ANALYSES**

| MEASUREMENT<br>PARAMETER             | SAMPLE<br>PREPARATION            | ANALYSIS<br>REFERENCE | REFERENCE<br>PREP./ANAL.* | ERD METHOD<br>DETECTION LIMITS<br>(MDLs) |
|--------------------------------------|----------------------------------|-----------------------|---------------------------|------------------------------------------|
| pH                                   | EPA 9045                         | EPA 9045              | 3 / 3                     | 0.01 pH units                            |
| Moisture Content                     | p. 3-54                          | p. 3-58               | 1 / 1                     | 0.1%                                     |
| Organic Content<br>(Volatile Solids) | p. 3-52                          | pp. 3-52 to 3-53      | 1 / 1                     | 0.1%                                     |
| Total Phosphorus                     | pp. 3-227 to 3-228<br>(Method C) | EPA 365.4             | 1 / 2                     | 0.005 mg/kg                              |
| Total Nitrogen                       | p. 3-201                         | pp. 3-201 to 3-204    | 1 / 1                     | 0.010 mg/kg                              |
| Specific Gravity<br>(Density)        | p. 3-61                          | pp. 3-61 to 3-62      | 1 / 1                     | NA                                       |

**\*REFERENCES:**

1. Procedures for Handling and Chemical Analysis of Sediments and Water Samples, EPA/Corps of Engineers, EPA/CE-81-1, 1981.
2. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.
3. Test Methods for Evaluating Solid Wastes, Physical-Chemical Methods, Third Edition, EPA-SW-846, Updated November 1990.

In addition to general sediment characterization, a fractionation procedure for inorganic soil phosphorus was conducted on each of the 42 collected sediment samples. The modified Chang and Jackson Procedure, as proposed by Peterson and Corey (1966), was used as the basis for the phosphorus fractionation. The Chang and Jackson Procedure allows the speciation of phosphorus in soils into saloid-bound phosphorus (defined as the sum of soluble plus easily exchangeable sediment phosphorus), iron-bound phosphorus, and aluminum-bound phosphorus. Although not used in this project, subsequent extractions of the Chang and Jackson procedure also provide calcium-bound and residual fractions.

The Chang and Jackson procedure was originally developed at the University of Wisconsin to evaluate phosphorus bonding in dried agricultural soils. However, drying of wet sediments will significantly impact the phosphorus speciation, particularly the soluble and iron-bound associations. Therefore, the basic Chang and Jackson method was adapted and modified by ERD for wet sediments by adjusting solution concentrations and extraction timing to account for the liquid volume in the wet sediments and the reduced solids mass. This modified method has been used as the basis for all sediment inactivation projects which have been conducted in the State of Florida.

Saloid-bound phosphorus is considered to be available under all conditions at all times. Iron-bound phosphorus is relatively stable under aerobic environments, generally characterized by redox potentials greater than 200 mv ( $E_h$ ), while unstable under anoxic conditions, characterized by redox potential less than 200 mv. Aluminum-bound phosphorus is considered to be stable under all conditions of redox potential and natural pH conditions. A schematic of the Chang and Jackson Speciation Procedure for evaluating soil phosphorus bounding is given in Figure 2-5.

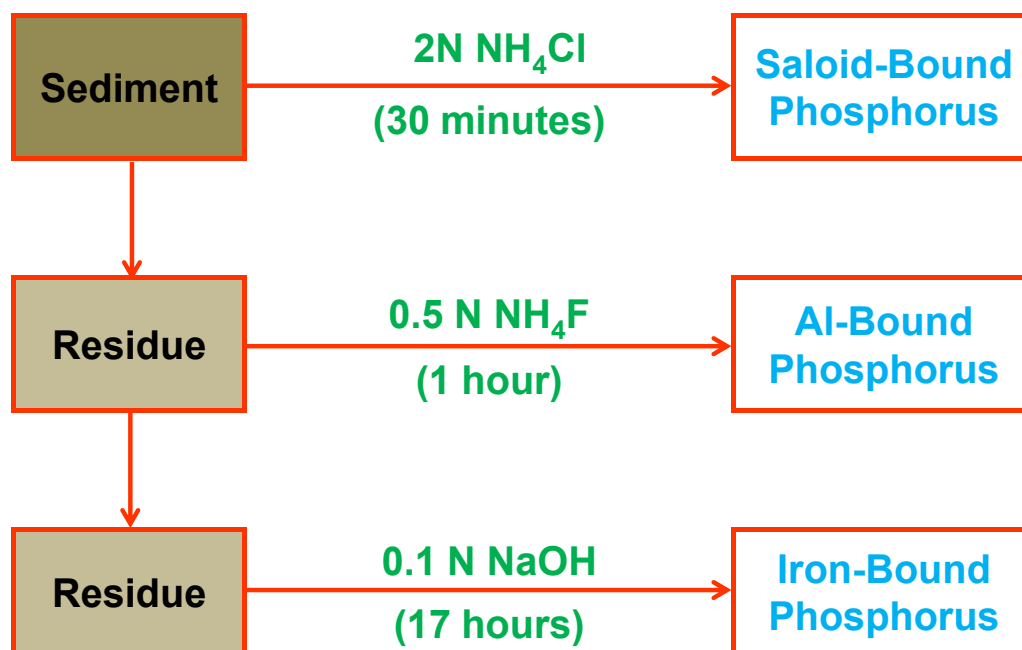


Figure 2-5. Schematic of Chang and Jackson Speciation Procedure for Evaluating Soil Phosphorus Bonding.

For purposes of evaluating release potential, ERD typically assumes that potentially available inorganic phosphorus in soils/sediments, particularly those which exhibit a significant potential to develop reduced conditions below the sediment-water interface, is represented by the sum of the soluble inorganic phosphorus and easily exchangeable phosphorus fractions (collectively termed saloid-bound phosphorus), plus iron-bound phosphorus which can become solubilized under reduced conditions. Aluminum-bound phosphorus is generally considered to be unavailable in the pH range of approximately 5.5-7.5 under a wide range of redox conditions.

### **2.2.3 Sediment Characteristics**

#### **2.2.3.1 Visual Characteristics**

Visual characteristics of sediment core samples were recorded for each of the 42 sediment samples collected in Lake Lawne during August 2011. A summary of visual characteristics of sediment core samples is given in Table 2-5. In general, a surficial layer of unconsolidated organic muck was observed at 21 of the 42 monitoring sites, with measured depths ranging from 0-48 cm. This unconsolidated surficial layer is comprised primarily of fresh organic material (such as dead algal cells) and detritus which has recently accumulated onto the bottom of the lake and is easily disturbed by wind action or boating activities. In deeper portions of the lake, characterized by thick muck deposits, the organic muck beneath the surficial layer becomes more consolidated, with a consistency similar to pudding, reflecting older organic deposits which are resistant to further degradation. These layers typically do not resuspend into the water column. Shallow and shoreline areas of the lake are characterized by fine sand and mixtures of brown fine sand and muck. Photographs of typical sandy sediments in Lake Lawne are given on Figure 2-6, with examples of muck type sediments given on Figure 2-7.

#### **2.2.3.2 General Sediment Characteristics**

After return to the ERD Laboratory, the collected sediment core samples were evaluated for general sediment characteristics, including pH, moisture content, organic content, sediment density, total nitrogen, and total phosphorus. A summary of general characteristics measured in each of the 42 collected sediment core samples is given in Table 2-6. In general, sediments in Lake Lawne were found to be slightly acidic in pH, with measured pH values ranging from 5.74-6.99 and an overall geometric mean of 6.50. These values are typical of pH measurements commonly observed in eutrophic urban lakes.

Isopleths of pH in the top 10 cm of sediments in Lake Lawne are illustrated on Figure 2-8, based upon the information provided in Table 2-6. The majority of areas within Lake Lawne are characterized by pH values ranging from approximately 6.0-6.6. In general, pH values of approximately 6.0-6.2 were observed in areas of deep organic muck within the lake, with higher pH values observed in shoreline areas of the lake, with the exception of an area of depressed pH in the southeast corner of the south lobe.

Measurements of sediment moisture content and organic content in Lake Lawne were found to be highly variable throughout the lake. Many of the collected sediment samples are characterized by a relatively low moisture content and low organic content, suggesting that these surficial sediments are comprised primarily of fine sand. In contrast, other sediment core samples are characterized by elevated values for both moisture content and organic content, suggesting areas of accumulated organic muck. Measured sediment moisture contents ranged from 17.9-91.4%, with an overall geometric mean of 44.7%.

TABLE 2-5

**VISUAL CHARACTERISTICS OF SEDIMENT CORE SAMPLES  
COLLECTED IN LAKE LAWNE DURING AUGUST 2011**

| <b>SITE</b> | <b>LAYER<br/>(cm)</b>       | <b>VISUAL APPEARANCE</b>                                                                                        |
|-------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1           | 0 - >13                     | Brown fine sand with organics                                                                                   |
| 2           | 0 - 10<br>10 - >18          | Brown fine sand with organics<br>Gray fine sand with organics                                                   |
| 3           | 0 - 5<br>5 - >21            | Brown fine sand with organics<br>Gray fine sand with organics                                                   |
| 4           | 0 - 3<br>3 - 10<br>10 - >37 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 5           | 0 - 10<br>10 - >22          | Brown fine sand with organics<br>Gray fine sand with organics                                                   |
| 6           | 0 - 6<br>6 - >37            | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck                                  |
| 7           | 0 - 8<br>8 - >47            | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck                                  |
| 8           | 0 - 3<br>3 - >17            | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 9           | 0 - 4<br>4 - 10<br>10 - >17 | Brown fine sand with organics<br>Gray fine sand with organics<br>Brown fine sand with organics                  |
| 10          | 0 - 8<br>8 - 35<br>35 - >51 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 11          | 0 - 3<br>3 - 45<br>45 - >49 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 12          | 0 - >13                     | Brown fine sand with organics                                                                                   |
| 13          | 0 - 4<br>4 - 31<br>31 - >48 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 14          | 0 - 10<br>10 - >16          | Brown fine sand with organics<br>Gray fine sand with organics                                                   |
| 15          | 0 - 6<br>6 - 52<br>52 - >57 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 16          | 0 - 48<br>48 - >53          | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 17          | 0 - >17                     | Brown fine sand with organics                                                                                   |
| 18          | 0 - 4<br>4 - 45<br>45 - >63 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 19          | 0 - 9<br>9 - >16            | Brown fine sand with organics<br>Gray fine sand with organics                                                   |
| 20          | 0 - >19                     | Brown fine sand with organics                                                                                   |

TABLE 2-5 -- CONTINUED

**VISUAL CHARACTERISTICS OF SEDIMENT CORE SAMPLES  
COLLECTED IN LAKE LAWNE DURING AUGUST 2011**

| <b>SITE</b> | <b>LAYER<br/>(cm)</b>         | <b>VISUAL APPEARANCE</b>                                                                                        |
|-------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 21          | 0 - 10<br>10 - 41<br>41 - >47 | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 22          | 0 - 3<br>3 - 46<br>46 - >51   | Dark brown unconsolidated organic muck<br>Detritus<br>Dark brown consolidated organic muck                      |
| 23          | 0 - >21                       | Brown fine sand with organics                                                                                   |
| 24          | 0 - 0.5<br>0.5 - >26          | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 25          | 0 - 4<br>4 - 9<br>9 - >16     | Brown fine sand with organics<br>Brown fine sand with organics<br>Brown fine sand with organics                 |
| 26          | 0 - >17                       | Brown fine sand with organics                                                                                   |
| 27          | 0 - >29                       | Brown fine sand with organics                                                                                   |
| 28          | 0 - >0.5<br>0.5 - >21         | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 29          | 0 - >18                       | Brown fine sand with organics                                                                                   |
| 30          | 0 - 2<br>2 - 36<br>36 - >39   | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 31          | 0 - 3<br>3 - 51<br>51 - >56   | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 32          | 0 - >17                       | Brown fine sand with organics                                                                                   |
| 33          | 0 - 5<br>5 - >19              | Light brown fine sand<br>Light brown fine sand                                                                  |
| 34          | 0 - 0.5<br>0.5 - >29          | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 35          | 0 - >11                       | Light brown fine sand                                                                                           |
| 36          | 0 - 4<br>4 - >56              | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck                                  |
| 37          | 0 - 1<br>1 - >32              | Dark brown unconsolidated organic muck<br>Brown fine sand with organics                                         |
| 38          | 0 - >17                       | Brown fine sand with organics                                                                                   |
| 39          | 0 - 2<br>2 - 49<br>49 - >62   | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck<br>Brown fine sand with organics |
| 40          | 0 - 1<br>1 - >59              | Dark brown unconsolidated organic muck<br>Dark brown consolidated organic muck                                  |
| 41          | 0 - >19                       | Brown fine sand with organics                                                                                   |
| 42          | 0 - >26                       | Brown fine sand with organics                                                                                   |

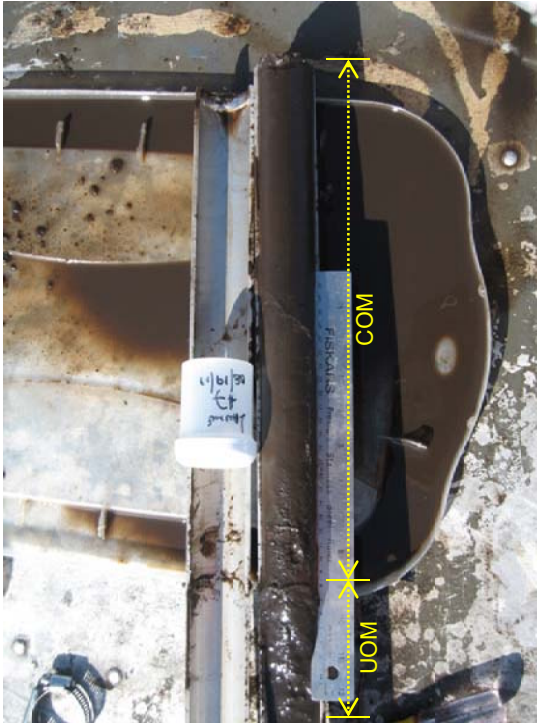




Figure 2-6. Examples of Typical Sandy Sediments in Lake Lawne.



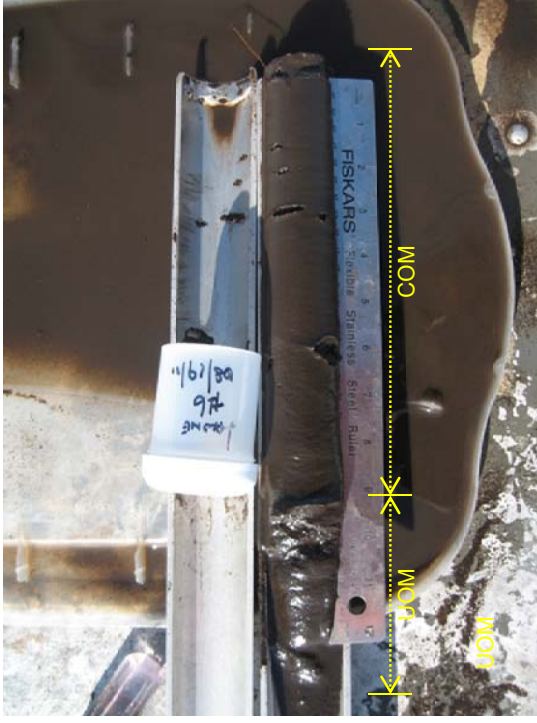
Deep organic muck accumulation



Deep organic muck accumulation



Organic muck overlying dark gray sand



Deep organic muck accumulation

Figure 2-7. Examples of Typical Muck Sediments in Lake Lawne.

TABLE 2-6

**GENERAL CHARACTERISTICS OF THE 0-10 cm LAYER SEDIMENT CORE  
SAMPLES COLLECTED IN LAKE LAWNE DURING AUGUST 2011**

| SITE                  | pH<br>(s.u.) | MOISTURE<br>CONTENT<br>(%) | ORGANIC<br>CONTENT<br>(%) | WET<br>DENSITY<br>(g/cm <sup>3</sup> ) | TOTAL<br>NITROGEN<br>(µg/cm <sup>3</sup> ) | TOTAL<br>PHOSPHORUS<br>(µg/cm <sup>3</sup> ) |
|-----------------------|--------------|----------------------------|---------------------------|----------------------------------------|--------------------------------------------|----------------------------------------------|
| 1                     | 6.85         | 31.6                       | 1.4                       | 2.01                                   | 4,636                                      | 661                                          |
| 2                     | 6.71         | 32.6                       | 1.5                       | 2.00                                   | 5,185                                      | 798                                          |
| 3                     | 6.69         | 29.7                       | 2.2                       | 2.03                                   | 6,253                                      | 857                                          |
| 4                     | 6.36         | 71.1                       | 14.2                      | 1.37                                   | 6,411                                      | 2,052                                        |
| 5                     | 6.62         | 33.7                       | 1.6                       | 1.98                                   | 6,679                                      | 705                                          |
| 6                     | 6.42         | 90.1                       | 46.6                      | 1.08                                   | 5,332                                      | 1,504                                        |
| 7                     | 6.45         | 76.6                       | 19.3                      | 1.28                                   | 6,200                                      | 2,427                                        |
| 8                     | 6.48         | 60.3                       | 6.9                       | 1.55                                   | 7,310                                      | 1,426                                        |
| 9                     | 6.68         | 27.2                       | 1.3                       | 2.08                                   | 6,503                                      | 946                                          |
| 10                    | 6.37         | 81.7                       | 26.8                      | 1.20                                   | 5,969                                      | 1,845                                        |
| 11                    | 6.06         | 86.4                       | 54.8                      | 1.09                                   | 4,318                                      | 1,113                                        |
| 12                    | 6.63         | 24.7                       | 1.1                       | 2.12                                   | 3,149                                      | 448                                          |
| 13                    | 6.29         | 86.8                       | 32.2                      | 1.13                                   | 5,338                                      | 1,613                                        |
| 14                    | 6.73         | 29.5                       | 1.0                       | 2.05                                   | 5,020                                      | 604                                          |
| 15                    | 6.33         | 91.4                       | 53.5                      | 1.06                                   | 5,384                                      | 1,324                                        |
| 16                    | 5.74         | 81.7                       | 52.9                      | 1.13                                   | 4,126                                      | 827                                          |
| 17                    | 6.01         | 28.9                       | 2.5                       | 2.04                                   | 6,133                                      | 2,821                                        |
| 18                    | 6.29         | 84.4                       | 26.6                      | 1.17                                   | 5,532                                      | 1,673                                        |
| 19                    | 6.41         | 26.4                       | 1.0                       | 2.09                                   | 5,903                                      | 1,052                                        |
| 20                    | 6.99         | 43.7                       | 2.9                       | 1.82                                   | 4,129                                      | 665                                          |
| 21                    | 6.37         | 88.4                       | 39.2                      | 1.11                                   | 5,427                                      | 1,306                                        |
| 22                    | 6.46         | 79.3                       | 35.5                      | 1.20                                   | 5,214                                      | 1,948                                        |
| 23                    | 6.78         | 26.9                       | 1.2                       | 2.08                                   | 4,882                                      | 1,741                                        |
| 24                    | 6.89         | 32.1                       | 1.3                       | 2.01                                   | 6,014                                      | 1,624                                        |
| 25                    | 6.80         | 26.4                       | 0.5                       | 2.10                                   | 3,616                                      | 622                                          |
| 26                    | 6.78         | 31.8                       | 1.6                       | 2.01                                   | 6,000                                      | 1,196                                        |
| 27                    | 6.85         | 36.0                       | 2.1                       | 1.94                                   | 6,566                                      | 1,216                                        |
| 28                    | 6.30         | 35.9                       | 2.2                       | 1.94                                   | 5,723                                      | 1,912                                        |
| 29                    | 6.75         | 34.0                       | 2.2                       | 1.97                                   | 6,542                                      | 1,114                                        |
| 30                    | 6.57         | 65.5                       | 11.1                      | 1.46                                   | 5,262                                      | 3,777                                        |
| 31                    | 6.45         | 87.3                       | 36.4                      | 1.12                                   | 5,522                                      | 2,045                                        |
| 32                    | 6.34         | 35.6                       | 2.0                       | 1.95                                   | 6,988                                      | 1,262                                        |
| 33                    | 6.67         | 26.9                       | 0.9                       | 2.09                                   | 3,024                                      | 6,086                                        |
| 34                    | 6.75         | 30.2                       | 1.6                       | 2.03                                   | 7,159                                      | 1,281                                        |
| 35                    | 6.94         | 22.4                       | 1.1                       | 2.15                                   | 3,472                                      | 2,569                                        |
| 36                    | 6.38         | 85.6                       | 40.6                      | 1.13                                   | 5,021                                      | 2,473                                        |
| 37                    | 6.60         | 28.8                       | 2.3                       | 2.04                                   | 5,046                                      | 2,339                                        |
| 38                    | 5.76         | 32.2                       | 2.1                       | 2.00                                   | 5,413                                      | 921                                          |
| 39                    | 6.31         | 89.0                       | 40.3                      | 1.10                                   | 5,433                                      | 2,276                                        |
| 40                    | 6.11         | 86.1                       | 59.6                      | 1.08                                   | 2,865                                      | 958                                          |
| 41                    | 6.94         | 28.6                       | 1.0                       | 2.06                                   | 3,448                                      | 809                                          |
| 42                    | 6.38         | 17.9                       | 0.9                       | 2.22                                   | 7,363                                      | 1,794                                        |
| <b>Minimum</b>        | <b>5.74</b>  | <b>17.9</b>                | <b>0.5</b>                | <b>1.06</b>                            | <b>2,865</b>                               | <b>448</b>                                   |
| <b>Maximum</b>        | <b>6.99</b>  | <b>91.4</b>                | <b>59.6</b>               | <b>2.22</b>                            | <b>7,363</b>                               | <b>6,086</b>                                 |
| <b>Geometric Mean</b> | <b>6.50</b>  | <b>44.7</b>                | <b>5.0</b>                | <b>1.63</b>                            | <b>5,228</b>                               | <b>1,365</b>                                 |





Figure 2-8. Isopleths of pH in the Top 10 cm of Sediments in Lake Lawne.

Isopleths of sediment moisture content in Lake Lawne are summarized on Figure 2-9 based upon the information provided in Table 2-6. Areas of elevated moisture content are present primarily in central portions of the north lobe, eastern portions of the east lobe, and central and southern portions of the south lobe. Sediment moisture contents in excess of 50% are often indicative of highly organic sediments, while moisture contents less than 50% reflect mixtures of sand and muck. The areas of elevated moisture contents correspond well with the areas of accumulated muck indicated on Figure 2-3.

Isopleths of sediment organic content in Lake Lawne are illustrated on Figure 2-10 based upon the information provided in Table 2-6. In general, sediment organic content values in excess of 20-30% are often indicative of organic muck type sediments, with values less than 20-30% representing either sand or mixtures of muck and sand. Based upon these criteria, areas of concentrated organic muck are apparent in central portions of the north lobe, eastern portions of the east lobe, and central and southern portions of the south lobe. These areas of high organic content correspond closely with the areas of accumulated organic muck deposits illustrated on Figure 2-3 and the areas of elevated sediment moisture content illustrated on Figure 2-9. Measured sediment organic content within Lake Lawne ranges from 0.5-59.6%, with an overall geometric mean of 5.0%. The mean sediment organic content of 5.0% in Lake Lawne is slightly less than the mean organic content of 8.4% in measured Lake Holden sediments.

Measured sediment density values are also useful in evaluating the general characteristics of sediments within a lake. Sediments with calculated wet densities between 1.0 g/cm<sup>3</sup> and 1.25 g/cm<sup>3</sup> are indicative of highly organic muck type sediments, while sediment densities of approximately 2.0 or greater are indicative of sandy sediment conditions. Values between 1.25 g/cm<sup>3</sup> and 2.0 g/cm<sup>3</sup> indicate mixtures of sand and muck. Measured sediment density values in Lake Lawne range from 1.06-2.22 g/cm<sup>3</sup>, with an overall geometric mean of 1.63 g/cm<sup>3</sup>.

Isopleths of wet density in Lake Lawne sediments are given in Figure 2-11. Areas of low density organic muck sediments are apparent in the central portions of the north lobe, eastern portions of the east lobe, and central and southern portions of the south lobe. Sediments characterized by densities indicative of sandy sediments are located primarily around perimeter shoreline areas. The areas of low density sediments corresponds well with the areas of accumulated organic muck (Figure 2-3), areas of elevated moisture content (Figure 2-2), and areas of elevated organic content (Figure 2-10).

Measured concentrations of total phosphorus in Lake Lawne sediments were found to be both highly variable and substantially elevated throughout the lake, ranging from 448-6,086 µg/cm<sup>3</sup>, with an overall geometric mean of 1,365 µg/cm<sup>3</sup>. In general, sandy sediments are often characterized by low total phosphorus concentrations, while highly organic muck type sediments are characterized by elevated total phosphorus concentrations. The mean sediment phosphorus concentrations of 1,365 µg/cm<sup>3</sup> in Lake Lawne are substantially greater than the mean sediment phosphorus concentration of 439 µg/cm<sup>3</sup> measured by ERD in Lake Holden, the concentration of 502 µg/cm<sup>3</sup> measured in Lake Pineloch, and the mean of 923 µg/cm<sup>3</sup> measured in Lake Killarney.





Figure 2-9. Isopleths of Moisture Content (%) in the Top 10 cm of Sediments in Lake Lawne.



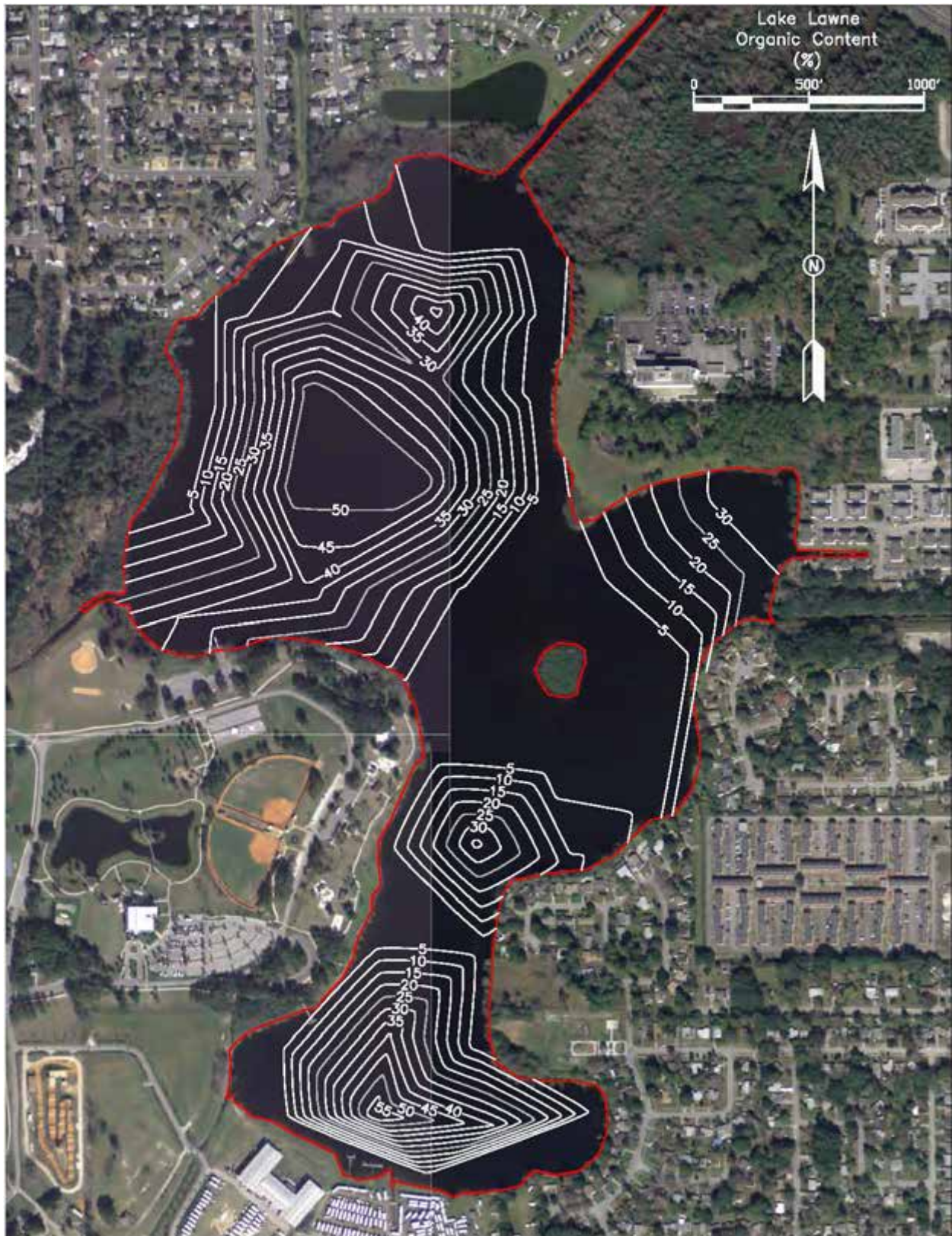


Figure 2-10. Isopleths of Organic Content (%) in the Top 10 cm of Sediments in Lake Lawne.



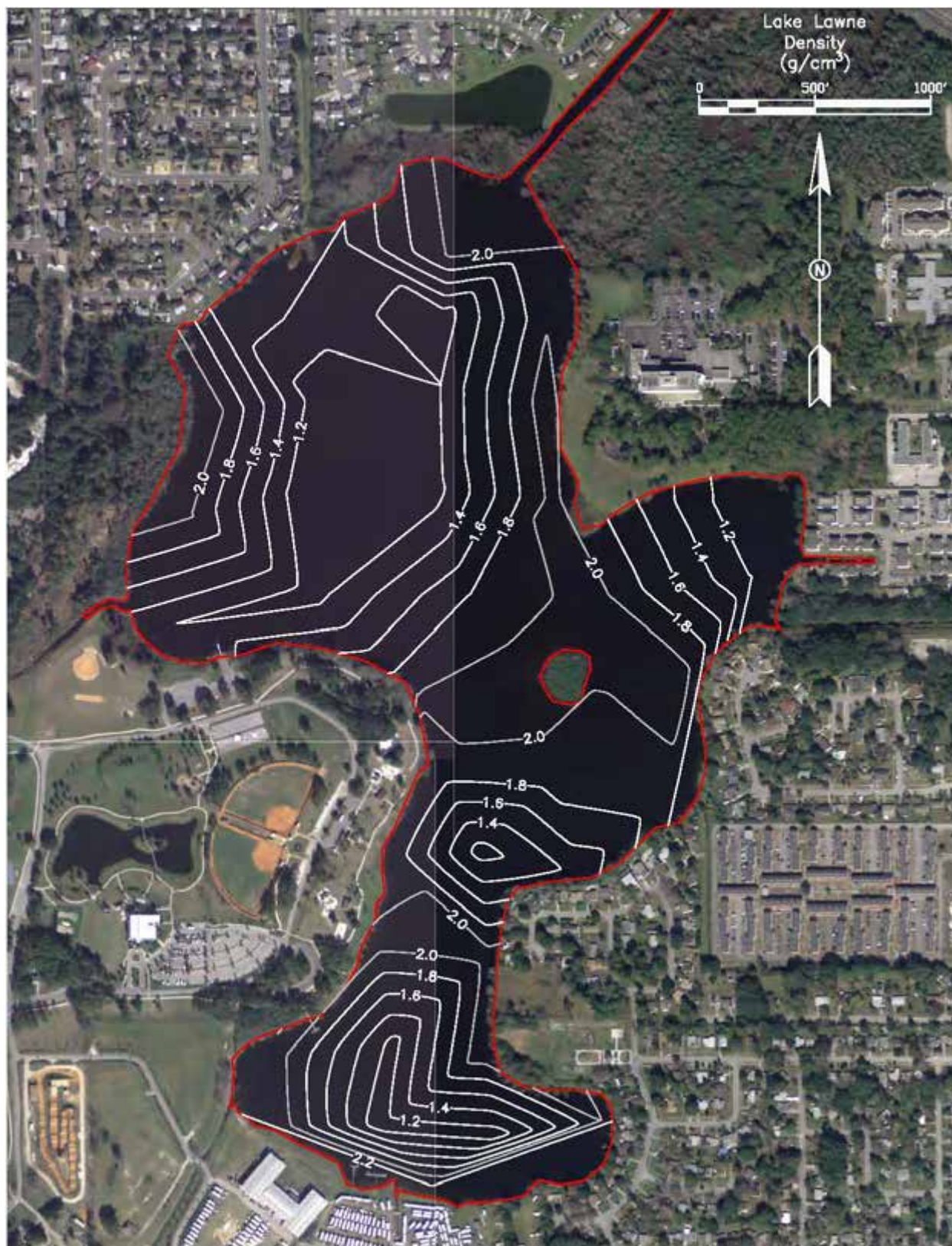


Figure 2-11. Isopleths of Wet Density ( $\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.

Isopleths of sediment phosphorus concentrations in Lake Lawne are presented on Figure 2-12, based on information contained in Table 2-6. Areas of elevated sediment phosphorus concentrations are present in the central portion of the north lobe, eastern portions of the east lobe, and central and southern areas of the south lobe. The most elevated concentrations of phosphorus within the lake were measured in the central portions of the south lobe in areas of deep muck accumulations. In general, overall total phosphorus concentrations observed in Lake Lawne appear to be substantially elevated compared with phosphorus sediment concentrations typically observed in urban lakes.

Similar to the trends observed for sediment phosphorus concentrations, sediment nitrogen concentrations are also highly variable throughout Lake Lawne. Measured sediment nitrogen concentrations in the lake range from 2,865-7,363  $\mu\text{g}/\text{cm}^3$ , with an overall geometric mean of 5,228  $\mu\text{g}/\text{cm}^3$ . Measured sediment nitrogen concentrations in Lake Lawne also appear to be elevated compared with values normally observed in urban lakes. The mean sediment nitrogen concentration measured in Lake Lawne is greater than the mean concentration of 4,470  $\mu\text{g}/\text{cm}^3$  measured in Lake Killarney and substantially greater than the mean of 1,198  $\mu\text{g}/\text{cm}^3$  measured by ERD in Lake Holden during September 2003. Isopleths of sediment nitrogen concentrations in Lake Lawne are illustrated on Figure 2-13. In general, areas of elevated nitrogen concentrations are present throughout the northern and southern lobes. However, sediment concentrations of total nitrogen in the north and south lobes are lowest in the areas of accumulated muck, possibly due to denitrification processes in the highly anoxic environment which exists in this area.

### **2.2.3.3 Phosphorus Speciation**

As discussed in Section 2.2.2, each of the collected sediment core samples was evaluated for phosphorus speciation based upon the Chang and Jackson speciation procedure. This procedure allows phosphorus to be speciated with respect to bonding mechanisms within the sediments. This information is useful in evaluating the stability of phosphorus in the sediments and the potential for release of phosphorus from the sediments under anoxic or other conditions.

A summary of phosphorus speciation in sediment core samples collected from Lake Lawne during August 2011 is given in Table 2-7. Saloid-bound phosphorus represents sediment phosphorus which is either soluble or easily exchangeable and is typically considered to be readily available for release from the sediments into the overlying water column. As seen in Table 2-7, saloid-bound phosphorus concentrations appear to be fairly uniform throughout the sediments of Lake Lawne. Measured values for saloid-bound phosphorus range from 1-33  $\mu\text{g}/\text{cm}^3$ , with an overall mean of 6  $\mu\text{g}/\text{cm}^3$ . Isopleths of saloid-bound phosphorus in the sediments of Lake Lawne are illustrated on Figure 2-14. In general, elevated levels of saloid-bound phosphorus are loosely associated with areas of deep organic muck.



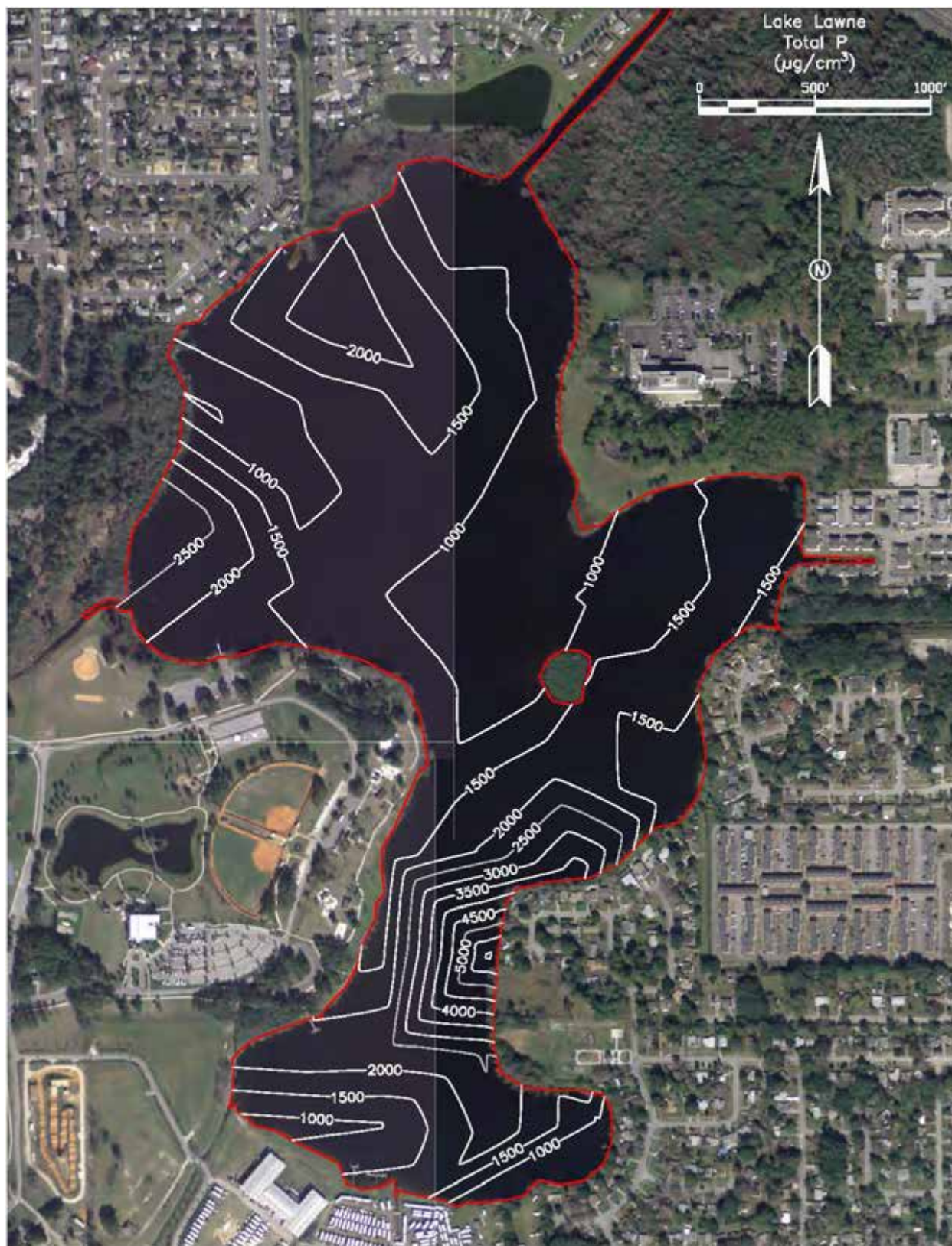


Figure 2-12. Isopleths of Total Phosphorus ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.





Figure 2-13. Isopleths of Total Nitrogen ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.



TABLE 2-7

**PHOSPHORUS SPECIATION IN THE 0-10 cm LAYER OF SEDIMENT  
CORE SAMPLES COLLECTED IN LAKE LAWNE DURING AUGUST 2011**

| SITE                  | SALOID-<br>BOUND P<br>( $\mu\text{g}/\text{cm}^3$ wet wt.) | Fe-BOUND P<br>( $\mu\text{g}/\text{cm}^3$ wet wt.) | TOTAL<br>AVAILABLE P<br>( $\mu\text{g}/\text{cm}^3$ wet wt.) | PERCENT OF<br>SEDIMENT P WHICH<br>IS AVAILABLE<br>(%) | Al-BOUND P<br>( $\mu\text{g}/\text{cm}^3$ wet wt.) |
|-----------------------|------------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------|
| 1                     | 10                                                         | 37                                                 | 46                                                           | 7.0                                                   | 31                                                 |
| 2                     | 10                                                         | 98                                                 | 108                                                          | 13.5                                                  | 38                                                 |
| 3                     | 6                                                          | 28                                                 | 35                                                           | 4.1                                                   | 52                                                 |
| 4                     | 8                                                          | 54                                                 | 63                                                           | 3.1                                                   | 71                                                 |
| 5                     | 3                                                          | 23                                                 | 26                                                           | 3.7                                                   | 25                                                 |
| 6                     | 6                                                          | 43                                                 | 49                                                           | 3.3                                                   | 58                                                 |
| 7                     | 26                                                         | 75                                                 | 101                                                          | 4.2                                                   | 94                                                 |
| 8                     | 5                                                          | 40                                                 | 45                                                           | 3.1                                                   | 45                                                 |
| 9                     | 6                                                          | 52                                                 | 58                                                           | 6.2                                                   | 31                                                 |
| 10                    | 6                                                          | 57                                                 | 63                                                           | 3.4                                                   | 63                                                 |
| 11                    | 2                                                          | 47                                                 | 49                                                           | 4.4                                                   | 54                                                 |
| 12                    | 2                                                          | 55                                                 | 57                                                           | 12.8                                                  | 25                                                 |
| 13                    | 3                                                          | 60                                                 | 63                                                           | 3.9                                                   | 88                                                 |
| 14                    | 17                                                         | 23                                                 | 40                                                           | 6.6                                                   | 41                                                 |
| 15                    | 6                                                          | 37                                                 | 43                                                           | 3.3                                                   | 50                                                 |
| 16                    | 1                                                          | 70                                                 | 70                                                           | 8.5                                                   | 94                                                 |
| 17                    | 1                                                          | 79                                                 | 80                                                           | 2.8                                                   | 134                                                |
| 18                    | 4                                                          | 70                                                 | 74                                                           | 4.4                                                   | 88                                                 |
| 19                    | 7                                                          | 81                                                 | 87                                                           | 8.3                                                   | 38                                                 |
| 20                    | 8                                                          | 95                                                 | 103                                                          | 15.4                                                  | 146                                                |
| 21                    | 5                                                          | 55                                                 | 60                                                           | 4.6                                                   | 72                                                 |
| 22                    | 1                                                          | 104                                                | 106                                                          | 5.4                                                   | 116                                                |
| 23                    | 6                                                          | 21                                                 | 28                                                           | 1.6                                                   | 42                                                 |
| 24                    | 15                                                         | 39                                                 | 53                                                           | 3.3                                                   | 56                                                 |
| 25                    | 10                                                         | 17                                                 | 27                                                           | 4.3                                                   | 24                                                 |
| 26                    | 20                                                         | 22                                                 | 42                                                           | 3.5                                                   | 39                                                 |
| 27                    | 8                                                          | 40                                                 | 48                                                           | 3.9                                                   | 42                                                 |
| 28                    | 7                                                          | 59                                                 | 65                                                           | 3.4                                                   | 75                                                 |
| 29                    | 14                                                         | 28                                                 | 42                                                           | 3.8                                                   | 38                                                 |
| 30                    | 30                                                         | 123                                                | 152                                                          | 4.0                                                   | 153                                                |
| 31                    | 10                                                         | 67                                                 | 77                                                           | 3.8                                                   | 100                                                |
| 32                    | 8                                                          | 30                                                 | 37                                                           | 3.0                                                   | 34                                                 |
| 33                    | 33                                                         | 58                                                 | 92                                                           | 1.5                                                   | 35                                                 |
| 34                    | 5                                                          | 25                                                 | 30                                                           | 2.4                                                   | 34                                                 |
| 35                    | 3                                                          | 113                                                | 116                                                          | 4.5                                                   | 68                                                 |
| 36                    | 6                                                          | 80                                                 | 86                                                           | 3.5                                                   | 110                                                |
| 37                    | 4                                                          | 71                                                 | 75                                                           | 3.2                                                   | 93                                                 |
| 38                    | 2                                                          | 28                                                 | 30                                                           | 3.3                                                   | 62                                                 |
| 39                    | 8                                                          | 63                                                 | 71                                                           | 3.1                                                   | 99                                                 |
| 40                    | 3                                                          | 73                                                 | 76                                                           | 7.9                                                   | 94                                                 |
| 41                    | 3                                                          | 16                                                 | 19                                                           | 2.4                                                   | 30                                                 |
| 42                    | 6                                                          | 22                                                 | 29                                                           | 1.6                                                   | 55                                                 |
| <b>Minimum</b>        | <b>1</b>                                                   | <b>16</b>                                          | <b>19</b>                                                    | <b>1.5</b>                                            | <b>24</b>                                          |
| <b>Maximum</b>        | <b>33</b>                                                  | <b>123</b>                                         | <b>152</b>                                                   | <b>15.4</b>                                           | <b>153</b>                                         |
| <b>Geometric Mean</b> | <b>6</b>                                                   | <b>47</b>                                          | <b>56</b>                                                    | <b>4.1</b>                                            | <b>57</b>                                          |

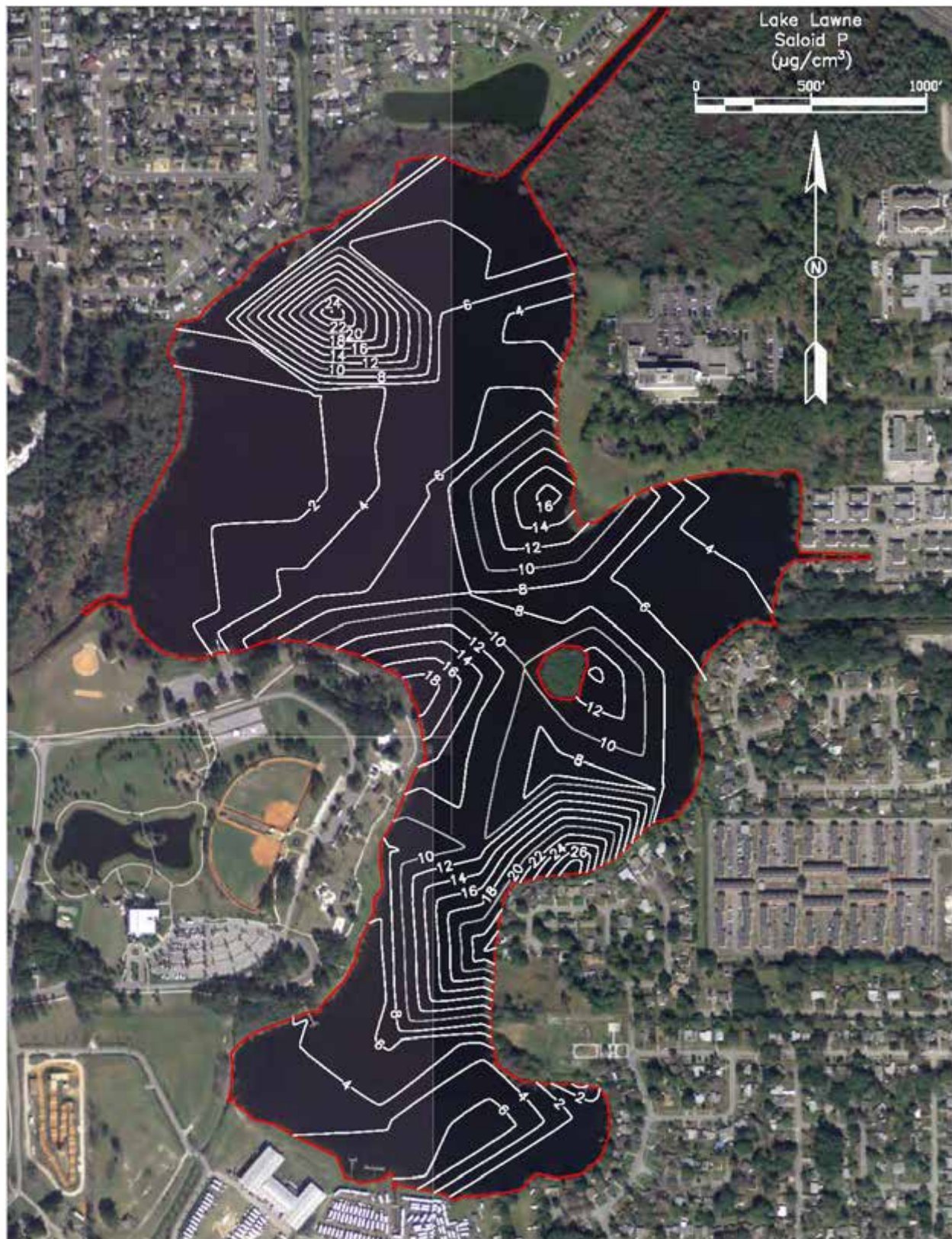


Figure 2-14. Isopleths of Saloid-Bound Phosphorus ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.

In general, iron-bound phosphorus associations in the sediments of Lake Lawne appear to be substantially elevated in value. Iron-bound phosphorus is relatively stable under oxidized conditions, but becomes unstable under a reduced environment, causing the iron-phosphorus complex to dissociate, releasing the bound phosphorus directly into the water column. Iron-bound phosphorus concentrations in the sediments of Lake Lawne range from 16-123  $\mu\text{g}/\text{cm}^3$ , with an overall geometric mean of 47  $\mu\text{g}/\text{cm}^3$ . Since iron-bound phosphorus can be released under anoxic (reducing) conditions, large portions of Lake Lawne may have conditions favorable for release of iron-bound sediment phosphorus into the water column throughout much of the year. The iron-bound phosphorus concentrations summarized in Table 2-7 appear to be similar to values commonly observed in urban lake systems. The geometric mean value of 47  $\mu\text{g}/\text{cm}^3$  measured in Lake Lawne is similar to the geometric mean iron-bound phosphorus concentration of 64  $\mu\text{g}/\text{cm}^3$  measured in Lake Killarney.

Isopleths of iron-bound phosphorus in the top 10 cm of sediments in Lake Lawne are illustrated on Figure 2-15. Areas of elevated iron-bound phosphorus are located primarily in areas characterized by accumulations of organic muck.

Total available phosphorus represents the sum of the saloid-bound phosphorus and iron-bound phosphorus associations in each sediment core sample. Since the saloid-bound phosphorus is immediately available, and the iron-bound phosphorus is available under reduced conditions, the sum of these speciations represents the total phosphorus which is potentially available within the sediments. This information can be utilized as a guide for future sediment inactivation procedures. A summary of total available phosphorus in each of the 42 collected sediment core samples is given in Table 2-7. Total available phosphorus concentrations within the lake range from 19-152  $\mu\text{g}/\text{cm}^3$ , with an overall mean of 56  $\mu\text{g}/\text{cm}^3$ . The mean sediment total available phosphorus in Lake Lawne is similar to the mean sediment available phosphorus measured in Lake Killarney and Lake Pineloch by ERD.

Isopleths of total available phosphorus in the top 10 cm of sediments in Lake Lawne are illustrated on Figure 2-16. Areas of elevated total available phosphorus are apparent in the central and northern portions of the north lobe, western portions of the east lobe, and central and southern portions of the south lobe, and correspond roughly to the areas of accumulated organic muck. The isopleths presented on Figure 2-16 can be utilized directly as a guide for future sediment inactivation activities.

Available sediment phosphorus is also expressed in Table 2-7 as a percentage of total phosphorus concentrations within the sediments. The percentage of available phosphorus within the sediments of Lake Lawne ranges from approximately 1.5-15.4%, with an overall geometric mean of 4.1%. This suggests that approximately 1.5-15.4% of the existing accumulation of phosphorus within the lake is potentially available for release into the overlying water column as a result of sediment agitation or anoxic conditions.

Isopleths of the percentage of available sediment phosphorus in the top 10 cm of sediments in Lake Lawne are illustrated on Figure 2-17. The highest percentages of available sediment phosphorus occur in southern portions of the north lobe and central portions of the south lobe where the percentage of available phosphorus ranges from approximately 3-7%.



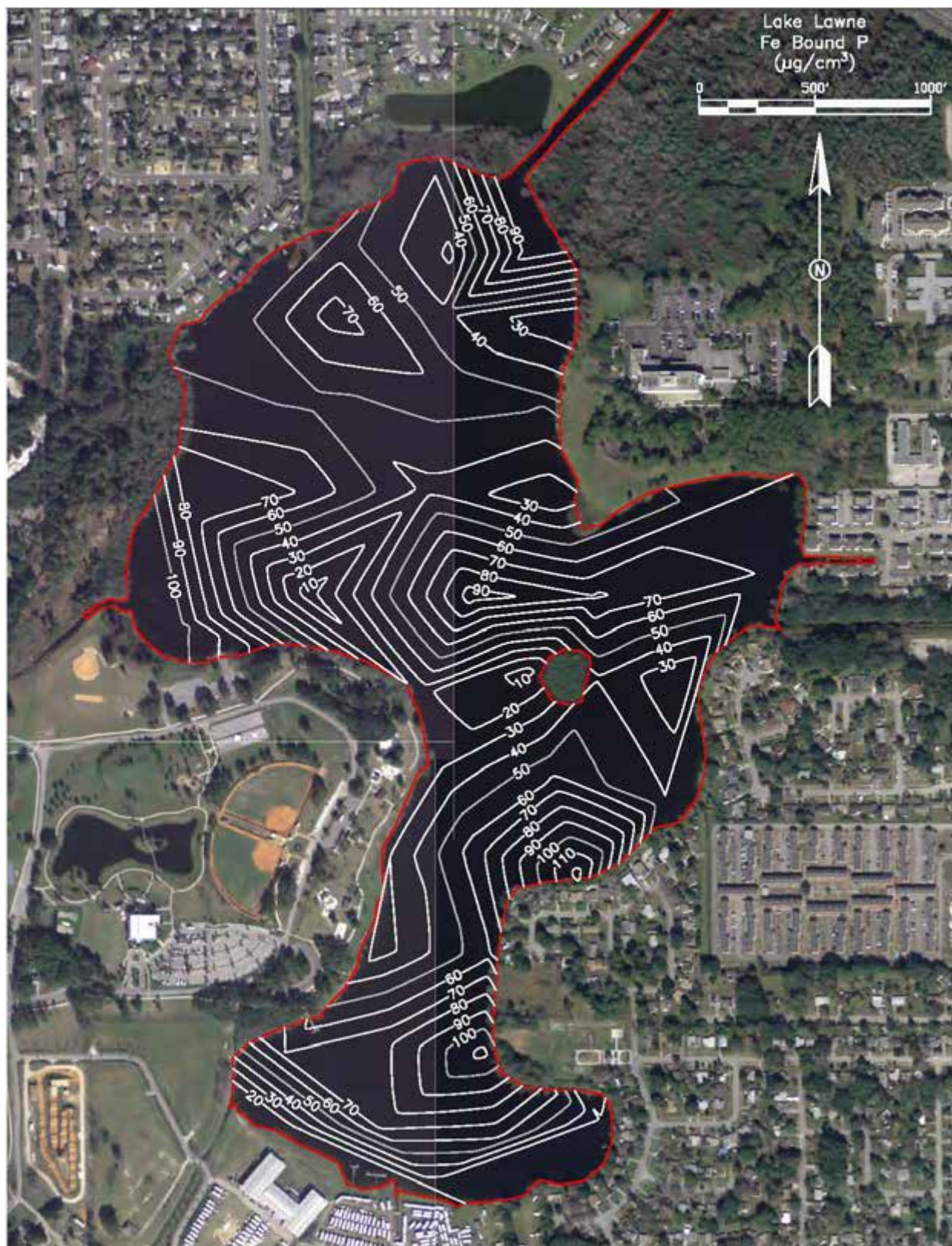


Figure 2-15. Isopleths of Iron-Bound Phosphorus ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.



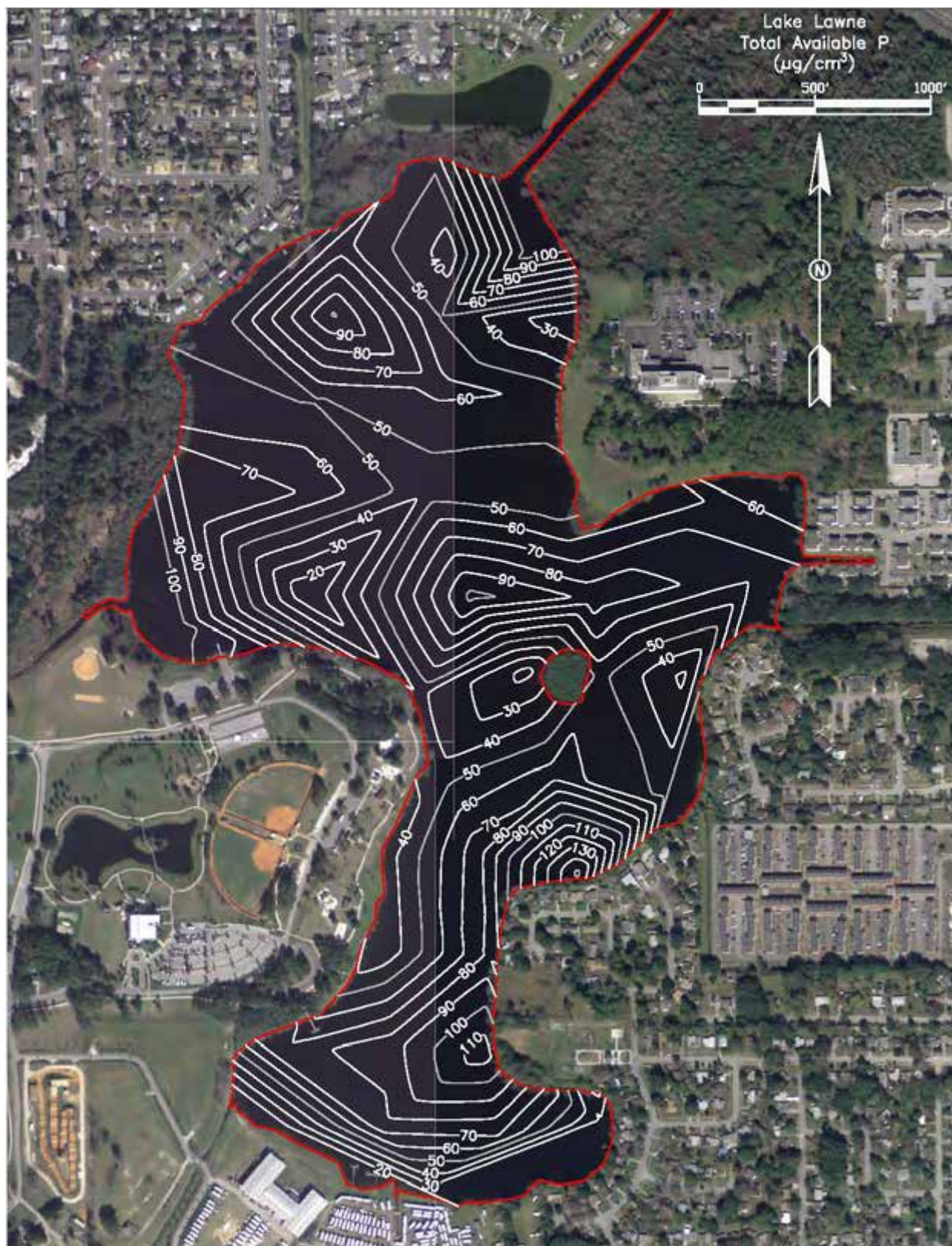


Figure 2-16. Isopleths of Total Available Phosphorus ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments In Lake Lawne.





Figure 2-17. Isopleths of Total Available Sediment Phosphorus (% of total sediment P) in the Top 10 cm of Sediments in Lake Lawne.

Aluminum-bound phosphorus represents an unavailable species of phosphorus within the sediments. Phosphorus bound with aluminum is typically considered to be inert under a wide range of pH and redox conditions within the sediments. Aluminum-bound phosphorus concentrations range from 24-153  $\mu\text{g}/\text{cm}^3$ , with an overall geometric mean of 57  $\mu\text{g}/\text{cm}^3$ . These values appear to be similar to aluminum-bound phosphorus concentrations commonly observed in urban lake systems.

Isopleths of aluminum-bound phosphorus in the sediments of Lake Lawne are illustrated on Figure 2-18. Areas of elevated aluminum phosphorus bonding are present in central portions of the lake, along with northern and southern portions of the south lobe.

## **2.3 Water Quality Characteristics of Lake Lawne**

### **2.3.1 Historical Water Quality**

#### **2.3.1.1 Historical Water Quality Data Availability**

Relatively extensive historical water quality monitoring has been conducted in Lake Lawne by OCEPD and the City of Orlando, with a limited number of samples collected during 2007 by FDEP to evaluate potential water quality impairment. A summary of available historical water quality data for Lake Lawne is given in Table 2-8. Water quality monitoring by Orange County is conducted at three separate locations, including the north lobe (LW10N), south lobe (LW10S), and middle lobe (LW10M). The designation “LW” in the site name indicates that the lake is in the Little Wekiva Basin, the “10” designates Lake Lawne, and the N-S-M reflect north, south, and middle lobes. Monitoring was initiated by Orange County during 1966, and has been continued on approximately a quarterly basis from 1966 to the present. Monitoring conducted by OCEPD includes measurement of field parameters and laboratory analyses for general parameters, nutrients, microbiological parameters, and metals. A total of 368 water quality samples have been collected as part of the OCEPD monitoring program in Lake Lawne.

Surface water monitoring in Lake Lawne was initiated by the City of Orlando during February 1990, with monitoring conducted at sites designated as “North” and “South”. Two monitoring events were conducted during 1990, with two additional events conducted during 1992. Beginning in 1993, monitoring by the City of Orlando was conducted on approximately a quarterly basis from 1993 to the present. Monitoring conducted by the City of Orlando includes measurement of field parameters and laboratory analyses for general parameters, nutrients, and microbiological parameters. A total of 149 water quality samples have been collected in Lake Lawne as part of the Orlando monitoring program.

Surface water monitoring by FDEP was conducted in Lake Lawne from February-December 2007 at five separate locations within the lake, with monitoring conducted on approximately a monthly to bi-monthly basis as part of the effort to identify “impaired waters”. The FDEP monitoring included measurements of pH, nutrients, Secchi depth, color, and chlorophyll-a. Four to five separate samples were collected at each of the five monitoring sites as part of the FDEP monitoring program.



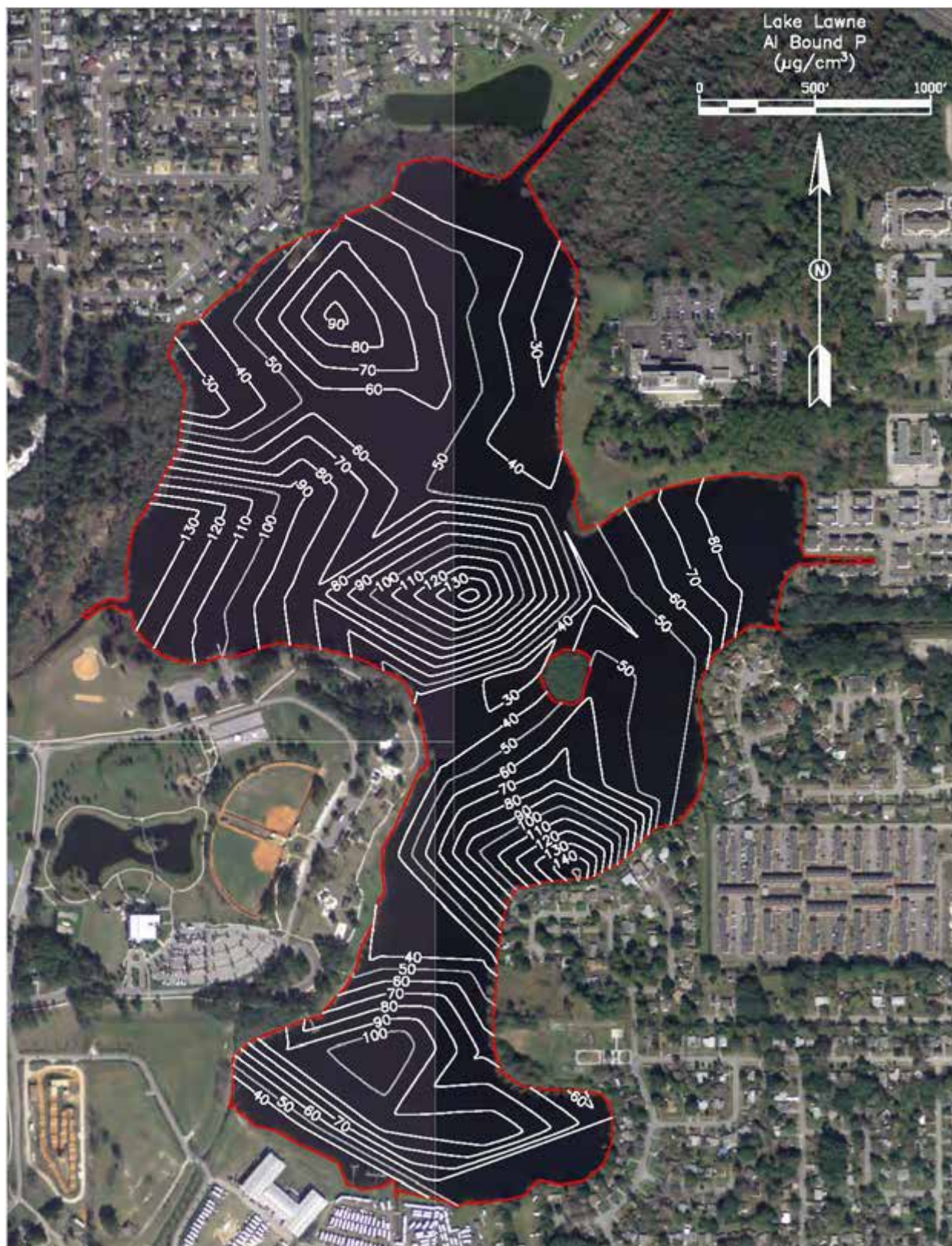


Figure 2-18. Isopleths of Aluminum-Bound Phosphorus ( $\mu\text{g}/\text{cm}^3$ ) in the Top 10 cm of Sediments in Lake Lawne.



TABLE 2-8

**SUMMARY OF AVAILABLE HISTORICAL  
WATER QUALITY DATA FOR LAKE LAWNE**

| AGENCY          | STATION I.D.                                             | COLLECTION DATES | MONITORING FREQUENCY    | NUMBER OF EVENTS | TYPE OF DATA                                                                                           |
|-----------------|----------------------------------------------------------|------------------|-------------------------|------------------|--------------------------------------------------------------------------------------------------------|
| OCEPD           | LW10N (North)                                            | 12/74-Present    | Approximately quarterly | 166              | Field parameters, general parameters, nutrients, microbiological parameters, metals, depending on date |
|                 | LW10S (South)                                            | 2/75-Present     | Approximately quarterly | 162              | Field parameters, general parameters, nutrients, microbiological parameters, metals, depending on date |
|                 | LW10M (Middle)                                           | 10/66-Present    | Approximately quarterly | 140              | Field parameters, general parameters, nutrients, microbiological parameters, metals, depending on date |
| City of Orlando | Lawne North                                              | 2/90-Present     | Approximately quarterly | 74               | Field parameters, general parameters, nutrients, microbiological parameters                            |
|                 | Lawne South                                              | 2/90-Present     | Approximately quarterly | 75               | Field parameters, general parameters, nutrients, microbiological parameters                            |
| FDEP            | 20010303<br>20010794<br>20010795<br>20010796<br>20010797 | 2/07-12/07       | Monthly to bi-monthly   | 4-5              | Chlorophyll, pH, nutrients, Secchi depth, color, alkalinity                                            |

A historical data set for Lake Lawne was developed by ERD using the available data collected by OCEPD and the City of Orlando. Historical water quality data collected by OCEPD are available beginning as early as 1966. However, much of this early data contains extremely elevated values for both nitrogen and phosphorus, and suffers from poor detection limits for many of the evaluated parameters. Therefore, a cutoff date of 1990 was established to separate these early data from more recent data, and water quality evaluations and discussions contained in this report pertain only to data collected from 1990 to the present. This approach was not necessary for data collected by the City of Orlando, since the City began collecting data in 1992. The available data set using data collected from 1990 to the present includes more than 20 years of historical data which are generally sufficient to evaluate historical water quality and water quality trends. Due to the limited amount of data collected by FDEP, the FDEP data are not included in the historical data set used for evaluation of historical water quality. A complete listing of historical water quality data collected in Lake Lawne by OCEPD, the City of Orlando, and FDEP is given in Appendix A, although data collected prior to 1990 are not used in subsequent analyses.

Historical water quality characteristics in Lake Lawne were evaluated by ERD based upon an examination of individual monitoring events as well as mean annual concentrations for total phosphorus, total nitrogen, chlorophyll-a, Secchi disk depth, TN/TP ratio, and TSI. Separate water quality evaluations were conducted for the north, middle, and south lobes of the lake.

### **2.3.1.2 Historical Characteristics of the North Lobe**

A graphical summary of historical water quality data and water quality trends for total phosphorus and total nitrogen in the north lobe of Lake Lawne from 1990-2011 is given on Figure 2-19. Individual measurements of total nitrogen and total phosphorus conducted by the City of Orlando are indicated in **red**, while data collected by Orange County are provided in **blue**. The yearly average concentrations for total nitrogen and total phosphorus are illustrated as **green** dots and lines which reflect the mean total nitrogen and total phosphorus concentrations for each annual period using the combined data collected by the City of Orlando and OCEPD.

The average yearly plots are used to generate a regression trend line for total nitrogen and total phosphorus to assist in identifying significant water quality trends. The calculated probability value (p value) for the regression model is also provided which indicates the level of significance associated with each regression model. A model which is significant at a 95% confidence level would be associated with a p value of 0.05. However, lakes exhibit normal cyclic variations in water quality which can reduce the statistical significance of the regression model and possibly lead to incorrect conclusions concerning the significance of an apparent water quality trend. Therefore, when evaluating water quality trends in lakes, a p value of 0.1 or less is generally considered to indicate a significant statistical trend, while p values greater than 0.1 suggest an insignificant trend.

Measured concentrations of total nitrogen in the north lobe of Lake Lawne from 1990-2011 ranged from approximately 600-2,600 µg/l, although the majority of measured values appear to range from approximately 1,000-2,000 µg/l. With only a few exceptions, concentrations of total nitrogen in Lake Lawne have exhibited a relatively high degree of variability between routine measurements. The regression trend line for total nitrogen, represented by the solid black line, indicates a slight decrease in total nitrogen over time. However, the calculated p value of 0.3872 indicates that the observed trend in total nitrogen concentrations is not statistically significant. The observed variability in total nitrogen concentrations appears to be lower from approximately 2003-2011 than observed prior to 2003.

Measured concentrations of total phosphorus in the north lobe of Lake Lawne have ranged from approximately 10-150 µg/l, although the vast majority of measured values appear to fall within the range of approximately 40-140 µg/l. Similar to the trend observed for total nitrogen, variability in measured total phosphorus concentrations in the north lobe of Lake Lawne appears to be less from approximately 2003 to the present than observed prior to 2003. The yearly average total phosphorus concentrations, illustrated by the **green** line, suggest relatively stable total phosphorus concentrations within the lake over a long-term basis. The regression trend line for total phosphorus indicates a trend of slightly decreasing total phosphorus concentrations over time, and the calculated p value of 0.0001 indicates that the trend of decreasing concentrations is highly significant. Mean annual average total phosphorus concentrations in Lake Lawne over the past 6-8 years have ranged from approximately 40-50 µg/l.

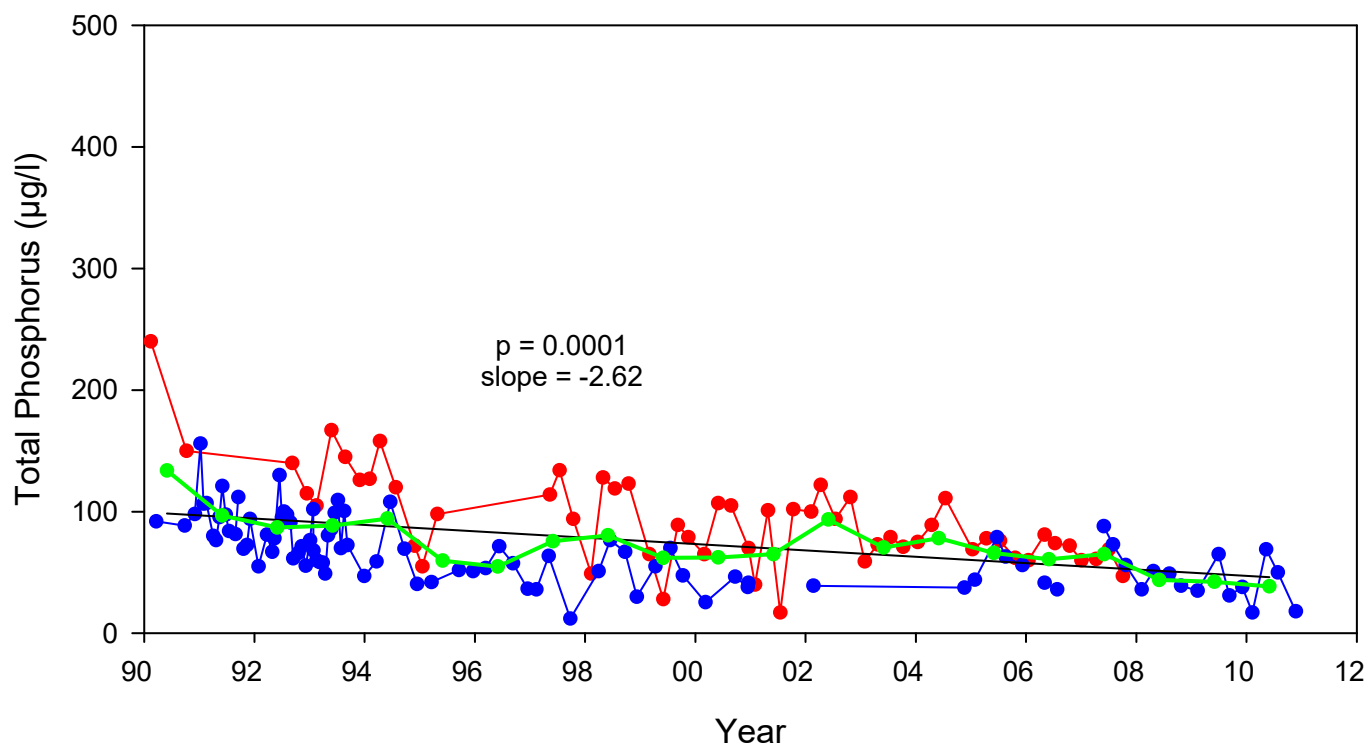
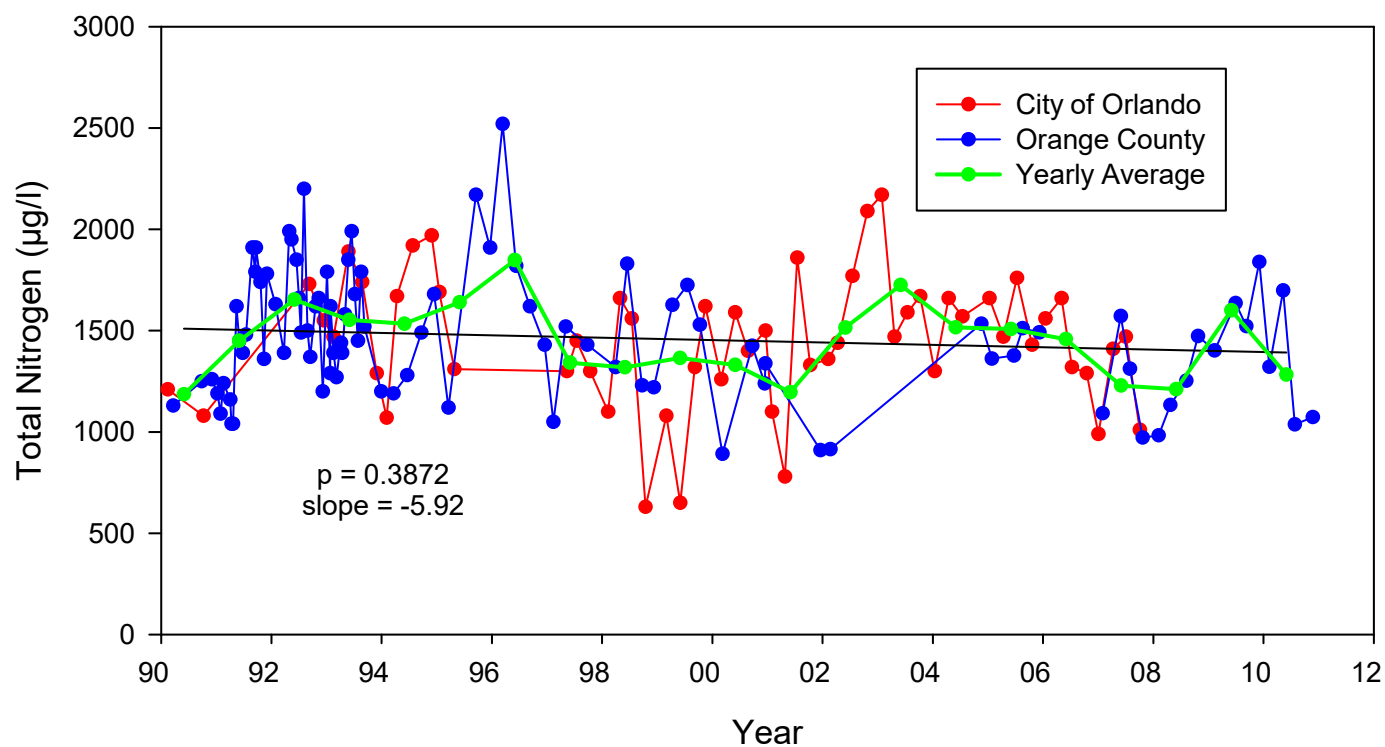


Figure 2-19. Historical Water Quality Data and Trends for Total Nitrogen and Total Phosphorus in the North Lobe of Lake Lawne.



A graphical summary of historical water quality data and trends in concentrations of chlorophyll-a and Secchi disk depth in the north lobe of Lake Lawne are given on Figure 2-20. Historical concentrations of chlorophyll-a in the north lobe have been highly variable, ranging from approximately 5-80 mg/m<sup>3</sup>, although the majority of measured values appear to fall in the range of approximately 10-60 mg/m<sup>3</sup>. The variability in measured values of chlorophyll-a appear to be lower in the north lobe of Lake Lawne over the past 6-8 years, compared with values measured prior to that period. The statistical regression line for chlorophyll-a suggests a trend of decreasing concentrations in the north lobe over time, and the calculated p value for the regression line of 0.0058 indicates that the trend is highly significant. Mean annual chlorophyll-a concentrations in Lake Lawne over the past 6-8 years have been approximately 20 mg/m<sup>3</sup>.

A summary of historical measurements and long-term trends in Secchi disk depth in the north lobe of Lake Lawne is given on the bottom of Figure 2-20. Measured Secchi disk depths within the north lobe have ranged from approximately 0.3-1.6 m, although the vast majority of measured Secchi disk depths have ranged from approximately 0.5-1 m. Measured Secchi disk depths within the lake appear to exhibit a lower degree of variability over the past 6-8 years compared with measurements performed before that period. A general trend of increasing Secchi disk depth over time is apparent on Figure 2-20, and the calculated p value of 0.0038 indicates that the trend is statistically significant.

Florida Trophic State Index (TSI) values were also calculated for each monitoring event in the north lobe over the available period of historical data. TSI is a summary statistic which is often considered to be a good overall indicator of the health of a lake system. Calculated TSI values less than 50 indicate oligotrophic conditions, representing lakes with low nutrient loadings and good to excellent water quality characteristics. Calculated TSI values from 50-60 indicate mesotrophic or fair water quality characteristics. Calculated TSI values between 60-70 indicate eutrophic or poor water quality characteristics, with hypereutrophic conditions, reflecting very poor water quality, indicated by TSI values in excess of 70.

The trophic state index was developed by Carlson (1977) as a relative measure of the degree of biological productivity in lakes. The TSI concept automatically incorporates forcing functions for biological productivity such as nutrient supplies, light availability, seasonality, and other factors. Since the TSI value is intended to reflect the level of biological productivity, the best estimator for productivity is chlorophyll-a. Some calculations also incorrectly include concentrations of nutrients and Secchi disk depth in addition to chlorophyll-a, but nutrients and Secchi disk depth should only be included as surrogates for biological productivity in TSI calculations when chlorophyll data are not available. TSI calculations for Lake Lawne are performed using concentrations of chlorophyll-a only according to the following relationship:

$$TSI (chlorophyll-a) = 16.8 + 14.4 \ln (chlorophyll-a)$$

where:

$$chlorophyll-a = \text{chlorophyll-a concentration (mg/m}^3\text{)}$$

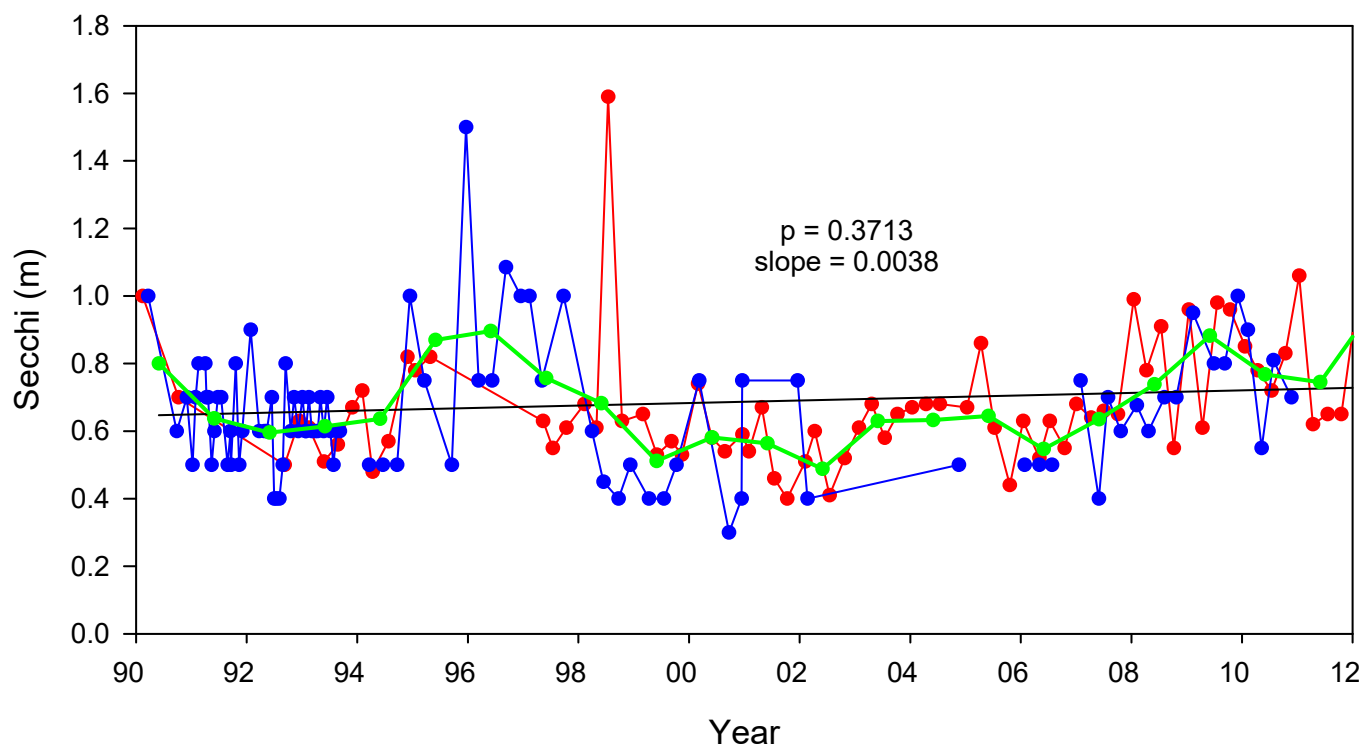
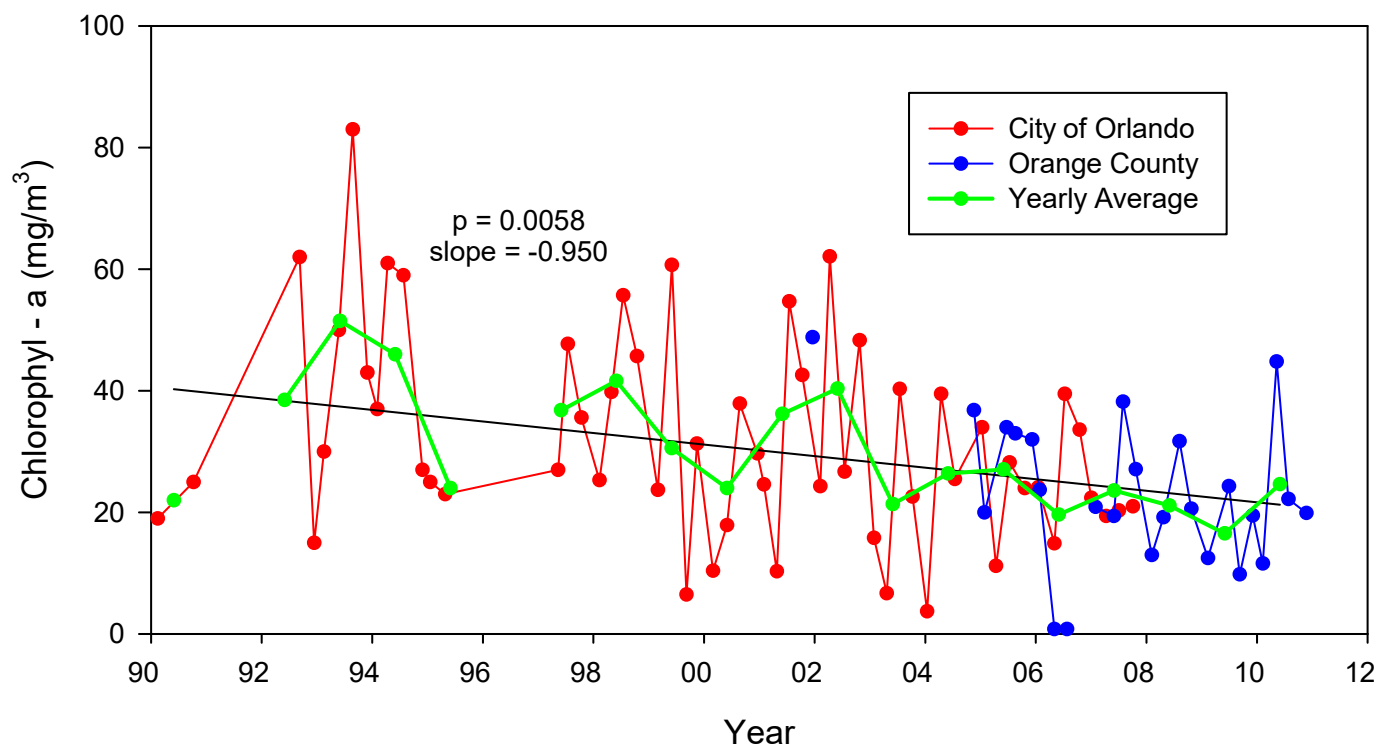


Figure 2-20. Historical Water Quality Data and Trends for Chlorophyll-a and Secchi Disk Depth in the North Lobe of Lake Lawne.

Event and mean annual TSI values in the north lobe of Lake Lawne from 1990-2011 are summarized on Figure 2-21. Calculated TSI values for individual monitoring events in the north lobe have ranged from approximately 10-80, although the vast majority of calculated TSI values have been in the range of approximately 40-75, spanning the range from oligotrophic to hypereutrophic conditions. A high degree of variation in TSI values is common in highly productive eutrophic waterbodies. The mean annual trend line for TSI in Lake Lawne exhibits a decreasing slope, indicating a trend of decreasing TSI values in the lake over time. The calculated p value of 0.0069 for the relationship of TSI vs. time indicates a highly significant relationship. Current TSI values in Lake Lawne indicate borderline eutrophic and mesotrophic conditions.

Nutrient limitation in a waterbody is often evaluated using the total nitrogen/total phosphorus (TN/TP) ratio. The calculated TN/TP ratio is a numerical ratio of the measured water column concentrations of total nitrogen and total phosphorus. This ratio is useful in evaluating the relative significance of nitrogen and phosphorus in regulating primary productivity (algal growth) in a waterbody. Measured TN/TP ratios less than 10 are considered to indicate nitrogen-limited conditions, suggesting that phosphorus is relatively abundant and nitrogen is the element which regulates primary productivity and the growth of algae within the lake system. Calculated TN/TP ratios between 10-30 may suggest nutrient-balanced conditions, with both nitrogen and phosphorus considered important for limiting aquatic growth. Calculated TN/TP ratios in excess of 30 indicate phosphorus-limited conditions which occur when nitrogen is abundant within the system and algal growth is limited by the availability of phosphorus. This is the typical situation observed in the majority of lakes in the Central Florida area, and indicates that inputs of phosphorus into the lake system should be controlled to regulate the growth of algal biomass within the lake. However, nutrient dynamics in lakes are extremely complex, and nutrient ratios should be only viewed as general guidelines rather than steadfast rules.

Calculated event and historical mean TN/TP ratios for the northern lobe of Lake Lawne are illustrated on the bottom of Figure 2-21. Historically, the north lobe of Lake Lawne has primarily exhibited balanced or phosphorus-limited conditions for a majority of the monitoring events. A trend toward more phosphorus-limiting conditions appears to have occurred since approximately 2008, with the majority of measurements conducted from 2008-2011 reflecting highly phosphorus-limited conditions. The trend line of annual average TN/TP ratios has a positive slope, indicating that Lake Lawne is becoming more phosphorus-limited over time. The calculated p value for the trend line of 0.0478 indicates that the trend of increasing phosphorus limitation is statistically significant.

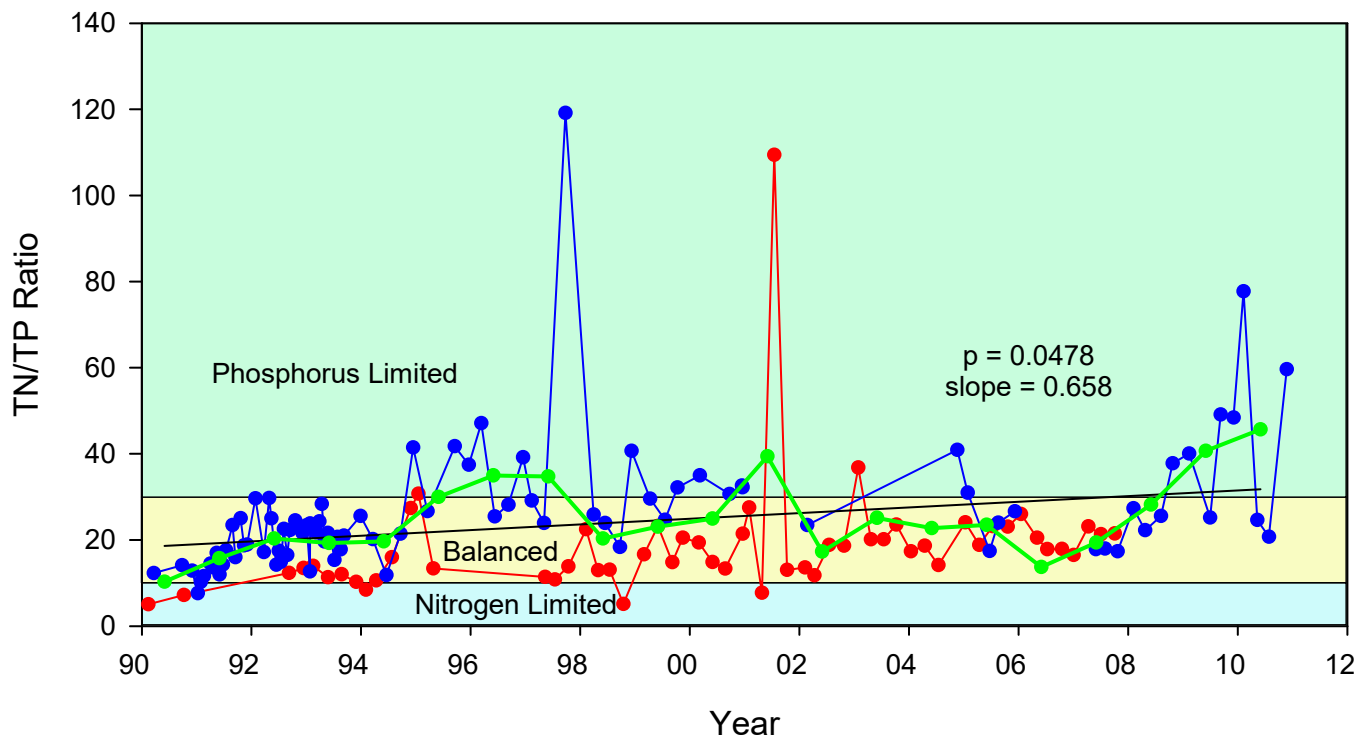
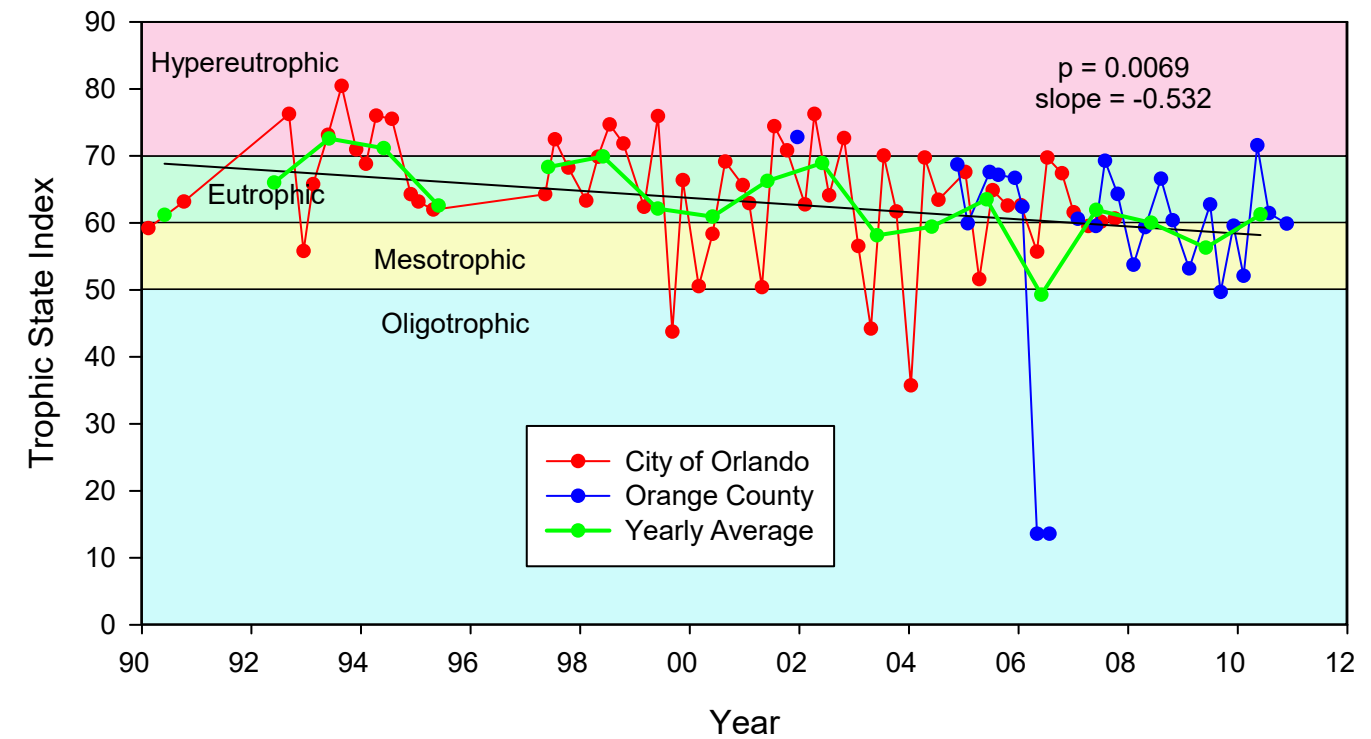


Figure 2-21. Historical Water Quality Data and Trends for TSI and TN/TP Ratios in the North Lobe of Lake Lawne.



### **2.3.1.3 Historical Characteristics of the Middle Lobe**

A graphical summary of measured values and annual average concentrations of total nitrogen and total phosphorus in the middle lobe of Lake Lawne from 1990-2011 is given on Figure 2-22. Data collection in the middle lobe has been conducted by Orange County only. Total nitrogen concentrations in the middle lobe have exhibited a relatively high degree of variability over time, ranging from approximately 900-2,300 µg/l, although the vast majority of measured concentrations have ranged from approximately 1,000-2,000 µg/l. A general trend of decreasing concentrations of total nitrogen over time is apparent in the middle lobe, and the calculated p value of 0.0790 indicates that the trend is statistically significant. Mean annual concentrations of total nitrogen in the middle lobe have ranged from approximately 1,200-1,500 µg/l over the past 6-8 years.

A graphical summary of individual measurements and mean annual concentrations for total phosphorus in the middle lobe of Lake Lawne is given on the bottom of Figure 2-22. Measured concentrations of total phosphorus in Lake Lawne have been highly variable, ranging from approximately 10-200 µg/l. A substantial drop in phosphorus concentrations in the middle lobe occurred during approximately 1994, with mean annual total phosphorus concentrations ranging from approximately 50-100 µg/l since that time. A general trend of decreasing concentrations of total phosphorus over time is apparent in the middle lobe, and the calculated p value of 0.0064 indicates that the trend is statistically significant.

A graphical summary of individual measurements for chlorophyll-a and calculated annual average values are illustrated on Figure 2-23. Measured concentrations of chlorophyll-a in the middle lobe of Lake Lawne have been highly variable over the available period of record, ranging from approximately 10-50 mg/m<sup>3</sup>. Measured concentrations of chlorophyll-a in the middle lobe appear to have decreased steadily over the past 6-8 years. The statistical trend line suggests a trend of decreasing chlorophyll-a concentrations in the middle lobe over time, and the calculated p value of 0.0002 indicates that the trend is statistically significant.

A graphical summary of measured Secchi disk depths and mean annual average values are illustrated on the bottom of Figure 2-23. Measured Secchi disk depths in Lake Lawne have ranged from approximately 0.3-2.0 m, with the vast majority of measured values falling in the range of 0.5-1 m. A trend of decreasing Secchi disk depths over time is apparent for the middle lobe, although the calculated p value of 0.6839 indicates that the trend is not statistically significant.

A graphical summary of calculated TSI values and TN/TP ratios in the middle lobe of Lake Lawne is given on Figure 2-24. Calculated TSI values are available only for data collected by Orange County since the City of Orlando did not conduct measurements of chlorophyll-a upon which the TSI calculation is based. Calculated TSI values in the middle lobe of Lake Lawne have ranged from approximately 40-70, although the vast majority of measured values appear to range from approximately 50-70. The regression line through the mean annual average TSI values indicates a trend of decreasing TSI values in the middle lobe of Lake Lawne over time, and the calculated p value of 0.0002 indicates that the trend is highly significant.

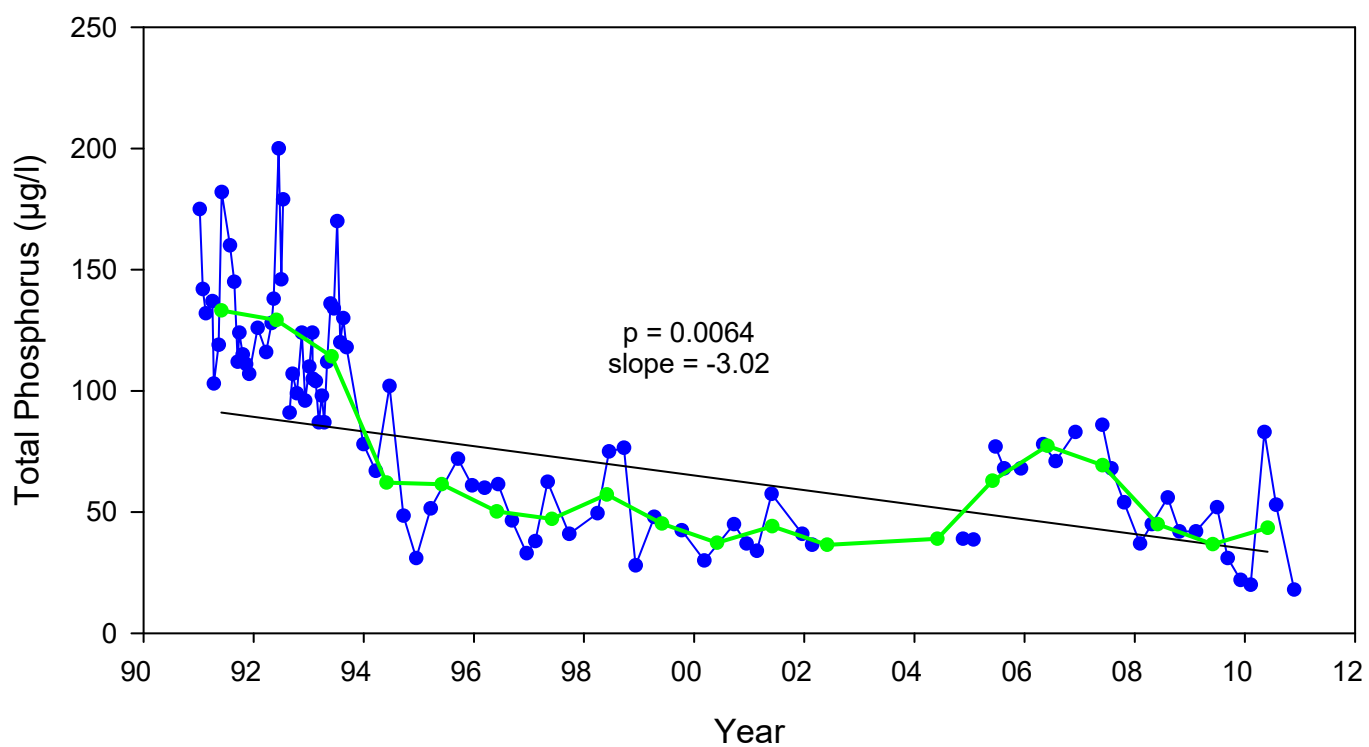
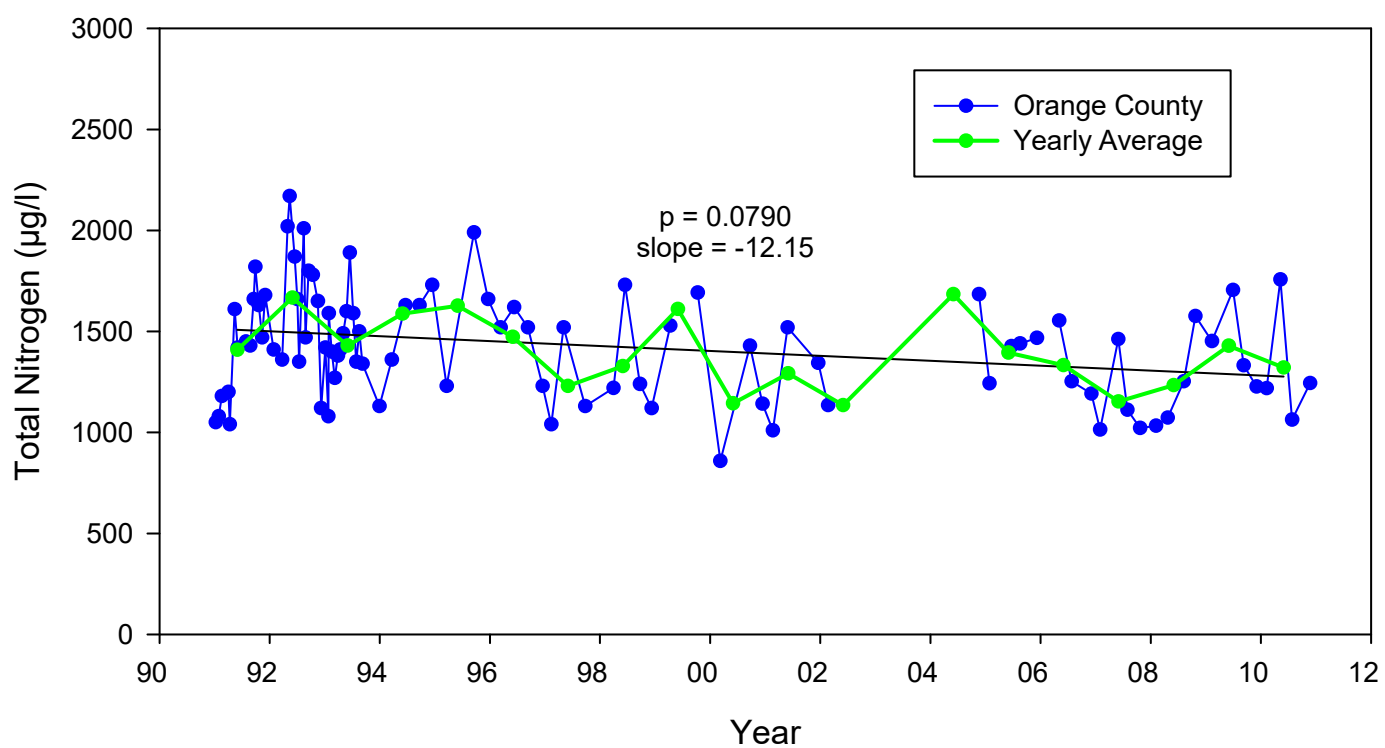


Figure 2-22. Historical Water Quality Data and Trends for Total Nitrogen and Total Phosphorus in the Middle Lobe of Lake Lawne.

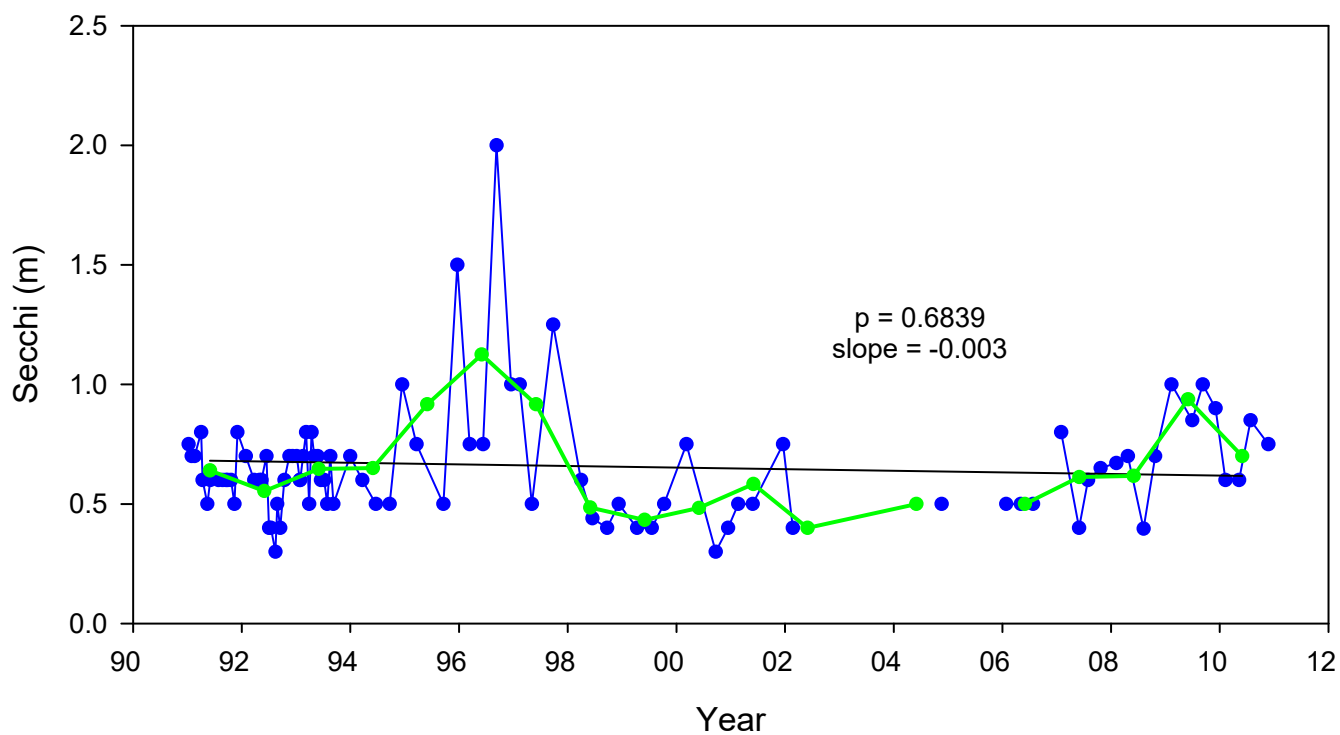
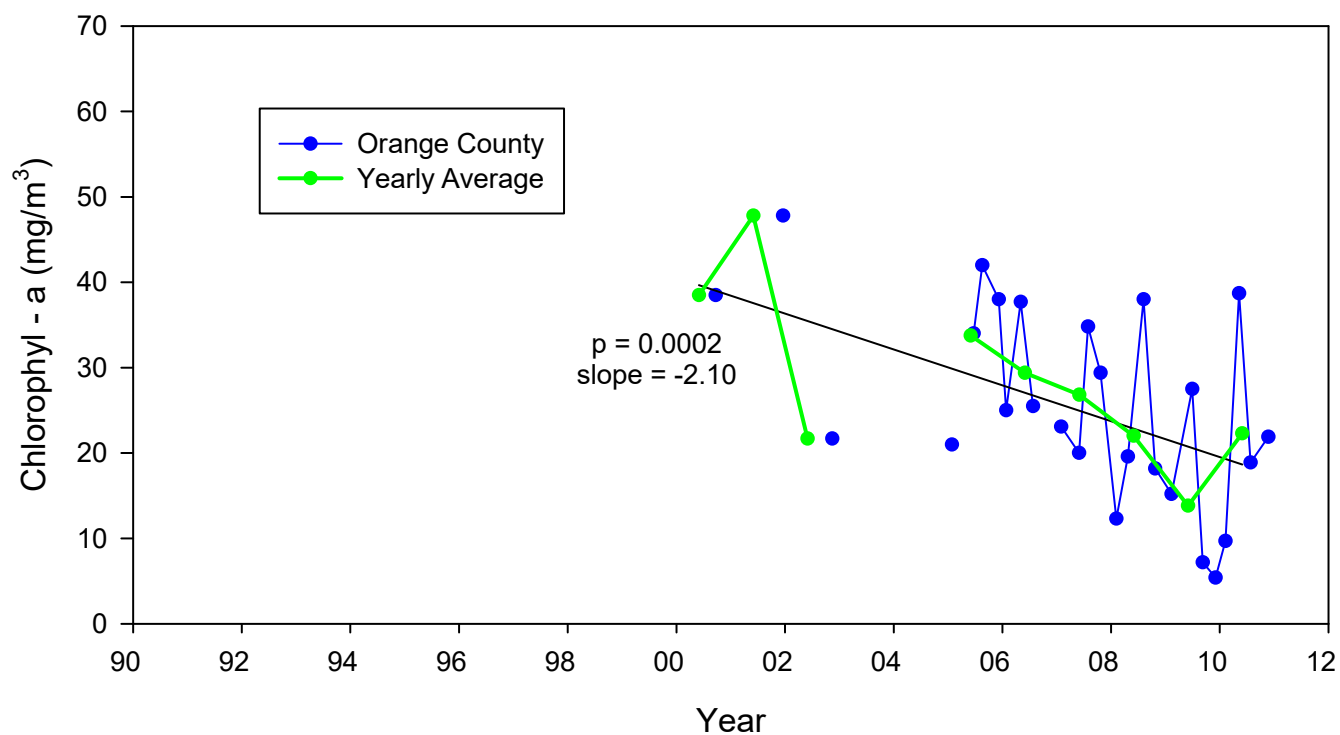


Figure 2-23. Historical Water Quality Data and Trends for Chlorophyll-a and Secchi Disk Depth in the Middle Lobe of Lake Lawne.

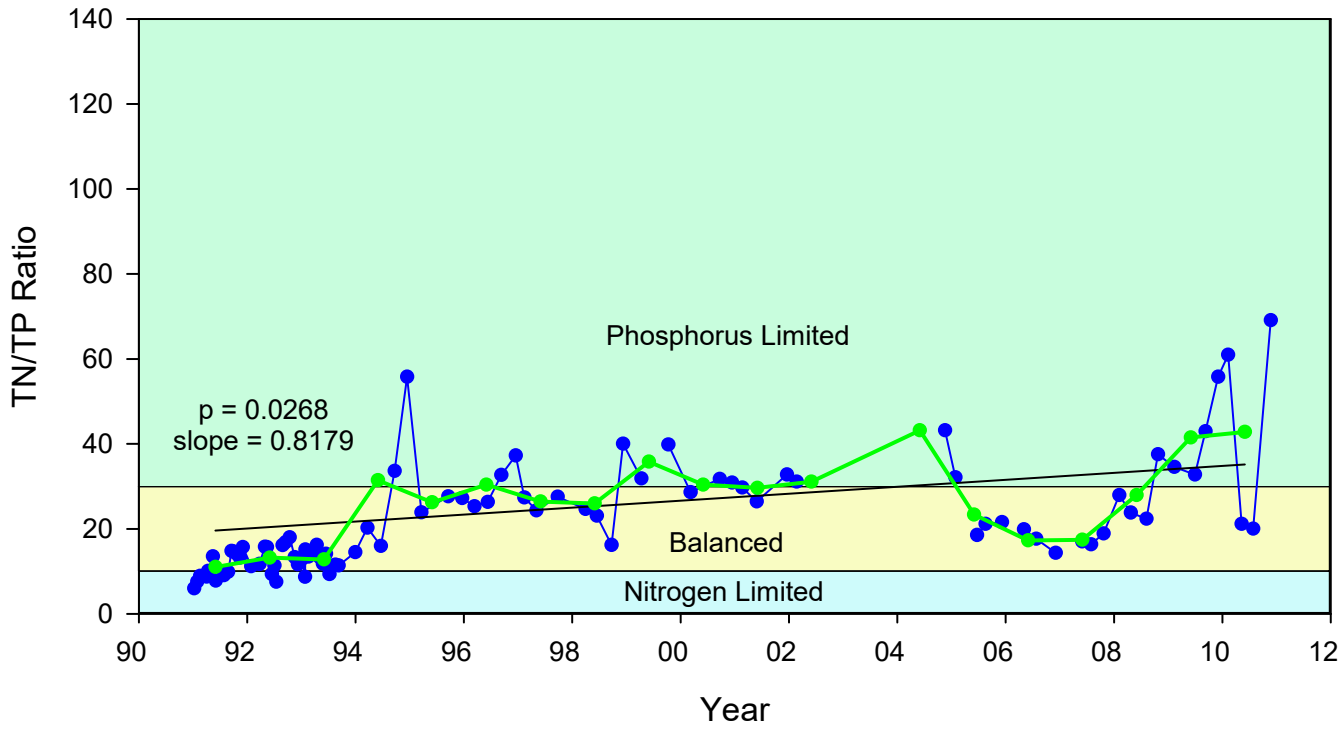
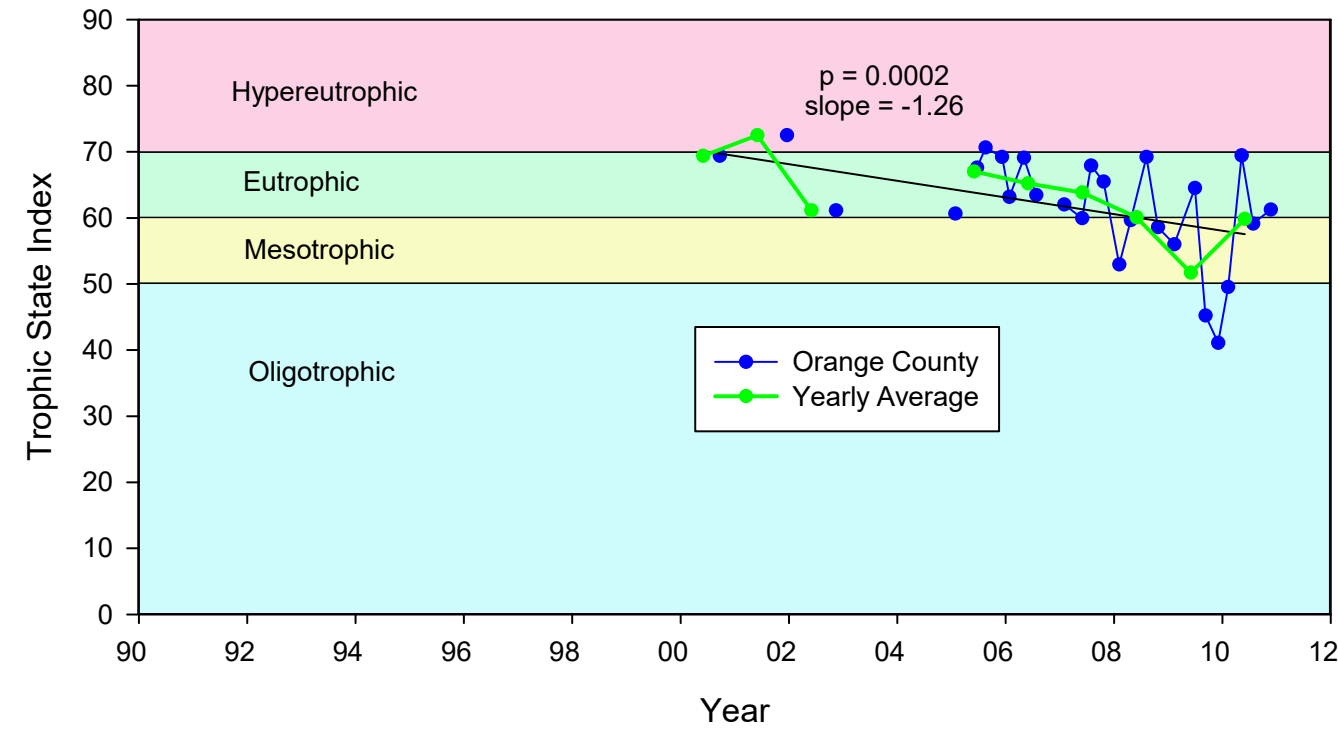


Figure 2-24. Historical Water Quality Data and Trends for TSI and TN/TP Ratios in the Middle Lobe of Lake Lawne.



A graphical summary of calculated TN/TP ratios for individual monitoring events and annual average values is given on the bottom of Figure 2-24. Prior to approximately 1994, the TN/TP ratio in the middle lobe of Lake Lawne indicated borderline nitrogen-limited and balanced conditions. However, after 1994, the middle lobe began to exhibit phosphorus-limited characteristics, and this portion of Lake Lawne has remained either phosphorus-limited or nutrient-balanced since that time. The regression line, based upon annual average TN/TP ratios, indicates a trend of increasing phosphorus limitation over time, and the calculated p value of 0.0268 indicates that the trend is statistically significant.

#### **2.3.1.4 Historical Characteristics of the South Lobe**

A graphical summary of individual measurements and mean annual average concentrations for total nitrogen and total phosphorus in the south lobe of Lake Lawne from 1990-2011 is given on Figure 2-25. Data for the south lobe are available from both the City of Orlando as well as Orange County. Measured concentrations of total nitrogen in the south lobe have ranged from approximately 1,000-2,500  $\mu\text{g/l}$ , although the vast majority of measured values appear to range from approximately 1,000-1,800  $\mu\text{g/l}$ . A high degree of variability has been observed in measured total nitrogen concentrations, although the degree of variability appears to have decreased somewhat in the south lobe after approximately 2004. The linear regression trend line for total nitrogen in the south lobe indicates a slight decrease in concentration over time, although the calculated p value of 0.8270 indicates that the trend is not statistically significant.

Highly variable concentrations of total phosphorus have been measured in the south lobe of Lake Lawne by both the City of Orlando and Orange County. Measured concentrations of total phosphorus in the south lobe have ranged from approximately 10-400  $\mu\text{g/l}$ , although the vast majority of measured concentrations have ranged from approximately 25-150  $\mu\text{g/l}$ . Variability in total phosphorus concentrations in the lake appears to have decreased over time, with a substantially lower degree of variability in phosphorus concentrations measured in the lake after approximately 2003. The overall mean annual concentrations for total phosphorus in the south lobe indicate a trend of decreasing concentrations of total phosphorus over time, and the calculated p value of -0.0001 suggests that the observed decrease is statistically significant.

A graphical summary of individual measurements and mean annual average concentrations of chlorophyll-a and Secchi disk depth in the south lobe of Lake Lawne from 1990-2011 is given on Figure 2-26. Measured concentrations of chlorophyll-a at the south lobe have been highly variable over time, ranging from approximately 5-100  $\text{mg/m}^3$ , although the vast majority of measured values have ranged from approximately 10-50  $\text{mg/m}^3$ . A trend of decreasing concentration over time is apparent for chlorophyll-a, and the calculated p value of 0.0155 indicates that the slope is statistically significant.

Measured Secchi disk depths in the south lobe have ranged from approximately 0.3-2.0 m, although more recent measurements appear to exhibit a lower degree of variability. The linear regression trend line through the annual average values indicates a trend of increasing Secchi disk depths over time, but the p value of 0.2309 indicates that the slope is not statistically significant.

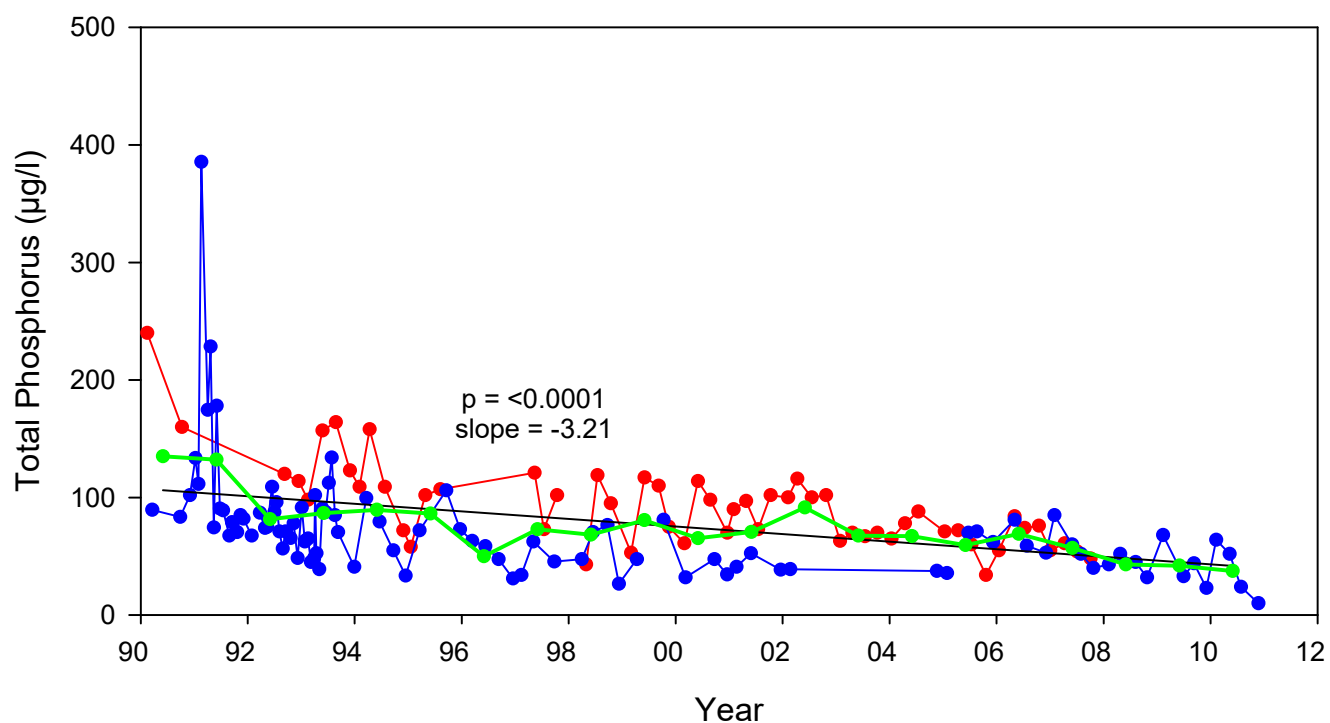
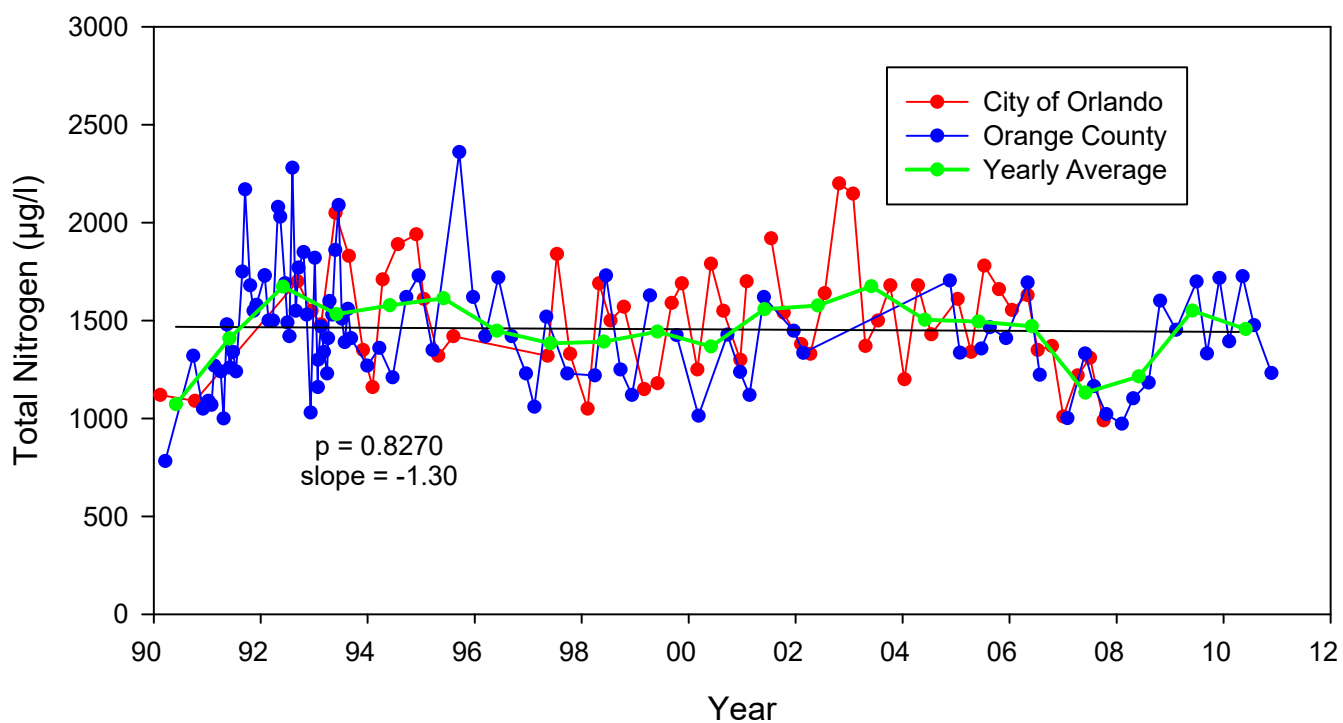


Figure 2-25. Historical Water Quality Data and Trends for Total Nitrogen and Total Phosphorus in the South Lobe of Lake Lawne.

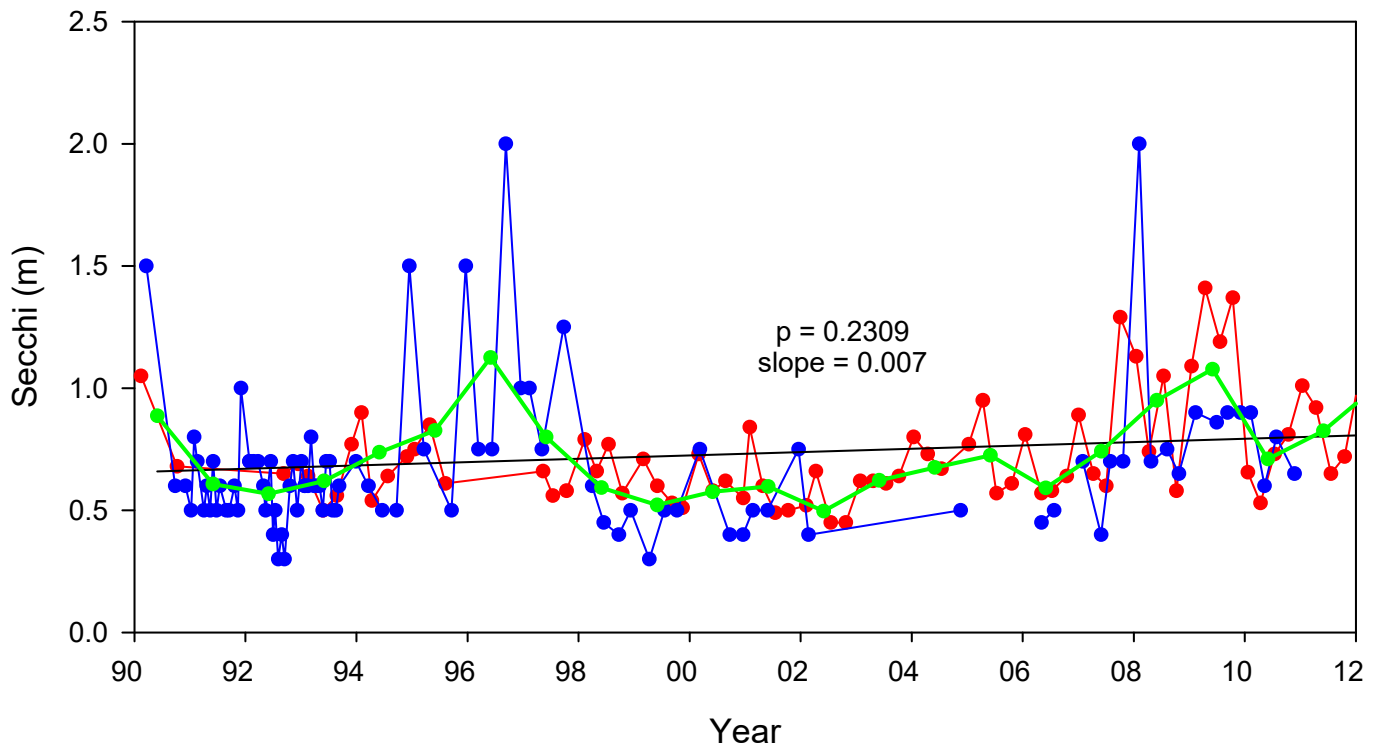
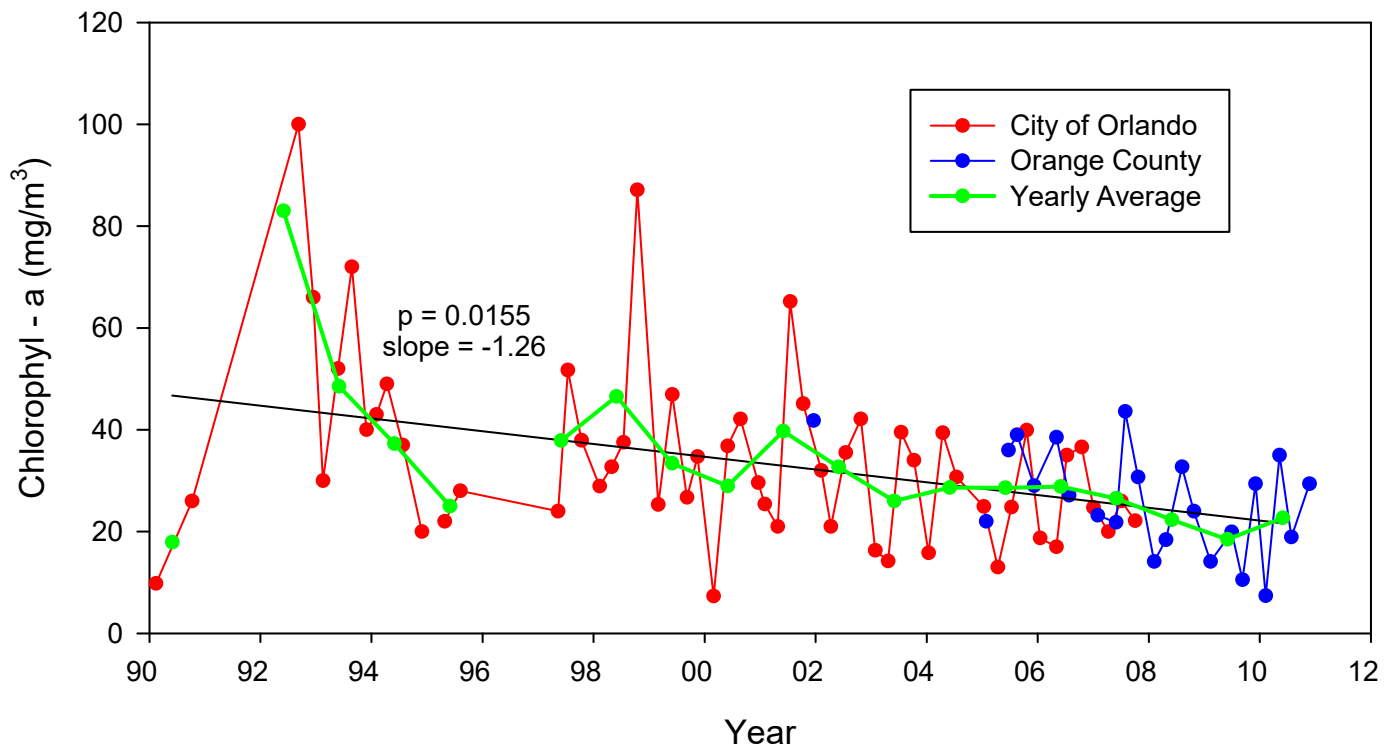


Figure 2-26. Historical Water Quality Data and Trends for Chlorophyll-a and Secchi Disk Depth in the South Lobe of Lake Lawne.

A graphical summary of calculated TSI and TN/TP ratios in the south lobe of Lake Lawne from 1990-2011 is given on Figure 2-27. Calculated TSI values in the south lobe of Lake Lawne have been highly variable, ranging from approximately 45-80, particularly during the period prior to 2004. However, beginning in 2004, variability in TSI values became substantially reduced, with the majority of measured concentrations indicating eutrophic or mesotrophic characteristics. The linear regression line for TSI values over time indicates a decreasing trend of TSI values, and the calculated p value of 0.0206 indicates that the trend is statistically significant.

A statistical summary of TN/TP ratios in the south lobe of Lake Lawne is given on Figure 2-27. The south lobe of Lake Lawne has primarily exhibited either balanced or phosphorus-limited conditions, although several monitoring events also indicate nitrogen limitation. Beginning in approximately 2008, the south lobe appears to be shifting toward a more phosphorus-limited condition. The mean annual trend line for TN/TP ratios in the south lobe indicates a trend of increasing TN/TP ratios, suggesting more phosphorus-limited conditions over time, and the calculated p value of 0.0017 indicates that the trend is statistically significant.

### **2.3.1.5 Summary of Water Quality Trends**

A summary of water quality trends in Lake Lawne from 1990-2011 is given on Table 2-9. Arrows are used to reflect combinations of parameters and locations which have exhibited significant downward or upward trends. No significant trends of increasing or decreasing concentrations of total nitrogen have been observed in either the north or south lobes, although a trend of decreasing concentrations is apparent in the middle lobe. Trends of decreasing concentrations were observed in each of the three lobes for total phosphorus, chlorophyll-a, and TSI, indicating statistically significant improvements in water quality in Lake Lawne over the historical period of record. Secchi disk depth in the lake has improved at a statistically significant level in the north lobe, although no significant changes have occurred in Secchi disk depth in either the middle or south lobes. Trends of increasing TN/TP ratios have been observed in each of the three lobes, indicating that Lake Lawne is becoming more phosphorus-limiting. This trend is beneficial in attempting to further improve water quality in Lake Lawne since phosphorus is much more easily removed from inflows than nitrogen. Overall, Lake Lawne appears to have exhibited significant improvements in water quality characteristics over the period from 1990-2011.



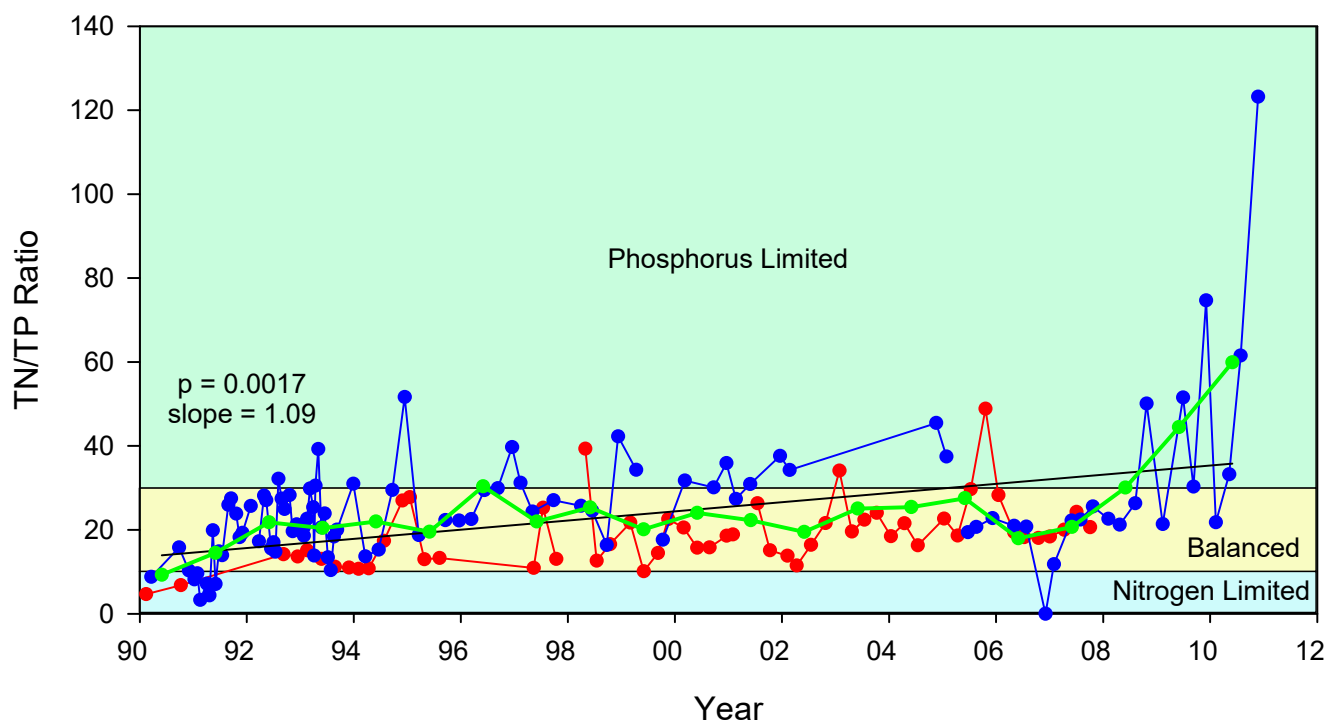
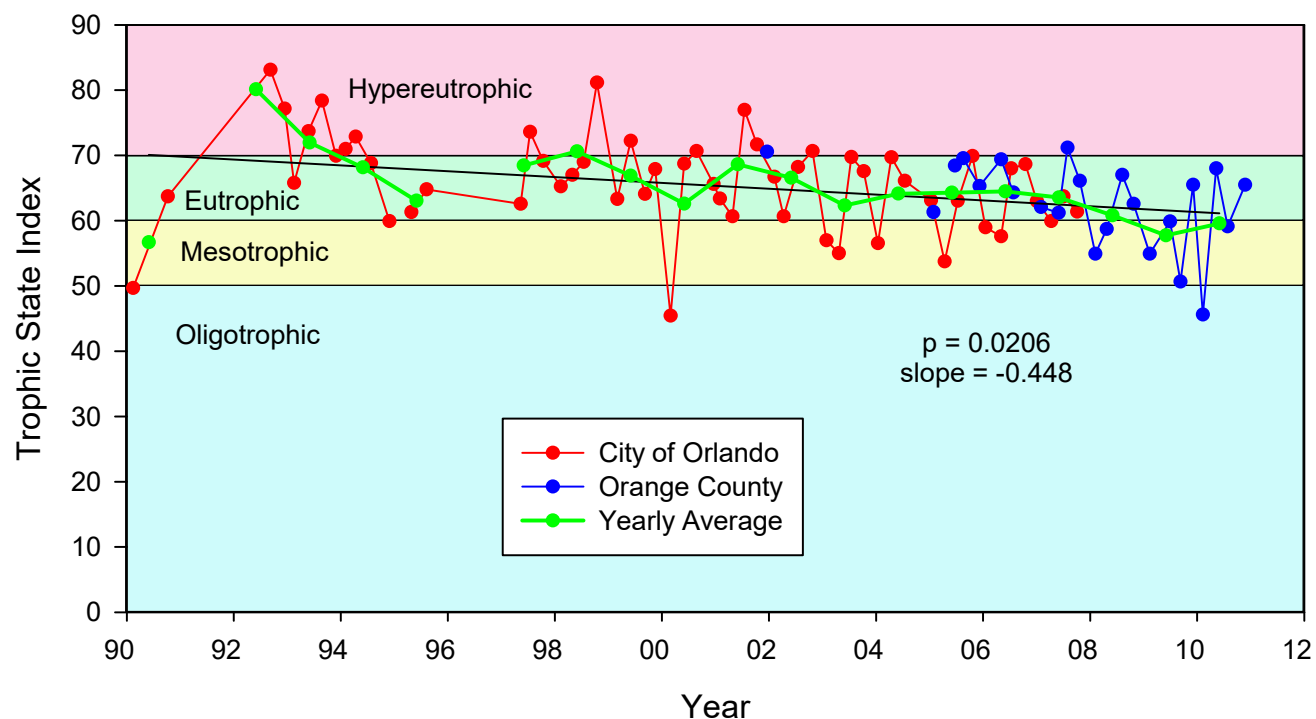


Figure 2-27. Historical Water Quality Data and Trends for TSI and TN/TP Ratios in the South Lobe of Lake Lawne.

**TABLE 2-9**  
**SUMMARY OF WATER QUALITY TRENDS**  
**IN LAKE LAWNE FROM 1990-2011**

| PARAMETER         | LOBE            |                |       |
|-------------------|-----------------|----------------|-------|
|                   | North           | Middle         | South |
| Total Nitrogen    | -- <sup>1</sup> | ↓ <sup>2</sup> | --    |
| Total Phosphorus  | ↓               | ↓              | ↓     |
| Chlorophyll-a     | ↓               | ↓              | ↓     |
| Secchi Disk Depth | ↑ <sup>3</sup>  | --             | --    |
| TSI               | ↓               | ↓              | ↓     |
| TN/TP Ratio       | ↑               | ↑              | ↑     |

1. --: No significant trend
2. ↓: Reflects significant downward trend
3. ↑: Reflects significant upward trend

#### **2.3.1.6 Seasonal Variability**

A graphical summary of seasonal variability in historical concentrations of total phosphorus in the north and south lobes of Lake Lawne from 1991-2011 is given on Figure 2-28. The total phosphorus values included in this figure reflect the combined data sets from Orange County and Orlando collected in the north and south lobes. The middle lobe is not included in this analysis due to the smaller amount of available data which was collected by Orange County only. In general, total phosphorus concentrations in the north lobe appear to be greatest during the period from April-October, with slightly lower measured values during other portions of the year. The observed increases in total phosphorus from June-October likely reflect impacts from runoff entering the lake during wet season conditions. However, the elevated levels of total phosphorus observed during April and May (which are generally considered to be dry season months) suggests that internal recycling of phosphorus may also be significant in the north lobe of Lake Lawne.

In the south lobe of Lake Lawne, total phosphorus concentrations appear to be greater during the months of February and April, with slightly lower values observed during the typical wet season months of June-October. These data suggest that internal recycling is also significant in the south lobe of Lake Lawne, resulting in increases in total phosphorus within the water column which are more substantial than increases resulting from stormwater runoff.

A graphical summary of seasonal variability in historical concentrations of total nitrogen in the north and south lobes of Lake Lawne from 1991-2011 is given on Figure 2-29. The most elevated levels of total nitrogen in the north lobe appear to occur during the period from May-November. The more elevated nitrogen concentrations observed from June-October likely reflect runoff inputs, while the elevated nitrogen concentrations observed during May suggest that sources other than stormwater runoff are impacting nitrogen concentrations in the lake during this period, and presumably reflect loadings from internal recycling.

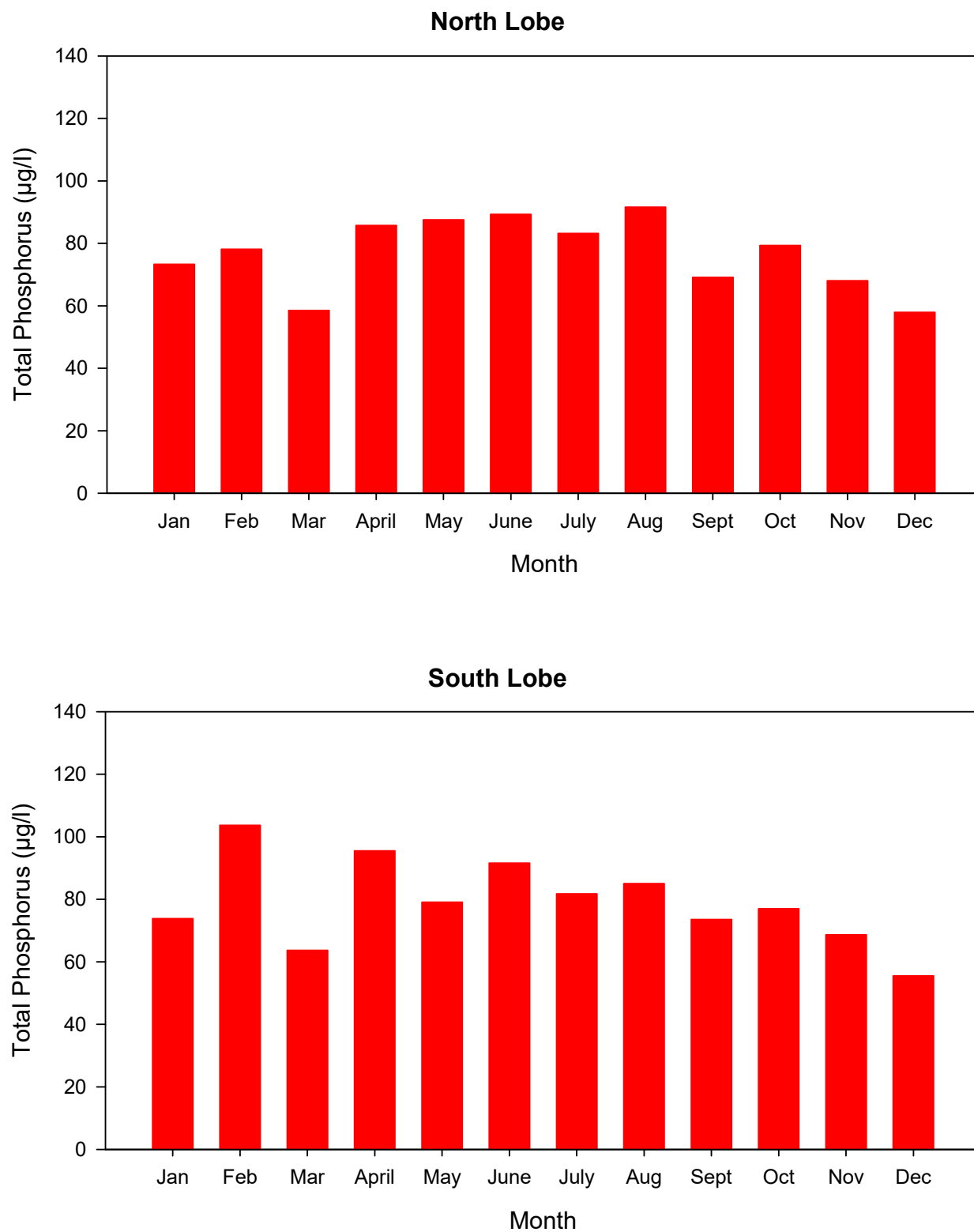


Figure 2-28. Mean Monthly Concentrations of Total Phosphorus in Lake Lawne from 1991-2011.

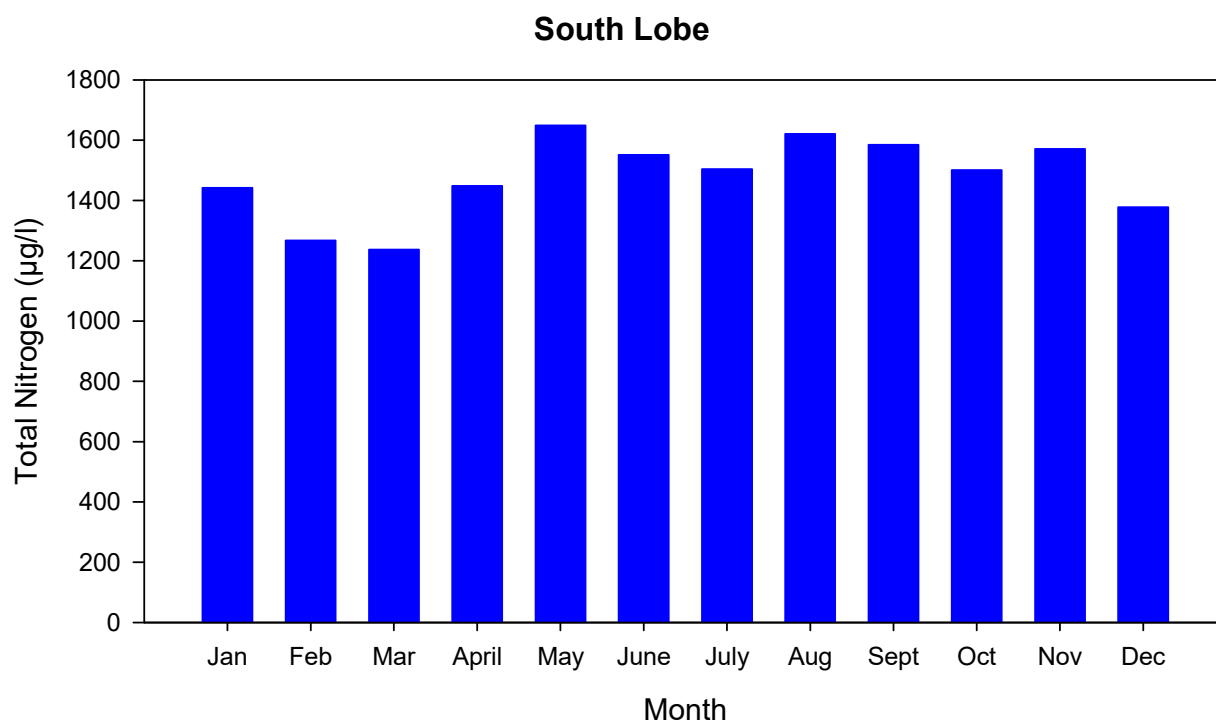
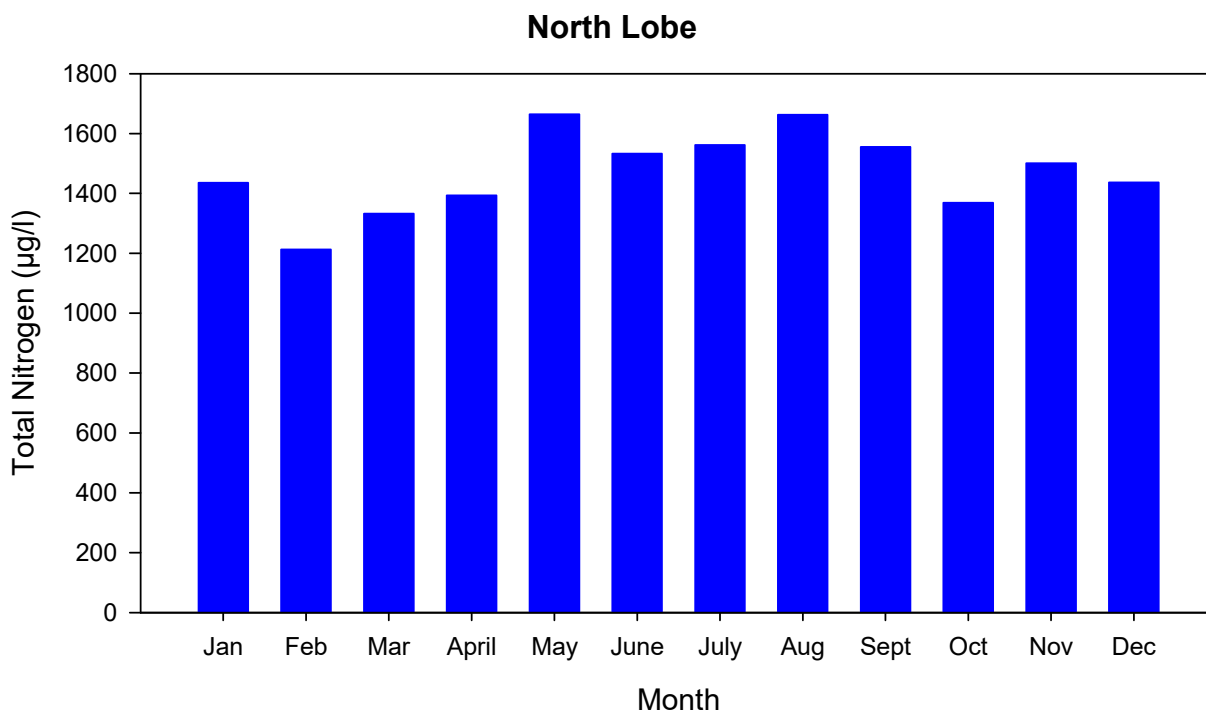


Figure 2-29. Mean Monthly Concentrations of Total Nitrogen in Lake Lawne from 1991-2011.



A similar pattern is also apparent for total nitrogen concentrations in the south lobe of Lake Lawne, with the most elevated monthly concentrations occurring during the period from May-November. These data suggest that nitrogen concentrations in the south lobe are impacted by both internal recycling as well as inputs of stormwater runoff.

A graphical summary of seasonal variability in historical concentrations of chlorophyll-a in the north and south lobes of Lake Lawne from 1991-2011 is given on Figure 2-30. The most elevated levels of chlorophyll-a in Lake Lawne appear to occur during the period from June-December, with lower concentrations of chlorophyll-a during other portions of the year. However, a somewhat elevated chlorophyll-a concentration has also been observed during April which is similar in value to concentrations observed during October-December, suggesting that an internal source of nutrients may be responsible for the additional algal growth observed during April.

Chlorophyll-a concentrations in the south lobe appear to be greatest over the period from May-December, with the lowest monthly values observed during the period from January-April. The observed elevated chlorophyll-a values during June-October can be explained as a result of runoff inputs into the lake. However, the elevated chlorophyll-a concentrations observed during December and May (generally considered to be dry season conditions) suggest additional nutrient loadings responsible for stimulation of algal growth during these months.

A graphical summary of seasonal variability in historical Secchi disk depths in the north and south lobes of Lake Lawne from 1991-2011 is given on Figure 2-31. In general, Secchi disk depths in Lake Lawne appear to be lowest during the period from May-November, with the highest annual values observed from December-April. This trend apparently supports the previously observed trend for total nitrogen and total phosphorus, suggesting that additional significant nutrient inputs likely occur into the lake during dry season conditions. A similar pattern is also apparent for measured Secchi disk depths in the south lobe, with the lowest measured Secchi disk depths occurring during May and August which include both dry and wet season conditions.

A graphical summary of seasonal variability in historical TN/TP ratios in the north and south lobes of Lake Lawne from 1991-2011 is given on Figure 2-32. Lake Lawne appears to be relatively nutrient-balanced in the north lobe during much of the year, with phosphorus limitation increasing during the fall and early-winter months. A similar pattern is apparent in the south lobe, although phosphorus limitation appears to be more severe in the south lobe during November and December than observed in the north lobe.

### **2.3.1.7 Mean Water Quality Characteristics**

A tabular summary of historical mean water quality characteristics of Lake Lawne, based upon the combined Orange County and Orlando data sets, is given in Table 2-10. The values summarized in this table reflect geometric mean values for each measured parameter over three different periods, including 1990-1999, 2000-2005, and 2006-2011.

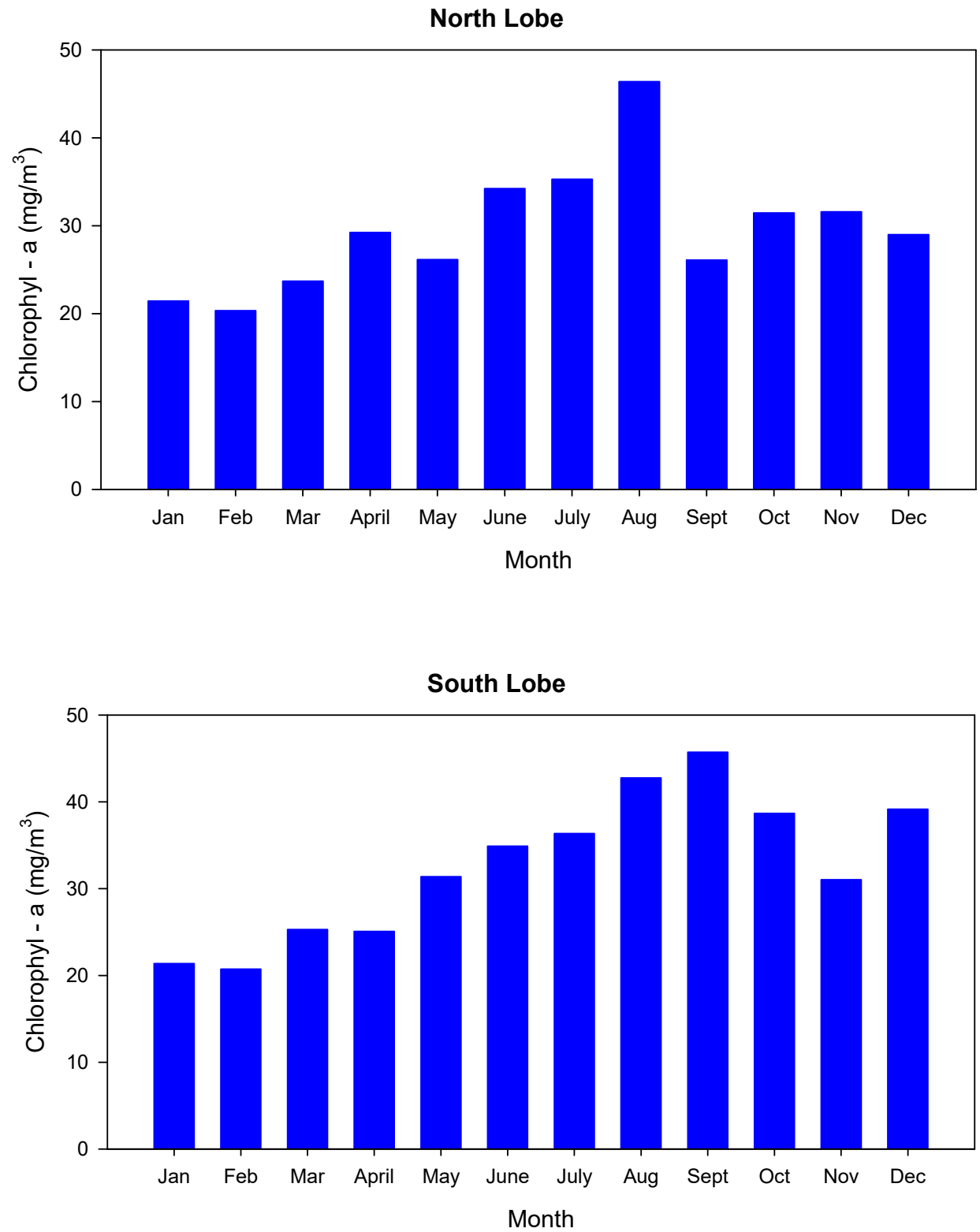


Figure 2-30. Mean Monthly Concentrations of Chlorophyll-a in Lake Lawne from 1991-2011.

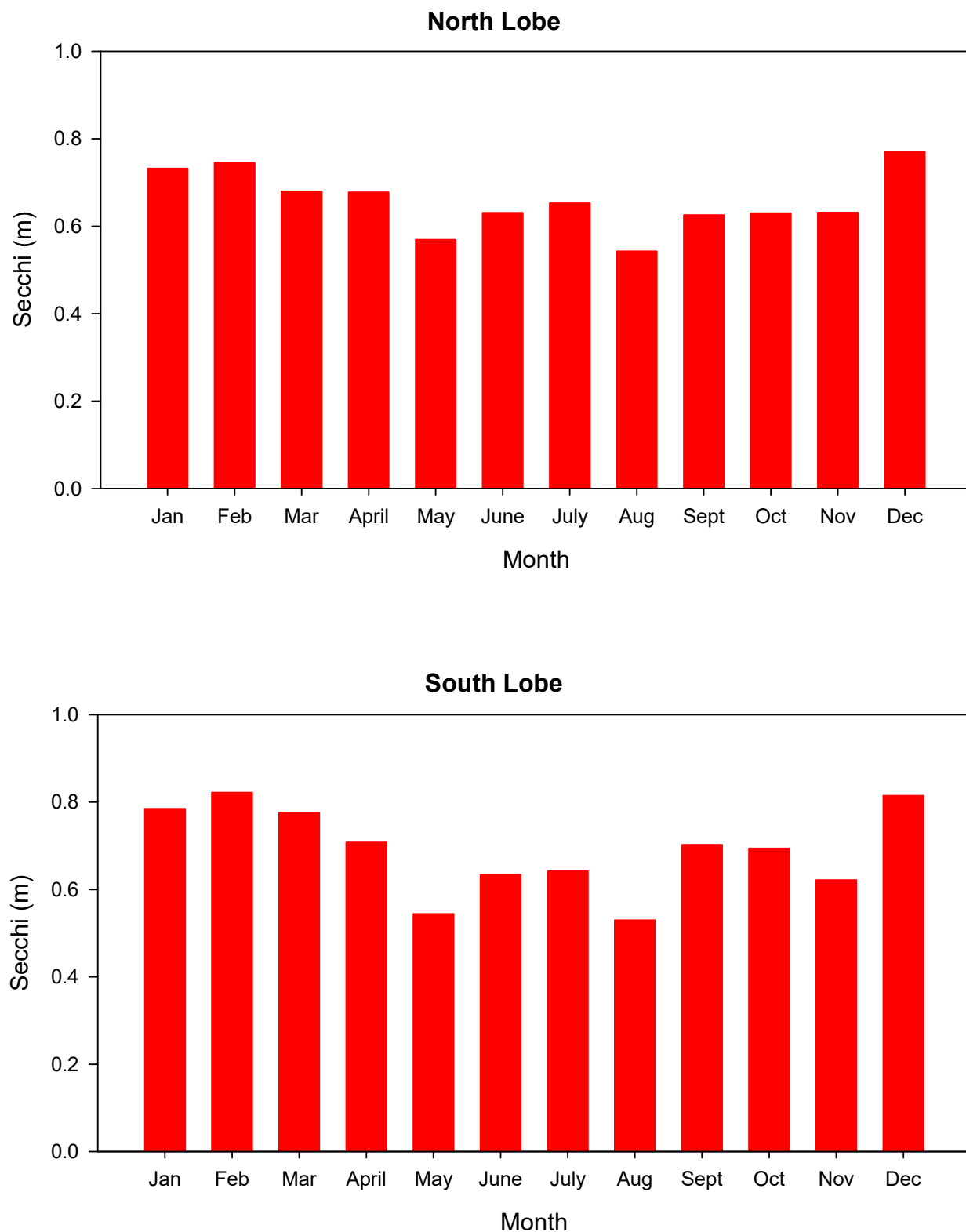


Figure 2-31. Mean Monthly Concentrations of Secchi Disk Depth in Lake Lawne from 1991-2011.

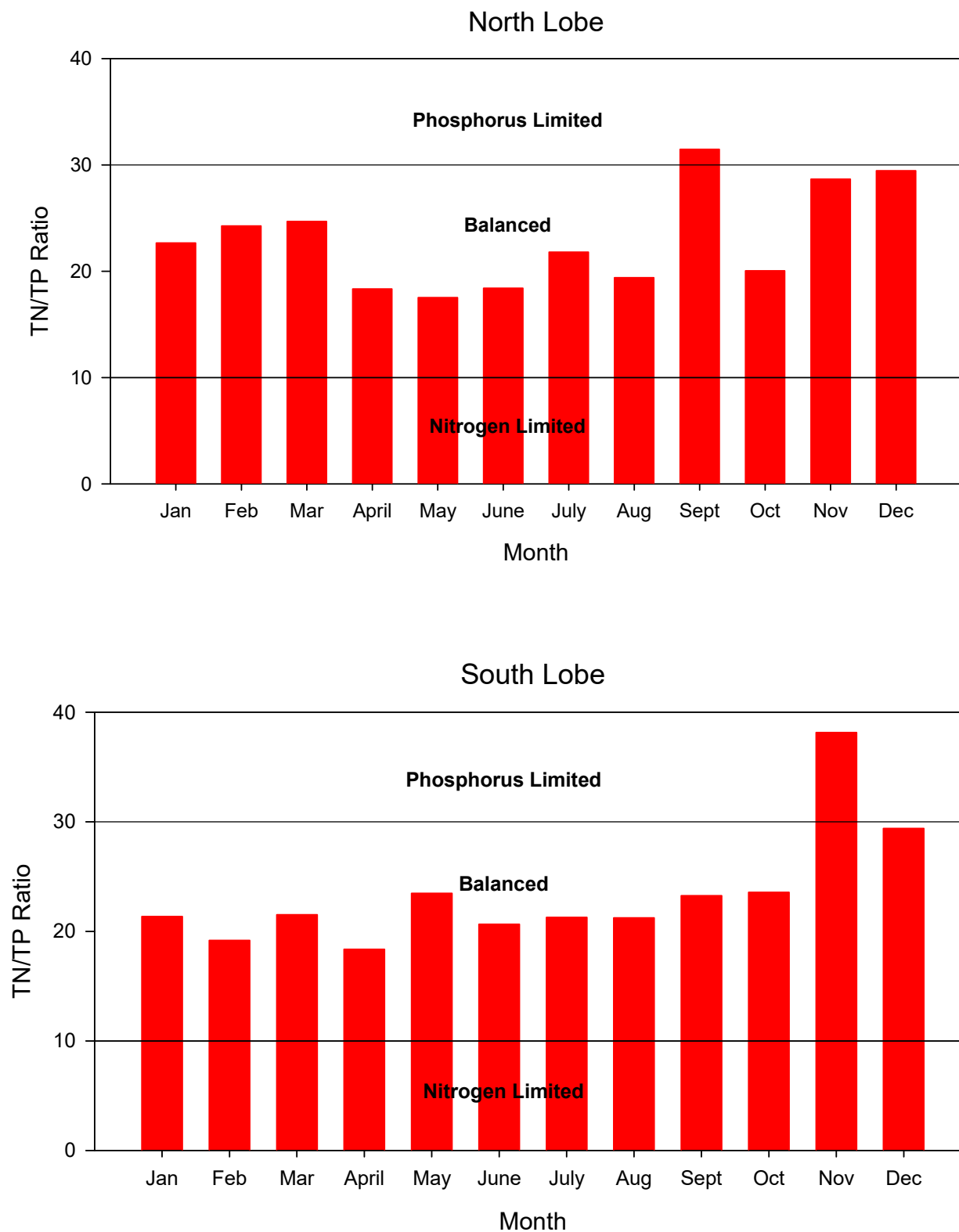


Figure 2-32. Mean Monthly Concentrations of TN/TP Ratio in Lake Lawne from 1991-2011.



TABLE 2-10

**HISTORICAL MEAN WATER QUALITY  
CHARACTERISTICS OF LAKE LAWNE  
(Combined Orange County and Orlando Data)**

| PARAMETER         | UNITS             | NORTH LOBE |           |           | MIDDLE LOBE |           |           | SOUTH LOBE |           |           |
|-------------------|-------------------|------------|-----------|-----------|-------------|-----------|-----------|------------|-----------|-----------|
|                   |                   | 1990-1999  | 2000-2005 | 2006-2011 | 1990-1999   | 2000-2005 | 2006-2011 | 1990-1999  | 2000-2005 | 2006-2011 |
| pH                | s.u.              | 7.57       | 7.76      | 7.76      | 7.61        | 7.48      | 7.58      | 7.52       | 7.75      | 7.74      |
| Alkalinity        | mg/l              | 60.1       | 66.9      | 59.3      | 60.4        | 70.8      | 72.5      | 60.3       | 68.1      | 71.9      |
| Conductivity      | µmho/cm           | 209        | 206       | 204       | 212         | 201       | 206       | 208        | 204       | 203       |
| Dissolved Oxygen  | mg/l              | 7.1        | 8.0       | 7.4       | 7.2         | 7.9       | 7.4       | 6.8        | 8.2       | 7.2       |
| Ammonia           | µg/l              | 54         | 27        | 25        | 26          | 23        | 22        | 40         | 31        | 20        |
| NO <sub>x</sub>   | µg/l              | 113        | 24        | 11        | 14          | 9         | 4         | 43         | 25        | 10        |
| Organic Nitrogen  | µg/l              | 1,408      | 1,257     | 1,282     | 1,381       | 1,251     | 1,249     | 1,368      | 1,325     | 1,299     |
| Total Nitrogen    | µg/l              | 1,431      | 1,394     | 1,313     | 1,463       | 1,287     | 1,273     | 1,466      | 1,465     | 1,307     |
| SRP               | µg/l              | 17         | 4         | 3         | 20          | 3         | 3         | 15         | 4         | 4         |
| Total Phosphorus  | µg/l              | 87         | 61        | 54        | 92          | 45        | 47        | 90         | 62        | 55        |
| Color             | Pt-Co             | 95         | 107       | 54        | 68          | 56        | 56        | 89         | 104       | 55        |
| BOD <sub>5</sub>  | mg/l              | 3.9        | 3.5       | 2.9       | 3.6         | 3.1       | 2.3       | 4.0        | 3.6       | 2.3       |
| TSS               | mg/l              | 11.0       | 9.7       | 7.7       | 10.6        | 9.5       | 6.3       | 9.4        | 9.8       | 7.7       |
| Chlorophyll-a     | mg/m <sup>3</sup> | 33.8       | 28.0      | 19.0      | --          | 33.3      | 19.9      | 36.5       | 30.0      | 23.2      |
| Fecal Coliform    | cfu/100 ml        | 28         | 57        | 42        | 80          | 118       | 64        | 44         | 82        | 63        |
| Secchi Disk Depth | m                 | 0.64       | 0.54      | 0.71      | 0.63        | 0.49      | 0.66      | 0.63       | 0.57      | 0.77      |

In general, surface water in Lake Lawne has been approximately neutral in pH, with geometric mean pH values ranging from approximately 7.5-7.8, and no apparent trend of increasing or decreasing pH values. The water in Lake Lawne is moderately buffered, with geometric mean alkalinity values ranging from approximately 60-72 mg/l. A trend of increasing alkalinity values is apparent in the middle and south lobes of Lake Lawne over time, although this trend does not appear to occur in the north lobe. Measured mean conductivity values in Lake Lawne range from approximately 200-210 µmho/cm from 1990-2011. A trend of slightly decreasing conductivity values is apparent in each of the three lobes, particularly from the period of 1990-1999 to the present. Surface concentrations of dissolved oxygen have generally been adequate to support aquatic life, with geometric mean concentrations ranging from approximately 6.8-8.2 mg/l.

Measured concentrations of both ammonia and  $\text{NO}_x$  have been extremely low in value in Lake Lawne, with the vast majority of total nitrogen present as organic nitrogen. Trends of decreasing concentrations of total nitrogen are apparent over time in each of the three lobes, although the trend is only significant in the middle lobe. In general, measured concentrations of soluble reactive phosphorus (SRP) have decreased substantially from the 1990s to the present, and a trend of decreasing concentrations of total phosphorus has also been observed in Lake Lawne, particularly in the north and south lobes. Current concentrations of total phosphorus in Lake Lawne are approximately 40% lower than observed during the period from 1990-1999.

Mean concentrations of BOD in Lake Lawne have ranged from approximately 2.3-4.0 mg/l within the three lobes and the three monitoring periods. A general trend of decreasing concentrations of BOD is apparent in each of the three lobes over time. A similar pattern is also apparent for TSS. Mean concentrations of TSS have ranged from 6.3-11.0 mg/l, with a distinct trend of decreasing concentrations over time. Measured concentrations of chlorophyll-a have also decreased substantially over time in each of the three lobes.

Geometric means of fecal coliform bacteria have typically been low in value, although more elevated values have been observed in the middle lobe. However, in general, contamination with fecal coliform bacteria does not appear to be a concern in Lake Lawne.

The observed reductions in nutrient concentrations in Lake Lawne over the past 15-20 years suggests that significant reductions have occurred in available nutrient loadings to the water column within the lake. Reductions in watershed loadings may have occurred as a result of constructed stormwater management systems within the drainage basin, enhanced maintenance activities for drainage systems, and increased homeowner awareness of personal pollution impacts.

## **2.3.2 Current Water Quality Characteristics**

### **2.3.2.1 Monitoring Activities**

A monthly surface water quality monitoring program was conducted in Lake Lawne by ERD from March 2011-February 2012 at four fixed monitoring locations in the north, west, central, and southern portions of the lake. Locations of the ERD monitoring sites are indicated on Figure 2-33. The water quality monitoring sites were selected to allow evaluation of vertical water quality in the deepest areas of the lake, horizontal variability in water quality, and general information on ambient water quality characteristics. Water quality monitoring was conducted on a monthly basis, with a total of 12 monitoring events conducted at each site during the 12-month monitoring program.

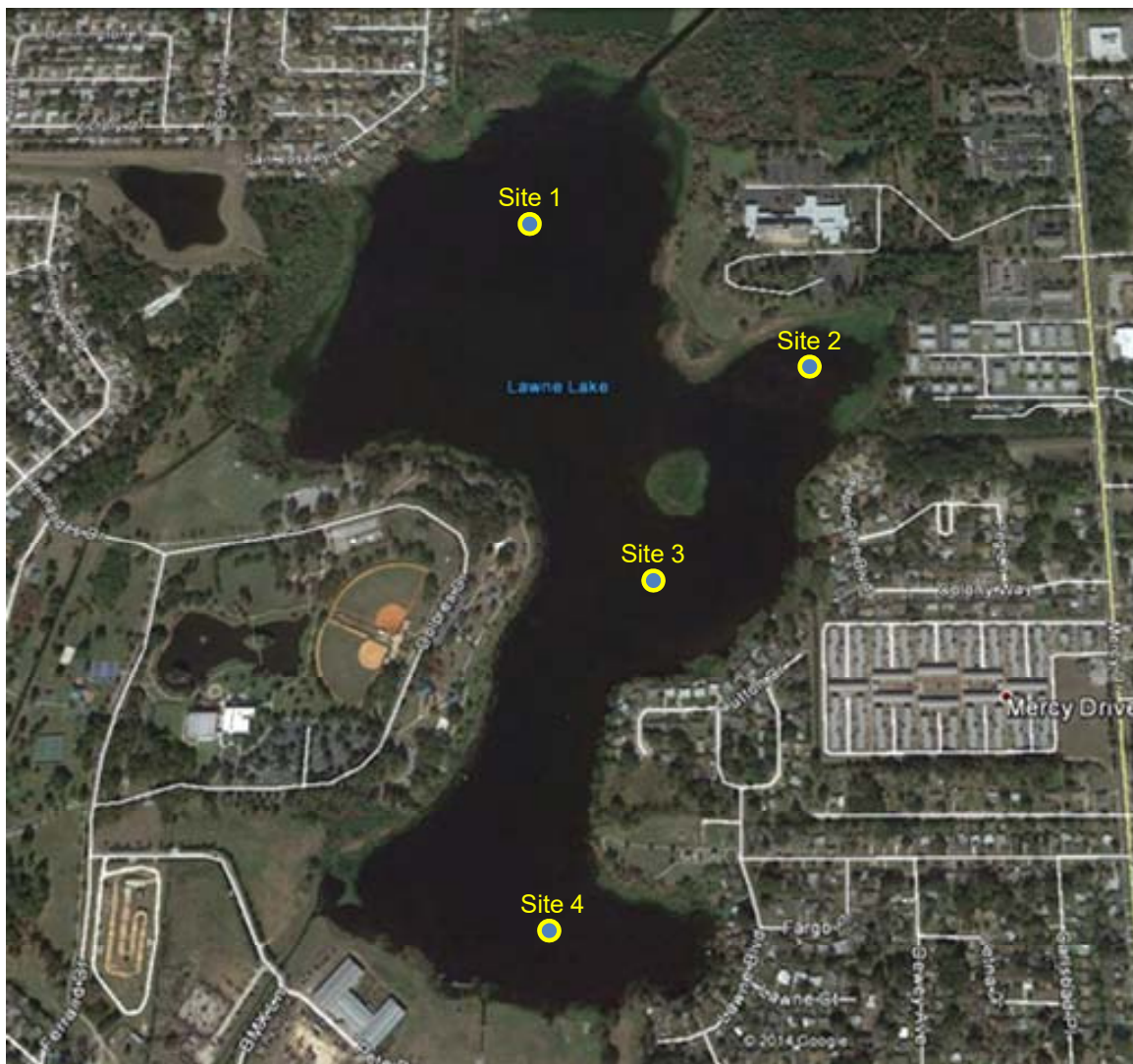


Figure 2-33. Locations of the ERD Surface Water Monitoring Sites in Lake Lawne.

Sample collection procedures followed methods outlined in DEP-SOP-001/01 titled “Department of Environmental Protection Standard Operating Procedures for Field Activities” dated February 1, 2004. Surface water samples were collected using a battery-powered peristaltic pump constructed of plastic and stainless steel. Two separate samples were collected at each site during each monitoring event. The first sample was collected at a depth equal to 50% of the Secchi disk depth at the time of sample collection. The second sample was collected at a depth of 0.5 m above the sediment/water interface. Each of the collected samples was preserved as appropriate for the parameter to be analyzed, stored in ice, and returned to the ERD Laboratory for chemical analyses. A listing of laboratory measurements performed on the collected samples is given in Table 2-11, along with a summary of analytical methods and laboratory detection limits.

TABLE 2-11

**ANALYTICAL METHODS AND DETECTION  
LIMITS FOR LABORATORY ANALYSES CONDUCTED BY  
ENVIRONMENTAL RESEARCH AND DESIGN, INC.**

| MEASUREMENT<br>PARAMETER |                                        | METHOD                                                    | METHOD DETECTION<br>LIMITS (MDLs) <sup>1</sup> |
|--------------------------|----------------------------------------|-----------------------------------------------------------|------------------------------------------------|
| General<br>Parameters    | Hydrogen Ion (pH)                      | EPA-83 <sup>2</sup> , Sec. 150.1/Manf. Spec. <sup>3</sup> | N/A                                            |
|                          | Alkalinity                             | SM-21 <sup>4</sup> , Sec. 2320 B                          | 0.6 mg/l                                       |
|                          | TSS                                    | EPA-83, Sec. 160.2                                        | 0.7 mg/l                                       |
|                          | Color                                  | SM-21, Sec. 2120 C                                        | 1 Pt-Co Unit                                   |
|                          | Specific Conductivity                  | SM-21, Sec. 2510 B                                        | 0.3 µmho/cm                                    |
|                          | Turbidity                              | EPA-83, Sec. 180.1                                        | 0.1 NTU                                        |
|                          | TSS                                    | EPA-83, Sec. 160.2                                        | 0.7 mg/l                                       |
| Nutrients                | Ammonia-N (NH <sub>3</sub> -N)         | EPA-83, Sec. 350.1                                        | 0.005 mg/l                                     |
|                          | Nitrate + Nitrite (NO <sub>x</sub> -N) | SM-21, Sec. 4500-NO <sub>3</sub> .F                       | 0.005 mg/l                                     |
|                          | Total Nitrogen                         | SM-21, Sec. 4500-N.C                                      | 0.025 mg/l                                     |
|                          | Orthophosphorus                        | SM-21, Sec. 4500-P.F                                      | 0.001 mg/l                                     |
|                          | Total Phosphorus                       | SM-21, Sec. 4500-P.F                                      | 0.001 mg/l                                     |
| Biological<br>Parameters | Chlorophyll-a                          | SM-21, Sec. 10200 H.3                                     | 0.08 mg/m <sup>3</sup>                         |
|                          | Fecal Coliform                         | SM-21, Sec. 9222 D (membrane filter)                      | 1 cfu                                          |

1. MDLs are calculated based on the EPA method of determining detection limits.
2. Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, Revised March 1983.
3. Subject to manufacturer's specifications for test equipment used.
4. Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition, 2005

During each monitoring event, vertical profiles of pH, temperature, conductivity, dissolved oxygen, ORP, and turbidity were conducted at each site. Field measurements were collected at water depths of 0.25 m and at 0.5 m, and at 0.5 m intervals to the bottom at each site. All field measurements were performed using either Hydrolab Data Sonde H2O and Data Sonde 4a units. A measurement of Secchi disk depth was also performed at each site.

### **2.3.2.2 Field Measurements**

A complete listing of vertical field profiles collected at each of the four monitoring sites in Lake Lawne from March 2011-February 2012 is given in Appendix B.1. Data are provided for each of the 12 monthly events except for September 2011 when the field data were lost due to an equipment memory malfunction.

#### **2.3.2.2.1 Site 1**

A compilation of vertical depth profiles collected at the north lobe monitoring site (Site 1) during each of the monthly monitoring events is given on Figure 2-34. Water depth at the monitoring site ranged from approximately 1.7-2.7 m during the monitoring program.

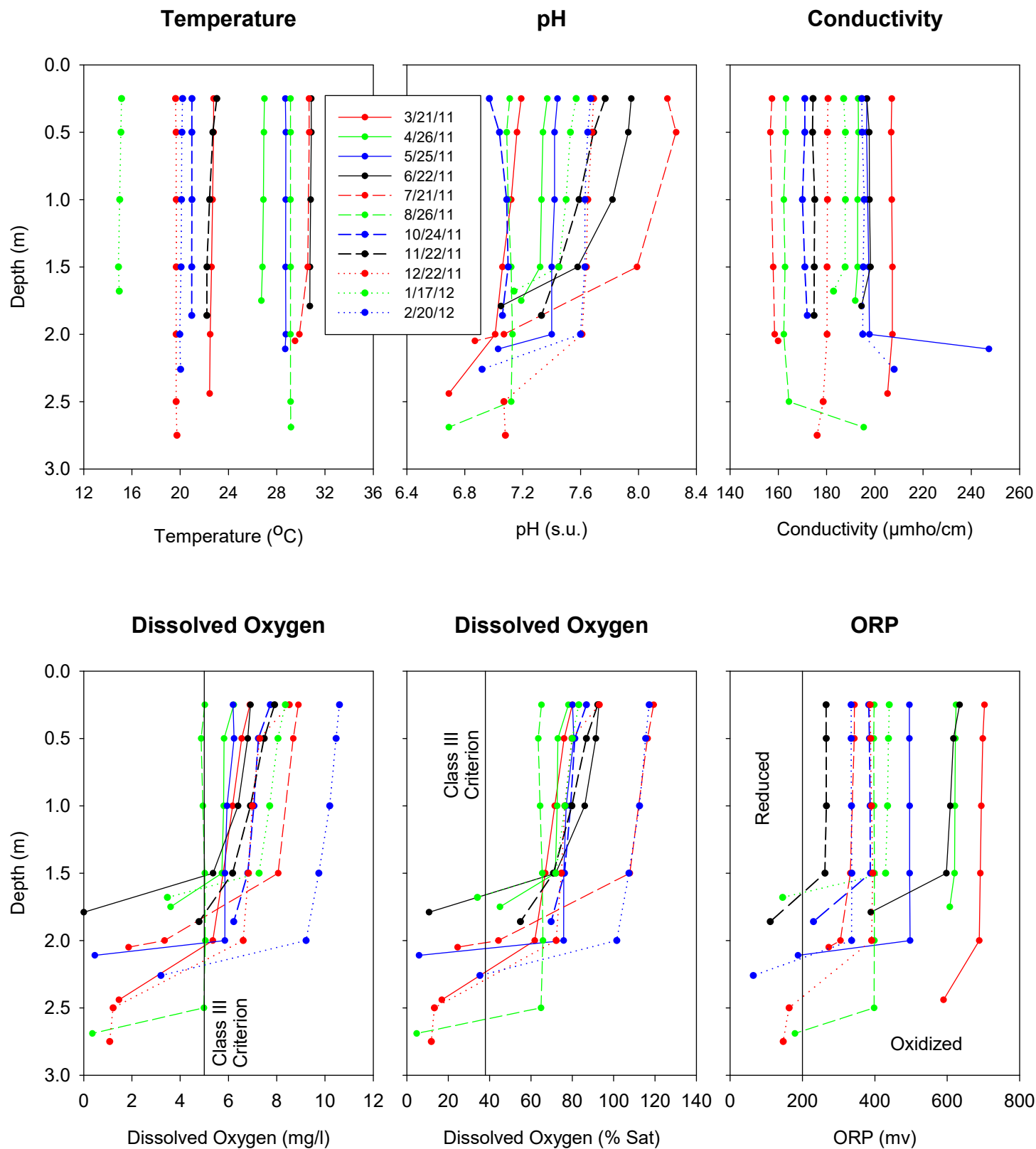


Figure 2-34. Vertical Field Profiles Collected at Site 1 in Lake Lawne from March 2011-February 2012.



In general, no significant thermal stratification was observed at Site 1 during any of the field monitoring events. Temperature differences between top and bottom measurements were generally less than 1°C during each of the monitored field events. The temperature profiles measured at Site 1 suggest a well mixed water column throughout the year.

Field measured surface pH values at Site 1 ranged from approximately 6.9-8.2 during the field monitoring program, with the majority of measured pH values ranging from approximately 7.0-7.6. A slight trend of decreasing pH with increasing water depth was observed during most of the monitoring events, with bottom pH measurements ranging from approximately 6.6-7.2. The most stratified pH profile was observed during the July 2011 monitoring event with a surface pH value of 8.2 and a bottom pH measurement of approximately 6.9.

Specific conductivity values at Site 1 ranged from approximately 160-210  $\mu\text{mho}/\text{cm}$  during the field monitoring program which is typical of values commonly observed in urban lakes. Relatively isograde conductivity values were observed throughout the water column during 8 of the monitoring events, with increases in conductivity near the water-sediment interface observed during 3 of the monitoring events. The observed increases in conductivity near the water-sediment interface were 10-20% higher than values measured in the water column. The lack of significant increases in conductivity at the water-sediment interface during a majority of the events does not necessarily indicate that internal recycling does not occur at Site 1, but simply reflects the impacts of a well mixed water column which minimizes the opportunity for released dissolved ions to accumulate in lower portions of the water column.

Surface dissolved oxygen concentrations at Site 1 in Lake Lawne ranged from approximately 5-10 mg/l during the field monitoring program. Relatively isograde dissolved oxygen concentrations were observed during most events to water depths ranging from approximately 1.5-2 m. Below these depths, dissolved oxygen decreased relatively rapidly, with concentrations ranging from 0-3.5 mg/l near the water-sediment interface.

The Class III freshwater standard for dissolved oxygen has historically been 5 mg/l, and this concentration is indicated on Figure 2-34. However, FDEP has recently adopted a revised dissolved oxygen criterion which is based upon dissolved oxygen saturation rather than a specific concentration. The revised Class III freshwater criterion for dissolved oxygen saturation for lakes in the Peninsula region states that the daily average percent dissolved oxygen saturation shall not be below 38% saturation (calculated as the average of measurements collected in the top 2 m of the water column in lakes) in more than 10% of the locations monitored. For purposes of evaluating compliance in Lake Lawne, the 38% saturation value is assumed to apply. As indicated on Figure 2-34, the upper 2 m of the water column in Lake Lawne easily met the minimum dissolved oxygen saturation of 38% throughout the field monitoring program. Based upon this revised dissolved oxygen criterion, upper portions of the water column at Site 1 met the criterion during all monitoring events. Based upon both the previous dissolved oxygen criterion of 5 mg/l and the revised criterion using dissolved oxygen saturation, Site 1 met the minimum oxygen requirements necessary to support a healthy ecosystem throughout the field monitoring program.

Field measurements of oxidation-reduction potential (ORP) indicated well oxygenated and oxidized conditions within the water column to depths ranging from approximately 1.5-2.5 m, depending upon the particular monitoring event, with relatively isograde ORP profiles observed within this range. However, rapid decreases in ORP were measured near the water-sediment interface during virtually all of the field monitoring events, with reduced conditions (indicated by ORP values less than 200 mV) observed during 6 of the 11 events illustrated on Figure 2-34. The data suggest that conditions were suitable for significant release of sediment phosphorus during approximately half of the year included in the field monitoring program.

#### 2.3.2.2.2 Site 2

A compilation of vertical field profiles collected at the eastern lobe monitoring site (Site 2) during each of the monthly monitoring events is given on Figure 2-35. Water depths at the monitoring site ranged from approximately 1.3-1.75 m during the monitoring program.

In general, no significant thermal stratification was observed at Site 2 during any of the field monitoring events, with temperature differences less than 1°C between top and bottom measurements during each of the monitored events. The temperature profiles measured at Site 2 suggest a well mixed water column throughout the year.

Field measured surface pH values at Site 2 ranged from approximately 7.0-8.0 during the field monitoring program. A slight trend of decreasing pH with increasing water depth was observed during virtually all of the monitoring events, with bottom pH measurements ranging from approximately 6.5-7.4.

Specific conductivity values at Site 2 ranged from approximately 160-210  $\mu\text{mho}/\text{cm}$  during the field monitoring program which is typical of values observed at Site 1. Relatively isograde conductivity values were observed throughout the water column during 7 of the monitoring events, with increases in conductivity near the water-sediment interface observed during 4 of the monitored events.

Dissolved oxygen concentrations at Site 2 ranged from 4.5-8 mg/l during the field monitoring program. Relatively isograde dissolved oxygen concentrations were observed during most events to water depths ranging from approximately 1-1.5 m. Below these depths, dissolved oxygen decreased relatively rapidly, with concentrations ranging from 0-3.5 mg/l near the water-sediment interface during all but one of the monitoring events. Dissolved oxygen saturation at Site 2 was above the minimum criterion of 38% to depths ranging from 1-1.5 m throughout the field monitoring program. However, measurements collected near the water-sediment interface were less than 38% during 8 of the 11 vertical profiles illustrated on Figure 2-35.

Field measurements of ORP were relatively uniform within the water column to depths ranging from 1-1.5 m. Decreases in ORP values were observed near the water-sediment interface during virtually all of the monitoring events, with ORP values less than 200 mV (indicating reduced conditions) observed during 6 of the 11 events. The observed conditions of low redox potential, combined with the measured increases in conductivity, suggest that internal recycling of ions from the sediments is significant in Lake Lawne at Site 2 during approximately half of the year.

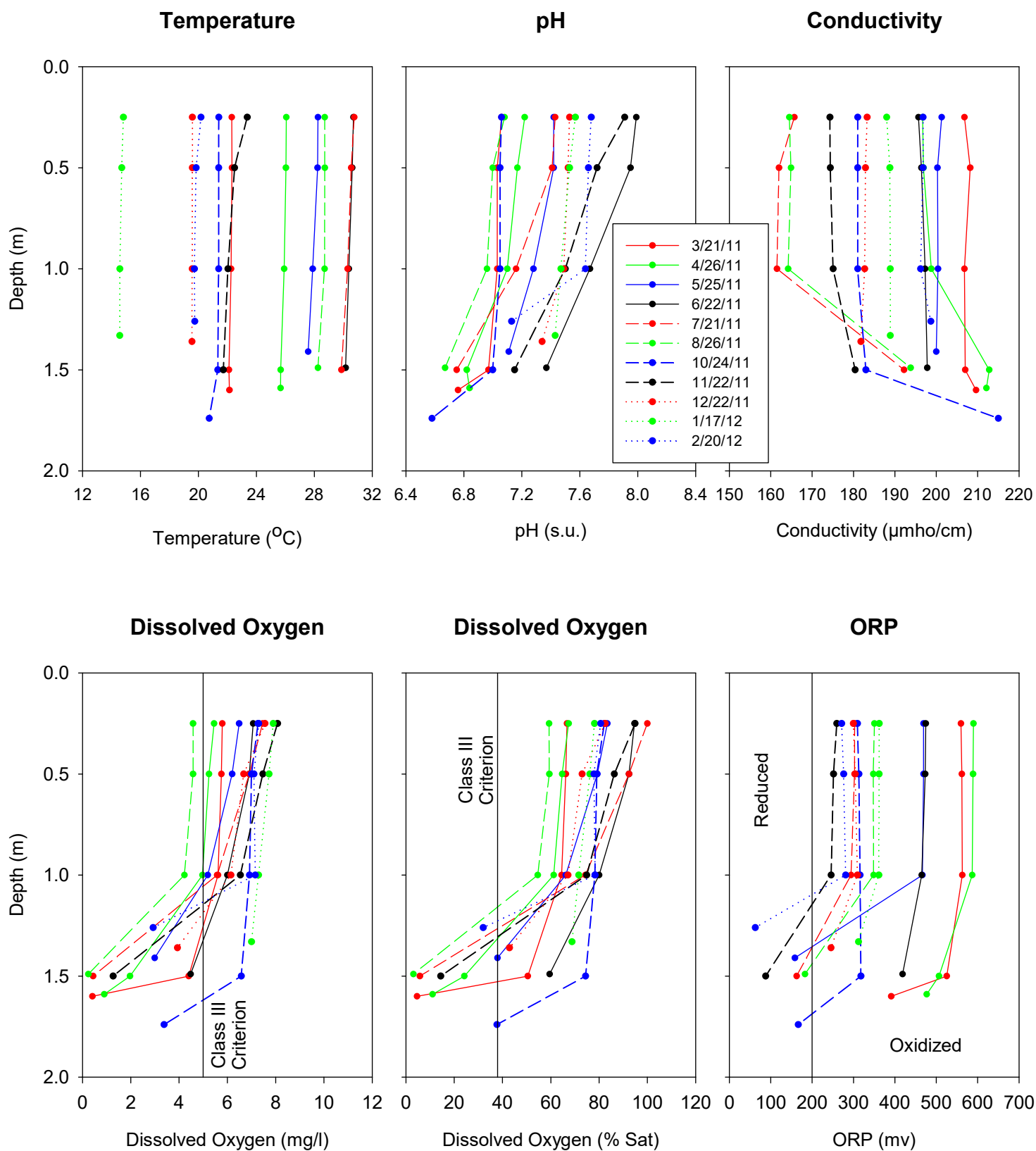


Figure 2-35. Vertical Field Profiles Collected at Site 2 in Lake Lawne from March 2011-February 2012.

### 2.3.2.2.3 Site 3

A compilation of vertical depth profiles collected at the middle monitoring site (Site 3) in Lake Lawne during each of the monthly monitoring events is given on Figure 2-36. Water depths at the monitoring site ranged from approximately 2-5.5 m during the monitoring program. As indicated on Figure 2-2, Site 3 is located in an area with steep contour lines, and small differences in horizontal positioning can create significant differences in water column depth.

No significant thermal stratification was observed at Site 3 during any of the field monitoring events, with temperature differences between top and bottom measurements generally less than 1-2°C during each of the monitored field events. The temperature profiles measured at Site 3 suggest a relatively mixed water column throughout the year.

Field measured pH values at Site 2 were highly variable, ranging from approximately 7.1-8.0 during the field monitoring program. A slight trend of decreasing pH with increasing water depth was observed during most of the monitoring events, with bottom pH measurements ranging from approximately 6.6-7.4. The most extreme pH profile was observed during the July 2011 monitoring event, with a surface pH value near 8.0 and a bottom pH measurement of approximately 6.7.

Specific conductivity values at Site 3 ranged from approximately 155-210  $\mu\text{mho}/\text{cm}$  during the field monitoring program which is similar to values measured at Sites 1 and 2. Relatively isograde conductivity values were observed throughout the water column during virtually all of the monitoring events. No measurable increases in specific conductivity were observed at Site 3 near the water-sediment interface, unlike the increases previously described for Sites 1 and 2.

Surface dissolved oxygen concentrations at Site 3 ranged from approximately 5-8 mg/l during the field monitoring program. A trend of decreasing dissolved oxygen with increasing water depth was observed during virtually all events, with concentrations less than 5 mg/l at water depths ranging from 1.5-3 m. Dissolved oxygen saturation values also decreased with increasing water depth. Saturation values less than 38% were measured during 5 of the monitoring events at Site 3 and typically occurred during summer and fall conditions.

Relatively isograde ORP profiles were observed at Site 3, with oxidized conditions maintained throughout most of the water column during most events. Reduced conditions were measured only during the November 2011 monitoring event at the water-sediment interface. The lack of conductivity increases combined with well oxygenated conditions within the water column suggest that internal recycling may be relatively minimal in Lake Lawne at Site 3.

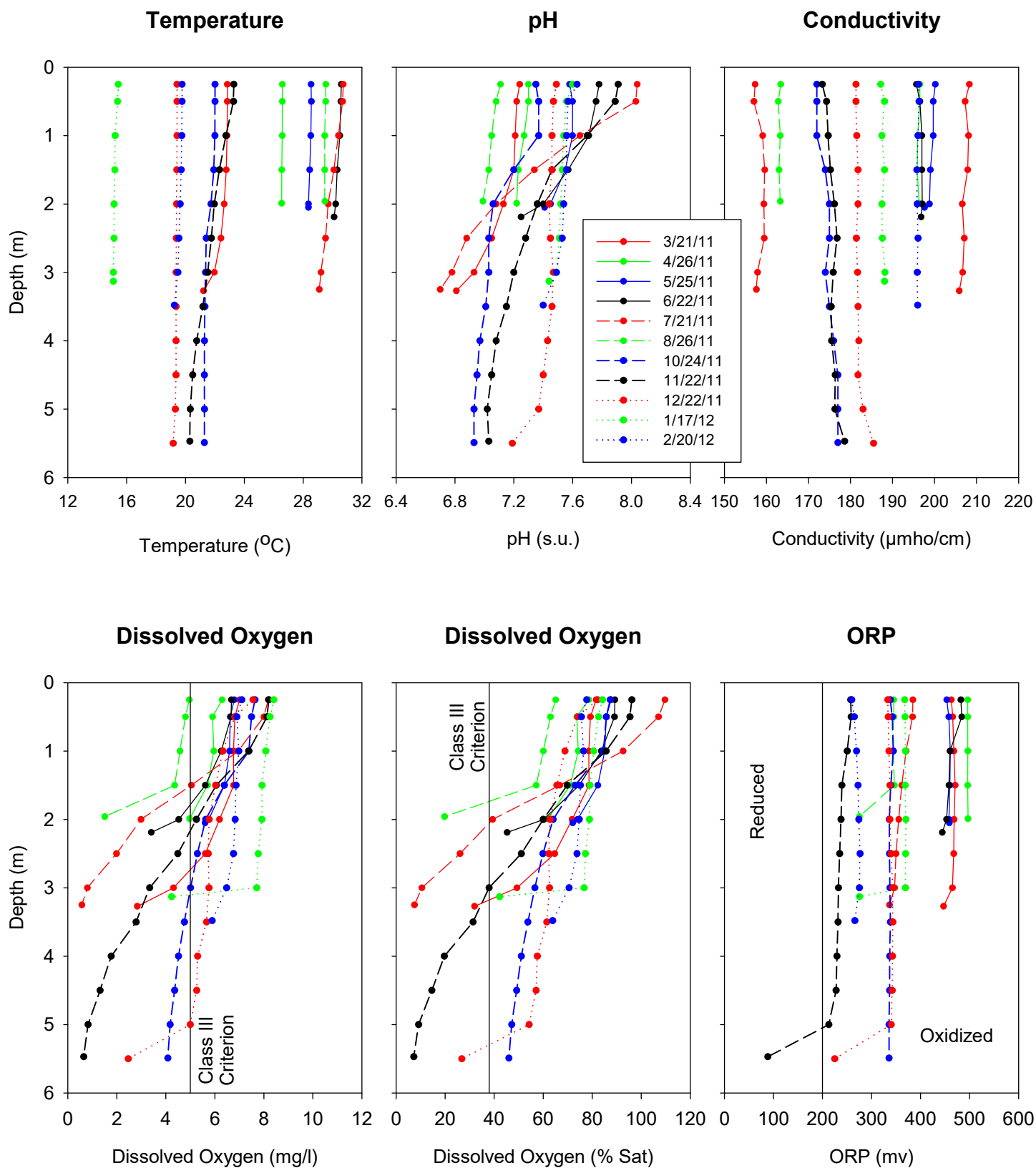


Figure 2-36. Vertical Field Profiles Collected at Site 3 in Lake Lawne from March 2011-February 2012.



#### **2.3.2.2.4 Site 4**

A compilation of vertical depth profiles collected at the south lobe monitoring site (Site 4) during each of the monthly monitoring events in Lake Lawne is given on Figure 2-37. Water depth at this monitoring site ranged from approximately 2.2-3.5 m during the field monitoring program.

No significant thermal stratification was observed at Site 4 during any of the field monitoring events, with temperature differences between top and bottom measurements generally less than 1°C during each event. The temperature profiles measured at Site 4 suggest a relatively well mixed water column throughout the year.

Field measured surface pH values at Site 4 ranged from approximately 7.0-7.9 during the field monitoring program. A trend of decreasing pH with increasing water depth was observed during each of the monitoring events, with bottom pH measurements ranging from approximately 6.8-7.2. Similar to the trend previously observed at Sites 1-3, the most extreme pH profile at Site 4 was observed during the July 2011 event which was characterized by a surface pH of approximately 7.9 and a bottom pH of approximately 6.9.

Measured specific conductivity values at Site 4 ranged from approximately 155-210 µmho/cm during the field monitoring program which is similar to values measured at the other surface water sites. Relatively isograde conductivity values were observed throughout the water column during virtually all of the monitoring events, with slight increases in conductivity observed near the water-sediment interface during 4 of the monitored events.

#### **2.3.2.2.5 Secchi Disk Measurements**

A summary of measured Secchi disk depths at each of the four monitoring sites in Lake Lawne from March 2011-February 2012 is given on Figure 2-38. In general, relatively close agreement was observed in measured Secchi disk depths between the individual monitoring sites for a given monitoring date. Measured Secchi disk depths ranged from 0.35-0.98 m during the 12-month field monitoring program, reflecting fair to poor water clarity. During the field monitoring conducted by ERD, the lowest Secchi disk depths were observed during summer and fall conditions, with larger Secchi depths measured during winter and spring conditions.

### **2.3.2.3 Water Quality Characteristics**

#### **2.3.2.3.1 Mean Water Quality Characteristics**

A complete listing of the results of laboratory analyses conducted on the monthly surface water samples collected from Lake Lawne is given in Appendix B.2. A summary of mean water quality characteristics at the 4 monitoring sites in Lake Lawne from March 2011-February 2012 is given in Table 2-12. Mean values summarized in this table reflect geometric means for each of the 12 monthly monitoring events.

In general, surface water in Lake Lawne was moderately buffered, with measured alkalinity values generally ranging from approximately 63-67 mg/l. Measured alkalinity values in the bottom samples were approximately 0.5-1.5 mg/l lower on an average basis.

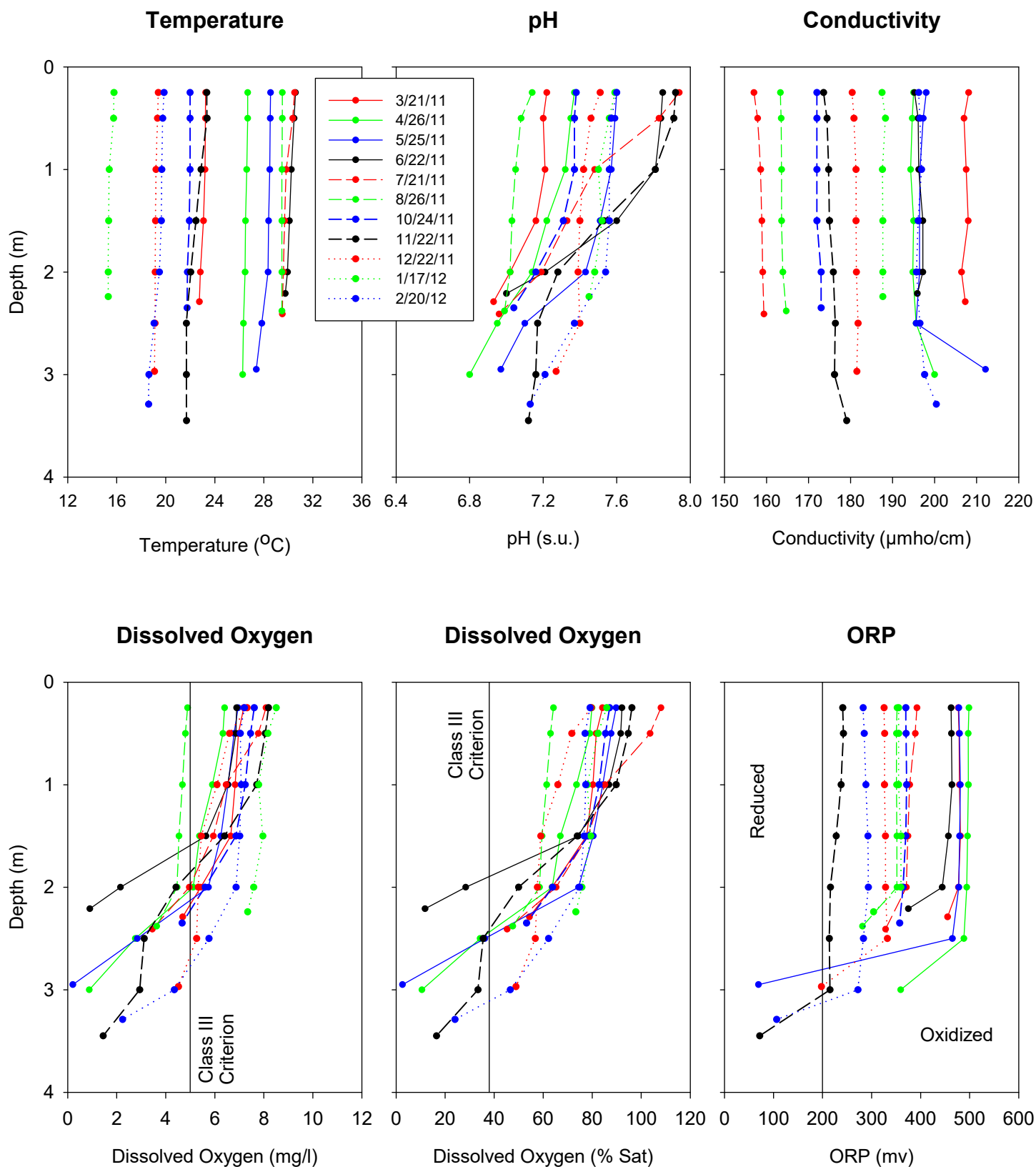


Figure 2-37. Vertical Field Profiles Collected at Site 4 in Lake Lawne from March 2011-February 2012.

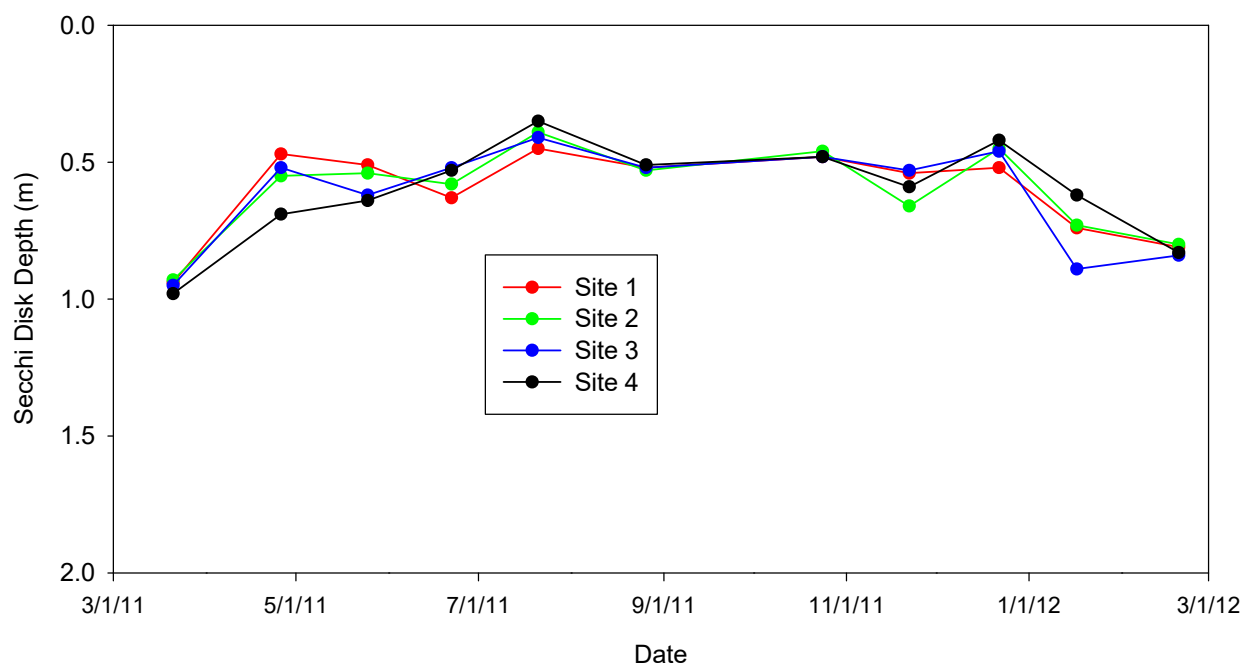


Figure 2-38. Measured Secchi Disk Depths in Lake Lawne from March 2011-February 2012.

**TABLE 2-12**

**MEAN WATER QUALITY CHARACTERISTICS MEASURED  
IN LAKE LAWNE FROM MARCH 2011 – FEBRUARY 2012**

| PARAMETER       | UNITS             | SITE 1 |        | SITE 2 |        | SITE 3 |        | SITE 4 |        |
|-----------------|-------------------|--------|--------|--------|--------|--------|--------|--------|--------|
|                 |                   | Top    | Bottom | Top    | Bottom | Top    | Bottom | Top    | Bottom |
| Alkalinity      | mg/l              | 66.3   | 64.6   | 64.5   | 63.0   | 65.5   | 64.6   | 64.1   | 63.6   |
| NH <sub>3</sub> | µg/l              | 29     | 27     | 35     | 32     | 32     | 61     | 27     | 47     |
| NO <sub>x</sub> | µg/l              | 6      | 4      | 4      | 5      | 4      | 4      | 3      | 4      |
| Diss. Org. N    | µg/l              | 310    | 463    | 468    | 575    | 505    | 408    | 296    | 343    |
| Particulate N   | µg/l              | 353    | 401    | 322    | 304    | 280    | 522    | 435    | 414    |
| Total N         | µg/l              | 810    | 937    | 948    | 982    | 867    | 1,074  | 864    | 880    |
| SRP             | µg/l              | 1      | 1      | 2      | 2      | 2      | 3      | 2      | 2      |
| Diss. Org. P    | µg/l              | 6      | 5      | 3      | 4      | 5      | 6      | 5      | 3      |
| Particulate P   | µg/l              | 37     | 45     | 49     | 50     | 42     | 46     | 37     | 50     |
| Total P         | µg/l              | 45     | 53     | 56     | 59     | 51     | 57     | 46     | 58     |
| Turbidity       | NTU               | 5.2    | 6.0    | 5.9    | 6.0    | 4.5    | 5.4    | 4.5    | 5.8    |
| Color           | Pt-Co             | 65     | 64     | 71     | 72     | 64     | 66     | 67     | 67     |
| Chlorophyll-a   | mg/m <sup>3</sup> | 22.1   | --     | 24.4   | --     | 29.4   | --     | 29.0   | --     |

Measured concentrations of both ammonia and NO<sub>x</sub> were low in value in the Lake Lawne samples, with mean surface values for ammonia ranging from 27-35 µg/l, and mean surface values for NO<sub>x</sub> ranging from 4-6 µg/l. No significant difference was observed between measured concentrations of NO<sub>x</sub> in top or bottom samples at any of the four monitoring sites. Measured concentrations of ammonia appear to be relatively similar in value between top and bottom samples at Sites 1 and 2, with somewhat higher bottom measurements of ammonia observed at Sites 3 and 4. Measured concentrations of dissolved organic nitrogen were moderately variable between the four sites, with surface mean values ranging from 296-505 µg/l. Concentrations of dissolved organic nitrogen in the bottom samples were higher in value than surface measurements at Sites 1, 2, and 4, with a lower bottom concentration for dissolved organic nitrogen measured at Site 3. Measured concentrations of particulate nitrogen were also highly variable, with mean values ranging from 280-435 µg/l in the surface samples. Concentrations of particulate nitrogen in the bottom samples ranged from 304-522 µg/l. Particulate nitrogen appears to be the dominant nitrogen species in surface samples collected at Sites 1 and 4, with dissolved organic nitrogen representing the dominant nitrogen species at Sites 2 and 3. Overall, total nitrogen concentrations in surface samples collected from Lake Lawne were moderately low in value, with mean concentrations ranging from 810-948 µg/l. Measured nitrogen concentrations in bottom samples were higher in value at each of the four sites than observed in the surface samples.

In general, low levels of SRP were observed in both top and bottom samples collected at each of the four sites, with mean concentrations ranging from 1-3 µg/l. Measured concentrations of dissolved organic phosphorus were also relatively low in value, ranging from 3-6 µg/l with relatively similar values between top and bottom measurements. The dominant phosphorus species measured in samples collected from Lake Lawne is particulate phosphorus, reflecting 80-88% of the total phosphorus measured in the surface samples and 81-86% of the total phosphorus in the bottom samples. Phosphorus concentrations in the bottom samples exceeded values measured in the surface samples by 5-26% at each of the four sites.

In general, Lake Lawne is characterized by relatively low concentrations of turbidity, with mean values ranging from 4.5-5.9 NTU at the surface monitoring sites. Turbidity values in the bottom samples exhibit higher mean values for each of the four sites compared with the surface samples. Water within Lake Lawne exhibited moderately high levels of color, with mean values ranging from approximately 64-72 Pt-Co units and relatively similar values between top and bottom measurements.

Measured chlorophyll-a concentrations in Lake Lawne during the field monitoring program ranged from moderate to elevated, with overall mean values for the surface samples ranging from 22.1-29.4 mg/m<sup>3</sup>.

In general, water quality appears to be relatively similar at each of the four monitoring sites in Lake Lawne. However, it is interesting to note that the most elevated levels for ammonia, dissolved organic nitrogen, total nitrogen, particulate phosphorus, total phosphorus, and turbidity were observed at Sites 2 and 3 which reflect central portions of the lake, with slightly lower concentrations measured at Sites 1 and 4 for many parameters.

### **2.3.2.3.2 Temporal Variability in Water Quality Characteristics**

A graphical comparison of temporal variability in alkalinity, turbidity, color, and chlorophyll-a in surface water samples collected from Lake Lawne over the period from March 2011-February 2012 is given on Figure 2-39. In general, measured concentrations of alkalinity were relatively consistent in value throughout the 12-month field monitoring program. No significant differences appear to exist in measured alkalinity values between any of the four sites.

Measured turbidity values in Lake Lawne also appear to be relatively similar between the four monitoring sites with the exception of more elevated turbidity measurements observed at Site 2 during 2 of the 12 monthly monitoring events. No seasonal patterns in turbidity concentrations are apparent in the data summarized on Figure 2-39.

In general, measured color concentrations appear to be relatively similar in value at each of the four monitoring sites, with the exception of more elevated color concentrations measured at Site 2 during 4 of the 12 monitoring events. Measured color concentrations appeared to peak during fall conditions, with lower color values during remaining portions of the year.

Measured chlorophyll-a concentrations in Lake Lawne exhibited a relatively high degree of variability, ranging from approximately 5-80 mg/m<sup>3</sup> at the monitoring sites. Chlorophyll-a values during the spring and summer conditions exhibited a higher degree of variability than during winter and spring conditions. No significant difference appears to exist between measured chlorophyll-a concentrations at any of the four monitoring sites. The most elevated levels of chlorophyll-a occurred during late-spring and early-summer within the lake.

A graphical comparison of temporal variability in nitrogen species measured in surface water samples collected from Lake Lawne over the period from March 2011-February 2012 is given on Figure 2-40. Measured concentrations of ammonia in Lake Lawne were generally low in value, with the vast majority of measured concentrations less than 50-100 µg/l. A relatively close agreement was observed in measured ammonia concentrations between the four sites with the exception of elevated peak concentrations observed at Site 2 during April 2011 and at Site 1 during July 2011. Ammonia concentrations during fall and winter conditions were low in value and virtually identical between the four monitoring sites.

Measured concentrations of NO<sub>x</sub> in Lake Lawne were generally low in value, with the majority of values less than 5-10 µg/l. Isolated peaks in NO<sub>x</sub> concentrations were observed at Site 1 during June 2011 and at Sites 1 and 2 during January 2012. With the exception of these isolated peaks, measured NO<sub>x</sub> concentrations were virtually identical between the four monitoring sites.

Measured concentrations of dissolved organic nitrogen were highly variable throughout the field monitoring program, with measured concentrations ranging from approximately 100-900 µg/l. The highest degree of variability was observed during spring and early-summer conditions, with low concentrations of dissolved organic nitrogen observed at Sites 1 and 4 and more elevated concentrations observed at Sites 2 and 3. Beginning in mid-summer, dissolved organic nitrogen concentrations began to be more consistent between the four monitoring sites. A similar pattern is also apparent for measured concentrations of particulate phosphorus, with a high degree of variability observed in spring and early-summer conditions and a lower degree of variability, combined with lower concentrations, observed during fall and winter conditions. Measured concentrations of particulate nitrogen ranged from approximately 100-1,100 µg/l during the field monitoring program.



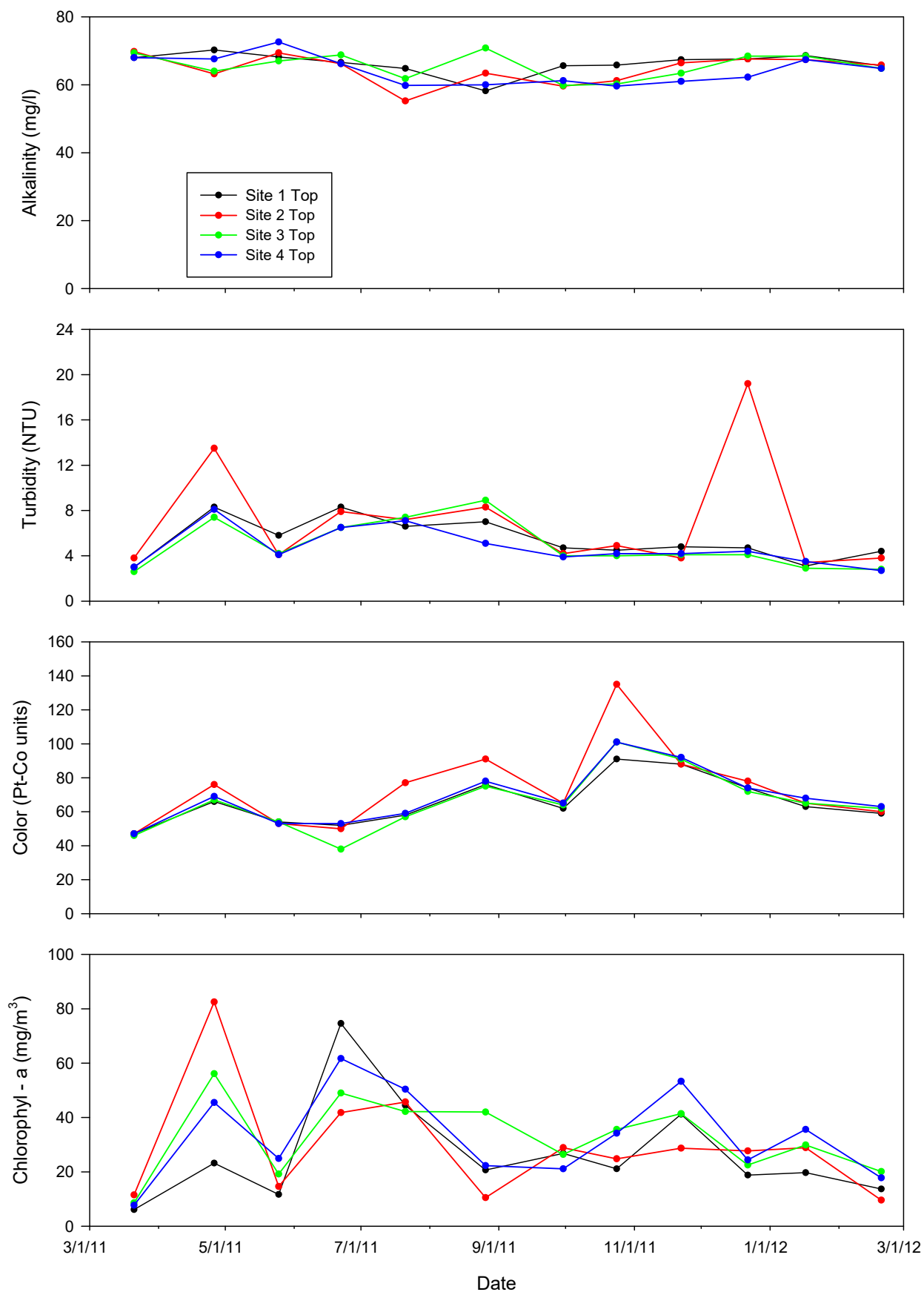


Figure 2-39. Temporal Variability in Alkalinity, Turbidity, Color, and Chlorophyll-a in Surface Water Samples Collected in Lake Lawne from March 2011-February 2012.

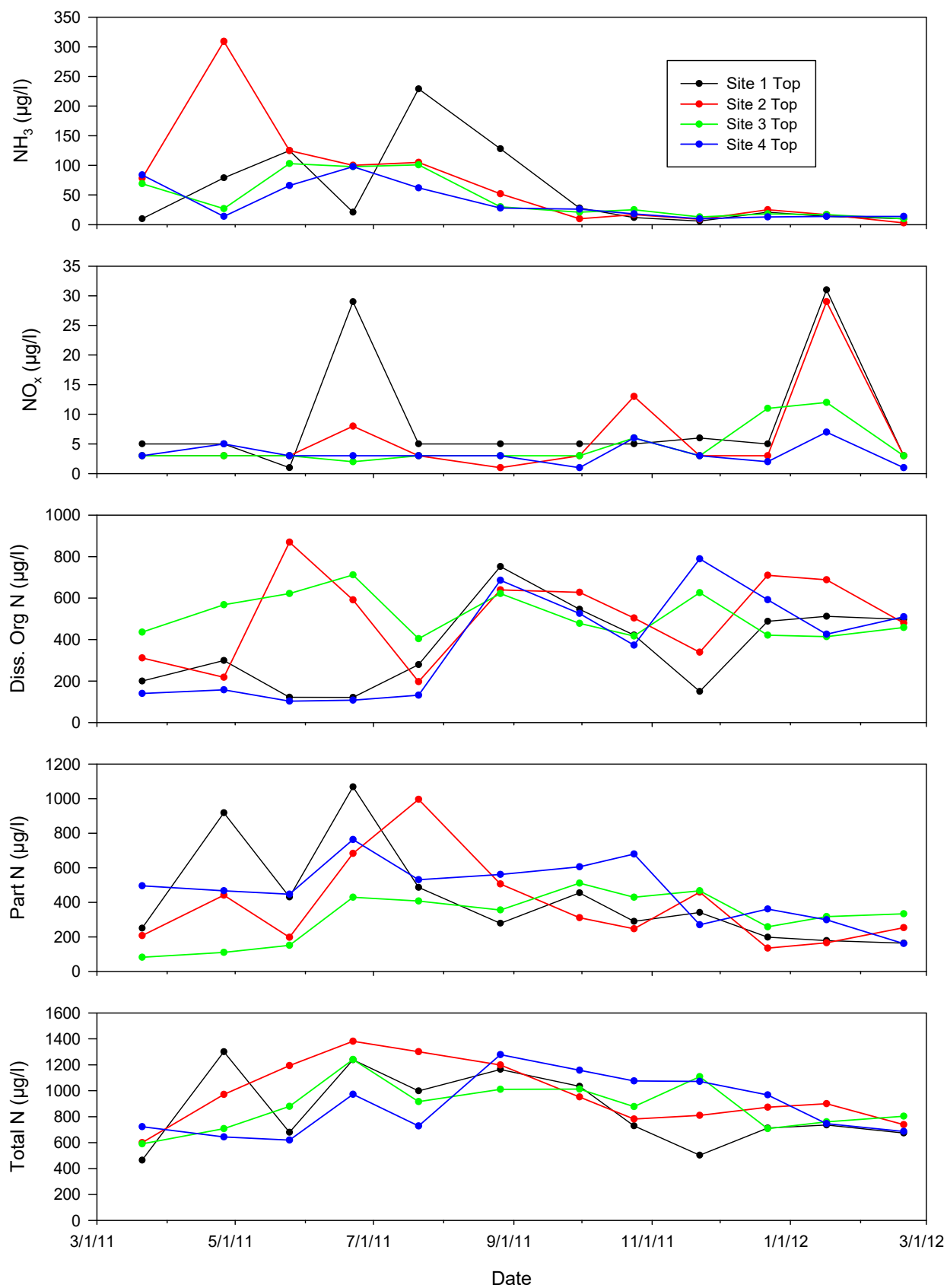


Figure 2-40. Temporal Variability in Nitrogen Species in Surface Water Samples Collected in Lake Lawne from March 2011-February 2012.

In spite of the variability observed for individual nitrogen species, measured concentrations of total nitrogen were relatively consistent throughout the field monitoring program. Measured nitrogen concentrations ranged from approximately 500-1,300 µg/l, with the most elevated concentrations observed during summer conditions. No consistent pattern of higher or lower concentrations of nitrogen are apparent at any of the four monitoring sites.

A graphical comparison of temporal variability in measured concentrations of phosphorus species in surface water samples collected from Lake Lawne over the period from March 2011-February 2012 is given on Figure 2-41. Measured concentrations of SRP ranged from 1-17 µg/l, although the vast majority of measured values were less than 4-5 µg/l. Somewhat higher SRP concentrations were observed during late-spring and early-summer conditions, with lower and more consistent values observed during remaining portions of the monitoring program. Isolated peaks in SRP concentrations were observed at Site 2 during October 2011 and February 2012.

Measured concentrations of dissolved organic phosphorus were highly variable but generally low in value during the field monitoring program. Measured concentrations ranged from 1-17 µg/l, although the vast majority of measured values were less than 8-10 µg/l. Isolated peaks in dissolved organic phosphorus were observed at each of the four sites during October 2011, with a supplemental peak in dissolved organic phosphorus observed at 3 of the 4 sites during February 2012. No consistent pattern of higher or lower concentrations of dissolved organic phosphorus were apparent at any of the monitoring sites.

Measured concentrations of particulate phosphorus ranged from approximately 20-90 µg/l, with the most elevated concentrations observed during late-spring and early-summer, followed by a steady decrease in concentrations at most sites throughout the remainder of the field monitoring program. With only a few exceptions, measured concentrations of particulate phosphorus were relatively similar in value at each of the four sites during each monitoring event. No significant pattern of higher or lower concentrations of particulate phosphorus are apparent at any of the four monitoring sites.

Measured concentrations of total phosphorus generally mimic the concentration patterns observed for particulate phosphorus since particulate phosphorus comprises the vast majority of total phosphorus in the lake samples. Total phosphorus concentrations during the field monitoring program ranged from approximately 25-95 µg/l, with the vast majority of measured values ranging from approximately 20-80 µg/l. The most elevated levels of total phosphorus were observed during late-spring and early-summer, with a steady decrease in total phosphorus at most sites throughout the remainder of the field monitoring program. The more elevated levels of total phosphorus observed during spring and early-summer conditions may be indicative of internal recycling within the lake.

A graphical comparison of temporal variability in calculated TSI values and TN/TP ratios in Lake Lawne during the field monitoring program is given on Figure 2-42. In general, TSI values at each of the four sites ranged from oligotrophic to hypereutrophic during the field monitoring program, with the vast majority of measured values in the eutrophic and upper-mesotrophic categories. The highest TSI values in the lake appear to occur during spring and early-fall conditions, further suggesting that internal recycling may be contributing additional nutrients to the lake during these times.

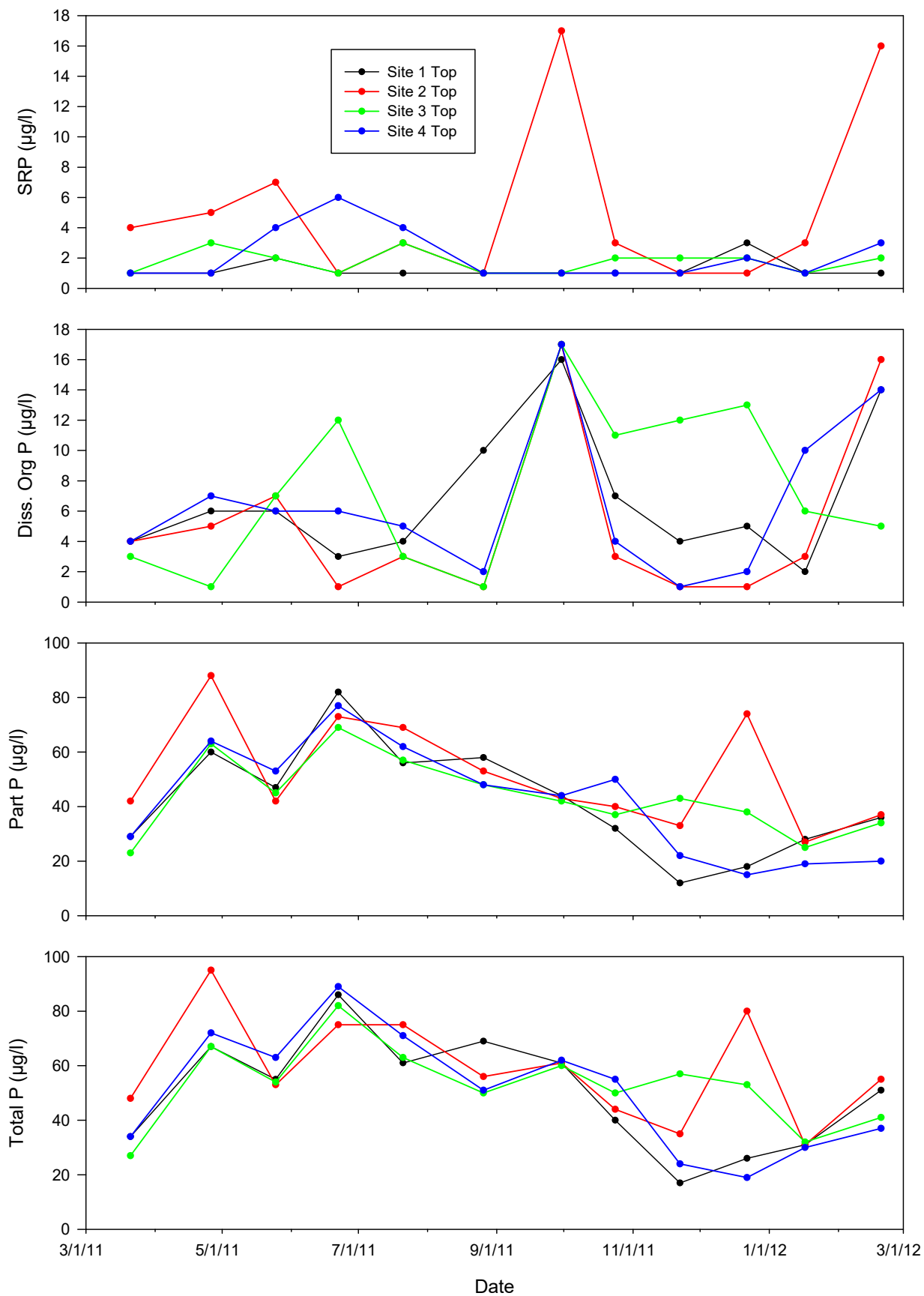


Figure 2-41. Temporal Variability in Phosphorus Species in Surface Water Samples Collected in Lake Lawne from March 2011-February 2012.

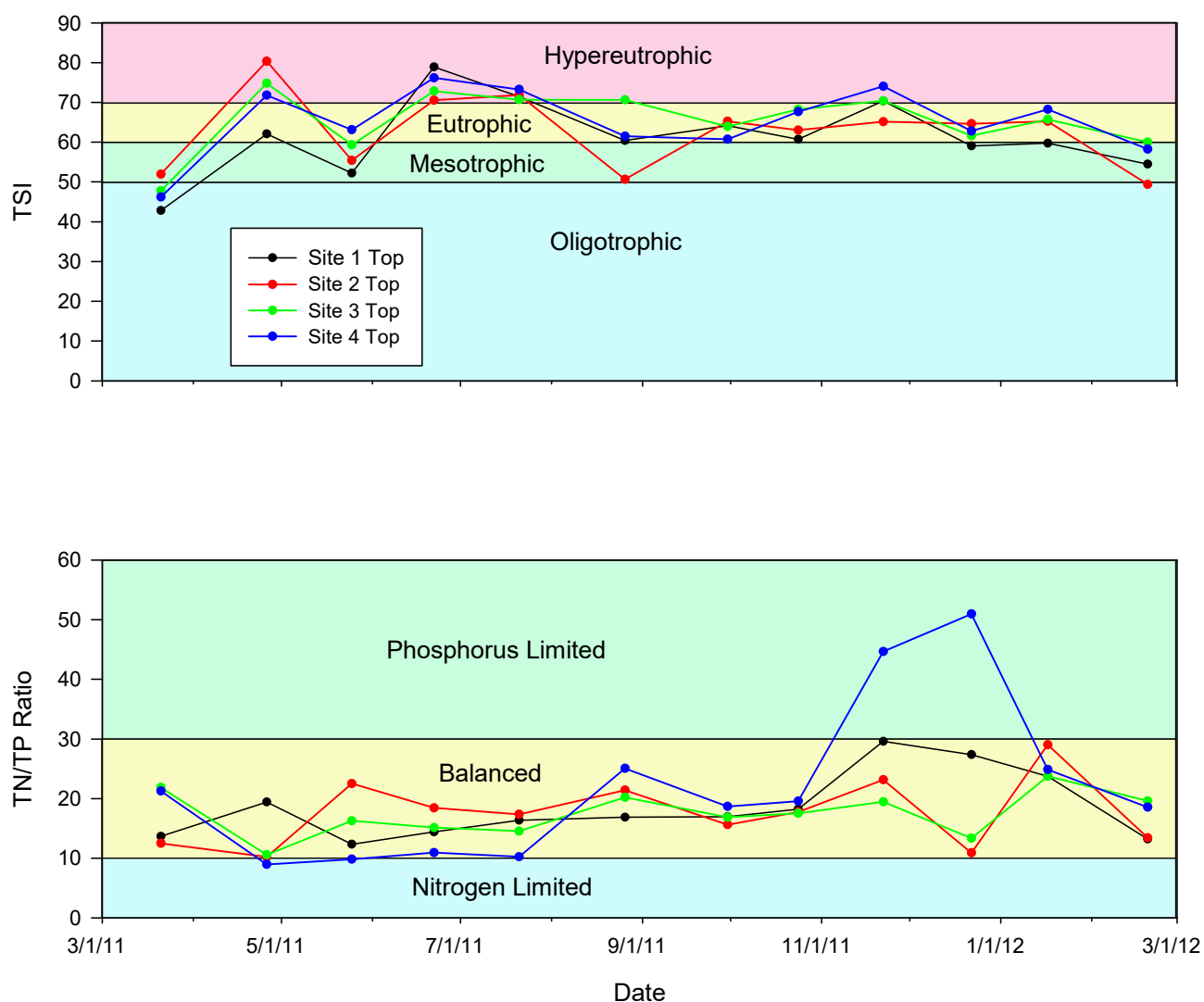


Figure 2-42. Temporal Variability in TSI Values and TN/TP Ratios in Surface Water Samples Collected in Lake Lawne from March 2011-February 2012.

Calculated TN/TP ratios for Lake Lawne indicate a nutrient-balanced condition throughout the field monitoring program, with the exception of highly phosphorus-limited conditions observed at Site 4 during winter conditions. Although the nutrient ratios suggest that both nitrogen and phosphorus should be managed to improve water quality in Lake Lawne, nitrogen is difficult to remove, and reductions in phosphorus loadings will quickly create phosphorus-limited conditions within the lake.



#### **2.3.2.4 Summary**

In general, Lake Lawne exhibits water quality characteristics which are typical of impacted urban lakes. Upper portions of the water column appear to be well mixed during much of the year to water depths of 1-2 m or more, with water quality in these upper layers ranging from moderately good to poor. Historical water quality monitoring conducted in Lake Lawne suggests that water column concentrations of total nitrogen and total phosphorus may be improving over time with a corresponding increase in Secchi disk depth. The water quality monitoring conducted by ERD within Lake Lawne suggests that the lake becomes chemically stratified in lower portions of the water column throughout much of the year. These lower portions of the water column are often anoxic and create conditions favorable for release of nutrients from the sediments into the overlying water column. Periodic episodes of circulation can cause these accumulated nutrients to be redistributed into the water column. Overall, the physical and chemical characteristics of Lake Lawne are indicative of a eutrophic lake system.

Sediment and bathymetric monitoring conducted by ERD indicate the presence of deep accumulations of organic muck, particularly in deeper portions of the lake. These sediments contain accumulated organic matter which contributes to creating the observed anoxic conditions near the water-sediment interface and creates conditions suitable for sediment release of nutrients. The historical data, as well as current data collected by ERD, suggests that Lake Lawne is impacted by both external and internal nutrient sources.

#### **2.3.3 Compliance with State Water Quality Criteria**

Water quality criteria for Florida lakes are outlined in Chapter 62-302 of the Florida Administrative Code (FAC) titled “Surface Water Quality Standards” and vary based upon the designated uses. Lake Lawne is considered to be a Class III surface water which is defined as waters used for “fish consumption; recreation; propagation of a healthy, well-balanced population of fish and wildlife” as defined in Section 62-302.400.

Water quality criteria for Class III freshwater systems are summarized in Section 62-302.530-Surface Water Quality Criteria. This section contains both numeric and narrative surface water quality which apply to Class III freshwater systems. Surface water quality criteria are provided for more than 100 parameters which include a variety of metals and organic compounds. However, only a handful of the standards identified in Section 62-302.530 address parameters which are routinely measured as part of ambient water quality monitoring programs in lakes. A summary of common applicable Class III water quality criteria for lakes is given in Table 2-13 and includes alkalinity, un-ionized ammonia, fecal coliform, BOD, specific conductance, dissolved oxygen, pH, and turbidity. Compliance status for these parameters in Lake Lawne, based on the historical Orange County and Orlando data, is summarized in the final column of Table 2-13.

Lake Lawne easily meets the minimum alkalinity criterion of 20 mg/l, and no violations for this parameter were observed at any time. Concentrations of un-ionized ammonia only become significant at pH values in excess of 9.0, and as a result of the low ammonia concentrations combined with the observed moderate pH levels, violations of the un-ionized ammonia criterion are unlikely.

**TABLE 2-13**  
**COMMON APPLICABLE CLASS III**  
**WATER QUALITY CRITERIA FOR LAKES**

| PARAMETER            | WATER QUALITY CRITERIA                                                                                                                                                                                                                          | VIOLATIONS                                               |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Alkalinity           | > 20 mg/l                                                                                                                                                                                                                                       | None                                                     |
| Un-ionized Ammonia   | ≤ 0.02 mg/l                                                                                                                                                                                                                                     | None                                                     |
| BOD                  | Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below limit for established class                                                                                                                    | None                                                     |
| Specific Conductance | Shall not be increased more than 50% above background or 1,275 µmho/cm, whichever is greater                                                                                                                                                    | None                                                     |
| Dissolved Oxygen     | > 38% oxygen saturation average within top 2 m of water column                                                                                                                                                                                  | Data available for vertical profiles (see Section 3.2.3) |
| pH                   | 6-8.5 s.u.                                                                                                                                                                                                                                      | None                                                     |
| Turbidity            | ≤ 29 NTU                                                                                                                                                                                                                                        | None                                                     |
| Fecal Coliform       | MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as a geometric mean of a minimum of 10 samples taken over a 30-day period. | See Table 2-14                                           |

The water quality criterion for BOD is a narrative standard which indicates that BOD levels cannot cause conditions where dissolved oxygen would be depressed below the Class III limit for this parameter. In general, BOD concentrations within Lake Lawne have generally been low to moderate in value, and significant long-term depressions of dissolved oxygen have not been observed at any site. Therefore, violations of the narrative BOD standard are also not likely.

Lake Lawne also easily meets the maximum criterion of 1,275 µmho/cm for specific conductivity at all times. The lake also meets the Class III criterion for pH of 6.0-8.5 units on a long-term average, although pH values slightly in excess of 8.5 have been observed during a limited number of monitoring events. No violations of the turbidity criterion of 29 NTU were observed in the field monitoring conducted by ERD from March 2011-February 2012.

The dissolved oxygen criterion for Class III freshwater systems has historically been 5 mg/l. However, during 2012 FDEP adopted a criterion based on oxygen saturation rather than oxygen concentration. The revised dissolved oxygen standard for freshwater systems is an average of 38% oxygen saturation within the top 2 m of the water column. Oxygen saturation is a function of both the dissolved oxygen concentration as well as temperature of the water at the time of the measurement since oxygen solubility increases at lower water temperatures and decreases at higher water temperatures. Oxygen saturation percentages are not included as part of the historical surface water data set for Lake Lawne but are included in the vertical profile data collected by ERD from March 2011-February 2012. In general, each of the monitoring sites in Lake Lawne met the dissolved oxygen saturation criterion within the top 2 m during the ERD monitoring.

The Class III standard for fecal coliform bacteria is a variable standard depending upon the availability of data. If a minimum of 10 samples are collected over a 30-day period, then the monthly geometric mean of the samples cannot exceed 200 cfu/100 ml, and no more than 10% of the samples during the monthly period can exceed 400 cfu/100 ml. If less than 10 samples are collected over a 30-day period (which is the case with the Lake Lawne data set), then the standard becomes 800 cfu/100 ml. However, in spite of the specific language included in the fecal coliform standard, a maximum fecal coliform standard of 400 cfu/100 ml is often assumed even if the number of samples do not meet the minimum requirements, and that the commonly assumed standard is used in this analysis. Over the available historical period of record, multiple exceedances of the fecal coliform criteria have been observed in Lake Lawne. Sewage disposal in the residential communities adjacent to Lake Lawne, as well as the interconnecting canal systems, occurs primarily using sanitary sewer systems, with septic tanks located primarily in outer portions of the watershed.

A summary of observed exceedances of the fecal coliform criteria in Lake Lawne is given on Table 2-14. Periodic exceedances of the 400 cfu/100 ml fecal coliform criterion were observed at each of the historical monitoring sites maintained by Orlando and Orange County. The observed exceedances represented 5-13% of the measured values. However, only 5% of the 22 observed exceedances were greater than 1,000 cfu/100 ml, suggesting that the inputs causing the exceedances are limited in magnitude and could possibly be contributed by waterfowl.

**TABLE 2-14**  
**SUMMARY OF EXCEEDANCES OF THE**  
**FECAL COLIFORM CRITERION IN LAKE LAWNE**

| AGENCY        | SITE  | DATE               | FECAL COLIFORM (cfu/100 ml) | PERCENTAGE OF TOTAL VALUES EXCEEDING CRITERION |
|---------------|-------|--------------------|-----------------------------|------------------------------------------------|
| Orlando       | North | 7/16/98            | 460                         | 5%                                             |
|               |       | 10/25/02           | 1,380                       | (2 of 39)                                      |
|               | South | 7/26/94            | 620                         | 7%                                             |
|               |       | 7/16/98<br>8/24/00 | 490<br>2,000                | (3 of 42)                                      |
| Orange County | LW10N | 7/15/92            | 1,420                       | 6%<br>(5 of 89)                                |
|               |       | 10/19/92           | 700                         |                                                |
|               |       | 9/21/94            | 650                         |                                                |
|               |       | 7/30/07            | 500                         |                                                |
|               |       | 7/27/10            | 440                         |                                                |
|               | LW10M | 9/9/96             | 560                         | 13%<br>(6 of 45)                               |
|               |       | 10/11/99           | 430                         |                                                |
|               |       | 12/13/00           | 480                         |                                                |
|               |       | 7/30/07            | 440                         |                                                |
|               |       | 10/23/07           | 510                         |                                                |
|               |       | 8/7/08             | 550                         |                                                |
|               | LW10S | 3/8/93             | 1,040                       | 6%<br>(6 of 94)                                |
|               |       | 12/14/94           | 1,000                       |                                                |
|               |       | 12/16/96           | 670                         |                                                |
|               |       | 3/8/00             | 460                         |                                                |
|               |       | 7/30/07            | 620                         |                                                |
|               |       | 10/23/07           | 740                         |                                                |

Surface water within Lake Lawne is also subject to the narrative nutrient criteria outlined in Chapter 62-302.531 FAC. This section provides numeric interpretations of the narrative nutrient criteria in Section 62-302.530 FAC. The applicable nutrient criteria vary on an annual basis depending upon geometric mean concentrations for color, alkalinity, and chlorophyll-a within the waterbody. The nutrient criteria also vary depending upon the availability of chlorophyll-a data and concentrations of nutrients and chlorophyll-a in the lake.

A tabular summary of Numeric Nutrient Criteria (NNC) for Florida lakes is given in Table 2-15. Florida lakes are divided into three general categories based upon lake color and alkalinity. Category I includes lakes where the long-term geometric mean color value exceeds 40 Pt-Co units as has been observed in Lake Lawne. If the geometric mean chlorophyll-a concentration in these lakes is less than 20 µg/l, then the numeric nutrient criteria for a given calendar year shall be the measured annual geometric means of nitrogen and phosphorus within the lake samples, subject to the minimum and maximum limits indicated in Table 2-15. If there are insufficient data to calculate the annual geometric mean chlorophyll-a concentration for a given year, or if the chlorophyll-a concentration exceeds 20 mg/m<sup>3</sup>, then the numeric nutrient criteria become the minimum values for this category listed in Table 2-15.

**TABLE 2-15**

**NUMERIC NUTRIENT CRITERIA FOR FLORIDA LAKES**  
(Source: Chapter 62-302.531 FAC)

| CATEGORY | LONG-TERM<br>GEOMETRIC MEAN<br>LAKE COLOR AND<br>ALKALINITY | ANNUAL<br>GEOMETRIC<br>MEAN<br>CHLOROPHYLL-a | MINIMUM CALCULATED<br>NUMERIC INTERPRETATION |                                            | MAXIMUM CALCULATED<br>NUMERIC INTERPRETATION |                                            |
|----------|-------------------------------------------------------------|----------------------------------------------|----------------------------------------------|--------------------------------------------|----------------------------------------------|--------------------------------------------|
|          |                                                             |                                              | Annual<br>Geometric Mean<br>Total Phosphorus | Annual<br>Geometric Mean<br>Total Nitrogen | Annual<br>Geometric Mean<br>Total Phosphorus | Annual<br>Geometric Mean<br>Total Nitrogen |
| I        | > 40 Pt-Co units                                            | 20 µg/l                                      | 0.05 mg/l                                    | 1.27 mg/l                                  | 0.16 mg/l                                    | 2.23 mg/l                                  |
| II       | ≤ 40 Pt-Co units and<br>> 20 mg/l CaCO <sub>3</sub>         | 20 µg/l                                      | 0.03 mg/l                                    | 1.05 mg/l                                  | 0.09 mg/l                                    | 1.91 mg/l                                  |
| III      | ≤ 40 Pt-Co units and<br>≤ 20 mg/l CaCO <sub>3</sub>         | 6 µg/l                                       | 0.01 mg/l                                    | 0.51 mg/l                                  | 0.03 mg/l                                    | 0.93 mg/l                                  |

NOTES:

- If there are sufficient data to calculate the annual geometric mean chlorophyll-a and the mean does not exceed the chlorophyll-a value for the lake type in the above table, then the TN and TP numeric interpretations for that calendar year shall be the annual geometric means of lake TN and TP samples, subject to the minimum and maximum limits in the above table. However, for lakes with color > 40 Pt-Co units in the West Central Nutrient Watershed Region, the maximum TP limit shall be the 0.49 mg/l TP streams threshold for the region; or
- If there are insufficient data to calculate the annual geometric mean chlorophyll-a for a given year or the annual geometric mean chlorophyll-a exceeds the values in the table above for the lake type, then the applicable numeric interpretations for TN and TP shall be the minimum values in the table above.

The same type of reasoning applies to lakes with long-term geometric mean color concentrations less than 40 Pt-Co units (Category II and III). Lakes in these categories are separated depending upon whether the alkalinity is greater than 20 mg/l or less than 20 mg/l. For lakes with long-term color concentrations less than 40 Pt-Co units, and alkalinity greater than 20 mg/l (Category II), the nutrient criteria depend upon whether the geometric mean chlorophyll-a concentration is less than or greater than 20 mg/m<sup>3</sup>. If the chlorophyll-a concentration is greater than 20 mg/m<sup>3</sup>, then the applicable numeric nutrient criteria are assumed to be the minimum calculated numeric values listed for this category in Table 2-15. This same reasoning would apply for lakes with color concentrations less than 40 Pt-Co units and alkalinity less than 20 mg/l (Category III).

A tabular summary of assumed applicable numeric nutrient criteria for Lake Lawne is given in Table 2-16. Lake Lawne is characterized by color concentrations greater than 40 Pt-Co units and chlorophyll-a concentrations greater than 20 mg/m<sup>3</sup> (Category I). Under these conditions, the applicable numeric nutrient criteria become the minimum values provided for this category in Table 2-15 which reflect a total phosphorus standard of 0.05 mg/l (50 µg/l) and a total nitrogen standard of 1.27 mg/l (1,270 µg/l). Based upon these criteria, Lake Lawne comes close to meeting the NNC for total phosphorus over the period from 2006-2011 and meets the NNC for total phosphorus based on the ERD field monitoring from March 2011-February 2012. As indicated on Figures 2-19, 2-22, and 2-25, statistically significant trends of decreasing total phosphorus concentrations have been observed in each of the three lobes. If the trend of decreasing phosphorus concentrations continues in Lake Lawne, the lake may meet the NNC for total phosphorus within the next few years.

**TABLE 2-16**

**APPLICABLE NUMERIC NUTRIENT  
CRITERIA FOR LAKE LAWNE**

| <b>NUTRIENT CRITERIA (mg/l)</b>                               |                                                              |
|---------------------------------------------------------------|--------------------------------------------------------------|
| <b>Total Phosphorus</b>                                       | <b>Total Nitrogen</b>                                        |
| (0.052) <sup>1</sup> (0.50) <sup>2</sup><br>0.05 <sup>3</sup> | (1.30) <sup>1</sup> (0.87) <sup>2</sup><br>1.27 <sup>3</sup> |

- NOTES: 1. Geometric mean of Lake Lawne monitoring sites from 2006-2011  
 2. Geometric mean of ERD monitoring data from March 2011-February 2012  
 3. Minimum annual geometric mean values listed in Chapter 62-302.531 (Table 2-15)

Measured total nitrogen concentrations slightly exceed the NNC over the period from 2006-2011 but meet the NNC based on the ERD monitoring. Overall, Lake Lawne appears to be close to meeting the applicable NNC for both total phosphorus and total nitrogen. As indicated on Figures 2-19, 2-22, and 2-25, concentrations of total nitrogen in Lake Lawne appear to be decreasing over time, although the trend is only statistically significant in the middle lobe. The trend of decreasing total nitrogen concentrations suggests that Lake Lawne may also meet the NNC for total nitrogen at all sites within the next few years.



## 2.4 Water Level Control

Water level elevations in Lake Lawne are regulated by a combination of drainage wells and an outfall structure located in the outflow canal. Two separate drainage well structures are located in Lake Lawne, with one of the wells constructed by the City of Orlando and the second well constructed by Orange County. Locations of existing well structures in Lake Lawne are shown on Figure 2-43. Physical characteristics of the drainage well structures are given in Table 2-17 based upon information contained in USGS Publication 96-316 titled “Estimation of Recharge Through Selected Drainage Wells and Potential Effects from Well Closure, Orange County, Florida” dated 1996, along with information provided by Mr. John Evertson (Program Manager, Surface Water Maintenance with the City of Orlando).



Figure 2-43. Locations of Existing Drainage Well Structures and Staff Gauge in Lake Lawne.

**TABLE 2-17**  
**CHARACTERISTICS OF DRAINAGE WELL**  
**STRUCTURES ON LAKE LAWNE**

| <b>WELL<br/>I.D. NO.</b> | <b>WELL<br/>DEPTH<br/>(ft)</b> | <b>BOTTOM<br/>OF CASING<br/>(ft)</b> | <b>WELL<br/>DIAMETER<br/>(inches)</b> | <b>INFLOW<br/>ELEVATION<br/>(ft, NAVD 88)</b> | <b>CONDITION</b> |
|--------------------------|--------------------------------|--------------------------------------|---------------------------------------|-----------------------------------------------|------------------|
| Orlando Well 22          | 329                            | 90                                   | 18                                    | 86.22                                         | Active           |
| Orlando Well W-46        | 383                            | 100                                  | 24                                    | N/A                                           | Plugged          |

The Orlando drainage well (No. 22) was constructed in 1948 and consists of an 18-inch casing which extends to a depth of 89 ft and an open bore hole extending to a depth of 329 ft. The invert elevation into the well is approximately 86.22 ft (NAVD 88) which is 0.08 ft higher than the lake control elevation of 86.14 ft (NAVD 88) at the outfall structure, indicating that the Orlando well receives routine inflows from the lake.

Drainage well No. W-46 was originally constructed by Orange County, but was transferred to the City as part of recent annexation. Well No. W-46 consists of a 24-inch casing which extends to a depth of 383 ft (NAVD 88). However, according to the USGS publication and the City of Orlando, the intake for this drainage well is currently plugged, and the well is not operational.

Photographs of the outfall water control structure for Lake Lawne are given on Figure 2-44. The outfall structure is located in the Lake Lawne outfall canal approximately 1,700 ft downstream from Lake Lawne. The structure was constructed in the mid-1970s to regulate water level elevations in Lake Lawne and increase available water storage. Water elevations are controlled by a series of flashboard riser structures with a control elevation of approximately 86.14 ft. As indicated on Figure 2-43a, the control boards are not necessarily maintained at the same elevation with floating or loose boards evident on both sides of the outfall structure. The outfall structure also contains a 12-inch cast iron pipe with an operable valve which can be opened to lower water level elevations within the lake in advance of tropical storms or hurricanes. No discharges were observed from this bleed-down pipe during the field monitoring conducted by ERD.

Historical water level elevations in Lake Lawne have been recorded by Orange County on approximately a monthly basis from 1960 to the present using a staff gauge located on the east side of the lake. The location of the staff gauge is shown in Figure 2-43. A graphical summary of water surface elevations in Lake Lawne over the available period of record is given on Figure 2-45. Over the available period of record, water surface elevations in Lake Lawne have ranged from approximately 83.9-91.6 ft (NAVD 88), a range of 7.7 ft. However, the vast majority of measured elevations have ranged from approximately 85-88 ft compared with the control elevation of 86.14 ft (NAVD 88). Minimum water level elevations in Lake Lawne appear to have occurred during the early-1970s, with maximum water level elevations observed during the early-1960s. As indicated on Figure 2-45, water elevations in Lake Lawne exceed the control level of 86.14 ft (NAVD 88) much of the time, indicating that discharges from Lake Lawne occur on a routine basis.



a. Control structure on upstream side of canal



b. Control structure on downstream side of canal

Figure 2-44. Lake Lawne Water Control Structure.

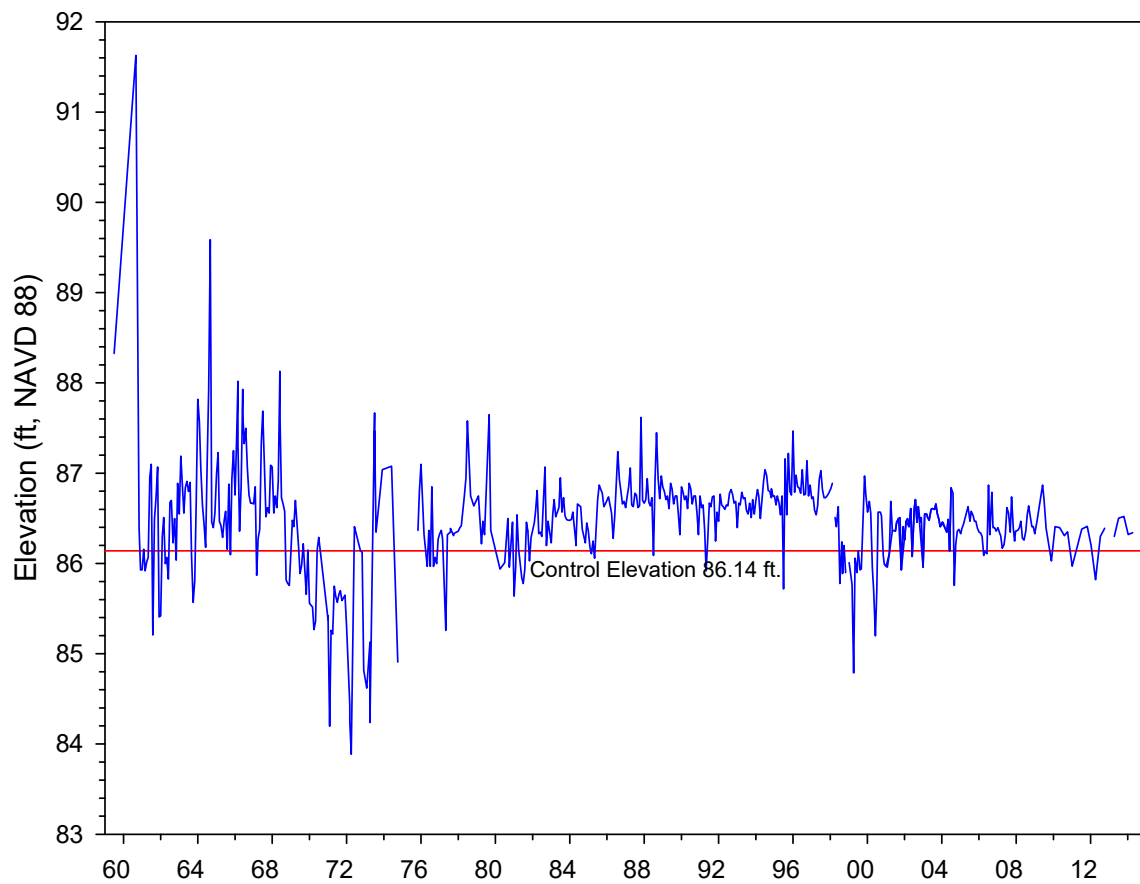


Figure 2-45. Historical Water Level Elevations in Lake Lawne. (Source: Orange County)

## **SECTION 3**

### **CHARACTERISTICS OF THE LAKE LAWNE DRAINAGE BASIN**

Characteristics of the drainage basin area for Lake Lawne are summarized in this section, including information on drainage basin delineations, land use characteristics, soil types, basin topography, governmental jurisdiction, stormwater treatment areas, and sewage disposal. A discussion of each of these elements is given in the following sections.

#### **3.1 Watershed Characteristics**

A delineation of contributing drainage basin areas to Lake Lawne was conducted by ERD as part of this project. A preliminary drainage basin boundary was established based upon information contained in the 2009 study titled “Preliminary Engineering Study – Lake Lawne Water Quality Improvement Project” which was prepared for OCEPD by BPC/TEK Joint Venture. The basin boundaries included in this document were modified, as appropriate, by reviewing 1-ft Lidar contour elevation maps provided to ERD by Orange County (2008), a review of Environmental Resource Permits (ERPs) for recent projects constructed within the drainage basin, 2008 high-definition aerial photography obtained from FDEP, extensive field reconnaissance, and observations of drainage patterns during significant rain events. After delineation of the overall basin boundary, sub-basins were delineated to identify areas which discharge into Lake Lawne through individual stormsewer inflows or tributaries.

An overview of the overall drainage basin delineation and individual sub-basin areas discharging into Lake Lawne, based upon the revised delineations conducted by ERD, is given on Figure 3-1. The drainage basin area delineated by ERD appears to be somewhat larger than the basin area included in the BPC/TEK Joint Venture report, particularly in northeastern and southern portions of the drainage basin.

A total of 24 separate sub-basins were delineated which discharge into Lake Lawne through individual stormsewers, channels, or tributaries. Areas located around the perimeter of the lake which discharge into the lake by overland flow are referred to as “overland flow” sub-basins. Sub-basins identified as 1-8 reflect inputs into Lake Lawne from the secondary drainage canals which are identified as Canals C-1 through C-8 by Orange County. The remaining sub-basin areas reflect relatively small basins which discharge into Lake Lawne through individual stormsewer systems.



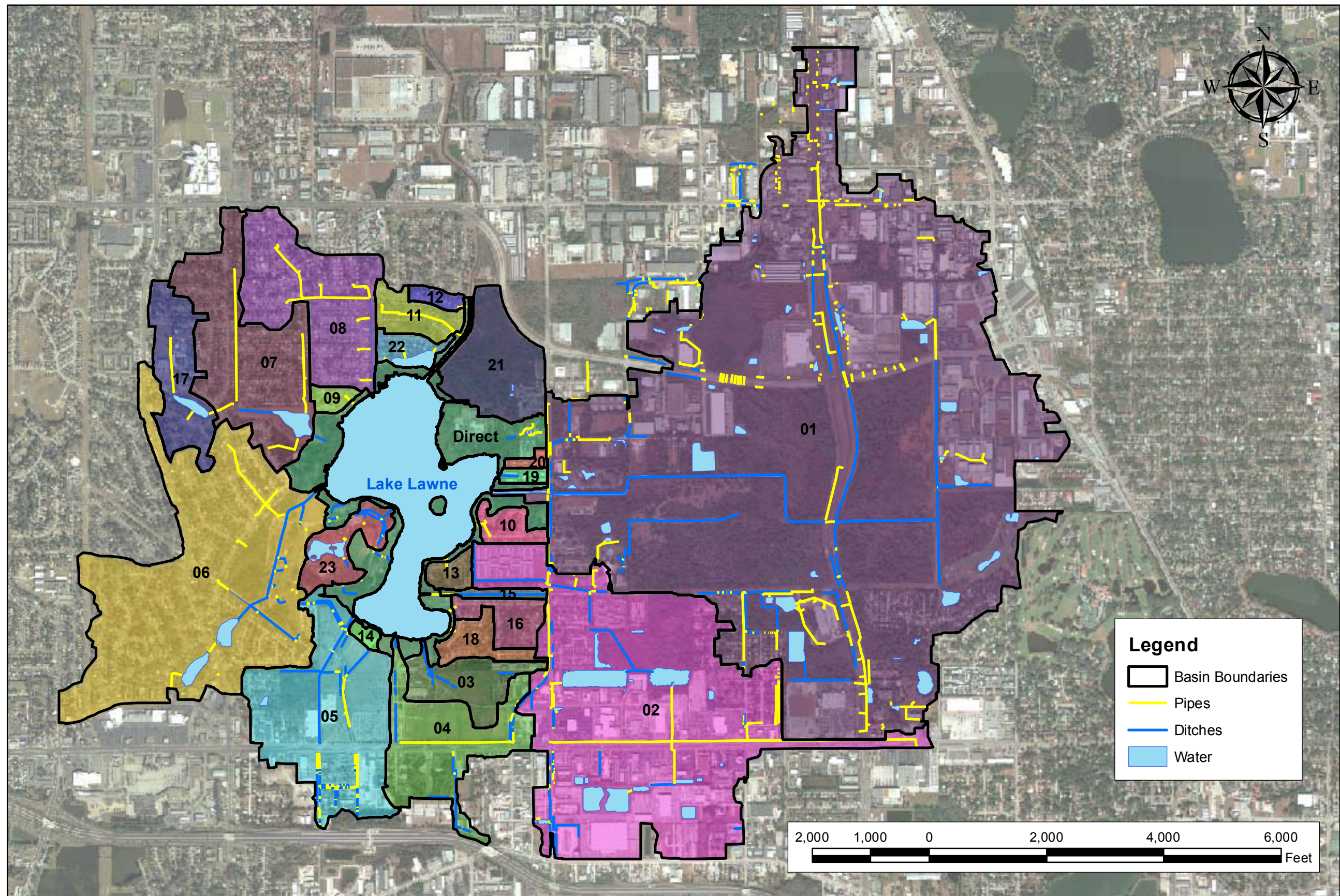


Figure 3-1. Delineation of Sub-basin Areas Discharging to Lake Lawne.



Drainage basin/lake area ratios are often useful in evaluating the potential for runoff inputs to have a significant impact on water quality within a waterbody. Some researchers have suggested that drainage basin/lake area ratios substantially less than 7 indicate lakes where nonpoint source pollution should have minimal impacts on lake water quality, while drainage basin/lake area ratios substantially in excess of 7 indicate waterbodies where nonpoint source runoff may have a significant impact on water quality. Based on the direct drainage basin area of 2,875.32 acres and a lake surface area of 148.0 acres for Lake Lawne, the calculated watershed/lake area ratio for this lake is 19.4. Based upon this ratio, Lake Lawne has a potential to have significant water quality impacts from nonpoint source inputs within the adjacent watershed area.

A tabular summary of sub-basin areas discharging to Lake Lawne is given on Table 3-1. The identified sub-basin areas range in size from 3.53-1,282 acres, with a total combined area of approximately 2,875.32 acres. The largest sub-basin area consists of the C-1 Canal sub-basin which includes much of the eastern portion of the drainage basin area and comprises 44.6% of the overall drainage basin. The second largest sub-basin area is the C-2 Canal sub-basin which is 411.22 acres in size and comprises 14.3% of the overall drainage basin area. Areas discharging through C-6 Canal (309.88 acres) comprise 10.8% of the drainage basin area, with the C-5 Canal sub-basin (143.4 acres) containing 5.0% of the overall basin and the C-7 Canal sub-basin (123.64 acres) containing 4.3% of the overall basin. Combined together, sub-basin areas discharging through the eight secondary canals contain approximately 2,493 acres, equivalent to 87% of the overall drainage basin area for Lake Lawne. With the exception of the overland flow sub-basin which comprises 4% of the overall drainage basin area, the remaining sub-basins contribute approximately 2% or less of the overall drainage basin for Lake Lawne.

### **3.2 Land Use**

Land use information for the Lake Lawne drainage basin was obtained from the 2009 Land Use Inventory conducted by the St. Johns River Water Management District (SJRWMD). This land use information was initially obtained by ERD in a GIS format in the form of Level III FLUCCS (Florida Land Use Cover and Classification System) codes which were condensed to a series of general land use categories to simplify presentation of the information and for use in estimation of runoff loadings. This land use information was used by ERD as a preliminary base map and modifications to the land use characterization data were made using a combination of aerial photography and field reconnaissance to reflect land use under current conditions.

An overview of current land use in the Lake Lawne drainage basin is given on Figure 3-2. The dominant land use categories within the drainage basin area appear to be medium-density residential, commercial, wetlands, open space, and forests, with smaller areas contributed by the remaining land use categories.

A tabular summary of current land use in the Lake Lawne drainage basin is given on Table 3-2. The largest individual land use categories within the drainage basin are medium-density residential (which occupies 23.1% of the total land area), commercial areas (19.5%), wetlands (14.4%), open space (10.3%), forests (7.7%), and transportation (6.0%). Each of the remaining land use categories comprises approximately 5% or less of the overall drainage basin area.

**TABLE 3-1**  
**SUMMARY OF SUB-BASIN AREAS IN**  
**THE LAKE LAWNE DRAINAGE BASIN**

| <b>BASIN I.D.</b> | <b>BASIN NAME</b>      | <b>AREA (acres)</b> | <b>PERCENT OF TOTAL (%)</b> |
|-------------------|------------------------|---------------------|-----------------------------|
| 1                 | C-1 Canal              | 1,281.84            | 44.6                        |
| 2                 | C-2 Canal              | 411.22              | 14.3                        |
| 3                 | C-3 Canal              | 36.43               | 1.3                         |
| 4                 | C-4 Canal              | 81.59               | 2.8                         |
| 5                 | C-5 Canal              | 143.40              | 5.0                         |
| 6                 | C-6 Canal              | 309.88              | 10.8                        |
| 7                 | C-7 Canal              | 123.64              | 4.3                         |
| 8                 | C-8 Canal              | 105.17              | 3.7                         |
| 9                 | Cal Ct.                | 6.91                | 0.2                         |
| 10                | Cape Cove Blvd.        | 13.47               | 0.5                         |
| 11                | Carousel Rd.           | 21.72               | 0.8                         |
| 12                | Chateau Rd.            | 6.07                | 0.2                         |
| 13                | Dutton Rd.             | 9.45                | 0.3                         |
| 14                | Fairground Building    | 3.53                | 0.1                         |
| 15                | Judge Dr.              | 6.52                | 0.2                         |
| 16                | Lake Lawne Ave.        | 20.76               | 0.7                         |
| 17                | Lake Pivot             | 50.55               | 1.8                         |
| 18                | Lawne Ct.              | 18.01               | 0.6                         |
| 19                | Mercy Dr. Apartments 1 | 4.81                | 0.2                         |
| 20                | Mercy Dr. Apartments 2 | 3.54                | 0.1                         |
| 21                | NE Lake Lawne Wetland  | 61.04               | 2.1                         |
| 22                | North Lawne Villas     | 13.30               | 0.5                         |
| 23                | Park Area              | 28.77               | 1.0                         |
| Direct            | Overland Flow          | 113.70              | 4.0                         |
| <b>TOTAL:</b>     |                        | <b>2,875.32</b>     | <b>100.0</b>                |

### **3.3 Governmental Jurisdictions**

An overview of governmental jurisdictions in the Lake Lawne drainage basin is given on Figure 3-3. Most of the eastern portions of the drainage basin are included within the Orlando city limits, with western and southwestern portions of the drainage basin located within unincorporated Orange County. A tabular summary of governmental jurisdictions is given in Table 3-3. The areas provided in this table include the lake area of 148.0 acres. Overall, approximately 63.7% of the Lake Lawne drainage basin is located within the City of Orlando, with 36.3% located in unincorporated Orange County.

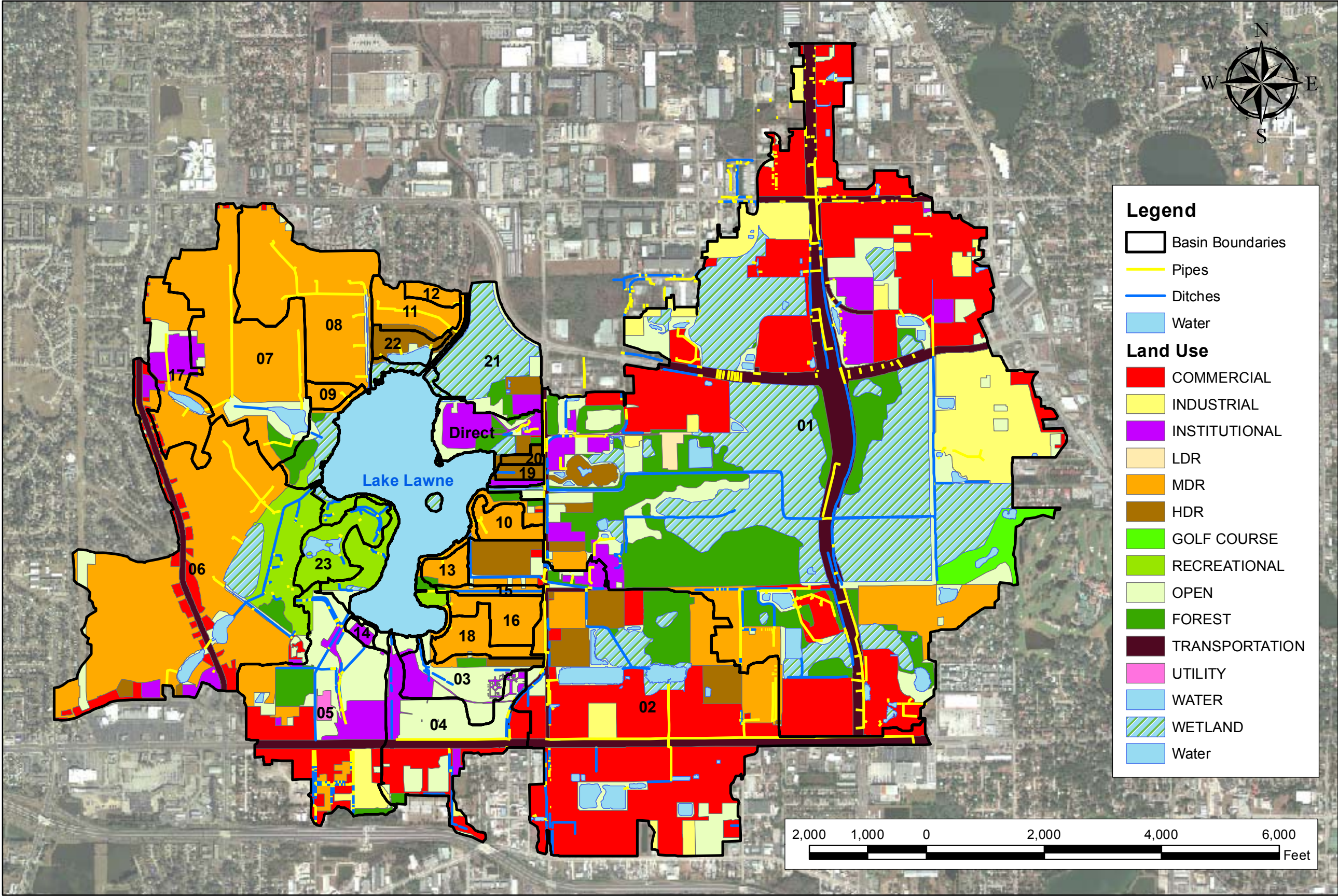


Figure 3-2. Current Land Use in the Lake Lawne Drainage Basin.



TABLE 3-2

## SUMMARY OF CURRENT LAND USE IN THE LAKE LAWNE DRAINAGE BASIN

| BASIN I.D.            | BASIN                   | LAND USE (acres)        |                            |                          |            |            |               |                |         |             |        |            |              |         |       | TOTAL   |
|-----------------------|-------------------------|-------------------------|----------------------------|--------------------------|------------|------------|---------------|----------------|---------|-------------|--------|------------|--------------|---------|-------|---------|
|                       |                         | Low-Density Residential | Medium-Density Residential | High-Density Residential | Commercial | Industrial | Institutional | Transportation | Utility | Golf Course | Forest | Open Space | Recreational | Wetland | Water |         |
| 01                    | C-1 Canal               | 4.40                    | 65.92                      | 12.28                    | 287.01     | 112.04     | 39.98         | 109.89         | --      | 20.51       | 159.87 | 112.17     | --           | 324.93  | 32.84 | 1281.84 |
| 02                    | C-2 Canal               | --                      | 41.26                      | 42.61                    | 192.29     | 10.59      | 4.61          | 30.89          | --      | --          | 22.37  | 26.98      | --           | 16.71   | 22.92 | 411.22  |
| 03                    | C-3 Canal               | --                      | 2.00                       | 3.25                     | --         | --         | 8.61          | --             | --      | --          | 1.77   | 20.80      | --           | --      | --    | 36.43   |
| 04                    | C-4 Canal               | --                      | --                         | --                       | 22.58      | 1.21       | 12.11         | 9.41           | --      | --          | 1.01   | 35.21      | --           | --      | 0.06  | 81.59   |
| 05                    | C-5 Canal               | --                      | 14.83                      | --                       | 33.12      | 10.87      | 17.42         | 7.55           | 2.64    | --          | 10.98  | 42.03      | 3.15         | --      | 0.81  | 143.40  |
| 06                    | C-6 Canal               | --                      | 193.87                     | 2.12                     | 22.94      | --         | 7.54          | 13.55          | --      | --          | 3.39   | 11.58      | 36.84        | 11.77   | 6.29  | 309.88  |
| 07                    | C-7 Canal               | --                      | 102.09                     | --                       | 0.28       | --         | 2.24          | --             | --      | --          | 4.08   | 11.19      | --           | --      | 3.76  | 123.64  |
| 08                    | C-8 Canal               | --                      | 100.93                     | 0.74                     | 0.28       | --         | --            | --             | --      | --          | --     | 2.75       | --           | 0.21    | 0.26  | 105.17  |
| 09                    | Cal Ct.                 | --                      | 6.90                       | --                       | --         | --         | --            | --             | --      | --          | --     | 0.02       | --           | --      | --    | 6.91    |
| 10                    | Cape Cove Blvd.         | --                      | 13.39                      | 0.08                     | --         | --         | --            | 0.01           | --      | --          | --     | --         | --           | --      | --    | 13.47   |
| 11                    | Carousel Rd.            | --                      | 19.35                      | 2.36                     | --         | --         | --            | --             | --      | --          | --     | --         | --           | --      | --    | 21.72   |
| 12                    | Chateau Rd.             | --                      | 6.07                       | --                       | --         | --         | --            | --             | --      | --          | --     | --         | --           | --      | --    | 6.07    |
| 13                    | Dutton Dr.              | --                      | 8.61                       | --                       | --         | --         | --            | --             | --      | --          | 0.71   | --         | 0.12         | --      | --    | 9.45    |
| 14                    | Fairground Building     | --                      | --                         | --                       | --         | --         | 2.28          | --             | --      | --          | --     | 1.25       | --           | --      | --    | 3.53    |
| 15                    | Judge Dr.               | --                      | 5.58                       | --                       | 0.06       | --         | --            | --             | --      | --          | 0.25   | 0.28       | 0.35         | --      | --    | 6.52    |
| 16                    | Lake Lawne Ave.         | --                      | 20.54                      | --                       | --         | --         | --            | --             | --      | --          | --     | --         | 0.21         | --      | --    | 20.76   |
| 17                    | Lake Pivot              | --                      | 32.18                      | --                       | 1.80       | --         | 9.86          | --             | --      | --          | --     | 4.81       | --           | --      | 1.90  | 50.55   |
| 18                    | Lawne Ct.               | --                      | 17.87                      | 0.08                     | --         | --         | --            | --             | --      | --          | --     | 0.07       | --           | --      | --    | 18.01   |
| 19                    | Mercy Dr. Apartments 01 | --                      | --                         | 4.66                     | --         | --         | --            | --             | --      | --          | --     | --         | --           | --      | 0.15  | 4.81    |
| 20                    | Mercy Dr. Apartments 02 | --                      | --                         | 3.53                     | --         | --         | --            | 0.01           | --      | --          | --     | --         | --           | --      | --    | 3.54    |
| 21                    | NE Lake Lawne Wetland   | --                      | --                         | 4.03                     | --         | --         | 3.75          | --             | --      | --          | 3.88   | 7.42       | --           | 41.81   | 0.15  | 61.04   |
| 22                    | North Lawne Villas      | --                      | 0.02                       | 8.99                     | --         | --         | --            | --             | --      | --          | --     | 1.19       | --           | 0.05    | 3.05  | 13.30   |
| 23                    | Park                    | --                      | --                         | --                       | --         | --         | --            | --             | --      | --          | --     | --         | 25.82        | --      | 2.95  | 28.77   |
| Direct                | Direct                  | --                      | 13.92                      | 3.88                     | 0.37       | --         | 17.60         | 0.01           | --      | --          | 14.74  | 18.14      | 25.72        | 19.18   | 0.14  | 113.70  |
| TOTAL:                |                         | 4.40                    | 665.31                     | 88.62                    | 560.72     | 134.71     | 126.00        | 171.32         | 2.64    | 20.51       | 223.06 | 295.88     | 92.21        | 414.67  | 75.28 | 2875.32 |
| PERCENT OF TOTAL (%): |                         | 0.2                     | 23.1                       | 3.1                      | 19.5       | 4.7        | 4.4           | 6.0            | 0.1     | 0.7         | 7.8    | 10.3       | 3.2          | 14.4    | 2.6   | 100.0   |

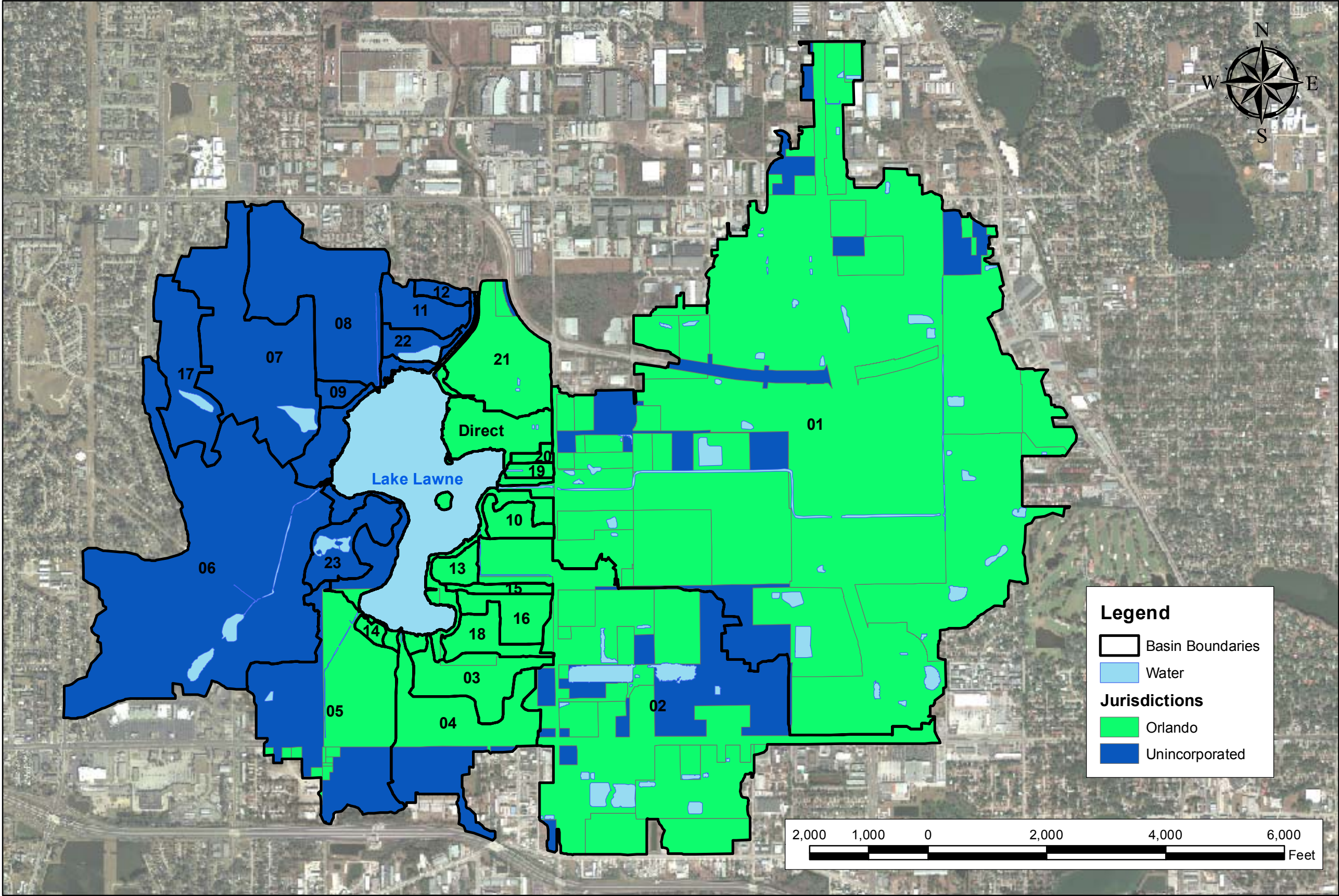


Figure 3-3. Governmental Jurisdictions in the Lake Lawne Drainage Basin.



**TABLE 3-3**  
**SUMMARY OF GOVERNMENTAL JURISDICTIONS**  
**IN THE LAKE LAWNE DRAINAGE BASIN**

| JURISDICTION                 | AREA <sup>1</sup><br>(acres) | PERCENT<br>OF TOTAL |
|------------------------------|------------------------------|---------------------|
| Orlando                      | 1,927.14                     | 63.7                |
| Unincorporated Orange County | 1,096.18                     | 36.3                |
| <b>TOTAL:</b>                | <b>3,023.32</b>              | <b>100</b>          |

1. Includes the direct lake area of 148.0 acres

### **3.4 Soil Characteristics**

Information on soil types within the Lake Lawne drainage basin was obtained from the St. Johns River Water Management District GIS database. Soil information was extracted in the form of Hydrologic Soil Groups (HSG) which classifies soil types with respect to runoff-producing characteristics. Using this system, soils are classified into groups for evaluation and modeling purposes. The chief consideration in each of the soil group types is the inherent capacity of bare soil to permit infiltration. A summary of the characteristics of each hydrologic soil group in the Lake Lawne drainage basin is given in Table 3-4.

**TABLE 3-4**  
**CHARACTERISTICS OF SCS HYDROLOGIC**  
**SOIL GROUP CLASSIFICATIONS**

| SOIL GROUP | DESCRIPTION                                                                                | RUNOFF<br>POTENTIAL                             | INFILTRATION<br>RATE                                |
|------------|--------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|
| A          | Deep sandy soils                                                                           | Very low                                        | High                                                |
| A / D      | Deep sandy soils with high water table in undeveloped condition                            | Very high in undeveloped condition              | Very low in undeveloped state                       |
|            |                                                                                            | Very low when developed and water table lowered | Very high when water table lowered with development |
| B / D      | Shallow sandy soils over low permeability layer; high water table in undeveloped condition | Very high in undeveloped condition              | Very low in undeveloped condition                   |
|            |                                                                                            | Low when developed and water table lowered      | High when developed and water table lowered         |
| C / D      | Sandy soil with high clay or organic content                                               | Very high in undeveloped condition              | Very low in undeveloped condition                   |
|            |                                                                                            | Moderate when developed and water table lowered | Low when developed and water table lowered          |
| W          | Wetland or hydric soils                                                                    | Very high                                       | Low to none                                         |

A graphical summary of hydrologic soil groups in the Lake Lawne drainage basin is given on Figure 3-4. The vast majority of soils within the overall drainage basin area appear to be relatively well drained soils in HSG A or A/D which consist of deep sandy soils with infiltration limited by high groundwater under developed conditions but which have high permeability and low runoff potential when the groundwater is lowered under developed conditions. Therefore, under current developed conditions, much of the overall drainage basin consists of deep sandy well drained soils with high infiltration rates and low runoff potentials. Southern portions of the drainage basin consist primarily of HSG C/D soils which are characterized by relatively high water tables and a moderate to high runoff potential. Soils in this classification exhibit an extremely low infiltration rate and high runoff potential in an undeveloped state but exhibit a slightly higher infiltration and lower runoff rate after development and lowering of the water table elevation.

A tabular summary of hydrologic soil groups in the Lake Lawne drainage basin is given on Table 3-5. Overall, approximately 65.9% of the soils within the drainage basin consist of well drained soils in HSG A, A/D, and B/D. Approximately 31.5% of the soils within the drainage basin consist of poorly drained soils with a moderate to high runoff potential. The remaining areas within the drainage basin consist of wetlands, hydric soils, or water.

### **3.5 Basin Topography**

Elevation contours in the vicinity of Lake Lawne are illustrated on Figure 3-5 based upon 1-ft Lidar data provided by Orange County. Land surface elevations within the drainage basin range from approximately 85 ft near Lake Lawne to approximately 125 ft in western portions of the drainage basin. The Lake Lawne drainage basin exhibits a relatively mild slope for areas east of the lake, with a steeper slope present in areas west of the lake.

### **3.6 Stormwater Treatment**

The Lake Lawne drainage basin contains a wide variety of structures and mechanisms which impact the volume and chemical characteristics of runoff discharges ultimately entering Lake Lawne. These mechanisms include permitted stormwater management ponds, roadside swales, wetlands, small lakes and ponds, depressions, and channelized conveyance systems. A discussion of each of these mechanisms is given in the following sections.

#### **3.6.1 Permitted Stormwater Treatment Systems**

Watershed areas which currently receive stormwater treatment through wet or dry pond systems were identified by ERD within the overall Lake Lawne drainage basin using a combination of aerial photography, field reconnaissance, and a review of historical permitting records in the possession of SJRWMD. A summary of the results of this evaluation is given on Figure 3-6. Permitted stormwater management systems using dry ponds typically rely upon infiltration into the soil and are indicated by orange colored areas on Figure 3-6. Areas which provide stormwater treatment through wet pond detention systems are highlighted in green. Stormwater which is diverted into wet and dry ponds generally receives a reduction in both volume and runoff concentrations compared with raw runoff. The information summarized on Figure 3-6 is used in Sections 4 and 5 for estimation of hydrologic inputs and mass loadings from stormwater runoff reaching Lake Lawne.



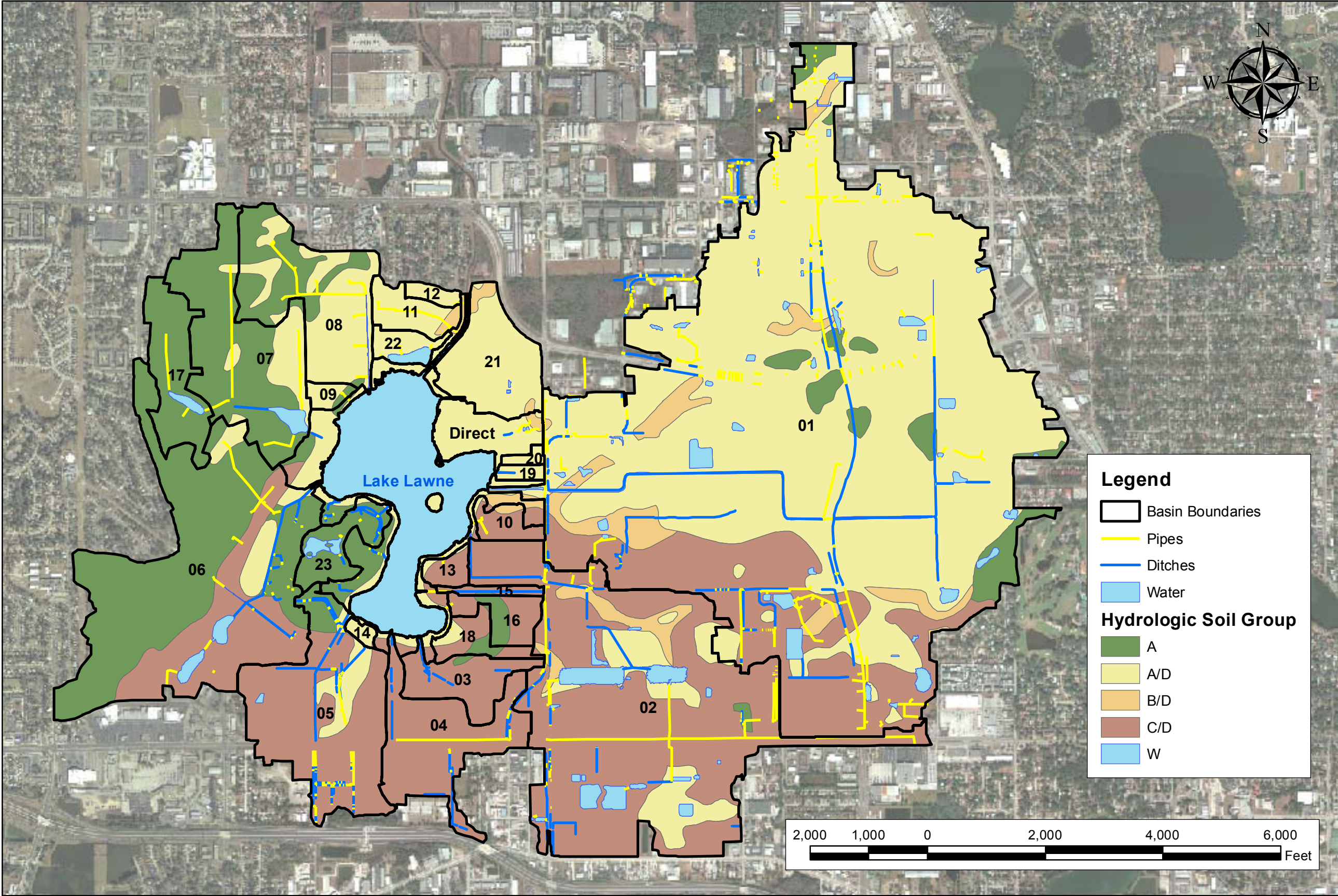


Figure 3-4. Hydrologic Soil Groups in the Lake Lawne Drainage Basin.

TABLE 3-5

**HYDROLOGIC SOIL GROUPS IN  
THE LAKE LAWNE DRAINAGE BASIN**

| BASIN<br>I.D.                | BASIN                   | HYDROLOGIC SOIL GROUP |                |              |               |              | TOTAL          |
|------------------------------|-------------------------|-----------------------|----------------|--------------|---------------|--------------|----------------|
|                              |                         | A                     | A / D          | B / D        | C / D         | W            |                |
| 01                           | C-1 Canal               | 51.33                 | 926.97         | 62.62        | 208.52        | 32.39        | 1281.84        |
| 02                           | C-2 Canal               | 2.19                  | 52.81          | 18.28        | 315.03        | 22.92        | 411.22         |
| 03                           | C-3 Canal               | 0.91                  | 0.28           | --           | 35.23         | --           | 36.43          |
| 04                           | C-4 Canal               | --                    | 0.23           | --           | 81.30         | 0.06         | 81.59          |
| 05                           | C-5 Canal               | 9.51                  | 17.41          | --           | 115.65        | 0.81         | 143.40         |
| 06                           | C-6 Canal               | 197.65                | 18.67          | --           | 87.27         | 6.29         | 309.88         |
| 07                           | C-7 Canal               | 97.30                 | 22.58          | --           | --            | 3.76         | 123.64         |
| 08                           | C-8 Canal               | 43.22                 | 61.63          | 0.06         | --            | 0.26         | 105.17         |
| 09                           | Cal Ct.                 | 1.50                  | 5.42           | --           | --            | --           | 6.91           |
| 10                           | Cape Cove Blvd.         | --                    | 0.63           | 1.66         | 11.17         | --           | 13.47          |
| 11                           | Carousel Rd.            | --                    | 19.09          | 2.63         | --            | --           | 21.72          |
| 12                           | Chateau Rd.             | --                    | 5.99           | 0.08         | --            | --           | 6.07           |
| 13                           | Dutton Dr.              | --                    | 1.32           | --           | 8.13          | --           | 9.45           |
| 14                           | Fairground Building     | --                    | 3.43           | --           | 0.10          | --           | 3.53           |
| 15                           | Judge Dr.               | 0.56                  | --             | --           | 5.96          | --           | 6.52           |
| 16                           | Lake Lawne Ave.         | 6.44                  | --             | 0.03         | 14.29         | --           | 20.76          |
| 17                           | Lake Pivot              | 48.61                 | 0.04           | --           | --            | 1.90         | 50.55          |
| 18                           | Lawne Ct.               | 3.26                  | 2.72           | 0.04         | 11.99         | --           | 18.01          |
| 19                           | Mercy Dr. Apartments 01 | --                    | 4.66           | --           | --            | 0.15         | 4.81           |
| 20                           | Mercy Dr. Apartments 02 | --                    | 3.54           | --           | --            | --           | 3.54           |
| 21                           | NE Lake Lawne Wetland   | --                    | 57.11          | 3.78         | --            | 0.15         | 61.04          |
| 22                           | North Lawne Villas      | --                    | 10.21          | 0.03         | --            | 3.05         | 13.30          |
| 23                           | Park                    | 24.98                 | 0.84           | --           | --            | 2.95         | 28.77          |
| Direct                       | Depression 02           | 20.63                 | 75.43          | 6.67         | 10.85         | 0.14         | 113.70         |
| <b>TOTAL:</b>                |                         | <b>508.08</b>         | <b>1291.04</b> | <b>95.87</b> | <b>905.50</b> | <b>74.83</b> | <b>2875.32</b> |
| <b>PERCENT OF TOTAL (%):</b> |                         | <b>17.7</b>           | <b>44.9</b>    | <b>3.3</b>   | <b>31.5</b>   | <b>2.6</b>   | <b>100.0</b>   |



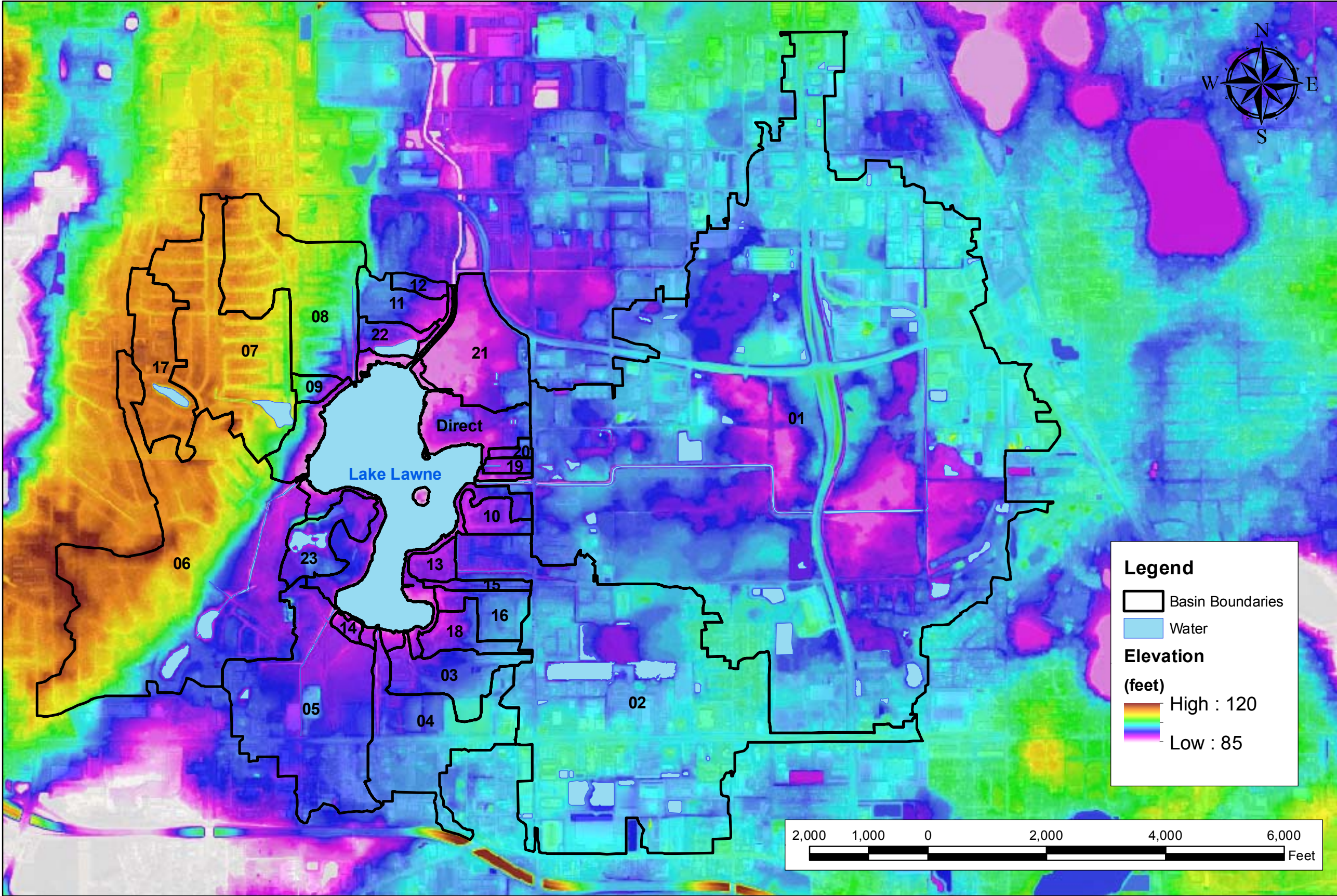


Figure 3-5. Elevation Contours in the Lake Lawne Drainage Basin.



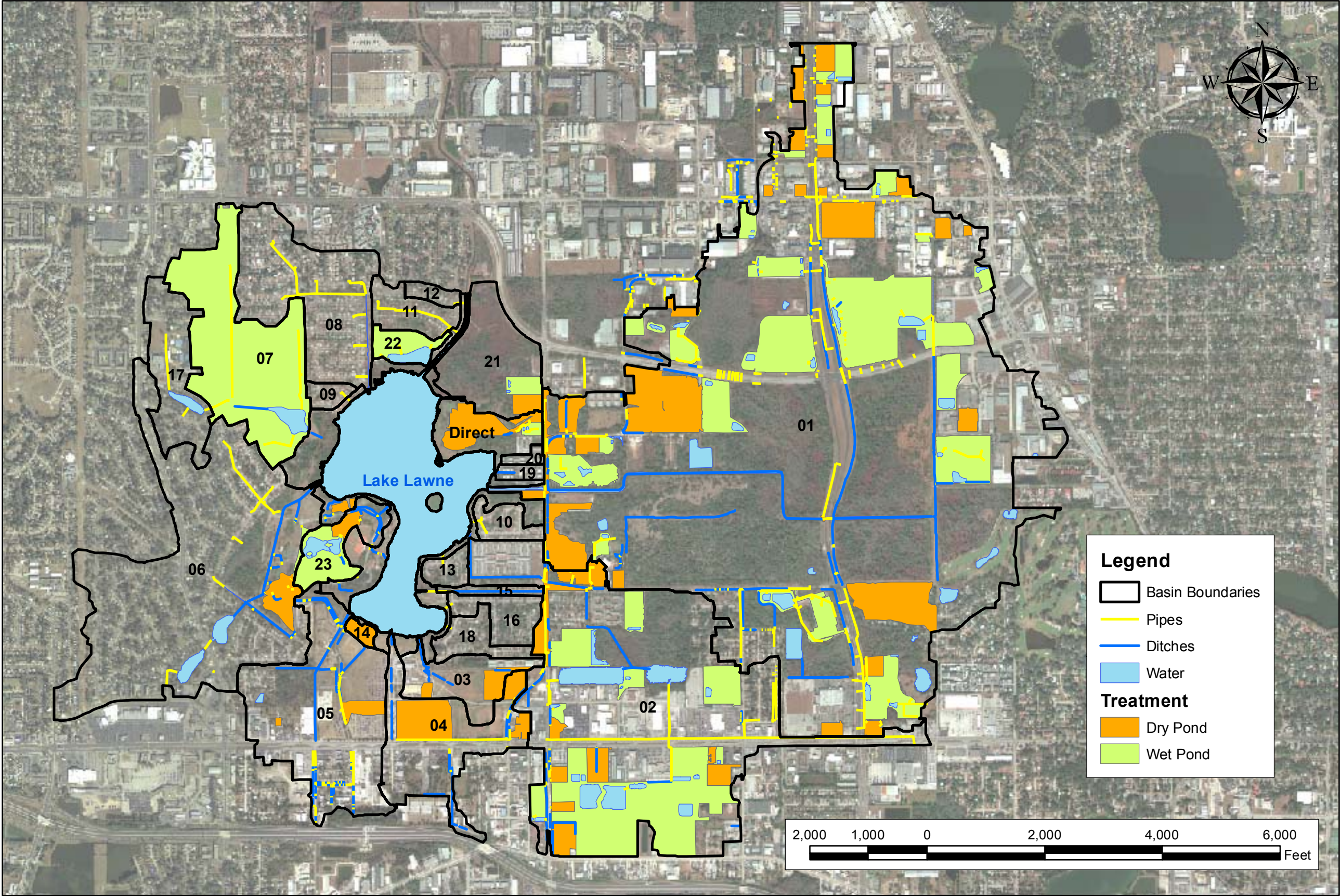


Figure 3-6. Areas in the Lake Lawne Drainage Basin Which Receive Stormwater Treatment Using Permitted Wet and Dry Ponds.



### **3.6.2 Swale Treatment**

Areas in the Lake Lawne drainage basin which receive stormwater treatment in roadside swales are illustrated on Figure 3-7. Roadside swales provide both conveyance as well as attenuation of runoff by mechanisms such as infiltration into groundwater and vegetative removal processes within the swales, and areas discharging to roadside swales typically receive a reduction in both runoff volume as well as runoff characteristics. The information summarized on Figure 3-7 is used in Sections 4 and 5 for estimation of hydrologic inputs and mass loadings from stormwater runoff reaching Lake Lawne.

### **3.6.3 Wetlands**

An overview of areas in the Lake Lawne drainage basin which receive stormwater treatment in wetlands is given on Figure 3-8. Many of the developed areas, particularly in areas east of Lake Lawne, ultimately discharge into an extensive wetland system prior to reaching Lake Lawne. Wetland systems can provide a significant reduction in runoff volume through evapotranspiration processes and often result in alterations of runoff concentrations although the alteration does not always result in a reduction in concentrations. The information summarized on Figure 3-8 is used in Sections 4 and 5 for estimation of hydrologic inputs and mass loadings from stormwater runoff reaching Lake Lawne.

### **3.6.4 Ponds and Depressional Areas**

An overview of areas in the Lake Lawne drainage basin which receive stormwater treatment in ponds and depressional areas is given on Figure 3-9. The ponds illustrated on this figure reflect both man-made ponds and natural lakes which were not constructed as permitted stormwater management systems. However, these areas still provide stormwater treatment for portions of the overall drainage basin which discharges to these systems. This information was considered by ERD in estimation of overall hydrologic and pollutant loadings discharging to Lake Lawne. In some cases, the pond areas illustrated on Figure 3-9 receive runoff which has already been treated in a permitted wet or dry pond.

Also indicated on Figure 3-9 are depressional areas, consisting primarily of wetland systems. These areas are hydrologically connected to other portions of the drainage system only during high level conditions, and provide full retention for runoff inputs during much of the year. The information summarized on Figure 3-9 is used in Sections 4 and 5 for estimation of hydrologic inputs and mass loadings from stormwater runoff reaching Lake Lawne.



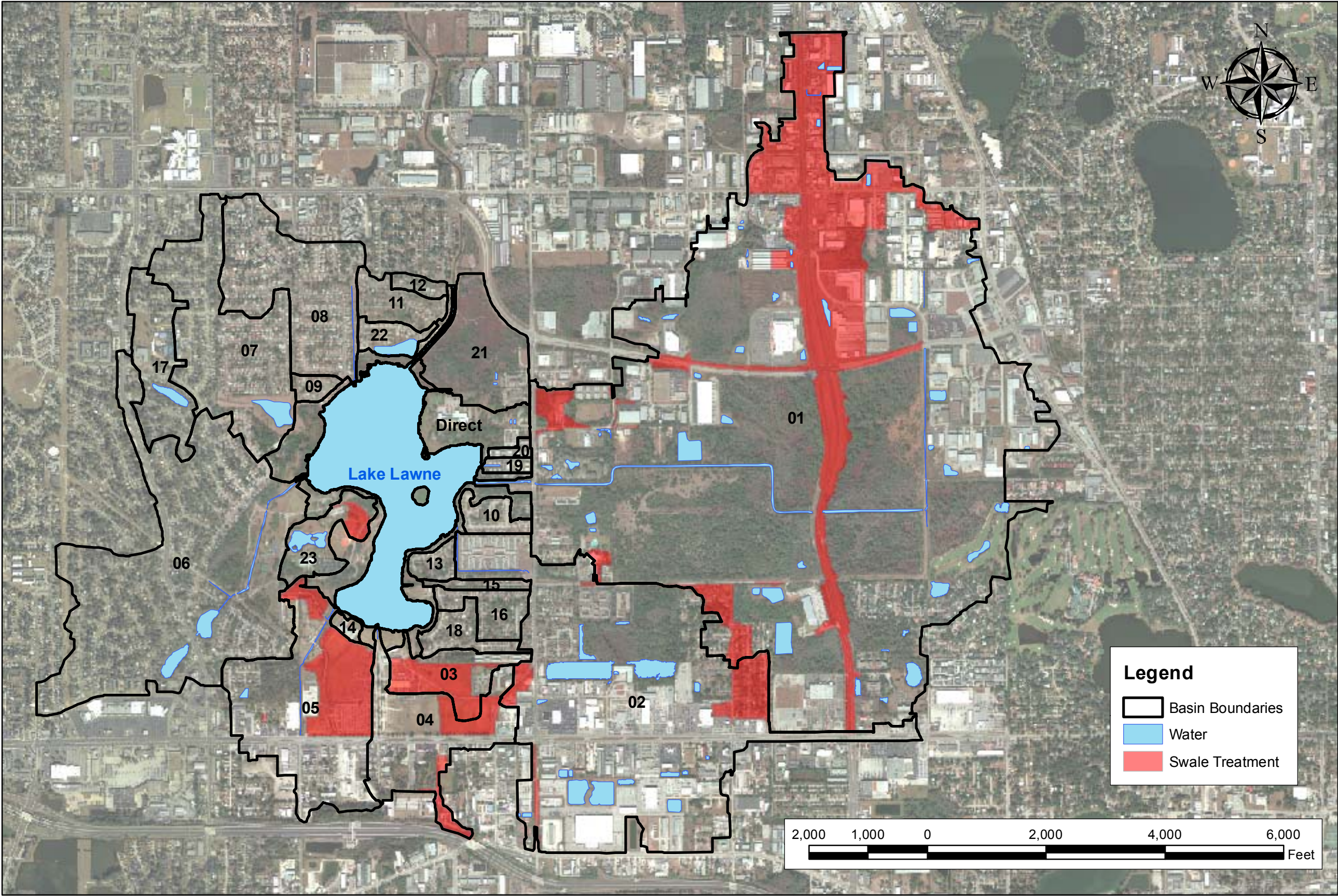


Figure 3-7. Areas in the Lake Lawne Drainage Basin Which Receive Stormwater Treatment in Roadside Swales.



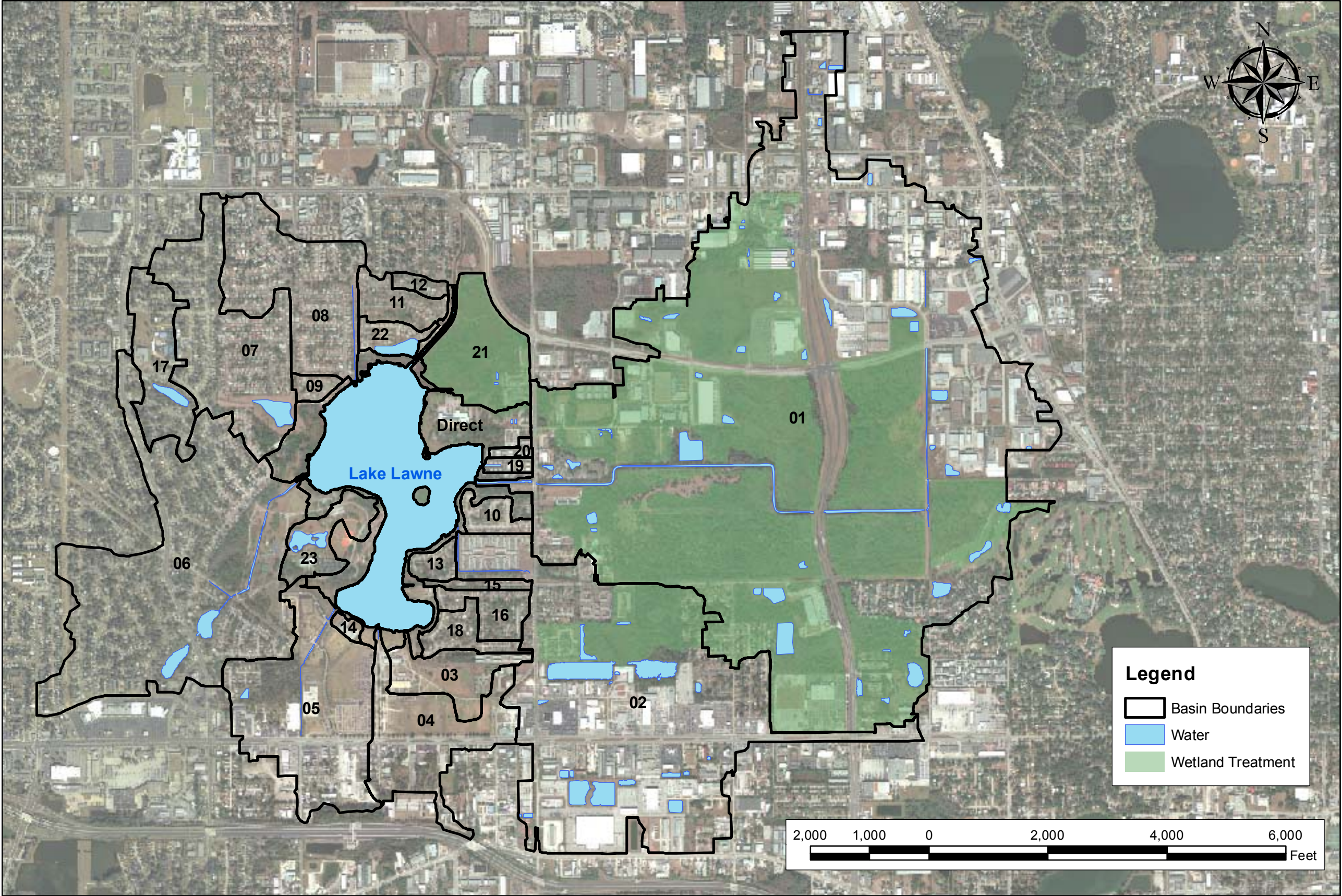


Figure 3-8. Areas in the Lake Lawne Drainage Basin Which Receive Stormwater Treatment in Wetlands.



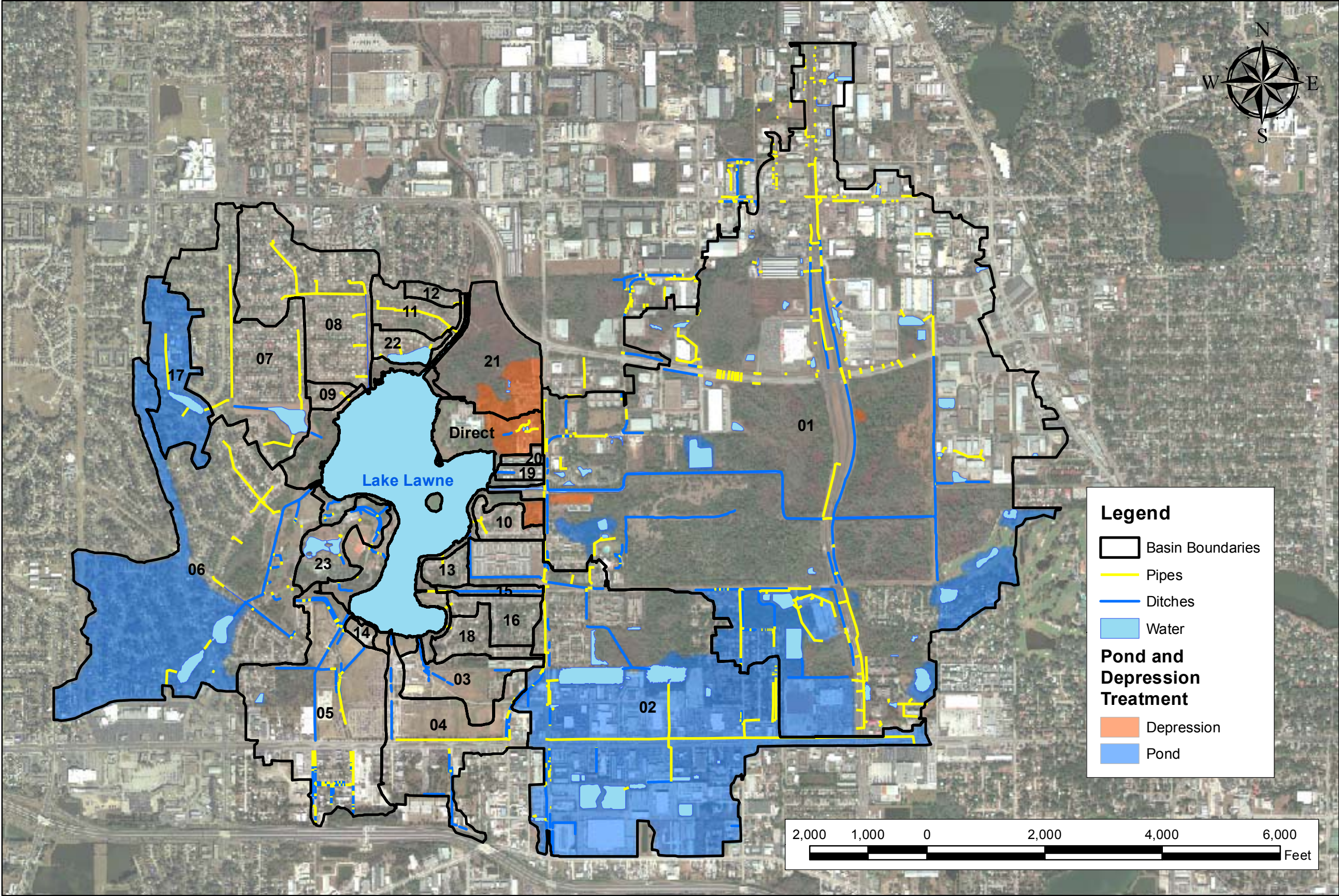


Figure 3-9. Areas in the Lake Lawne Drainage Basin Which Receive Stormwater Treatment in Ponds and Depressional Areas.



### **3.6.5 Conveyance Channels and Systems**

Large portions of the overall Lake Lawne drainage basin discharge to the lake through the secondary canal systems identified as Canals C-1 through C-8. Much of the water which ultimately discharges into these conveyance systems has been previously treated in dry ponds, wet ponds, swales, or wetlands. However, even though the runoff entering the conveyance channels and canals has been previously treated, additional reductions in both runoff volume and runoff concentrations occurs during migration through the relatively extensive conveyance systems within the drainage basin. An overview of areas with likely volumetric losses is given on Figure 3-10. This information was also considered by ERD in evaluating hydrologic inputs and mass loadings from stormwater runoff entering Lake Lawne.

### **3.7 Sewage Disposal**

Disposal of sanitary sewage within the Lake Lawne drainage basin occurs using a combination of on-site septic systems and central sanitary sewer systems. Information on current septic tank systems for developed parcels in the Lake Lawne drainage basin was provided to ERD by OCEPD. An overview of developed parcels with septic tanks for sewage disposal in the Lake Lawne drainage basin is given on Figure 3-11. A majority of the existing septic tank systems are located in eastern and southern portions of the overall drainage basin area along John Young Parkway and W. Colonial Drive. Septic tank systems are also located in western portions of the drainage basin, primarily along Silver Star Road. However, overall, the vast majority of the Lake Lawne drainage basin appears to be serviced by central sewer systems, with the septic tank areas generally located in perimeter portions of the drainage basin.



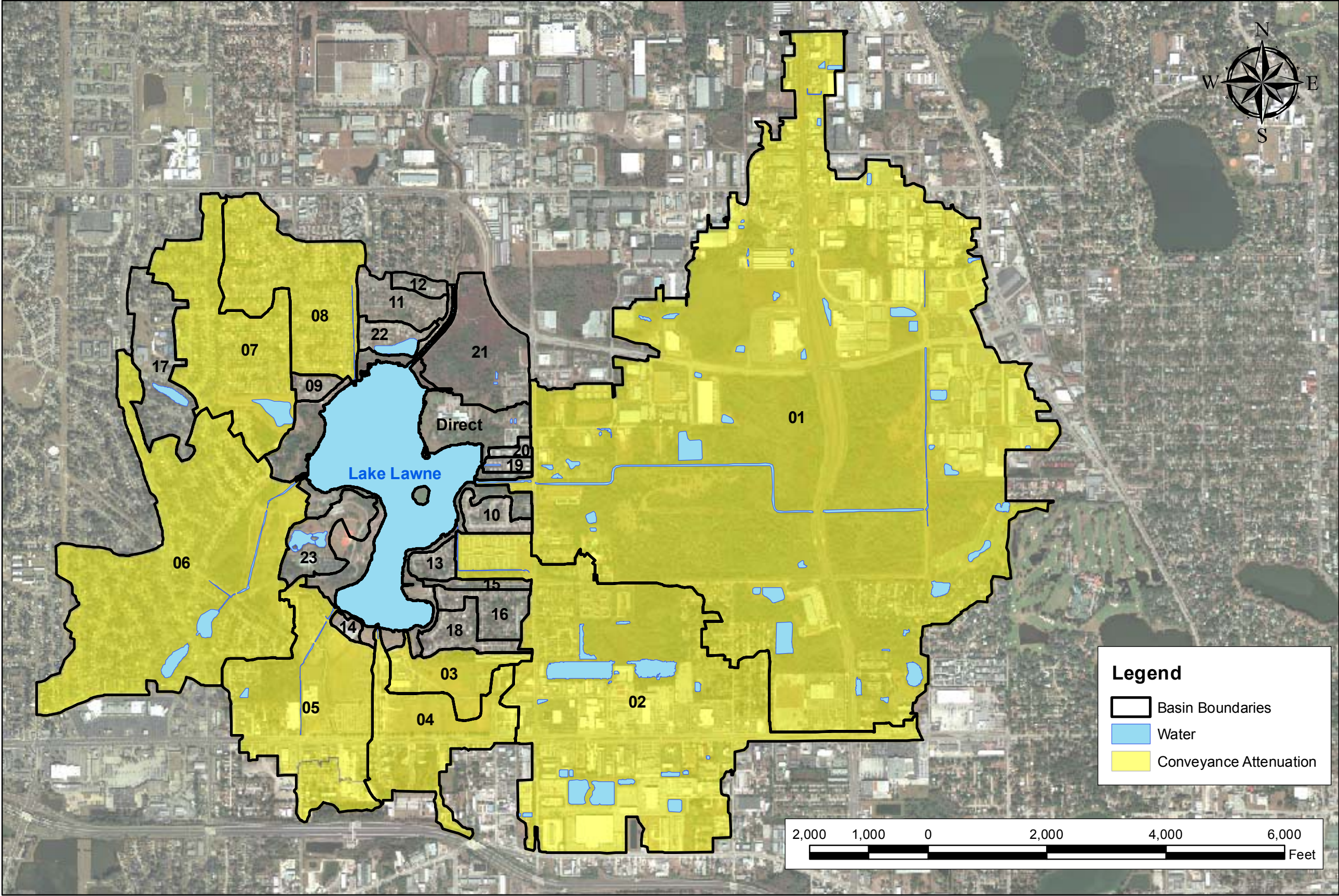


Figure 3-10. Areas in the Lake Lawne Drainage Basin Which Receive Stormwater Treatment in Conveyance Channels and Systems.



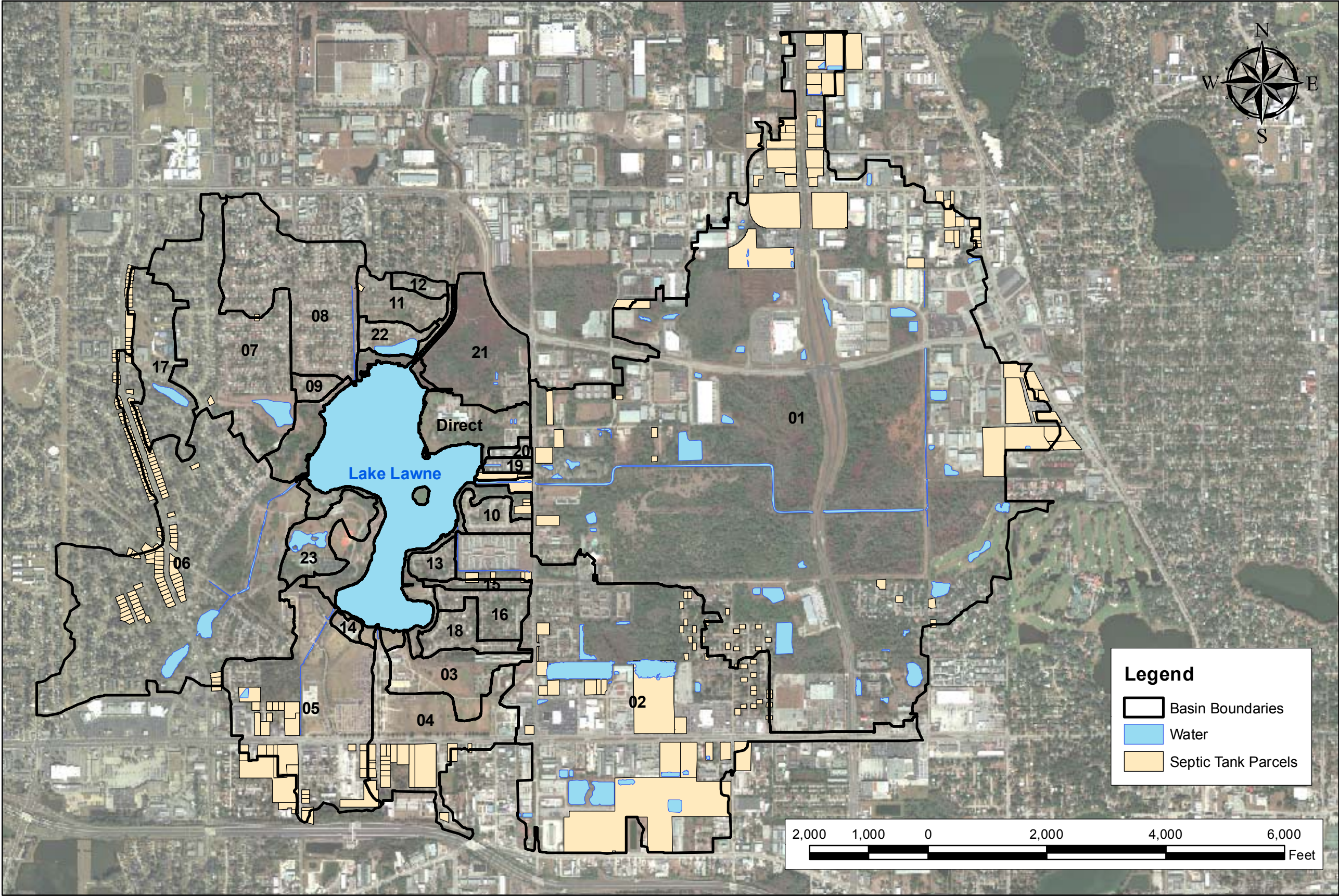


Figure 3-11. Developed Parcels Using Septic Tanks for Sewage Disposal in the Lake Lawne Drainage Basin.



## SECTION 4

### HYDROLOGIC INPUTS AND LOSSES

An average annual hydrologic budget was developed for Lake Lawne which includes inputs from direct precipitation, stormwater runoff, and groundwater seepage. Hydrologic losses are estimated for evaporation, deep recharge, inflow from interconnected lakes, and discharges through the outfall structure. The hydrologic budget is used as input for development of nutrient budgets as well as estimation of hydraulic residence time. A conceptual schematic of evaluated hydrologic inputs and losses in Lake Lawne is given on Figure 4-1. A discussion of identified hydrologic inputs and losses for Lake Lawne is given in the following sections.

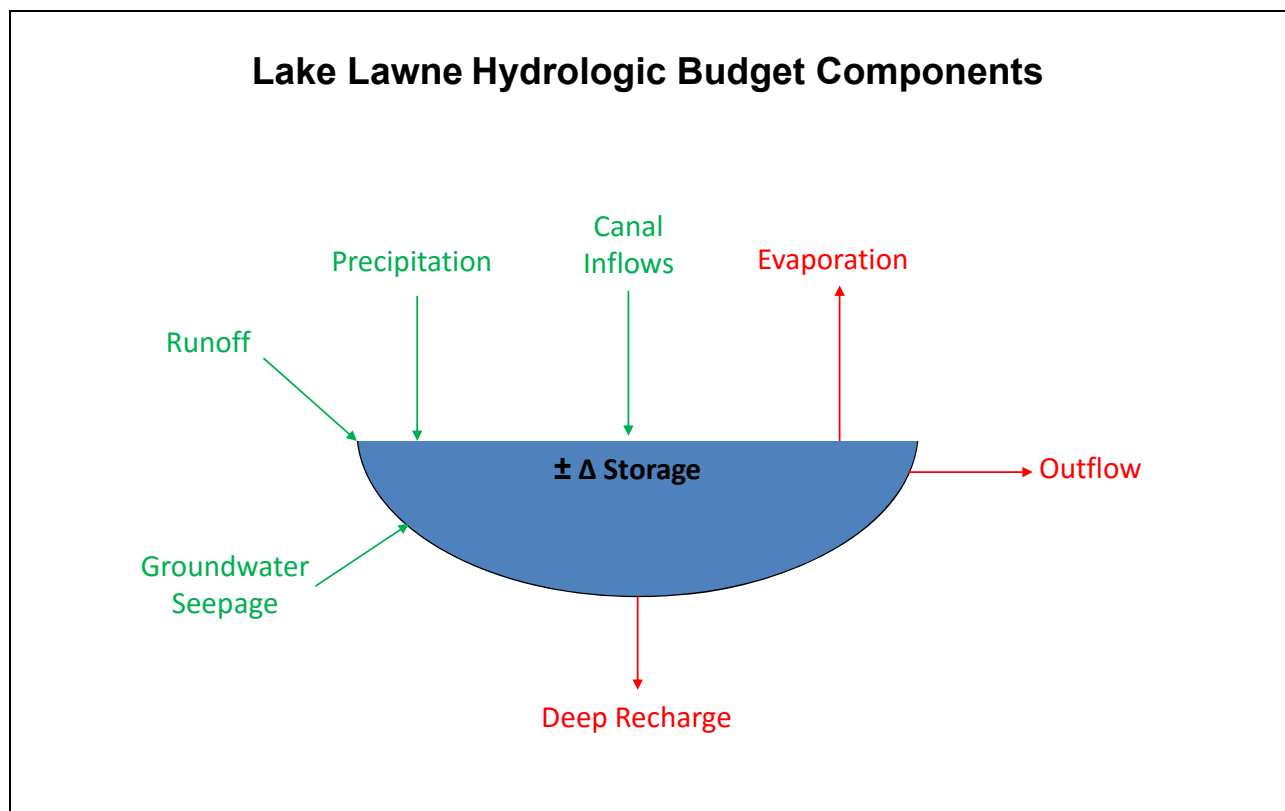


Figure 4-1. Conceptual Schematic of Evaluated Hydrologic Inputs and Losses to Lake Lawne.



## 4.1 Hydrologic Inputs

### 4.1.1 Direct Precipitation

#### 4.1.1.1 Rainfall Characteristics

Hydrologic inputs from direct precipitation to Lake Lawne are calculated based upon historical mean monthly precipitation for the Central Florida area. Estimates of mean monthly precipitation were generated by ERD based upon historical monthly rainfall at the Orlando International Airport (OIA) meteorological station over the period from 1942-2010.

A summary of mean monthly rainfall at the OIA meteorological station is given in Table 4-1. Mean monthly rainfall depths range from a low of 2.04 inches during December to a high of 7.61 inches in July, with an annual total of approximately 50.03 inches.

**TABLE 4-1**  
**SUMMARY OF MEAN MONTHLY RAINFALL**  
**IN THE ORLANDO AREA FROM 1942-2010**

| MONTH    | RAINFALL DEPTH<br>(inches) | MONTH         | RAINFALL DEPTH<br>(inches) |
|----------|----------------------------|---------------|----------------------------|
| January  | 2.53                       | July          | 7.61                       |
| February | 2.46                       | August        | 6.16                       |
| March    | 3.62                       | September     | 6.27                       |
| April    | 2.82                       | October       | 2.60                       |
| May      | 3.82                       | November      | 2.61                       |
| June     | 7.49                       | December      | 2.04                       |
|          |                            | <b>TOTAL:</b> | <b>50.03</b>               |

#### 4.1.1.2 Hydrologic Inputs

Estimated monthly hydrologic inputs from direct precipitation into Lake Lawne were calculated by multiplying the mean monthly rainfall measured at the OIA monitoring site (as summarized in Table 4-1) times the assumed lake surface area of 148.0 acres. A summary of estimated mean monthly hydrologic inputs to Lake Lawne from direct precipitation is given in Table 4-2. During an average annual rainfall year, direct precipitation contributes approximately 617 ac-ft of water to Lake Lawne.

TABLE 4-2

**ESTIMATED MEAN MONTHLY HYDROLOGIC INPUTS  
TO LAKE LAWNE FROM DIRECT PRECIPITATION**

| MONTH    | MONTHLY<br>RAINFALL<br>(inches) | HYDROLOGIC<br>INPUTS<br>(ac-ft/month) | MONTH          | MONTHLY<br>RAINFALL<br>(inches) | HYDROLOGIC<br>INPUTS<br>(ac-ft/month) |
|----------|---------------------------------|---------------------------------------|----------------|---------------------------------|---------------------------------------|
| January  | 2.53                            | 31.2                                  | July           | 7.61                            | 93.9                                  |
| February | 2.46                            | 30.3                                  | August         | 6.16                            | 76.0                                  |
| March    | 3.62                            | 44.6                                  | September      | 6.27                            | 77.3                                  |
| April    | 2.82                            | 34.8                                  | October        | 2.60                            | 32.1                                  |
| May      | 3.82                            | 47.1                                  | November       | 2.61                            | 32.2                                  |
| June     | 7.49                            | 92.4                                  | December       | 2.04                            | 25.2                                  |
|          |                                 |                                       | <b>TOTALS:</b> | <b>50.03</b>                    | <b>617</b>                            |

#### **4.1.2 Stormwater Runoff**

Estimates of hydrologic inputs to Lake Lawne from stormwater runoff were calculated for each of the identified sub-basin areas based upon mean rainfall characteristics from 1942-2010. Individual estimates of runoff inputs were generated for each of the 24 sub-basin areas discharging to Lake Lawne and are utilized for development of both hydrologic and nutrient budgets. Details of evaluation methods and results of the runoff modeling efforts are given in the following sections.

##### **4.1.2.1 Computational Methods**

Estimates of volumetric inputs from direct stormwater runoff were generated for each of the identified sub-basin areas discharging to Lake Lawne. The estimated runoff volumes were calculated for average annual rainfall conditions based upon hydrologic modeling of individual rain events measured at the OIA meteorological station over the period from 1942-2010. A continuous runoff simulation model was developed, and the historical rainfall data were used as the precipitation input data. This model provides an estimate of mean annual runoff inputs from each sub-basin based on actual rainfall events over the period from 1942-2010.

The SCS curve number methodology was used to provide estimates of the runoff volumes generated within each delineated drainage sub-basin area for each historical rain event from 1942-2010. The SCS methodology utilizes the hydrologic characteristics of the drainage basin, including impervious area, directly connected impervious area, and soil curve numbers to estimate runoff volumes for modeled storm events. Hydrologic characteristics of the sub-basin areas were determined by ERD based upon aerial photography and a field reconnaissance of the watershed areas. Test plots were selected in each drainage sub-basin and impervious and DCIA areas were digitally delineated and quantified. A summary of hydrologic characteristics of the delineated sub-basin areas is given on Table 4-3.

**TABLE 4-3**  
**HYDROLOGIC CHARACTERISTICS OF**  
**THE LAKE LAWNE DRAINAGE BASIN AREAS**

| <b>BASIN I.D.</b> | <b>BASIN NAME</b>      | <b>AREA (acres)</b> | <b>DCIA</b> | <b>IMPERVIOUS</b> | <b>Curve Number (CN)</b> |
|-------------------|------------------------|---------------------|-------------|-------------------|--------------------------|
| 1                 | C-1 Canal              | 1,281.84            | 25.2        | 34.3              | 79.0                     |
| 2                 | C-2 Canal              | 411.22              | 49.6        | 62.5              | 81.4                     |
| 3                 | C-3 Canal              | 36.43               | 9.5         | 22.8              | 83.1                     |
| 4                 | C-4 Canal              | 81.59               | 29.0        | 39.5              | 83.8                     |
| 5                 | C-5 Canal              | 143.40              | 26.1        | 36.5              | 78.4                     |
| 6                 | C-6 Canal              | 309.88              | 22.7        | 41.4              | 64.6                     |
| 7                 | C-7 Canal              | 123.64              | 20.2        | 41.5              | 56.1                     |
| 8                 | C-8 Canal              | 105.17              | 19.8        | 43.9              | 58.3                     |
| 9                 | Cal Ct.                | 6.91                | 20.0        | 44.9              | 57.5                     |
| 10                | Cape Cove Blvd.        | 13.47               | 20.0        | 44.8              | 79.2                     |
| 11                | Carousel Rd.           | 21.72               | 22.2        | 46.6              | 59.4                     |
| 12                | Chateau Rd.            | 6.07                | 20.0        | 45.0              | 57.6                     |
| 13                | Dutton Rd.             | 9.45                | 18.2        | 41.0              | 77.7                     |
| 14                | Fairground Building    | 3.53                | 39.2        | 43.5              | 69.6                     |
| 15                | Judge Dr.              | 6.52                | 8.1         | 39.4              | 80.7                     |
| 16                | Lake Lawne Ave.        | 20.76               | 19.8        | 44.9              | 74.0                     |
| 17                | Lake Pivot             | 50.55               | 22.1        | 44.2              | 56.9                     |
| 18                | Lawne Ct.              | 18.01               | 19.8        | 44.6              | 73.4                     |
| 19                | Mercy Dr. Apartments 1 | 4.81                | 44.5        | 74.0              | 70.4                     |
| 20                | Mercy Dr. Apartments 2 | 3.54                | 37.4        | 75.3              | 74.7                     |
| 21                | NE Lake Lawne Wetland  | 61.04               | 4.6         | 7.7               | 89.5                     |
| 22                | North Lawne Villas     | 13.30               | 50.0        | 63.5              | 63.4                     |
| 23                | Park Area              | 28.77               | 24.3        | 33.6              | 55.0                     |
| Direct            | Overland Flow          | 113.70              | 9.5         | 16.8              | 70.0                     |
| <b>TOTAL:</b>     |                        | <b>2,875.32</b>     | <b>26.8</b> | <b>39.4</b>       | <b>74.6</b>              |

After estimating the hydrologic characteristics of each sub-basin area, the runoff volume for a given rainfall event is calculated by adding the rainfall excess from the non-directly connected impervious area (non-DCIA) portion to the rainfall excess created from the DCIA portion for the basin. Rainfall excess from the non-DCIA areas is calculated using the following set of equations:

$$\text{Soil Storage (S)} = \left( \frac{1000}{n_{DCIA} \text{ CN}} - 10 \right)$$

$$n_{DCIA} \text{ CN} = \frac{[CN * (100 - IMP)] + [98 (IMP - DCIA)]}{(100 - DCIA)}$$

$$Q_{nDCIA} = \frac{(P_i - 0.2S)^2}{(P_i + 0.8S)}$$

where:

|                     |   |                                                          |
|---------------------|---|----------------------------------------------------------|
| CN                  | = | curve number for pervious area                           |
| IMP                 | = | percent impervious area                                  |
| DCIA                | = | percent directly connected impervious area               |
| nDCIA CN            | = | curve number for non-DCIA area                           |
| P <sub>i</sub>      | = | rainfall event depth (inches)                            |
| Q <sub>nDCIAi</sub> | = | rainfall excess for non-DCIA for rainfall event (inches) |

For the DCIA portion, rainfall excess is calculated using the following equation:

$$Q_{DCIAi} = (P_i - 0.1)$$

When P<sub>i</sub> is less than 0.1, Q<sub>DCIAi</sub> is equal to zero. This methodology is used to estimate the generated runoff volume within each of the delineated sub-basin areas for each rainfall event which occurred over the period from 1942-2010.

The methodology outlined above provides an estimate of the runoff volume “generated” from each of the individual rain events in each sub-basin over the 69-year period from 1942-2010. The sum of the total runoff was then divided by 69 years to obtain an estimate of the mean annual runoff volume. However, significant portions of the generated runoff volume may be attenuated during migration through stormwater management systems within each sub-basin area. If the stormwater management system provides dry retention treatment, a large portion of the runoff volume may be infiltrating into the ground and not reach the receiving water as a surface flow. If the stormwater system provides wet detention treatment, a portion of the generated runoff volume may be lost due to evaporation within the pond or infiltration through the pond bottom. Volumetric losses of runoff also occur in the swale conveyance systems, wetlands, and the natural ponds and borrow pits.



The watershed model includes information on the types of stormwater management systems utilized within each sub-basin area and the amount of developed area treated by each stormwater management type based on the information summarized on Figure 3-6. The runoff volume discharging to wet or dry stormwater treatment systems is reduced or attenuated for likely volumetric removal processes in the wet or dry treatment systems. Estimates of the generated runoff volume which is attenuated by each type of stormwater management system are calculated in the model, and the attenuated volume is subtracted from the generated volume within each sub-basin. The result is an estimate of the runoff volume which actually discharges from the stormwater treatment system to downstream portions of the basin.

Runoff discharging from stormwater treatment systems may be subjected to additional volumetric losses in roadside swales, secondary canals, natural ponds and lakes, borrow pits, depressional areas, and wetlands. Estimates are also included in the hydrologic model for anticipated losses in these additional attenuation mechanisms before ultimately discharging into Lake Lawne.

A summary of estimated volumetric removal efficiencies for stormwater management systems and other attenuation mechanisms in the Lake Lawne drainage sub-basins is given in Table 4-4. These volumetric removals are based on previous research performed by ERD on the performance efficiencies of stormwater management systems used in the State of Florida. Developed areas treated by dry retention are assumed to have a volumetric loss of approximately 80% for runoff inputs due to infiltration and evaporation within the pond. Wet detention ponds are assumed to have a volumetric loss of approximately 20%, due primarily to evaporation and infiltration through the pond bottom. The depressional areas and borrow pits, most of which have no formal outfall structure, are assumed to retain 90% of the runoff which reaches these systems. Roadside swale systems are assumed to infiltrate approximately 25% of the runoff reaching these areas, with a 10% attenuation assumed for canals and a 20% volumetric attenuation assumed for natural lakes and ponds. Wetland systems are assumed to remove approximately 20% of the runoff which enters the wetland due to evapotranspiration processes.

**TABLE 4-4**  
**ESTIMATED ANNUAL VOLUMETRIC**  
**LOSSES FOR ATTENUATION SYSTEMS IN THE**  
**LAKE LAWNE DRAINAGE BASIN**

| <b>SYSTEM TYPE</b> | <b>VOLUME LOSS (%)</b> |
|--------------------|------------------------|
| Dry Pond           | 80                     |
| Wet Pond           | 20                     |
| Swale              | 25                     |
| Canal              | 10                     |
| Pond               | 20                     |
| Borrow Pit         | 90                     |
| Depression         | 90                     |
| Wetland            | 20                     |

A summary of estimated runoff volumes which discharge from each drainage sub-basin area on an average annual basis, following stormwater treatment, is given in Table 4-5. The generated runoff volume represents the modeled runoff volume within each sub-basin prior to volume reduction in stormwater management systems. Estimates of the volume removed in dry retention ponds, and wet detention ponds are also included, based upon the volumetric removal efficiencies summarized in Table 4-4. The resulting value represents the observed mean annual runoff volume which is actually discharged within each sub-basin following stormwater treatment, if applicable. Estimates of the generated and observed runoff coefficients (C value) are also provided for each drainage sub-basin for comparison purposes.

The generated and observed runoff coefficients are calculated as follows:

$$\text{Generated } C \text{ Value} = \frac{\text{Generated Runoff Volume (ac-ft)}}{\text{Total Basin Area (ac)} \times \text{Rainfall Depth (ft)}}$$

$$\text{Observed } C \text{ Value} = \frac{\text{Observed Runoff Volume (ac-ft)}}{\text{Total Basin Area (ac)} \times \text{Rainfall Depth (ft)}}$$

Calculations used to estimate runoff loadings to Lake Lawne are given in Appendix C.

A summary of estimated runoff volumes discharging from each of the sub-basin areas to Lake Lawne on an average annual basis is given in Table 4-6. This table includes additional attenuation processes within the overall drainage basin area, such as swales, wetlands, depressional areas, and conveyance channels which provide additional attenuation of runoff volumes following discharge from stormwater treatment systems or other portions of the drainage basin. The estimated volumetric removals are based upon the percentages summarized in Table 4-5 for each of the evaluated processes. The calculated runoff volume following the watershed removal processes provides an estimate of the annual runoff volume which actually reaches Lake Lawne from each of the identified sub-basin areas. Runoff C values are also provided in Table 4-6 based upon the final observed runoff volumes after consideration for attenuation in stormwater management systems and other watershed processes.

TABLE 4-5

**ESTIMATED OBSERVED RUNOFF VOLUMES DISCHARGING  
FROM LAKE LAWNE SUB-BASIN AREAS FOLLOWING TREATMENT  
IN STORMWATER MANAGEMENT SYSTEMS**

| BASIN         | BASIN<br>AREA<br>(ac) | GENERATED<br>RUNOFF<br>VOLUME<br>(ac-ft) | GENERATED<br>C VALUE | VOLUME REMOVED<br>(ac-ft) |            | OBSERVED<br>RUNOFF<br>VOLUME<br>(ac-ft) | OBSERVED<br>C VALUE | PERCENT<br>OF<br>TOTAL<br>(%) |
|---------------|-----------------------|------------------------------------------|----------------------|---------------------------|------------|-----------------------------------------|---------------------|-------------------------------|
|               |                       |                                          |                      | Dry Ponds                 | Wet Ponds  |                                         |                     |                               |
| 01            | 1,281.84              | 2136                                     | 0.400                | 161                       | 95.1       | 1,880                                   | 0.352               | 48.6                          |
| 02            | 411.22                | 855                                      | 0.499                | 52.9                      | 57.4       | 745                                     | 0.435               | 19.3                          |
| 03            | 36.43                 | 43.2                                     | 0.284                | 6.68                      | 0.00       | 36.5                                    | 0.240               | 0.9                           |
| 04            | 81.59                 | 133                                      | 0.391                | 22.8                      | 0.00       | 110                                     | 0.323               | 2.8                           |
| 05            | 143.40                | 210                                      | 0.351                | 3.49                      | 0.00       | 207                                     | 0.345               | 5.3                           |
| 06            | 309.88                | 329                                      | 0.255                | 4.19                      | 0.19       | 325                                     | 0.251               | 8.4                           |
| 07            | 123.64                | 103                                      | 0.200                | 0.00                      | 20.5       | 82.5                                    | 0.160               | 2.1                           |
| 08            | 105.17                | 82.3                                     | 0.188                | 0.00                      | 0.00       | 82.3                                    | 0.188               | 2.1                           |
| 09            | 6.91                  | 5.27                                     | 0.183                | 0.00                      | 0.00       | 5.27                                    | 0.183               | 0.1                           |
| 10            | 13.47                 | 14.2                                     | 0.253                | 0.00                      | 0.00       | 14.2                                    | 0.252               | 0.4                           |
| 11            | 21.72                 | 18.5                                     | 0.204                | 0.00                      | 0.00       | 18.5                                    | 0.204               | 0.5                           |
| 12            | 6.07                  | 4.63                                     | 0.183                | 0.00                      | 0.00       | 4.63                                    | 0.183               | 0.1                           |
| 13            | 9.45                  | 9.67                                     | 0.245                | 0.00                      | 0.00       | 9.67                                    | 0.245               | 0.3                           |
| 14            | 3.53                  | 6.02                                     | 0.409                | 4.82                      | 0.00       | 1.20                                    | 0.082               | 0.0                           |
| 15            | 6.52                  | 6.28                                     | 0.231                | 0.00                      | 0.00       | 6.28                                    | 0.231               | 0.2                           |
| 16            | 20.76                 | 20.5                                     | 0.237                | 0.00                      | 0.00       | 20.5                                    | 0.237               | 0.5                           |
| 17            | 50.55                 | 44.3                                     | 0.210                | 0.00                      | 0.00       | 44.3                                    | 0.210               | 1.1                           |
| 18            | 18.01                 | 17.7                                     | 0.236                | 0.00                      | 0.00       | 17.7                                    | 0.235               | 0.5                           |
| 19            | 4.81                  | 7.89                                     | 0.393                | 0.00                      | 0.00       | 7.89                                    | 0.393               | 0.2                           |
| 20            | 3.54                  | 5.21                                     | 0.353                | 0.02                      | 0.00       | 5.19                                    | 0.352               | 0.1                           |
| 21            | 61.04                 | 102                                      | 0.401                | 2.97                      | 1.31       | 97.7                                    | 0.385               | 2.5                           |
| 22            | 13.30                 | 24.4                                     | 0.440                | 0.00                      | 4.84       | 19.6                                    | 0.352               | 0.5                           |
| 23            | 28.77                 | 27.1                                     | 0.226                | 1.59                      | 4.00       | 21.5                                    | 0.179               | 0.6                           |
| Direct        | 113.70                | 129                                      | 0.271                | 23.7                      | 0.36       | 105                                     | 0.220               | 2.7                           |
| <b>TOTAL:</b> | <b>2,875.32</b>       | <b>4,333</b>                             |                      | <b>284</b>                | <b>184</b> | <b>3,866</b>                            | <b>0.322</b>        |                               |

TABLE 4-6

**ESTIMATED OBSERVED MEAN ANNUAL RUNOFF VOLUMES  
DISCHARGING FROM SUB-BASIN AREAS TO LAKE LAWNE**

| BASIN         | BASIN<br>AREA<br>(ac) | OBSERVED<br>RUNOFF<br>VOLUME<br>(ac-ft) | VOLUME REMOVED<br>(ac-ft) |            |             |            | FINAL<br>VOLUME<br>(ac-ft) | FINAL<br>C<br>VALUE | PERCENT<br>OF<br>TOTAL<br>(%) |
|---------------|-----------------------|-----------------------------------------|---------------------------|------------|-------------|------------|----------------------------|---------------------|-------------------------------|
|               |                       |                                         | Swales                    | Wetlands   | Depressions | Conveyance |                            |                     |                               |
| 01            | 1,281.84              | 1,880                                   | 71.2                      | 223        | 154         | 143        | 1,289                      | 0.241               | 55.1                          |
| 02            | 411.22                | 745                                     | 7.92                      | 14.2       | 546         | 17.7       | 159                        | 0.093               | 6.8                           |
| 03            | 36.43                 | 36.5                                    | 5.86                      | 0.00       | 0.00        | 3.06       | 27.6                       | 0.182               | 1.2                           |
| 04            | 81.59                 | 110                                     | 5.47                      | 0.00       | 0.00        | 10.4       | 94.3                       | 0.277               | 4.0                           |
| 05            | 143.40                | 207                                     | 9.81                      | 0.00       | 1.08        | 19.5       | 176                        | 0.295               | 7.5                           |
| 06            | 309.88                | 325                                     | 0.00                      | 0.00       | 174         | 15.1       | 136                        | 0.105               | 5.8                           |
| 07            | 123.64                | 82.5                                    | 0.00                      | 0.00       | 0.00        | 8.24       | 74.3                       | 0.144               | 3.2                           |
| 08            | 105.17                | 82.3                                    | 0.00                      | 0.00       | 0.00        | 8.23       | 74.1                       | 0.169               | 3.2                           |
| 09            | 6.91                  | 5.27                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 5.27                       | 0.183               | 0.2                           |
| 10            | 13.47                 | 14.2                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 14.2                       | 0.253               | 0.6                           |
| 11            | 21.72                 | 18.5                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 18.5                       | 0.204               | 0.8                           |
| 12            | 6.07                  | 4.63                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 4.63                       | 0.183               | 0.2                           |
| 13            | 9.45                  | 9.67                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 9.67                       | 0.245               | 0.4                           |
| 14            | 3.53                  | 1.20                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 1.20                       | 0.082               | 0.1                           |
| 15            | 6.52                  | 6.28                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 6.28                       | 0.231               | 0.3                           |
| 16            | 20.76                 | 20.5                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 20.5                       | 0.237               | 0.9                           |
| 17            | 50.55                 | 44.3                                    | 0.00                      | 0.00       | 39.9        | 0.00       | 4.40                       | 0.021               | 0.2                           |
| 18            | 18.01                 | 17.7                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 17.7                       | 0.236               | 0.8                           |
| 19            | 4.81                  | 7.89                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 7.89                       | 0.393               | 0.3                           |
| 20            | 3.54                  | 5.19                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 5.19                       | 0.352               | 0.2                           |
| 21            | 61.04                 | 97.7                                    | 0.00                      | 19.6       | 14.6        | 0.00       | 63.5                       | 0.250               | 2.7                           |
| 22            | 13.30                 | 19.6                                    | 0.00                      | 0.00       | 0.00        | 0.00       | 19.6                       | 0.353               | 0.8                           |
| 23            | 28.77                 | 21.5                                    | 0.86                      | 0.00       | 0.00        | 0.00       | 20.7                       | 0.172               | 0.9                           |
| Direct        | 113.70                | 105                                     | 0.00                      | 0.04       | 15.4        | 0.00       | 89.5                       | 0.189               | 3.8                           |
| <b>TOTAL:</b> | <b>2,875.32</b>       | <b>3,866</b>                            | <b>101</b>                | <b>257</b> | <b>945</b>  | <b>225</b> | <b>2,339</b>               | <b>0.195</b>        |                               |



As indicated on Table 4-6, the single largest source of volumetric runoff inputs to Lake Lawne on an annual basis is Sub-basin 1 which contributes approximately 55.1% of the annual runoff inflows. The second largest volumetric input to Lake Lawne on an annual basis is Sub-basin 5 which contributes approximately 7.5% of the annual runoff inputs, followed by Sub-basin 2 (6.8%), Sub-basin 6 (5.8%), Sub-basin 4 (4.0%), direct overland flow (3.8%), Sub-basins 7 and 8 (each contributing 3.2%), and Sub-basin 21 (2.7%). Each of the remaining sub-basin areas contributes approximately 1% or less of the annual runoff inflow.

On an average annual basis, approximately 4,334 ac-ft of runoff is generated within the Lake Lawne drainage basin area. Approximately 468 ac-ft is retained in on-site stormwater management systems. An additional 101 ac-ft/yr is attenuated in roadside swales, with 257 ac-ft/yr lost through wetland evapotranspiration, 945 ac-ft/yr retained in depressional areas, and 225 ac-ft/yr infiltrated into groundwater in the secondary conveyance systems. The net runoff volume actually reaching Lake Lawne is approximately 2,338 ac-ft/yr. The water which is infiltrated into the ground within the overall basin area is either intercepted by the extensive canal system and contributes to baseflow inputs or is lost to deeper groundwater. The overall estimated observed runoff coefficient for the Lake Lawne drainage basin is 0.195, indicating that approximately 19.5% of the average annual rainfall which falls within the drainage basin is discharged to Lake Lawne through the stormwater conveyance systems.

#### **4.1.3 Shallow Groundwater Seepage**

Field investigations were performed by ERD to evaluate the quantity and quality of shallow groundwater seepage entering Lake Lawne during the monitoring period from March 2011-May 2012. Groundwater seepage was quantified using a series of underwater seepage meters installed at locations throughout each lake. Seepage meters provide a mechanism for direct measurement of groundwater inflow into a lake by isolating a portion of the lake bottom so that groundwater seeping up through the bottom sediments into the lake can be collected and characterized. Use of the direct seepage meter measurement technique avoids errors, assumptions, and extensive input data required when indirect techniques are used, such as the Gross Water Budget or Subtraction Method, as well as computer modeling and flow net analyses.

The seepage meter technique has been recommended by the U.S. Environmental Protection Agency (EPA) and has been established as an accurate and reliable technique in field and tank test studies (Lee, 1977; Erickson, 1981; Cherkauer and McBride, 1988; Belanger and Montgomery, 1992). With installation of adequate numbers of seepage meters and proper placement, seepage meters are a very effective tool to estimate groundwater-surface water interactions. One distinct advantage of seepage meters is that seepage meters can provide estimates of both water quantity and quality entering a lake system, whereas estimated methods can only provide information on water quantity.

#### **4.1.3.1 Seepage Meter Construction and Locations**

A schematic of a typical seepage meter installation used in Lake Lawne is given in Figure 4-2. A photograph of seepage meters being prepared for deployment is given in Figure 4-3. Seepage meters were constructed from a 2-ft diameter aluminum container with a closed top and open bottom. Each seepage meter isolated a sediment area of approximately 3.14 ft<sup>2</sup>. Seepage meters were inserted into the lake sediments to a depth of approximately 8-12 inches, isolating a portion of the lake bottom. Approximately 3-6 inches of water was trapped inside the seepage meter above the lake bottom.

A 0.75-inch PVC fitting was threaded into the top of each aluminum container. The 0.75-inch PVC fitting was attached to a female quick-disconnect PVC camlock fitting. A flexible polyethylene bag, with an approximate volume of 40 gallons, was attached to the seepage meters using a quick-disconnect PVC male camlock fitting with a terminal ball valve. Each of the collection bags was constructed of black polyethylene to prevent light penetration into the bag. Light could potentially stimulate photosynthetic activity within the sample prior to collection and result in an undesirable alteration of the chemical characteristics of the sample.

Prior to attachment to the seepage meter, all air was removed from inside the polyethylene collection bag, and the PVC ball valve was closed so that lake water would not enter the collection container prior to attachment to the seepage meter. A diver then connected the collection bag to the seepage meter using the PVC camlock fitting. After attaching the collection bag to the seepage meter, the PVC ball valve was then opened. As groundwater influx occurs into the open bottom of the seepage meter, it is collected inside the flexible polyethylene bag.

Each seepage meter was installed with a slight tilt toward the outlet point so that any gases which may be generated inside the seepage meter would exit into the collection container. A plastic-coated fishing weight was placed inside each of the collection bags to prevent the bags from floating up towards the water surface as a result of trapped gases. The location of each seepage meter was indicated by a floating marker in the lake which was attached to the seepage meter using a coated wire cable.

Twenty (20) seepage meters were installed in Lake Lawne on March 16, 2011. Locations for the seepage meters are indicated on Figure 4-4. Since seepage inflow is often most variable around the perimeter of a lake, the majority of the seepage meters were installed around the perimeter of the lakes at a uniform water depth of approximately 4-5 ft. Seepage meters were also installed in central portions of the lake.

Collection bags were installed on each of the seepage meters at the time of installation, and the monitoring program was initiated. Each of the seepage meters was monitored on approximately a monthly to bi-monthly basis, depending on rainfall, from March 2011-May 2012. During the initial monitoring event, the volume of seepage collected was recorded, and the sample was discarded since the water within the collection bag represented a combination of seepage and the initial lake water trapped at the time of installation. During all subsequent events, samples were retained for analysis of seepage characteristics. Nine separate seepage monitoring events were conducted for evaluation of seepage quantity, with eight events conducted to evaluate seepage quality at each of the monitoring sites. A total of 150 volumetric inflow samples was collected between the 20 sites over the 441-day monitoring program.

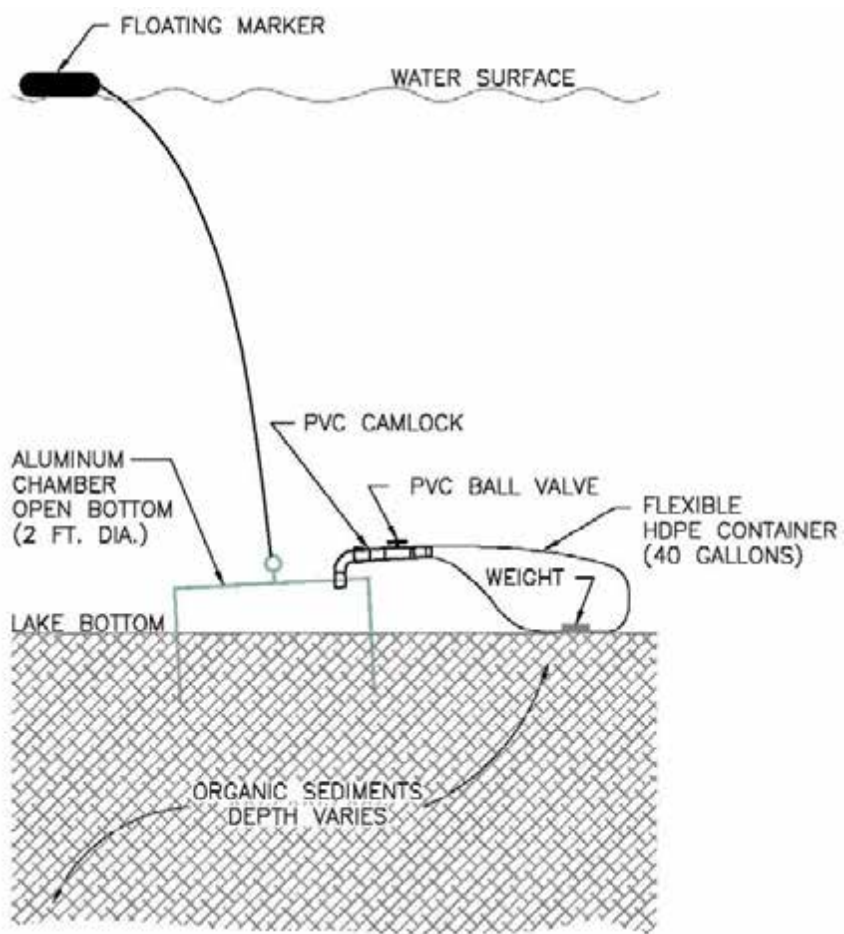


Figure 4-2.

Typical Seepage  
Meter Installation.

Figure 4-3.  
Seepage Meters Being  
Prepared for Installation in  
Lake Lawne.



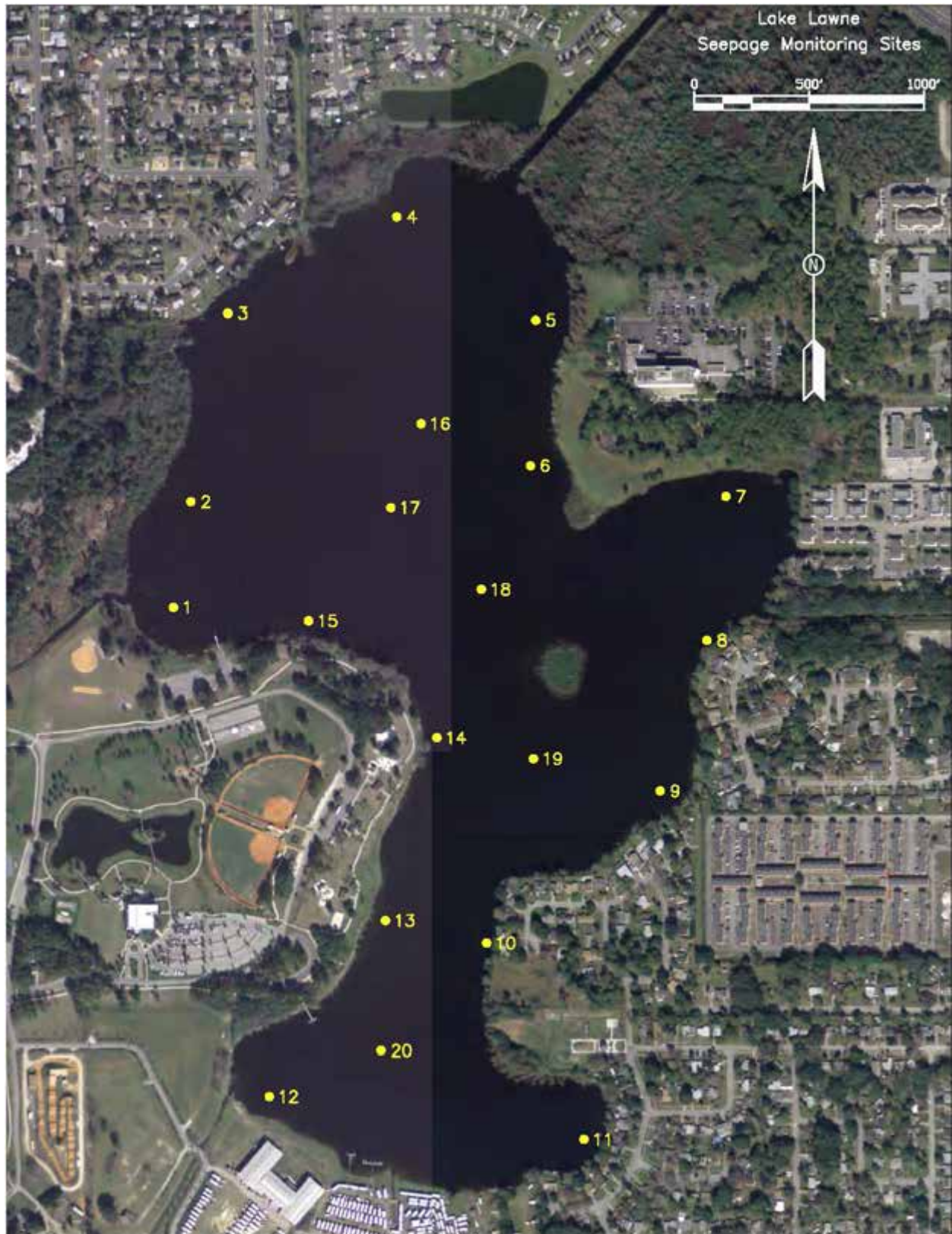


Figure 4-4. Locations of Seepage Meter Monitoring Sites in Lake Lawne.



#### **4.1.3.2 Seepage Meter Sampling Procedures**

After the initial installation of collection bags, site visits were performed at monthly to bi-monthly intervals to collect the seepage samples. During the collection process, a diver was used to close the PVC ball valve and remove the collection bag from the seepage meter using the quick-disconnect camlock fitting. The collection bag was placed onto the boat and the contents were emptied into a polyethylene container. The volume of seepage collected in the container was measured using either a 4-liter graduated cylinder or a 20-liter graduated polyethylene bucket, depending on the collected volume.

Following the initial purging, seepage meter samples were collected for return to the laboratory for chemical analysis. On many occasions, seepage meter samples were found to contain turbidity or particles originating from the sediments isolated within the seepage meter. Since these contaminants are not part of the seepage flow, all seepage meter samples collected for chemical analyses were field-filtered using a 0.45 micron disposable glass fiber filter typically used for filtration of groundwater samples. A new filter was used for each seepage sample. Seepage samples were filtered immediately following collection using a battery operated peristaltic pump at a flow rate of approximately 0.25 liter/minute. The filtered seepage sample was placed in ice for return to the ERD laboratory for further chemical analyses.

A summary of field measurements of seepage inflow over the monitoring period from March 2011-May 2012 is given in Appendix D.1. During collection of the seepage samples, information was recorded on the time of sample collection, the total volume of seepage collected at each site, and general observations regarding the condition of the seepage collection bags and replacement/repair details. The seepage flow rate at each location is calculated by dividing the total collected seepage volume (liters) by the area of the seepage meter ( $0.27 \text{ m}^2$ ) and the time (days) over which the seepage sample was collected.

As seen in Appendix D.1, several seepage meter sites contain missing data for one or more events as a result of missing or damaged collection bags and seepage meters. A large portion of the lost data occurred from seepage meters located in central open portions of the lake. Periodic damage to these seepage meters resulted in missing samples for some of the monitoring sites. Some of the seepage meters in the open water were repeatedly moved or vandalized and were repaired or replaced multiple times.

#### **4.1.3.3 Seepage Inflow**

A statistical summary of seepage inflow measurements is given in Table 4-7. In general, mean seepage values measured at the monitoring sites range from 0.42-4.81 liters/ $\text{m}^2$ -day. However, the majority of mean values range from approximately 0.5-1.0 liters/ $\text{m}^2$ -day. Mean seepage rates are calculated by dividing the total seepage volume collected during the field monitoring program by the total number of days over which the seepage was collected.

TABLE 4-7

**SUMMARY OF SEEPAGE INFLOWS MEASURED  
IN LAKE LAWNE FROM JULY 2010-AUGUST 2011**

| SITE | NUMBER<br>OF SAMPLES | SEEPAGE INFLOW (liters/m <sup>2</sup> -day) |         |      |
|------|----------------------|---------------------------------------------|---------|------|
|      |                      | Minimum                                     | Maximum | Mean |
| 1    | 8                    | 0.43                                        | 5.69    | 2.14 |
| 2    | 8                    | 0.52                                        | 1.98    | 0.87 |
| 3    | 8                    | 0.40                                        | 2.05    | 0.87 |
| 4    | 8                    | 0.65                                        | 2.20    | 1.09 |
| 5    | 9                    | 0.40                                        | 1.73    | 0.91 |
| 6    | 9                    | 0.24                                        | 1.43    | 0.78 |
| 7    | 9                    | 0.46                                        | 1.90    | 0.72 |
| 8    | 7                    | 0.25                                        | 0.63    | 0.42 |
| 9    | 8                    | 0.22                                        | 1.31    | 0.68 |
| 10   | 9                    | 0.27                                        | 1.69    | 0.62 |
| 11   | 8                    | 0.45                                        | 4.45    | 1.43 |
| 12   | 9                    | 0.38                                        | 1.21    | 0.61 |
| 13   | 9                    | 0.30                                        | 1.13    | 0.59 |
| 14   | 9                    | 0.17                                        | 1.12    | 0.60 |
| 15   | 9                    | 0.36                                        | 0.95    | 0.58 |
| 16   | 6                    | 0.36                                        | 1.76    | 1.06 |
| 17   | 2                    | 0.58                                        | 1.19    | 0.89 |
| 18   | 5                    | 0.55                                        | 2.65    | 1.03 |
| 19   | 4                    | 0.64                                        | 8.54    | 4.81 |
| 20   | 6                    | 0.24                                        | 1.50    | 0.53 |

The mean seepage values summarized on Table 4-7 were combined with the geographic coordinates for each site to generate an isopleth contour map for mean seepage inflow into the lake using the Autodesk Land Desktop 2007 Module for AutoCAD. Isopleths of mean seepage inflow into Lake Lawne from March 2011-May 2012 are given in Figure 4-5. The range of seepage values indicated on this figure is from 0.5-4.5 liter/m<sup>2</sup>-day. Much of the area within Lake Lawne appears to exhibit relatively low seepage inflow, with large portions of the lake indicating seepage of approximately 1 liter/m<sup>2</sup>-day or less. Areas of elevated seepage inflow were observed in central portions of the lake, south of the bird island, with seepage rates increasing to as high as 4.5 liter/m<sup>2</sup>-day.

The seepage isopleths indicated on Figure 4-5 were graphically integrated to obtain estimates of mean daily seepage influx into the lake. A summary of the results of this analysis is given in Table 4-8. The mean seepage influx to Lake Lawne during the field monitoring program was 1.16 liters/m<sup>2</sup>-day, which is equivalent to approximately 0.56 ac-ft/day or 206 ac-ft/yr.

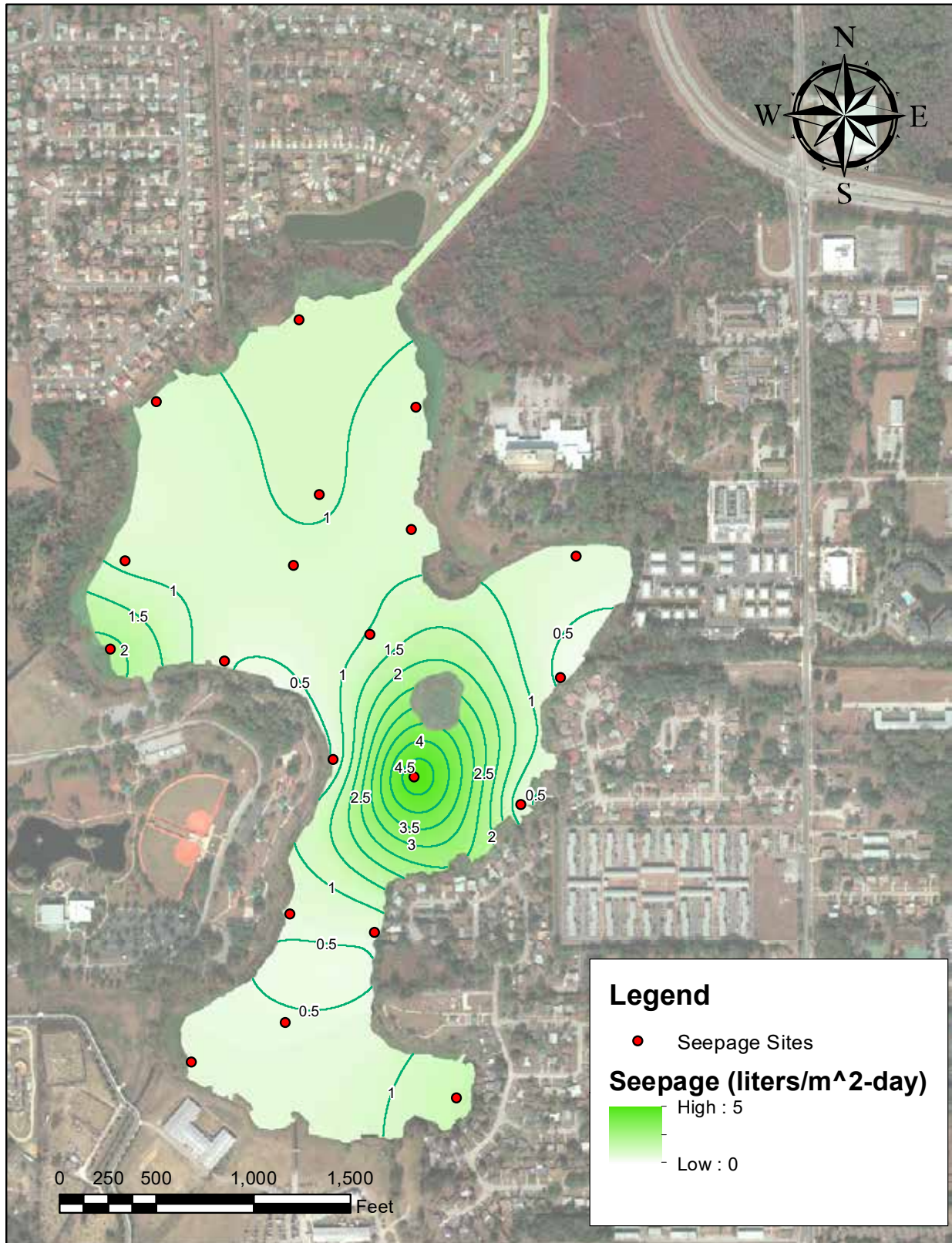


Figure 4-5. Isopleths of Mean Seepage Inflow into Lake Lawne from March 2011-May 2012.

**TABLE 4-8**

**ESTIMATED SEEPAGE INFLOW TO LAKE  
LAWNE FROM MARCH 2011 – MAY 2012**

| PARAMETER                  | UNITS                                    | VALUE       |
|----------------------------|------------------------------------------|-------------|
| Lake Area                  | acres                                    | 148.0       |
| Mean Seepage Inflow        | liters/m <sup>2</sup> -day<br>ac-ft/year | 1.16<br>206 |
| Seepage/Surface Area Ratio | ft/yr                                    | 1.39        |

The calculated seepage/surface area ratio is provided in the final row of Table 4-8. This value provides an estimate of seepage inflow in terms of a water depth over the entire lake surface and provides a method for comparing relative seepage inflow between lakes without consideration of lake area. During the field monitoring program, seepage inflow into Lake Lawne contributed a water volume equivalent to 1.39 ft over the entire surface area of the lake. This value is slightly lower than the mean seepage loading rate of 2 ft/yr measured by ERD in other Central Florida lakes. The seepage inflow listed on Table 4-8 is utilized in subsequent sections for development of an overall hydrologic budget for the lake.

#### **4.1.4 Baseflow**

Field monitoring was conducted by ERD from July 2011-April 2012 to quantify discharge rates in each of the eight secondary canal systems which discharge into Lake Lawne, reflecting inflows from Sub-basins 1-8. Flow measurements were conducted on approximately a biweekly to monthly basis, depending upon rainfall patterns and flow conditions. The discharge monitoring sites were located near the point of discharge into Lake Lawne and are illustrated on Figure 4-6.

Discharge rates at each of the canal inflow monitoring sites were conducted using the velocity/cross-sectional area method as outlined by USGS. Velocity measurements were performed at known distances across each channel using a Sontek Acoustic Doppler Velocity (ADV) meter with a minimum measurable velocity of 0.01 fps. The spacing between the velocity measurements was determined in the field such that no more than 10% of the total flow was represented by any one vertical cross-section. The water depth at each section was also simultaneously measured using a graduated rod. A graduated tape was stretched across each channel so that reference locations could be determined for each simultaneous measurement of velocity and water depth.

If the water depth was less than 2.5 ft at a measurement point, the velocity was measured at 60% of the total water depth. If the water column depth exceeded 2.5 ft at a measurement point, velocity measurements were performed at 20% and 80% of the total water depth, with the mean section velocity determined as the average of the two measurements. The measured velocities were then integrated over the cross-sectional areas to determine the total discharge through the channel section on each monitoring date.



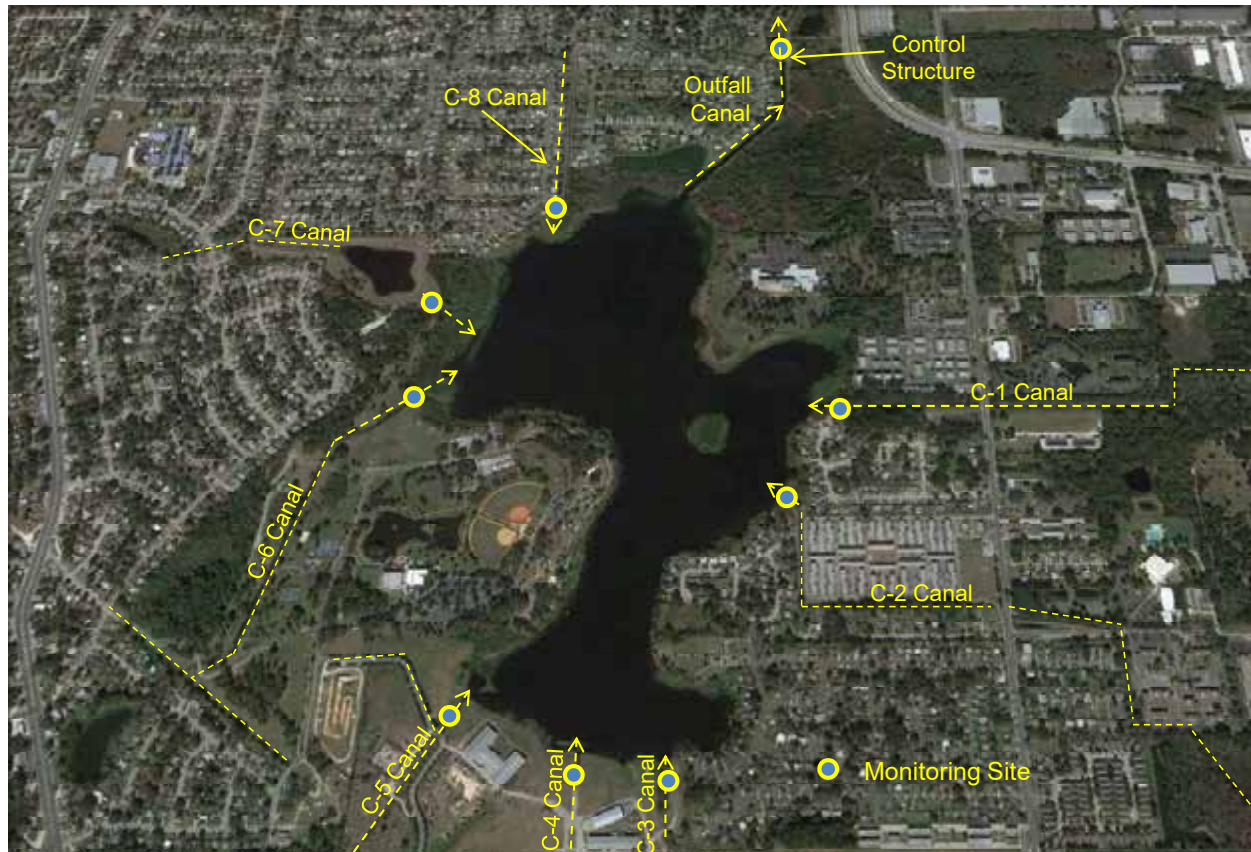


Figure 4-6. Tributary Monitoring Sites.

A tabular summary of field measured discharge rates in the secondary canal systems discharging to Lake Lawne over the field monitoring program from July 2011-April 2012 is given in Table 4-9, with a graphical comparison of measured discharge rates provided in Figure 4-7.

Relatively continuous discharges were observed throughout the field monitoring program in canal systems discharging from Sub-basins 1, 2, 6, 7, 8, and to a lesser extent Sub-basin 4, even in the absence of significant rain events. Little or no measurable discharge was observed for Sub-basins 3 and 5. As indicated on Figure 3-1, sub-basin areas discharging through the eight secondary canal systems contain an extensive system of pipes, ditches, depression areas, ponds, wetlands, and lakes which collect and attenuate large portions of the rainfall excess which is released at a slow controlled rate into the system of ditches and canals. Some of the ditches and canals are cut deep into the ground and intercept both stormwater and groundwater inputs, which are commonly referred to as baseflow.

TABLE 4-9

**FIELD MEASURED DISCHARGE RATES IN SECONDARY CANAL SYSTEMS  
DISCHARGING TO LAKE LAWNE FROM JULY 2011-APRIL 2012**

| DATE                   | MEASURED CANAL DISCHARGE (cfs) |              |             |              |              |              |              |              |
|------------------------|--------------------------------|--------------|-------------|--------------|--------------|--------------|--------------|--------------|
|                        | C-1                            | C-2          | C-3         | C-4          | C-5          | C-6          | C-7          | C-8          |
| 7/25/11                | 1.611                          | 2.681        | 0           | 0.106        | 0            | 0.281        | 0.116        | 0.120        |
| 8/8/11                 | 5.887                          | 4.069        | 0           | 0.173        | 0.084        | 0.205        | 0.062        | 0.192        |
| 8/23/11                | 3.027                          | 2.737        | 0           | 0.148        | 0            | 0.523        | 0.140        | 0.092        |
| 9/6/11                 | 1.907                          | 1.724        | 0           | 0.071        | 0            | 0.199        | 0.087        | 0.060        |
| 10/6/11                | 2.747                          | 0.335        | 0           | 0.076        | 0            | 0.109        | 0.081        | 0.040        |
| 10/17/11               | 3.957                          | 1.484        | 0           | 0.604        | 0            | 0.302        | 0.669        | 0.242        |
| 11/7/11                | 1.977                          | 1.084        | 0           | 0.211        | 0            | 0.244        | 0.213        | 0.160        |
| 11/30/11               | 0.496                          | 0            | 0           | 0.106        | 0            | 0.198        | 0.059        | 0.080        |
| 12/14/11               | 1.312                          | 0.533        | 0           | 0.198        | 0            | 0.237        | 0.131        | 0.100        |
| 1/19/12                | 0.618                          | 0            | 0           | 0.095        | 0            | 0.146        | 0.024        | 0.080        |
| 3/19/12                | 0.814                          | 0            | 0           | 0            | 0            | 0.234        | 0            | 0.120        |
| 4/11/12                | 0.534                          | 0            | 0           | 0            | 0            | 0.112        | 0            | 0            |
| <b>Average</b>         | <b>2.074</b>                   | <b>1.238</b> | <b>0</b>    | <b>0.149</b> | <b>0.007</b> | <b>0.233</b> | <b>0.132</b> | <b>0.107</b> |
| <b>Ac-ft/Yr</b>        | <b>1,501</b>                   | <b>896</b>   | <b>0</b>    | <b>107.8</b> | <b>5.1</b>   | <b>168</b>   | <b>95.4</b>  | <b>77.6</b>  |
| <b>Basin Area (ac)</b> | <b>1,282</b>                   | <b>411.2</b> | <b>36.4</b> | <b>81.59</b> | <b>143.4</b> | <b>309.9</b> | <b>123.6</b> | <b>105.2</b> |

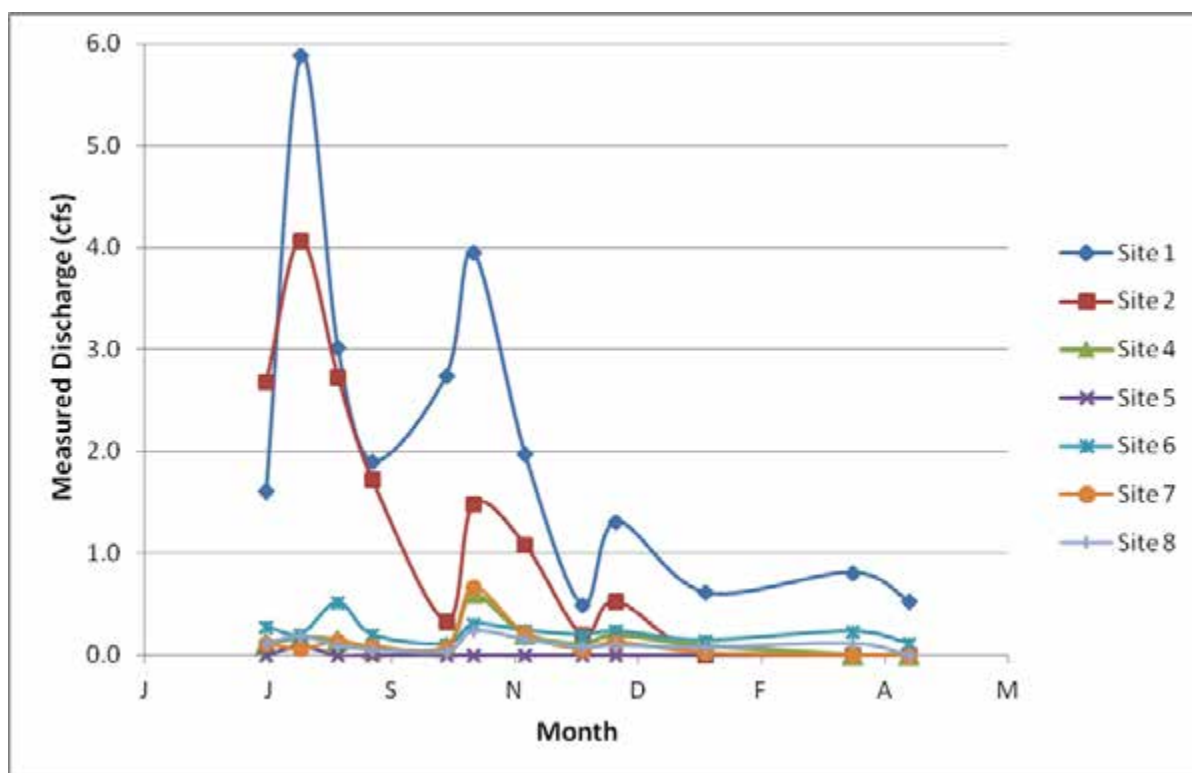


Figure 4-7. Graphical Comparison of Measured Discharge Rates.

Discharges through many of the secondary canals into Lake Lawne did not exhibit a traditional urban hydrograph consisting of a rapidly rising limb, followed by a high peak runoff rate and a rapid decrease in runoff discharge. Instead, these areas exhibited a gradual increase in discharge followed by a slow decline which lasted several days or even weeks. This phenomenon was very pronounced in Sub-basins 1, 2, 4, 6, and 7, but was not observed in Sub-basins 3 or 5. Sub-basin 3 is an extremely small sub-basin with shallow drainage ditches which appears to exhibit more of a traditional runoff hydrograph. As a result, significant baseflow discharges were not observed within this sub-basin. Sub-basin 5 consists of a highly developed drainage basin with a large degree of impervious cover, combined with shallow drainage channels, which also appears to exhibit a traditional runoff hydrograph. However, each of the remaining sub-basin areas exhibit a gradual increase in discharge following rain events with a gradual slow bleed-down of stormwater and baseflow over an extended period of time.

As a result of the significant storage and attenuation provided in the larger secondary canal drainage basins, the water which ultimately discharges through the canals into Lake Lawne reflects a combination of stormwater and baseflow characteristics. As indicated on Table 4-9, mean measured discharge rates for Canals C-1, C-2, C-4, C-6, C-7, and C-8 ranged from 0.107-2.074 cfs during the field monitoring program which, if extended over an annual period, would contribute from 77.6-1,501 ac-ft of inflow on an annual basis.

A summary of estimated baseflow contributions from secondary canals to Lake Lawne is given in Table 4-10. The modeled runoff volumes summarized in Table 4-6 are subtracted from the extrapolated annual canal inflows to provide an estimate of the proportion of the inflow allocated to baseflow for canal/Sub-basins 1, 2, 4, 6, 7, and 8. Based upon this analysis, baseflow inputs from these canals to Lake Lawne range from 3.5-737 ac-ft/yr. Calculated baseflow/runoff ratios are provided in the final row of Table 4-10 for comparison purposes. With the exception of canal/Sub-basin 2, baseflow/runoff ratios range from 0.05-0.29, indicating that baseflow inputs are equivalent to 5-29% of the modeled runoff volume for each sub-basin. A substantially higher baseflow/runoff ratio of 4.6 was observed for canal/Sub-basin 2 which suggests a different hydrologic condition in this sub-basin than exists in the other canal/sub-basin areas. As indicated on Figure 3-1, canal/Sub-basin 2 contains numerous stormwater ponds and large borrow pit areas which both attenuate stormwater and can intercept groundwater flow within the area, resulting in a much larger baseflow volume for this drainage basin. A large baseflow/runoff ratio is not uncommon and is similar to the baseflow/runoff relationships observed by ERD in Lake Down sub-basin 15 during the Butler Chain-of-Lakes study.

Based upon the discussion provided previously, baseflow inputs into Lake Lawne are estimated to be approximately 1,020 ac-ft/yr, representing the sum of the estimated baseflow inputs for canal/Sub-basins 1, 2, 4, 6, 7, and 8. The substantially lower baseflow/runoff ratio observed in Sub-basin 8 appears appropriate for this sub-basin which consists of a large amount of impervious residential areas which discharge into relatively shallow vegetated conveyance systems as opposed to the larger watershed areas and deeper conveyance channels observed in the remaining sub-basins.

**TABLE 4-10**

**ESTIMATED BASEFLOW CONTRIBUTIONS  
FROM SECONDARY CANALS TO LAKE LAWNE**

| PARAMETER                     | CANAL / SUB-BASIN |     |      |      |      |      | TOTAL |
|-------------------------------|-------------------|-----|------|------|------|------|-------|
|                               | C-1               | C-2 | C-4  | C-6  | C-7  | C-8  |       |
| Measured Inflow (ac-ft/yr)    | 1,501             | 896 | 108  | 168  | 95.4 | 77.6 | 2,846 |
| Runoff Volume (ac-ft/yr)      | 1,289             | 159 | 94.3 | 136  | 74.3 | 74.1 | 1,827 |
| Estimated Baseflow (ac-ft/yr) | 212               | 737 | 13.7 | 32.3 | 21.1 | 3.5  | 1,020 |
| Baseflow/Runoff Ratio         | 0.16              | 4.6 | 0.15 | 0.24 | 0.28 | 0.05 |       |

## 4.2 Hydrologic Losses

Hydrologic losses from Lake Lawne occur as a result of evaporation from the lake surface, discharge through the outfall structure, and discharges from deeper portions of the lake bottom to underground aquifers. Estimated losses from each of these sources are discussed in the following sections.

### 4.2.1 Evaporation Losses

Estimates of monthly evaporation from Lake Lawne were generated based upon mean monthly evaporation data collected at the Lake Alfred Experimental Station over the 30-year period from 1965-1994. The Lake Alfred Station is located approximately 30 miles southwest of Orlando and appears to be the closest long-term evaporation monitoring site to the Central Florida area. A summary of mean monthly evaporation for this site is given in Table 4-11. For purposes of this project, the mean evaporation measured at the Lake Alfred site is assumed to be similar to evaporation at Lake Lawne. The recorded data at the Lake Alfred site reflects pan evaporation, with lake evaporation assumed to be equal to 70% of the pan evaporation values.

A summary of estimated monthly evaporation losses from Lake Lawne is given in Table 4-12. The values summarized in this table were obtained by multiplying the lake surface area times the estimated monthly lake evaporation values. Mean annual volumetric losses from lake evaporation remove approximately 614 ac-ft/yr from Lake Lawne.



**TABLE 4-11**

**MEAN MONTHLY LAKE EVAPORATION AT  
THE LAKE ALFRED EXPERIMENTAL STATION SITE**

| <b>MONTH</b>  | <b>MEAN PAN<br/>EVAPORATION<br/>(inches)</b> | <b>LAKE<br/>EVAPORATION<sup>1</sup><br/>(inches)</b> | <b>MONTH</b> | <b>MEAN PAN<br/>EVAPORATION<br/>(inches)</b> | <b>LAKE<br/>EVAPORATION<sup>1</sup><br/>(inches)</b> |
|---------------|----------------------------------------------|------------------------------------------------------|--------------|----------------------------------------------|------------------------------------------------------|
| January       | 3.47                                         | 2.43                                                 | July         | 7.57                                         | 5.30                                                 |
| February      | 4.21                                         | 2.95                                                 | August       | 7.16                                         | 5.01                                                 |
| March         | 6.26                                         | 4.38                                                 | September    | 6.28                                         | 4.40                                                 |
| April         | 7.60                                         | 5.32                                                 | October      | 5.51                                         | 3.86                                                 |
| May           | 8.47                                         | 5.93                                                 | November     | 3.98                                         | 2.79                                                 |
| June          | 7.65                                         | 5.36                                                 | December     | 3.22                                         | 2.25                                                 |
| <b>TOTAL:</b> |                                              |                                                      |              | <b>71.38</b>                                 | <b>49.98</b>                                         |

1. Assumed to be 70% of pan evaporation

**TABLE 4-12**

**ESTIMATED MONTHLY HYDROLOGIC LOSSES FROM  
LAKE LAWNE AS A RESULT OF SURFACE EVAPORATION**

| <b>MONTH</b>  | <b>MEAN MONTHLY<br/>LAKE EVAPORATION<br/>(inches)</b> | <b>HYDROLOGIC<br/>LOSSES<br/>(ac-ft/month)</b> |
|---------------|-------------------------------------------------------|------------------------------------------------|
| January       | 2.43                                                  | 30.0                                           |
| February      | 2.95                                                  | 36.4                                           |
| March         | 4.38                                                  | 54.0                                           |
| April         | 5.32                                                  | 65.6                                           |
| May           | 5.93                                                  | 73.1                                           |
| June          | 5.36                                                  | 66.1                                           |
| July          | 5.30                                                  | 65.4                                           |
| August        | 5.01                                                  | 61.8                                           |
| September     | 4.40                                                  | 54.3                                           |
| October       | 3.86                                                  | 47.6                                           |
| November      | 2.79                                                  | 34.4                                           |
| December      | 2.25                                                  | 27.8                                           |
| <b>TOTAL:</b> | <b>49.98</b>                                          | <b>616</b>                                     |

#### 4.2.2 Deep Aquifer Recharge

In addition to losses through the two drainage wells, a portion of the annual hydrologic inputs to Lake Lawne is lost as a result of downward migration of water in deeper permeable portions of the lake into intermediate aquifer layers. This phenomenon occurs simultaneously with groundwater seepage which is a result of groundwater movement into the lake above the initial confining layer, while deep recharge occurs as a result of permeable connections in deeper portions of the lake to underlying aquifers.

Information on aquifer recharge rates for Lake Lawne was obtained from the SJRWMD GIS recharge map for the Middle St. Johns River Basin. A summary of the recharge map for areas in the vicinity of Lake Lawne is given on Figure 4-8. According to the SJRWMD GIS recharge map, deep recharge to the Floridan Aquifer in the vicinity of Lake Lawne is estimated to be approximately 8-12 inches/year. This implies that a volume equivalent to 8-12 inches over the lake surface would be lost as a result of recharge into deeper aquifers. For purposes of this analysis, a recharge loss of 10 inches/year is assumed for Lake Lawne.

Estimates of annual aquifer recharge losses from Lake Lawne were generated assuming an annual loss of 10 inches/year over the lake surface. A summary of estimated annual volumetric losses from deep recharge in each lake is given in Table 4-13. On an average annual basis, deep recharge removes approximately 123 ac-ft/yr from Lake Lawne.

**TABLE 4-13**

**ESTIMATED ANNUAL DEEP RECHARGE  
LOSSES FROM LAKE LAWNE**

| LAKE       | AREA<br>(acres) | ESTIMATED DEEP RECHARGE LOSS |          |
|------------|-----------------|------------------------------|----------|
|            |                 | inches/year                  | ac-ft/yr |
| Lake Lawne | 148.0           | 10                           | 123      |

#### 4.2.3 Drainage Well / Outfall Discharges

##### 4.2.3.1 Drainage Wells

Lake Lawne contains two drainage wells owned by Orlando and Orange County. As discussed in Section 2.4, the Orange County/Orlando well (W-46) is thought to be currently plugged and does not receive inflow on an active basis. The Orlando well (Well No. 22) is currently active and receives inflows whenever the water level in Lake Lawne exceeds the intake elevation of 86.22 ft (NAVD 88). As indicated on Figure 2-45, water levels routinely exceed the intake elevation and discharges to the drainage well occur on a routine basis.

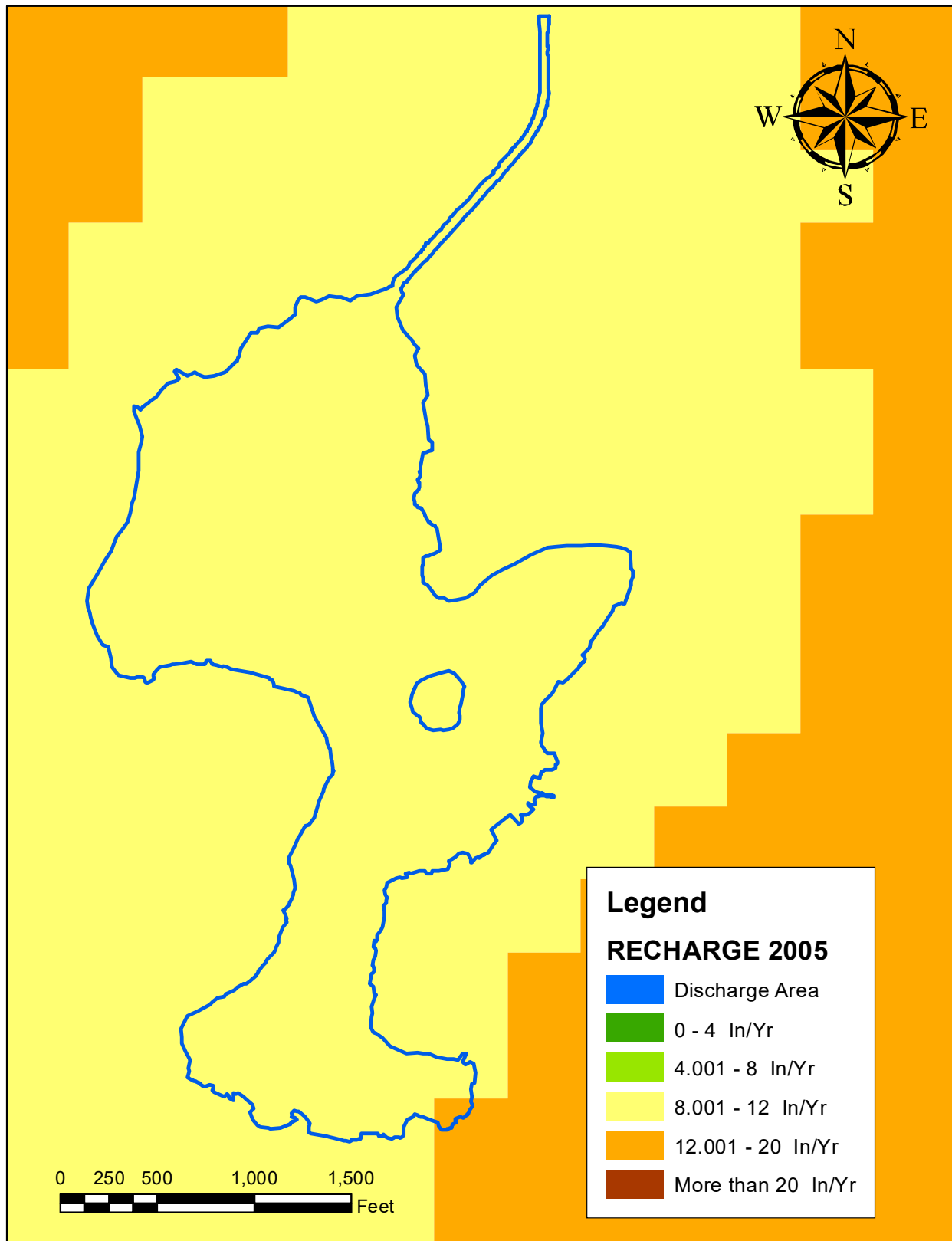


Figure 4-8. Estimated Annual Recharge Rates for Lake Lawne.  
(Source: SJRWMD Recharge Map)

Estimates of discharges to Well No. 22 were calculated using the historical water levels summarized on Figure 2-45 and a standard weir equation. The well intake was modeled as a weir with a length equal to the circumference of the 18-inch intake, equivalent to 4.71 ft. Inflow modeling was conducted for each water level data point over the period from 2000-2013 to reflect current operational conditions, and the calculated inflows were averaged on a monthly basis. A graphical summary of calculated inflows to Well No. 22 from 2000-2013 is given on Figure 4-9.

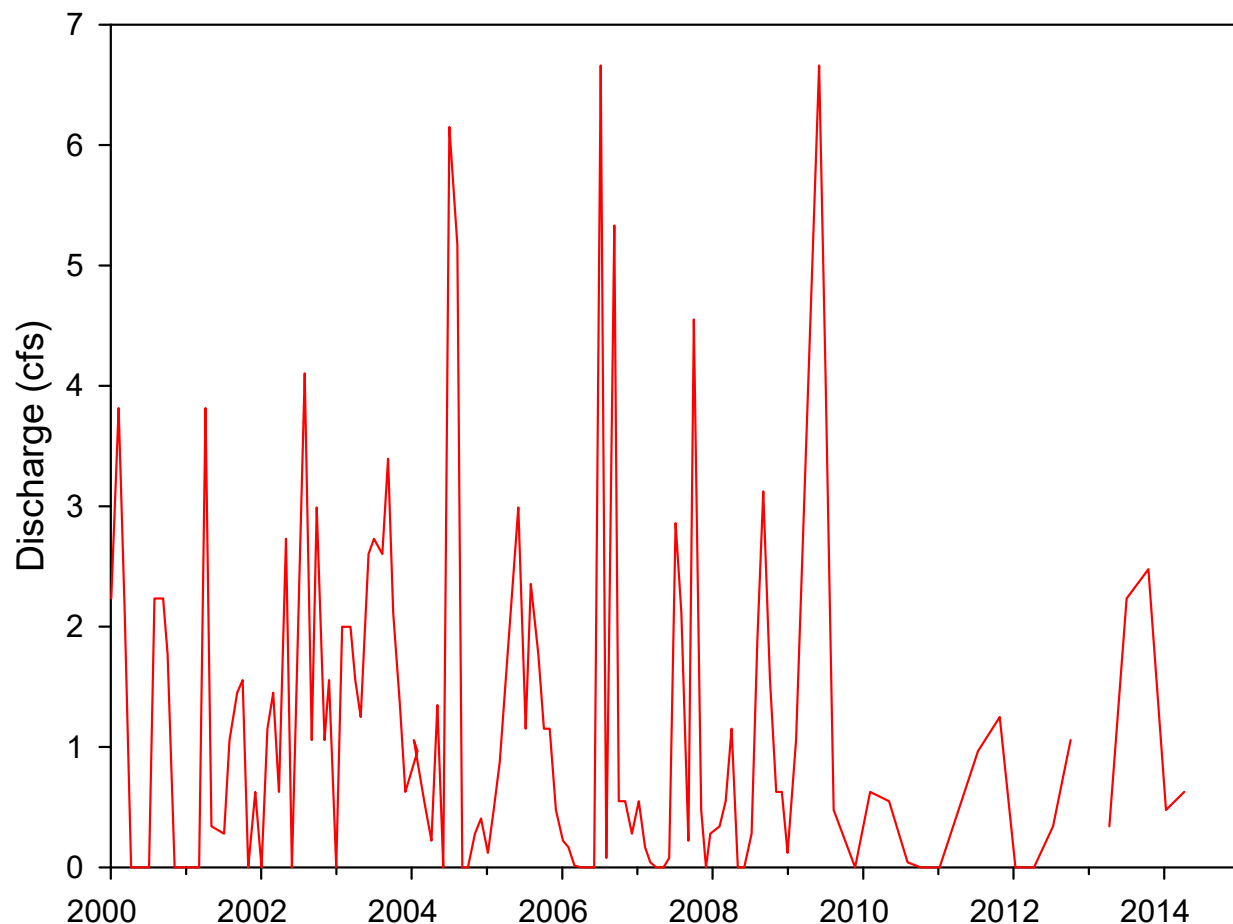


Figure 4-9. Calculated Inflow Rates to Drainage Well No. 22 from 2000-2013.

A tabular summary of mean monthly well inflows from 2000-2013 in terms of cfs and acre-feet is given on Table 4-14. Mean monthly inflow rates range from 0.34 cfs during December to 2.38 cfs during July, corresponding to volumetric inflows of 21.2-146 ac-ft. Overall, an average inflow of 853 ac-ft occurs into the drainage well each year. This value is used in a subsequent section to estimate annual average hydrologic losses for Lake Lawne.



TABLE 4-14

**ESTIMATED MEAN MONTHLY DISCHARGE  
TO DRAINAGE WELL NO. 22 FROM 2000-2013**

| MONTH    | MEAN FLOW (cfs) | MONTHLY VOLUME (ac-ft) | MONTH          | MEAN FLOW (cfs) | MONTHLY VOLUME (ac-ft) |
|----------|-----------------|------------------------|----------------|-----------------|------------------------|
| January  | 0.60            | 37.2                   | July           | 2.38            | 146.1                  |
| February | 1.13            | 63.5                   | August         | 1.88            | 115.9                  |
| March    | 0.75            | 46.3                   | September      | 1.96            | 116.7                  |
| April    | 0.83            | 49.6                   | October        | 1.50            | 92.4                   |
| May      | 0.55            | 34.0                   | November       | 0.64            | 38.1                   |
| June     | 1.54            | 91.7                   | December       | 0.34            | 21.2                   |
|          |                 |                        | <b>Annual:</b> | <b>1.21</b>     | <b>852.7</b>           |

#### 4.2.3.2 Outfall Structure

As indicated on Figure 2-45, water level elevations in Lake Lawne frequently exceed the control elevation of 86.14 ft for the outfall structure, indicating that discharges occur from the lake on a relatively frequent basis. For purposes of this evaluation, outfall discharges are calculated as the difference between inputs to the lake from precipitation, runoff, baseflow, and seepage and losses resulting from evaporation, drainage well losses, and deep recharge according to the following equation:

$$\begin{aligned}
 \text{Outfall Discharges} = & \\
 & (\text{Precipitation} + \text{Runoff Inputs} + \text{Baseflow} + \text{Seepage}) \\
 & - (\text{Evaporation} + \text{Drainage Well Losses} + \text{Recharge})
 \end{aligned}$$

This information is calculated as part of the hydrologic budget summarized in Section 4.3.

### 4.3 Hydrologic Budget

A summary of identified hydrologic inputs to Lake Lawne on an average annual basis is given in Table 4-15. Estimates of hydrologic inputs are provided for direct precipitation, stormwater runoff, direct overland flow, groundwater seepage, and baseflow. A graphical comparison of hydrologic inputs to Lake Lawne is given on Figure 4-10.

**TABLE 4-15****CALCULATED HYDROLOGIC INPUTS TO LAKE LAWNE**

| <b>SOURCE</b>        | <b>ANNUAL INFLOW<br/>(ac-ft/yr)</b> | <b>PERCENT OF TOTAL<br/>(%)</b> |
|----------------------|-------------------------------------|---------------------------------|
| Precipitation        | 617                                 | 15                              |
| Runoff               | 2,248                               | 54                              |
| Direct Overland Flow | 89.5                                | 2                               |
| Groundwater Seepage  | 206                                 | 5                               |
| Baseflow             | 1,020                               | 24                              |
| <b>TOTAL:</b>        | <b>4,181</b>                        | <b>100</b>                      |

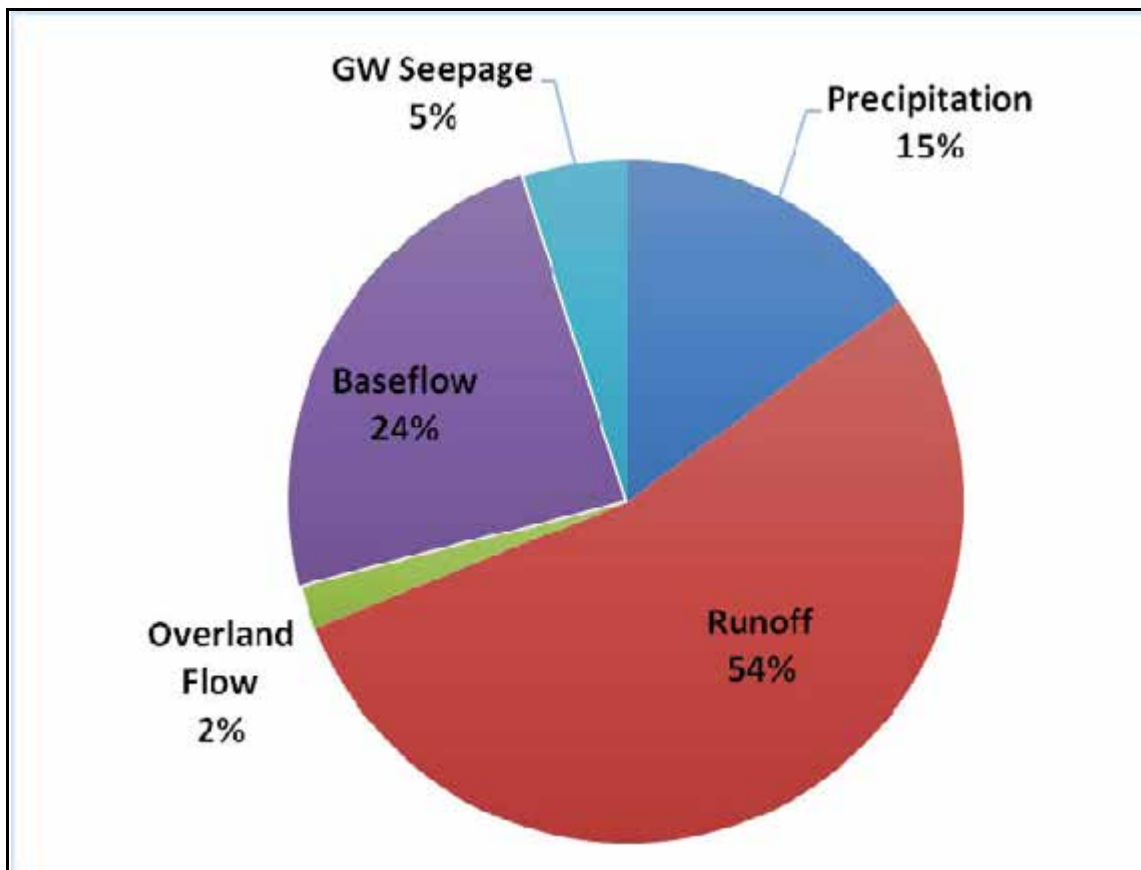


Figure 4-10. Summary of Mean Annual Hydrologic Inputs to Lake Lawne.

The largest annual hydrologic input to Lake Lawne is runoff which contributes 54% of the total annual hydrologic inputs to the lake. Approximately 24% of the average annual hydrologic inputs originate as a result of baseflow, while direct precipitation contributes approximately 15%. Groundwater seepage contributes approximately 5% of the annual hydrologic inputs, with 2% contributed by direct overland flow. On an average annual basis, approximately 4,181 ac-ft of water enters Lake Lawne each year.

A summary of mean annual hydrologic losses from Lake Lawne is given in Table 4-16. Approximately 62% of the annual hydrologic inputs are discharged through the outfall structure, with 20% of the average annual hydrologic inputs lost to the drainage well, 15% to evaporation, and 3% lost as deep recharge to underground aquifers. A graphical comparison of mean annual hydrologic losses for Lake Lawne is given on Figure 4-11.

**TABLE 4-16**  
**CALCULATED HYDROLOGIC**  
**LOSSES FROM LAKE LAWNE**

| <b>SOURCE</b>     | <b>ANNUAL LOSSES<br/>(ac-ft/yr)</b> | <b>PERCENT OF TOTAL<br/>(%)</b> |
|-------------------|-------------------------------------|---------------------------------|
| Evaporation       | 616                                 | 15                              |
| Deep Recharge     | 123                                 | 3                               |
| Outfall Structure | 2,589                               | 62                              |
| Drainage Well     | 853                                 | 20                              |
| <b>TOTAL:</b>     | <b>4,181</b>                        | <b>100</b>                      |

In addition to field monitoring conducted at the canal inflows to Lake Lawne, monitoring of discharge rates was also conducted at the outfall structure to provide estimates of discharge rates leaving Lake Lawne. Field monitoring at this site was conducted downstream from the outfall structure so that all discharges from the outfall structure would be included in the field measurement. A summary of field measured discharges from Lake Lawne at the outfall structure from July 2011-April 2012 is given on Table 4-17. Measured discharge rates ranged from 0-12.8 cfs during the field monitoring program, with an overall average discharge of 4.37 cfs. If this average discharge rate is extrapolated over an annual period, the corresponding annual volumetric discharge would be 3,164 ac-ft/yr. This value is within 18% of the estimated annual hydrologic loss of 2,589 ac-ft from the outfall structure summarized in Table 4-16, indicating close agreement between the estimated and measured discharges through the outfall structure which provides a level of confidence in the overall hydrologic budget.

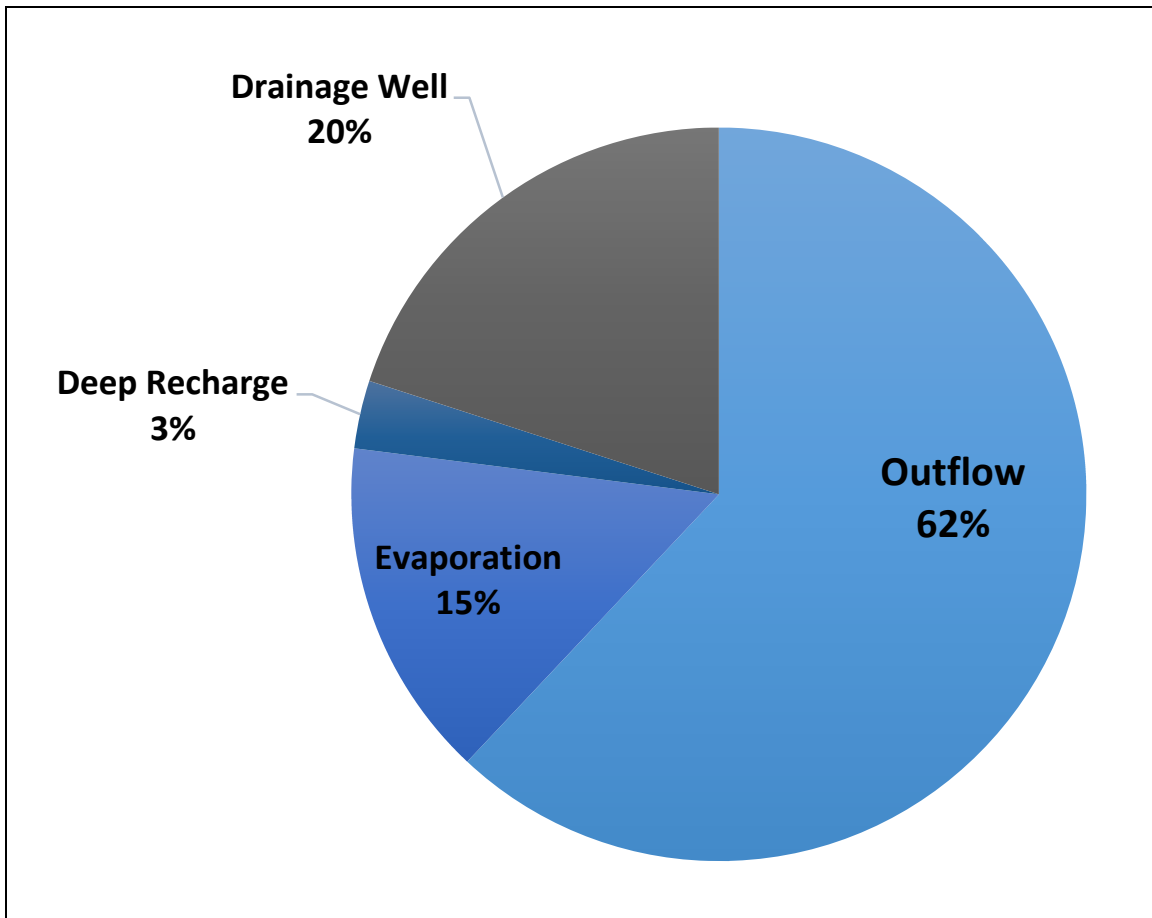


Figure 4-11. Summary of Mean Annual Hydrologic Losses from Lake Lawne.

**TABLE 4-17**

**MEASURED DISCHARGES FROM LAKE LAWNE AT  
THE OUTFALL STRUCTURE FROM JULY 2011-APRIL 2012**

| DATE     | OUTFALL<br>(cfs) | DATE            | OUTFALL<br>(cfs) |
|----------|------------------|-----------------|------------------|
| 7/25/11  | 5.57             | 11/30/11        | 1.26             |
| 8/8/11   | 12.83            | 12/14/11        | 2.92             |
| 8/23/11  | 5.89             | 1/19/12         | 0                |
| 9/6/11   | 2.97             | 3/19/12         | 0                |
| 10/6/11  | 5.79             | 4/11/12         | 0                |
| 10/17/11 | 11.3             | <b>Average</b>  | <b>4.37</b>      |
| 11/7/11  | 3.89             | <b>Ac-ft/yr</b> | <b>3,164</b>     |



#### **4.4 Water Residence Time**

The mean annual water residence time was calculated for Lake Lawne by dividing the estimated water volume for the lake (summarized in Table 2-1) by the calculated mean annual hydrologic inputs (summarized in Table 4-14). A summary of this information is given in Table 4-18. Based upon this analysis, the calculated residence time in Lake Lawne is approximately 81 days. The observed residence time in Lake Lawne is approximately half of the residence times commonly observed in urban lakes in the Central Florida area.

**TABLE 4-18**  
**CALCULATED MEAN ANNUAL**  
**RESIDENCE TIMES IN LAKE LAWNE**

| <b>LAKE VOLUME<br/>(ac-ft)</b> | <b>ANNUAL INFLOW<br/>(ac-ft/yr)</b> | <b>MEAN RESIDENCE TIME<br/>(days)</b> |
|--------------------------------|-------------------------------------|---------------------------------------|
| 932                            | 4,181                               | 81                                    |

## SECTION 5

### NUTRIENT INPUTS AND LOSSES

Lake Lawne receives nutrient inputs from a variety of sources which include bulk precipitation, stormwater runoff, baseflow, shallow groundwater seepage, and internal recycling. Characteristics of stormwater/baseflow and groundwater seepage were measured directly by ERD during the period from January 2011-February 2012. A discussion of these inputs, along with calculated mass loadings, is given in the following sections. Nutrient inputs from bulk precipitation are estimated based upon previous monitoring of bulk precipitation performed by ERD in the Central Florida area. Information from each of these sources is used to generate average annual nutrient budgets for total nitrogen, total phosphorus and TSS for the lake. A conceptual schematic of evaluated nutrient sources and sinks in Lake Lawne is given in Figure 5-1.

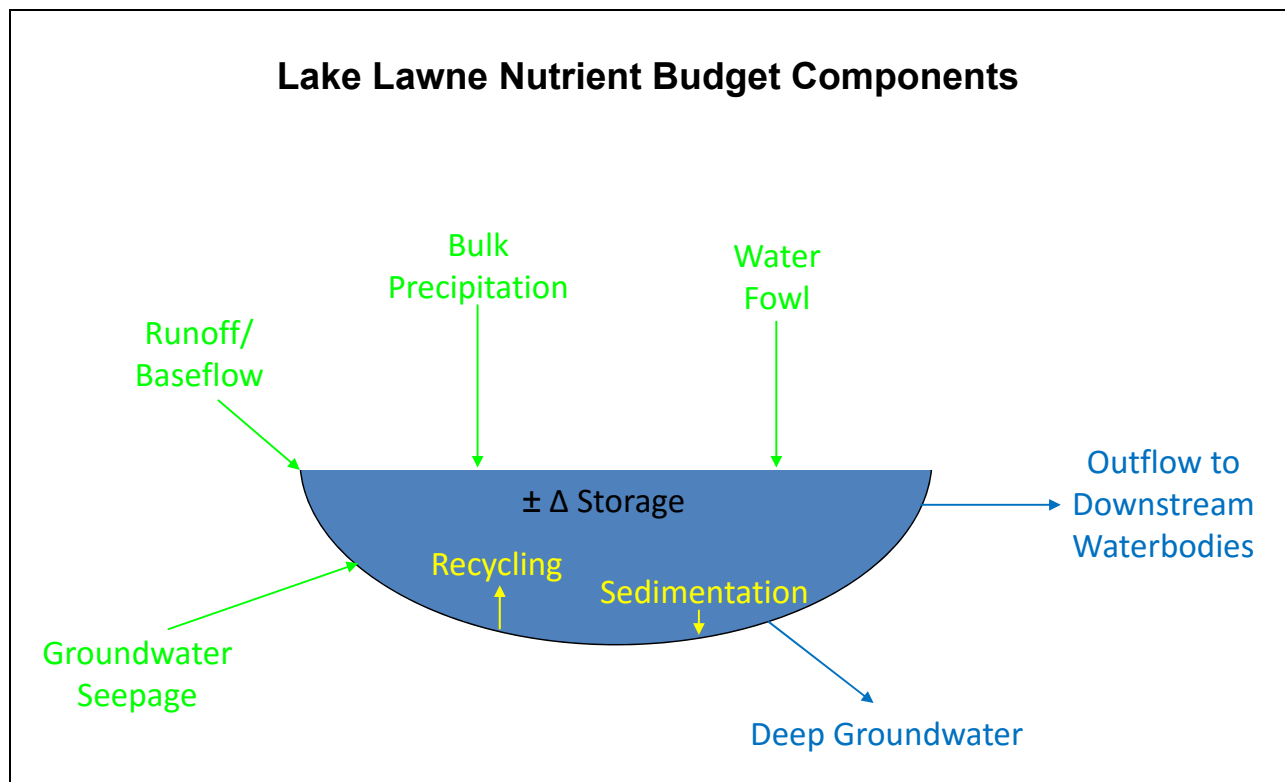


Figure 5-1. Conceptual Schematic of Evaluated Nutrient Inputs and Losses for Lake Lawne.

## 5.1 Characteristics of Nutrient Inputs

### 5.1.1 Bulk Precipitation

#### 5.1.1.1 Chemical Characteristics

ERD has performed several evaluations of the characteristics of bulk precipitation in the Central Florida area. The most recent of these evaluations was conducted as part of the Butler Chain-of-Lakes evaluation. Bulk precipitation samples were collected by ERD on a continuous basis from December 2004-November 2005 at a monitoring site located adjacent to the Keene's Point boat ramp on Lake Isleworth. Twenty-nine bulk precipitation samples were collected at the monitoring site and analyzed for general parameters, nutrients, and TSS. A summary of the mean characteristics of measured concentrations for nitrogen, phosphorus, and TSS in bulk precipitation at the Butler Chain-of-Lakes monitoring site is given in Table 5-1. For purposes of this evaluation, it is assumed that the bulk precipitation characteristics summarized in Table 5-1 are similar to bulk precipitation which falls on Lake Lawne.

**TABLE 5-1**  
**MEAN CHARACTERISTICS OF BULK**  
**PRECIPITATION IN THE CENTRAL FLORIDA AREA**

| PARAMETER  | UNITS | CONCENTRATION |
|------------|-------|---------------|
| Nitrogen   | µg/l  | 770           |
| Phosphorus | µg/l  | 61            |
| TSS        | mg/l  | 17.3          |

#### 5.1.1.2 Mass Loadings

Estimates of annual mass loadings from bulk precipitation to Lake Lawne were calculated for total nitrogen, total phosphorus, and TSS based upon the assumed characteristics listed in Table 5-1 and the estimated annual volumetric input from direct precipitation of 617 ac-ft/yr listed on Table 4-2. A summary of estimated loadings to Lake Lawne from bulk precipitation is given in Table 5-2. On an average annual basis, inputs from bulk precipitation contribute approximately 586 kg of total nitrogen, 46.4 kg of total phosphorus, and 13,165 kg of TSS.

TABLE 5-2

**ESTIMATED LOADINGS TO LAKE  
LAWNE FROM BULK PRECIPITATION**

| PARAMETER | MASS LOADINGS<br>(kg/yr) |
|-----------|--------------------------|
| Total N   | 586                      |
| Total P   | 46.4                     |
| TSS       | 13,165                   |

## **5.1.2 Stormwater Runoff / Baseflow**

### **5.1.2.1 Field Monitoring Program**

A field monitoring program was conducted by ERD from July 2011-April 2012 to generate runoff and baseflow characterization data for significant inflows into Lake Lawne. This monitoring was conducted to obtain site-specific runoff characteristics for discharges into the lake to increase the accuracy of the runoff and baseflow loading calculations rather than using standard literature-based values. Field monitoring was conducted at each of the eight secondary canals discharging to Lake Lawne, indicated on Figure 4-6. Each of the monitoring sites was located immediately upstream from the point of inflow into Lake Lawne at a location most conducive to field monitoring. Surface water samples were collected at each canal site simultaneously with flow measurements, and the collected samples were returned to the ERD Laboratory for analysis of each of the surface water parameters outlined in Table 2-11 with the exception of chlorophyll-a. In some instances, a surface water sample may have been collected in a canal system when the depth of flow was too shallow to allow adequate measurement of discharge. Samples collected from each of the eight canals are thought to represent the combined inflows from stormwater and baseflow. A discussion of monitoring locations in each of the canal systems is given in the following sections.

#### **5.1.2.1.1 Canals C-1 and C-2**

An overview of inflow monitoring sites for Canals C-1 and C-2 is given on Figure 5-2. Monitoring for each of these canals was conducted approximately 100 ft upstream from the point of inflow into the lake at a location conducive for flow measurements.

An overview of conditions in the C-1 Canal is given on Figure 5-3. The C-1 Canal provides drainage for a 1,281.8-acre drainage basin which comprises 44.6% of the overall drainage basin discharging to Lake Lawne. The C-1 Canal receives discharges from an extensive system of canals and conveyance systems which ultimately discharge into Lake Lawne and maintained a constant discharge throughout much of the field monitoring program which consisted of both runoff and baseflow. Much of the C-1 Canal system is cut deep into the ground which encourages inflow and collection of groundwater which contributes to the baseflow loadings.



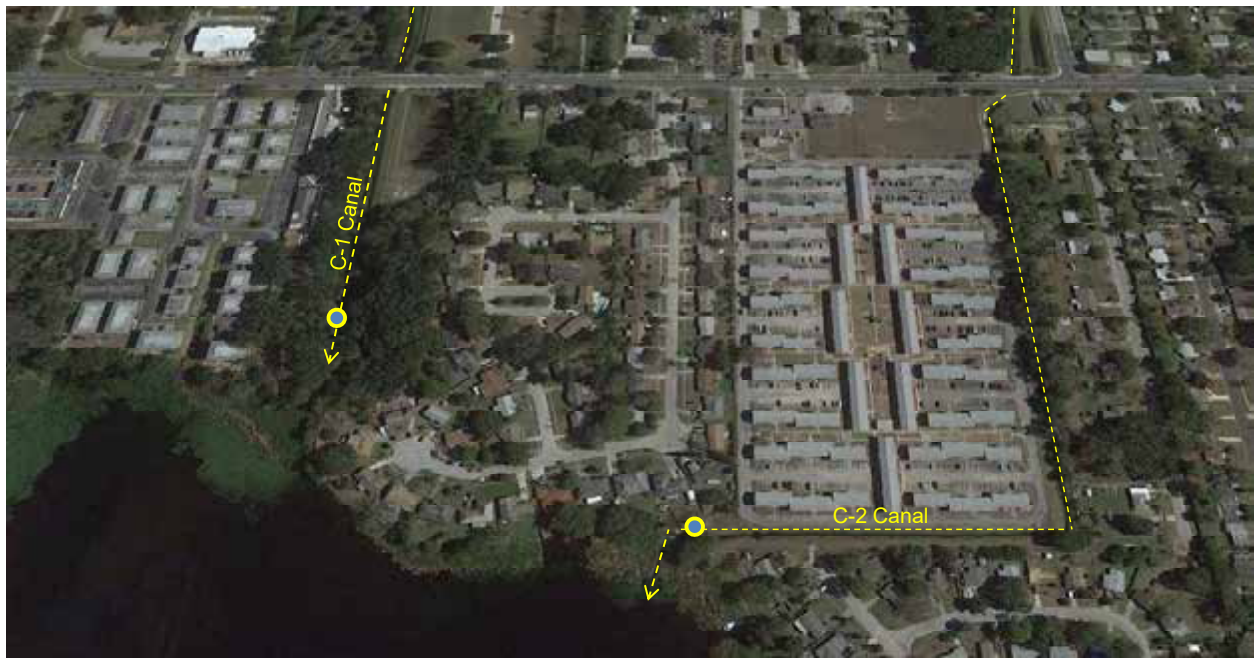


Figure 5-2. Overview of Inflow Monitoring Sites 1 and 2.



Canal at Mercy Drive



Typical canal conditions



C-1 Canal discharge to lake

Figure 5-3. Overview of Conditions in the C-1 Canal.

An overview of conditions in the C-2 Canal is given on Figure 5-4. The C-2 Canal drains an area of approximately 411.2 acres and comprises the second largest drainage basin discharging to Lake Lawne. The C-2 Canal also consists of an extensive system of channels, ponds, and conveyance systems which ultimately discharges into the east side of Lake Lawne. Much of the canal is cut approximately 8-10 ft into the existing landscape which contributes to interception of groundwater and maintains a relatively constant baseflow throughout the year. Even during extended dry season conditions, portions of the C-2 Canal still maintained standing water, although measurable discharge did not occur.



Dry season conditions



Typical baseflow conditions

Figure 5-4. Overview of Conditions in the C-2 Canal.

#### **5.1.2.1.2 Canals C-3, C-4, and C-5**

An overview of inflow monitoring sites 3, 4, and 5 is given on Figure 5-5. The C-3 Canal provides drainage for a relatively small drainage basin of 36.4 acres which consists primarily of pervious and impervious areas associated with the Central Florida Fairgrounds. The canal cut is relatively shallow, and in many places resembles a swale rather than a canal. Due to extensive infiltration of rainfall into the permeable soils within this sub-basin, runoff discharges only occur during relatively significant rain events. No measurable baseflow was observed at this site during any of the field monitoring events.

An overview of conditions in the C-4 Canal near the point of inflow into Lake Lawne is given on Figure 5-6. The C-4 Canal consists of an earthen channel which is cut approximately 5-6 ft into the existing landscape. This canal provides drainage for approximately 81.6 acres consisting of pervious parking areas associated with the Central Florida Fairgrounds and commercial areas south of Colonial Drive. Discharges caused by interception of groundwater and gradual drawdown of stormwater management systems was observed throughout much of the field monitoring program. Field monitoring at this site was conducted at the 60-inch culvert indicated on Figure 5-6.





Figure 5-5. Overview of Inflow Monitoring Sites 3, 4, and 5.



C-4 Canal upstream from lake



C-4 Canal inflow to lake

Figure 5-6. Overview of Conditions in the C-4 Canal.

An overview of conditions in the C-5 Canal near the point of inflow into Lake Lawne is given on Figure 5-7. The C-5 Canal provides drainage for an area of approximately 143.4 acres, consisting of a combination of park areas and commercial properties on the north and south sides of Colonial Drive. Measurable discharges through this canal system were measured on an infrequent basis, indicating that much of the generated runoff and baseflow is attenuated prior to reaching Lake Lawne.



C-5 Canal upstream from lake



C-5 Canal inflow to lake

Figure 5-7. Overview of Conditions in the C-5 Canal.

#### **5.1.2.1.3 Canals C-6 and C-7**

An overview of inflow monitoring sites 6 and 7 is given on Figure 5-8. The C-6 Canal provides drainage for a large sub-basin area of approximately 309.9 acres, while the C-7 Canal contains approximately 123.6 acres. Each of these drainage basins contains multiple wet ponds and lakes which provide attenuation and pre-treatment for runoff prior to discharging into Lake Lawne. An overview of conditions in the C-6 Canal is given on Figure 5-9, with conditions in the C-7 Canal provided on Figure 5-10.

Each of these canals are cut deep into the landscape, particularly in upper portions of the watersheds, and maintained standing water and measurable discharges throughout most of the field monitoring program. The pond, indicated on Figure 5-8, which intercepts the C-7 Canal is a wet detention pond recently constructed by Orange County to reduce loadings from the drainage basin before discharging into Lake Lawne. The watershed soils in the basin areas for Canals C-6 and C-7 are highly permeable, and a large portion of the rainfall infiltrates into the soils and becomes baseflow.





Figure 5-8. Overview of Inflow Monitoring Sites 6 and 7.



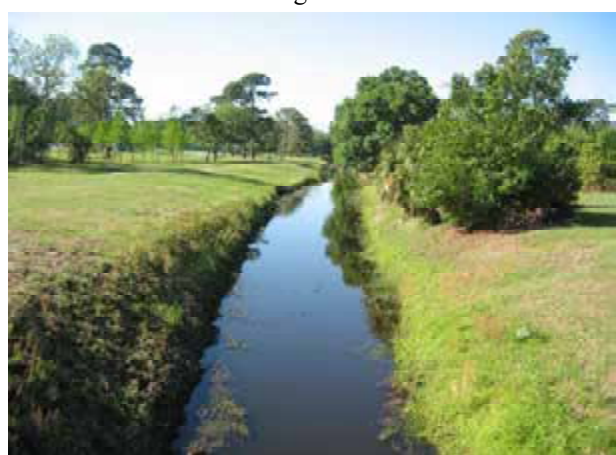
Upstream portions of C-6 Canal



Culvert crossing at Delores Drive



Canal downstream from pedestrian bridge



Downstream portion of C-6 Canal

Figure 5-9. Overview of Conditions in the C-6 Canal.



C-7 Canal wet detention pond



Pond discharge to C-7 Canal



C-7 Canal downstream from pond outfall



C-7 Canal discharge into wetlands

Figure 5-10. Overview of Conditions in the C-7 Canal.

#### 5.1.2.1.4 C-8 Canal and Outfall Canal

An overview of the C-8 Canal and Outfall Canal monitoring sites is given on Figure 5-11. The C-8 Canal provides drainage for a sub-basin area of approximately 105.2 acres consisting primarily of single-family homes. Due to the highly permeable soils within the watershed, the vast majority of rainfall infiltrates into the ground and discharges through C-8 Canal at a slow controlled rate. An overview of conditions in the C-8 Canal near the point of inflow into Lake Lawne is given on Figure 5-12. Low level discharges were observed from the C-8 Canal throughout the entire field monitoring program.

Field monitoring of discharge and collection of surface water samples was also conducted approximately 50 ft downstream from the outfall canal control structure. Discharges from Lake Lawne through the Outfall Canal were observed during 9 of the 12 field monitoring events conducted at this site. Photographs of the outfall structure are provided in Figure 2-44.



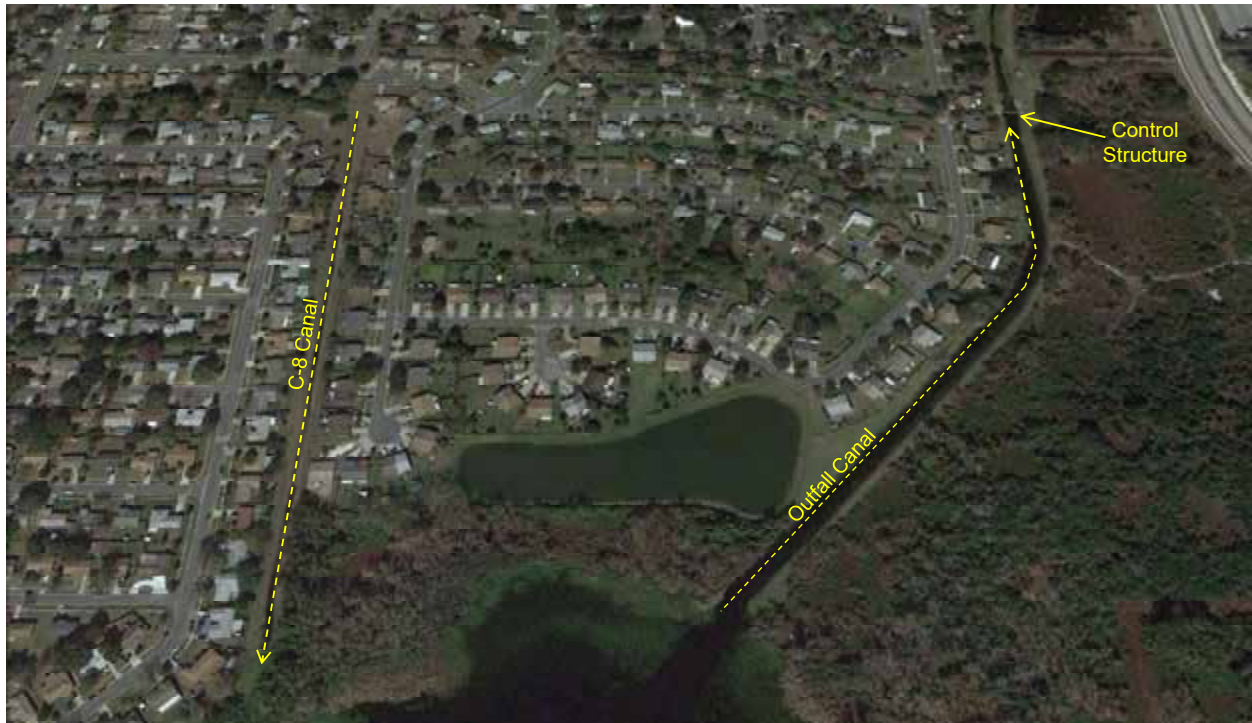


Figure 5-11. Overview of the C-8 Canal and Outfall Canal Monitoring Sites.



Typical conditions in C-8 Canal



C-8 Canal inflow to lake

Figure 5-12. Overview of Conditions in the C-8 Canal.

### 5.1.2.2 Characteristics of Monitored Inflow Samples

Field monitoring was conducted at each of the eight secondary canals and downstream of the water control structure over the period from July 2011-April 2012 on a biweekly to monthly basis. A summary of the number of samples collected at each monitoring site during the field monitoring program is given on Figure 5-13. The number of samples collected at each of the inflow monitoring sites ranged from 0 (C-3 Canal) to 17 (C-6 Canal), with an overall total of 88 inflow samples collected during the field monitoring program.

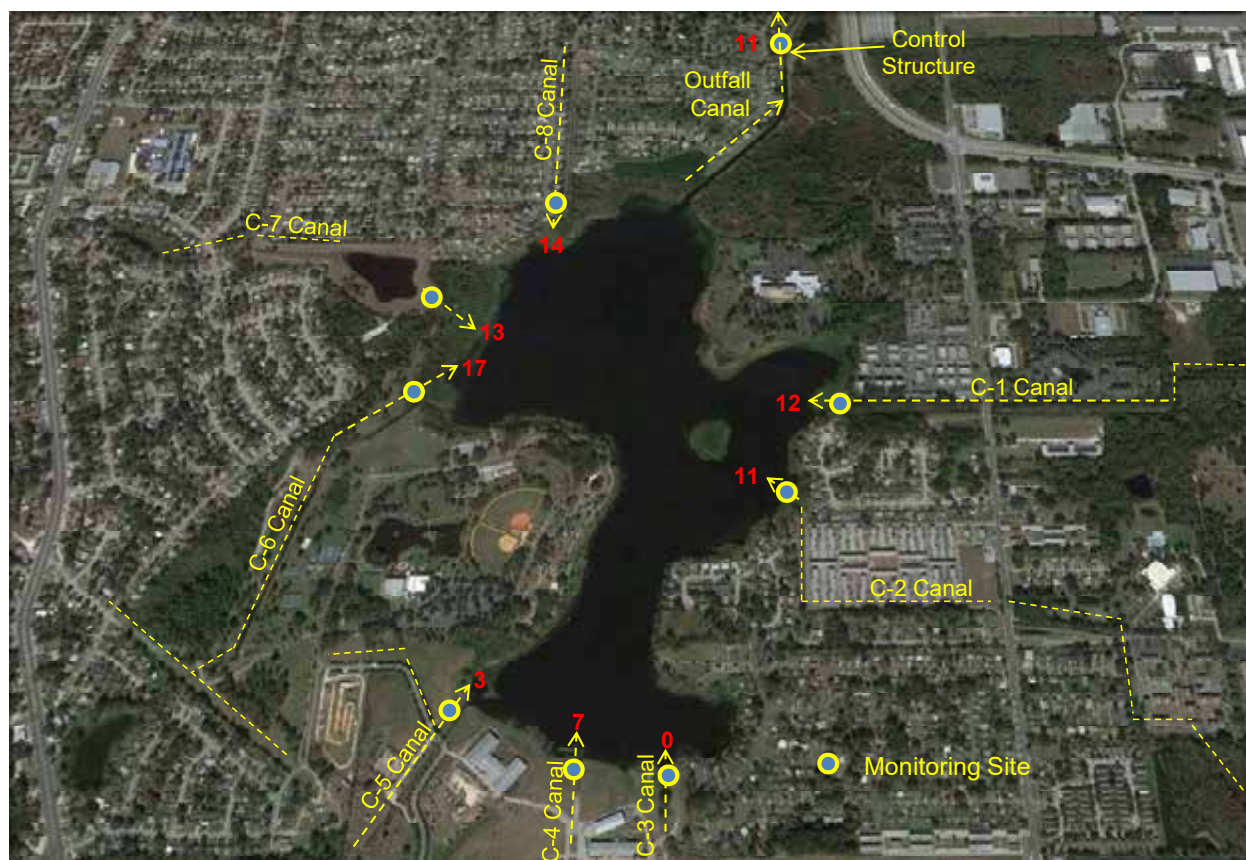


Figure 5-13. Number of Inflow Samples per Site.

Each of the collected samples was returned to the ERD Laboratory and analyzed for general parameters and nutrients. A complete listing of the results of laboratory analyses conducted on the inflow samples is given in Appendix E.

A tabular summary of mean chemical characteristics of inflow samples collected in the Lake Lawne drainage basin is given on Table 5-3. The values summarized in this table reflect the log-normal or geometric mean of the data since the data exhibit a log-normal distribution.



**TABLE 5-3**  
**MEAN CHARACTERISTICS OF INFLOWS**  
**FROM THE SECONDARY CANALS INTO LAKE LAWNE**

| SITE<br>(CANAL) | PARAMETER    |                      |                           |                   |                              |                           |                         |                   |               |                           |                         |                   |                    |                  |               |
|-----------------|--------------|----------------------|---------------------------|-------------------|------------------------------|---------------------------|-------------------------|-------------------|---------------|---------------------------|-------------------------|-------------------|--------------------|------------------|---------------|
|                 | pH<br>(s.u.) | Alkalinity<br>(mg/l) | Conductivity<br>(µmho/cm) | Ammonia<br>(µg/l) | NO <sub>x</sub> -N<br>(µg/l) | Diss. Organic N<br>(µg/l) | Particulate N<br>(µg/l) | Total N<br>(µg/l) | SRP<br>(µg/l) | Diss. Organic P<br>(µg/l) | Particulate P<br>(µg/l) | Total P<br>(µg/l) | Turbidity<br>(NTU) | Color<br>(Pt-Co) | TSS<br>(mg/l) |
| C-1             | 6.74         | 76.9                 | 244                       | 110               | 80                           | 434                       | 85                      | 955               | 14            | 14                        | 16                      | 52                | 3.1                | 268              | 3.0           |
| C-2             | 6.64         | 46.9                 | 208                       | 160               | 99                           | 181                       | 147                     | 665               | 37            | 17                        | 12                      | 75                | 3.3                | 154              | 1.5           |
| C-4             | 6.59         | 106                  | 277                       | 64                | 40                           | 267                       | 164                     | 665               | 34            | 5                         | 37                      | 80                | 2.3                | 43               | 1.4           |
| C-5             | 6.77         | 107                  | 280                       | 124               | 85                           | 224                       | 394                     | 1,040             | 12            | 7                         | 42                      | 64                | 2.6                | 42               | 3.3           |
| C-6             | 6.09         | 31.2                 | 171                       | 76                | 33                           | 275                       | 163                     | 645               | 6             | 13                        | 35                      | 62                | 3.1                | 54               | 3.7           |
| C-7             | 6.63         | 56.6                 | 171                       | 132               | 21                           | 400                       | 302                     | 969               | 7             | 11                        | 33                      | 69                | 5.1                | 120              | 3.7           |
| C-8             | 7.34         | 72.2                 | 172                       | 55                | 14                           | 142                       | 100                     | 465               | 15            | 6                         | 11                      | 37                | 1.6                | 48               | 1.8           |
| Outfall         | 6.84         | 61.2                 | 163                       | 42                | 9                            | 295                       | 234                     | 789               | 3             | 6                         | 39                      | 54                | 4.2                | 65               | 5.2           |

Mean measured pH values in the Lake Lawne inflow samples were approximately neutral and relatively similar in value, with mean pH values ranging from 6.09-7.34. Inflow samples to Lake Lawne were poorly to well buffered, with mean alkalinity values ranging from 31.2-107 mg/l. Measured alkalinity values at Canals C-4 and C-5 were substantially higher in value than concentrations measured at the remaining sites. Measured conductivity values were low to moderate in value at all sites, ranging from 163-280 µmho/cm. In general, these values are on the lower end of conductivity values commonly observed in urban runoff.

Measured nitrogen concentrations in the canal samples were generally moderate to low in value. Relatively low concentrations of ammonia were measured at each of the monitoring sites, with overall mean values ranging from 42-160 µg/l. Low concentrations of NO<sub>x</sub> were also measured, with mean concentrations ranging from 9-99 µg/l. The lowest mean concentrations for both ammonia and NO<sub>x</sub> were measured in the outfall samples, indicating that inorganic nitrogen was removed within the lake. The dominant nitrogen species at each of the canal monitoring sites appear to be dissolved organic nitrogen and particulate nitrogen which comprise approximately 50% or more of the total nitrogen measured at each site. Overall mean concentrations of total nitrogen at the canal monitoring sites ranged from 465 µg/l in the C-8 Canal to 1,040 µg/l in C-5 Canal.

Low levels of SRP were observed entering Lake Lawne from each of the canal monitoring sites, with overall mean values ranging from 3-37 µg/l. Measured concentrations of dissolved organic phosphorus were also generally low in value and similar to concentrations observed for SRP at many sites. Overall mean concentrations for dissolved organic phosphorus ranged from 5-17 µg/l. Particulate phosphorus appears to be the dominant phosphorus species at many of the canal monitoring sites, with the exception of Canals C-2 and C-8 where SRP represents the dominant phosphorus species present. Overall, mean total phosphorus concentrations for the canal inflows were extremely low in value compared with concentrations commonly observed in urban runoff. Mean total phosphorus concentrations at the monitoring sites ranged from 37-80 µg/l.

Low levels of both turbidity and TSS were observed at each of the inflow monitoring sites. The observed low concentrations for these parameters are due to the significant attenuation and filtering processes which are present throughout the canal drainage system. Measured color concentrations for the inflow canals were highly variable, with elevated color concentrations observed in discharges from Canals C-1, C-2, and C-7, each of which contain significant areas of wetlands within the overall drainage basin. Measured color concentrations at the remaining sites were relatively similar in value, ranging from 42-65 Pt-Co units.

A statistical summary of general parameters measured in inflow samples at Lake Lawne is given in Figure 5-14. A graphical summary of laboratory data is presented in the form of Tukey box plots, also often called "box and whisker plots". The bottom of the box portion of each plot represents the lower quartile, with 25% of the data points lying below this value. The upper line of the box represents the 75% upper quartile, with 25% of the data lying above this value. The blue horizontal line within the box represents the median value, with 50% of the data lying both above and below this value, while the red horizontal line represents the mean value. The vertical lines, also known as "whiskers", represent the 10 and 90 percentiles for the data sets. Individual values which lie outside of the 10-90 percentile range are indicated as red dots.

As seen on Figure 5-14, measured pH values were relatively similar at each of the canal monitoring sites, with the exceptions of the C-6 Canal (which exhibited a slightly lower range of pH values) and the C-8 Canal (which exhibited a somewhat higher range of pH values). Measured alkalinity values in the canal discharges were highly variable, both in terms of measured values as well as the range of measured values. The highest measured alkalinity values were observed in discharges from Canals C-4 and C-5, with the lowest alkalinity values observed in discharges from the C-6 Canal. Measured conductivity values appear to be relatively similar at each of the canal monitoring sites with the exceptions of Canals C-4 and C-5 where somewhat higher measured conductivity values were observed. Each of these basins contains significant commercial land use activities which may be responsible for the observed increases in conductivity. Measured concentrations of TSS were also relatively similar in value with the exceptions of the C-7 Canal and the Outfall Canal where somewhat higher TSS values were observed. A high degree of variability was observed in measured TSS values at the C-7 Canal which reflects discharges from the recently constructed wet detention pond. Some of this variability may be due to the unstabilized canal banks downstream from the pond which were present during early portions of the field monitoring program.

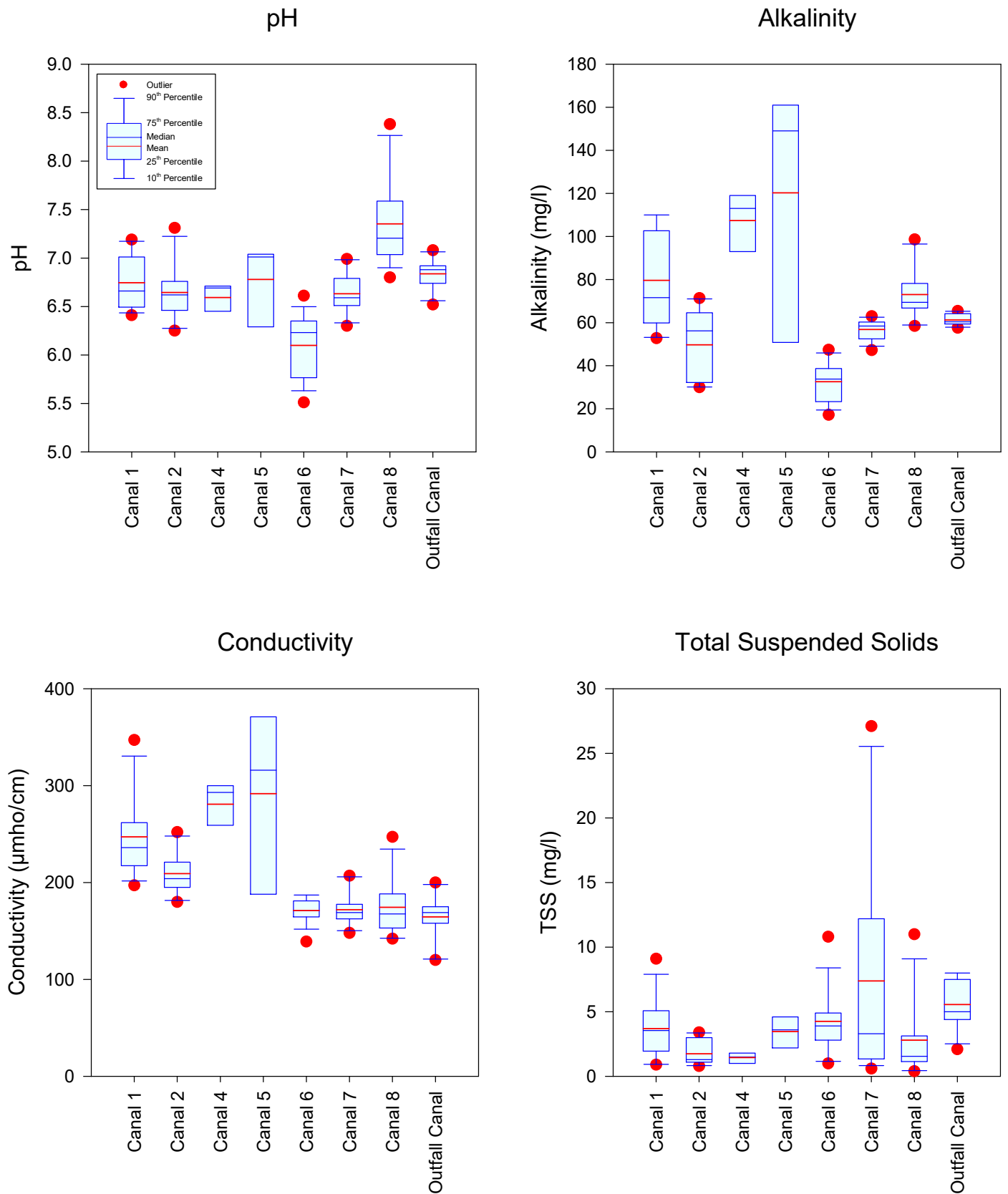


Figure 5-14. Statistical Summary of General Parameters Measured in Canal Inflows to Lake Lawne.

A statistical summary of measured concentrations of nitrogen species in canal inflow samples collected at each of the monitoring sites is given on Figure 5-15. Mean ammonia concentrations appear to be relatively similar in value at each of the monitoring sites, although somewhat elevated ammonia concentrations were observed on at least one occasion in Canals C-1, C-2, C-7, C-8, and in the Outfall Canal. A relatively high degree of variability was observed in measured  $\text{NO}_x$  concentrations, particularly at Canals C-1, C-2, and C-5, with a substantially lower degree of variability in Canals C-4, C-6, C-7, C-8, and the Outfall Canal. A relatively high degree of variability was observed in measured concentrations of particulate nitrogen, particularly in Canals C-5, C-7, and the Outfall Canal, with a relatively low degree of variability observed in particulate nitrogen concentrations at the remaining sites. Overall, measured total nitrogen concentrations were generally low in value at each of the monitoring sites, with the most elevated total nitrogen concentrations observed in inflows from the C-1 Canal and the lowest concentrations observed in inflows from the C-8 Canal.

A statistical summary of measured concentrations of phosphorus species in inflow samples collected at each of the monitoring sites is given on Figure 5-16. Relatively low levels of SRP were observed at each of the inflow monitoring sites, with the possible exceptions of Canals C-2 and C-4 where slightly more elevated concentrations were observed. Measured concentrations of dissolved organic phosphorus were relatively similar at each of the monitoring sites, with the possible exceptions of Canals C-1 and C-2 where more elevated concentrations were observed. Low concentrations of particulate phosphorus were observed at most of the canal inflow sites, with the lowest concentrations observed in Canals C-1, C-2, and C-8, and more elevated concentrations at the remaining sites. Overall, total phosphorus concentrations were relatively similar between the monitoring sites, with mean values substantially lower than commonly observed in untreated urban runoff. The substantial attenuation and uptake mechanisms present in the watershed areas for each of the canals appears to be providing significant removal for phosphorus prior to discharge into Lake Lawne.

A statistical summary of measured concentrations of turbidity and color in inflow samples collected at each of the inflow monitoring sites is given on Figure 5-17. Measured turbidity concentrations were relatively similar at each of the canal monitoring sites, with the exceptions of the C-7 Canal and the Outfall Canal. Turbidity concentrations in the C-7 Canal discharges exhibited a high degree of variability in measured values. In general, measured color concentrations were generally low in value in each of the inflow sites, with the exceptions of Canals C-1, C-2, and C-7 where more elevated concentrations were observed. The most elevated concentrations of color occurred in discharges from the C-1 Canal, presumably due to the extensive wetland system present within the drainage basin.



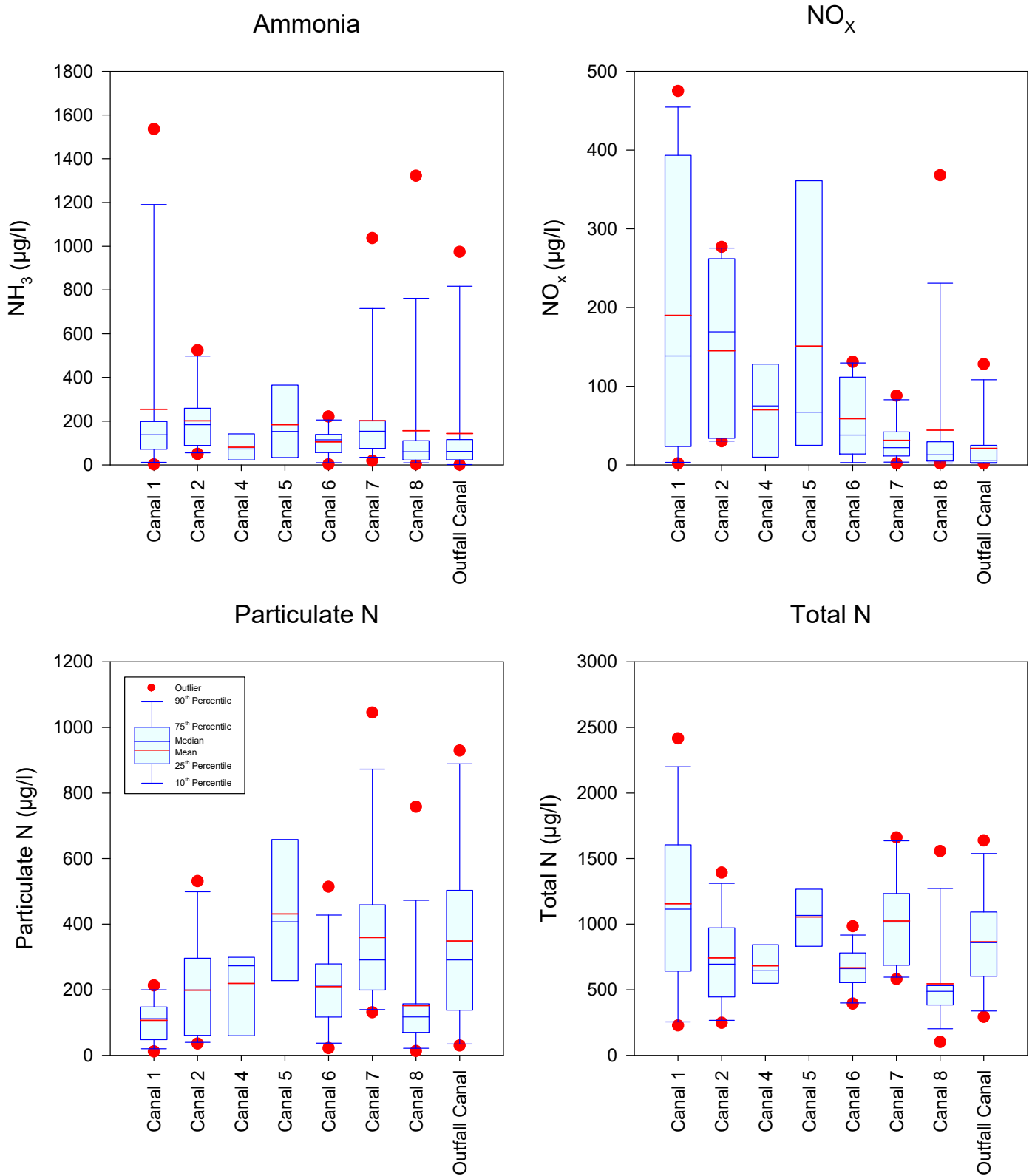


Figure 5-15. Statistical Summary of Nitrogen Species Measured in Canal Inflows to Lake Lawne.

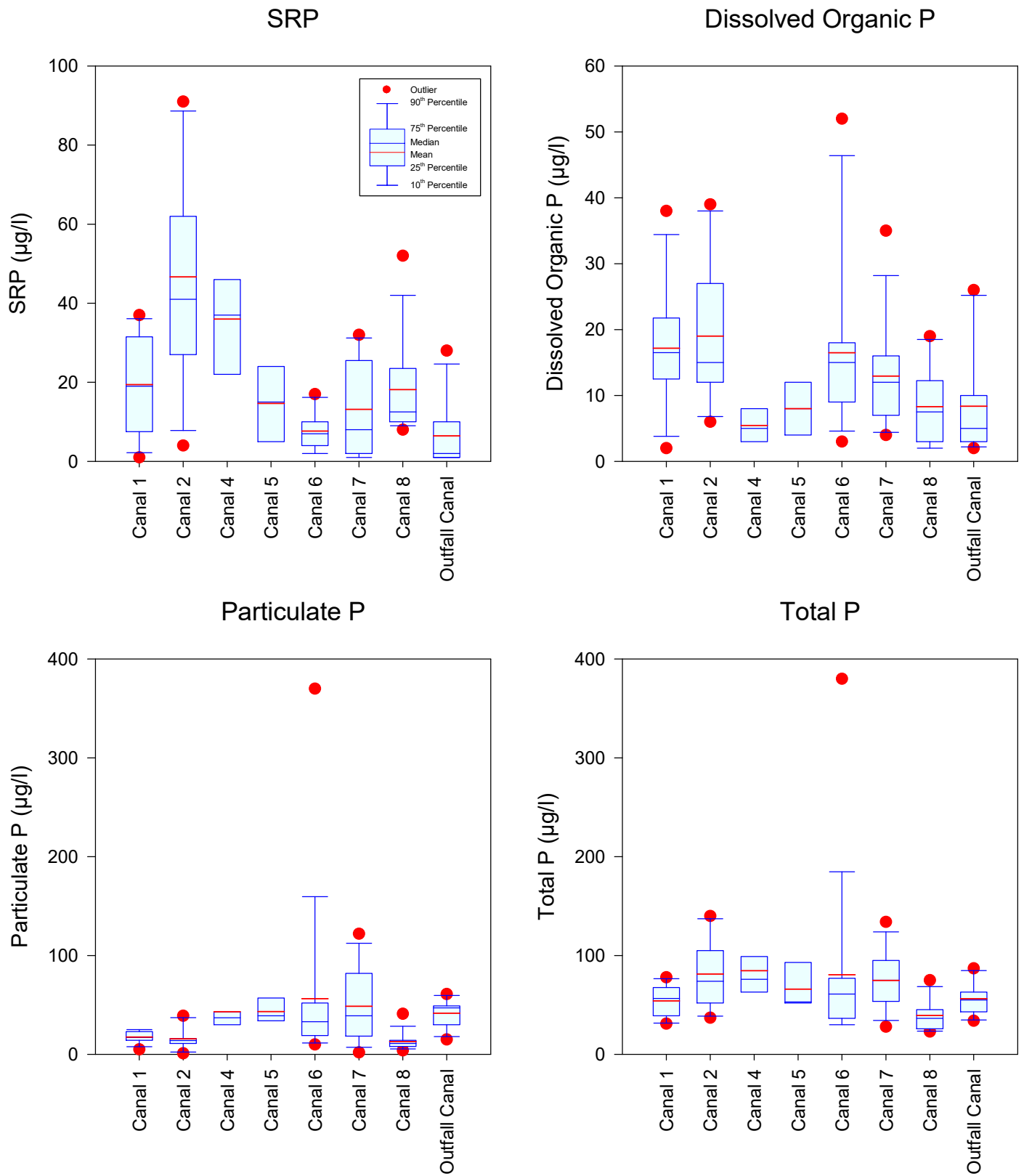


Figure 5-16. Statistical Summary of Phosphorus Species Measured in Canal Inflows to Lake Lawne.

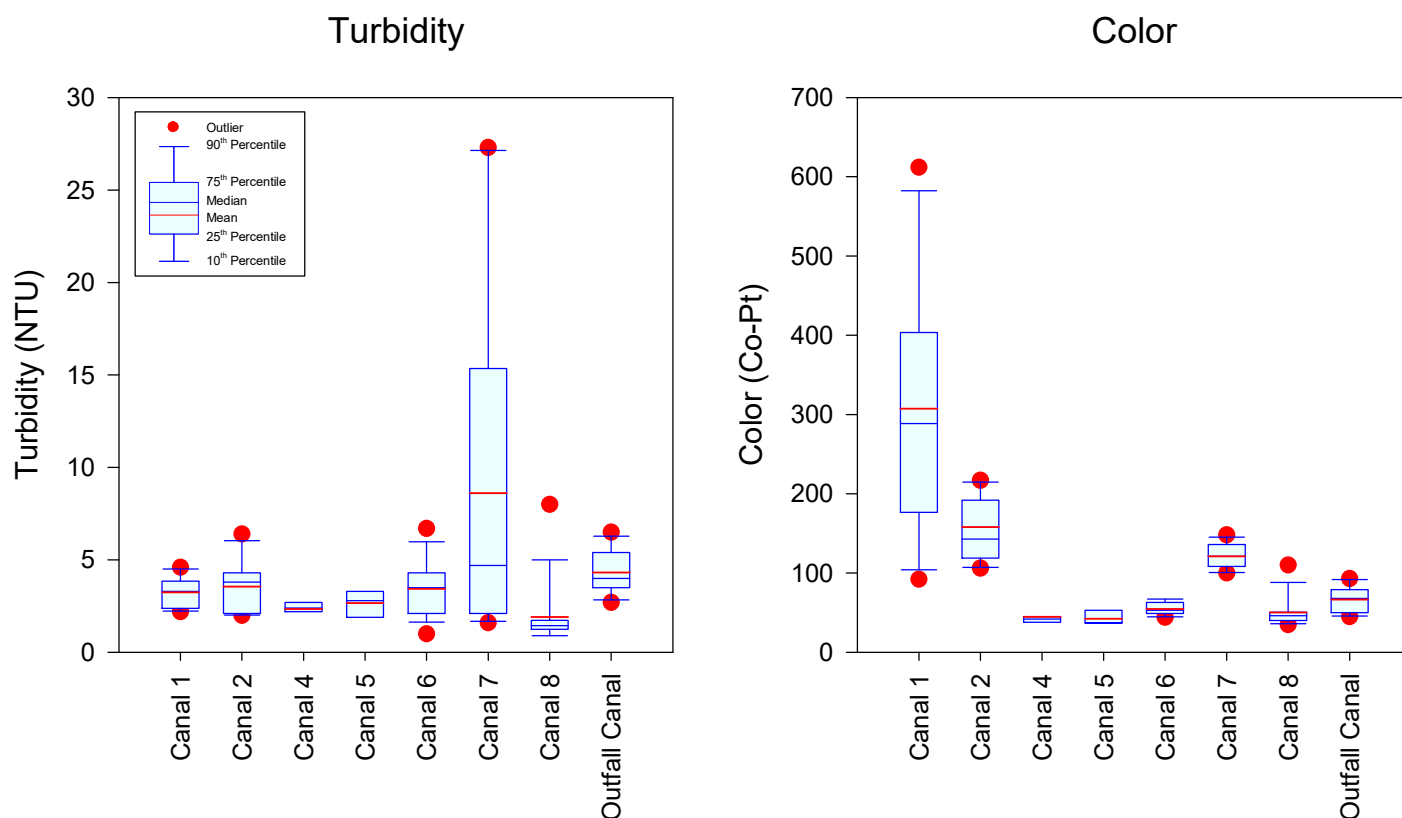


Figure 5-17. Statistical Summary of Turbidity and Color Measured in Canal Inflows to Lake Lawne.

### 5.1.2.3 Selection of Runoff Characterization Data

Runoff characterization data for total nitrogen, total phosphorus, and TSS are necessary to estimate annual loadings to Lake Lawne from stormwater inflows. Direct measurements of inflow concentrations were conducted at inflow sites for Canals C-1, C-2, C-4, C-5, C-6, C-7, and C-8, and the measured characteristics of these samples are assumed to reflect the combination of stormwater and baseflow discharges from each of these drainage basins. Inflow samples were not collected from the C-3 Canal during the field monitoring program. Therefore, for purposes of this evaluation, the chemical characteristics of inflows from the C-3 Canal are assumed to be represented by the mean of inflows from Canals C-2 and C-4 which reflect watershed areas immediately adjacent to the C-3 Canal watershed.

Runoff characteristics for the remaining watershed areas are based upon typical emc values for runoff generated by the dominant land use category within the sub-basin area. The dominant land use for Sub-basins 9, 10, 11, 12, 13, 15, 16, 17, and 18 is medium-density residential, and runoff concentrations for total nitrogen, total phosphorus, and TSS are assumed to be similar to the values listed in the Florida emc Database for medium-density residential communities. The dominant land use in Sub-basin 4 is institutional, and the raw runoff characteristics for this sub-basin are assumed to be equivalent to the values listed in the Florida emc Database for institutional land use. High-density residential comprises the dominant land use in Sub-basins 19, 20, and 22, and values for this land use category were also obtained from the Florida emc Database. The dominant land use in Sub-basin 21 is wetlands, and typical wetland concentrations were assumed to reflect runoff characteristics within this sub-basin. Recreational land use is the dominant land use in Sub-basin 23, and runoff concentrations for this land use are estimated to be similar to the low-density residential land use category in the Florida emc Database. The direct overland flow sub-basin contains a mixture of medium-density residential, high-density residential, institutional, wetland, and recreational land uses. For purposes of this evaluation, the runoff characteristics from the direct overland flow basin is assumed to be the mean of the five land uses which are included within this overall basin.

A significant portion of the runoff generated in Sub-basins 14, 17, 22, and 23 receives treatment in wet or dry stormwater treatment systems prior to discharge into Lake Lawne. Volumetric losses for stormwater treatment systems were incorporated into the evaluation of runoff volumes provided in Section 4. However, wet and dry ponds also result in reductions in concentrations for total nitrogen, total phosphorus, and TSS. Based upon previous research conducted by ERD, a wet or dry pond treatment typically results in a removal of 35% for total nitrogen, 60% for total phosphorus, and 80% for TSS. Therefore, the assumed runoff characteristics for these sub-basins were reduced using these treatment efficiencies to reflect the impacts of stormwater management systems within the basin and to estimate the overall characteristics of treated runoff which discharges into Lake Lawne.

A summary of assumed runoff characteristics for Lake Lawne sub-basins, based upon the assumptions discussed previously, is given in Table 5-4. This information is used in a subsequent section for estimation of annual runoff loadings to Lake Lawne from the identified sub-basin areas.

#### **5.1.2.4 Mass Loadings**

Estimates of annual mass loadings of total nitrogen, total phosphorus, and TSS discharging from sub-basin areas into Lake Lawne as a result of stormwater runoff are summarized in Table 5-5. The mass loadings summarized in this table were obtained by multiplying the assumed runoff characteristics for each sub-basin area (summarized in Table 5-4) times the observed runoff volume for each sub-basin area (summarized in Table 4-6). The estimated loading values summarized in Table 5-5 reflect both the volumetric and water quality impacts of stormwater treatment systems discussed previously. Overall, stormwater runoff contributes approximately 2,777 kg/yr of total nitrogen, 229 kg/yr of total phosphorus, and 16,100 kg/yr of TSS to Lake Lawne.



**TABLE 5-4**  
**ASSUMED RUNOFF CHARACTERISTICS**  
**FOR LAKE LAWNE SUB-BASINS**

| SUB-BASIN | LAND USE      | RUNOFF CONCENTRATION<br>(mg/l) |         |      | RUNOFF CONCENTRATION / REFERENCE        |
|-----------|---------------|--------------------------------|---------|------|-----------------------------------------|
|           |               | Total N                        | Total P | TSS  |                                         |
| 1         | Mixed         | 0.955                          | 0.052   | 3.0  | Direct Measurement - C-1 Canal (Site 1) |
| 2         | Mixed         | 0.665                          | 0.075   | 1.5  | Direct Measurement - C-2 Canal (Site 2) |
| 3         | Mixed         | 0.665                          | 0.077   | 1.5  | Direct Measurement - C-3 Canal (Site 3) |
| 4         | Mixed         | 0.665                          | 0.080   | 1.4  | Direct Measurement - C-4 Canal (Site 4) |
| 5         | Mixed         | 1.040                          | 0.064   | 3.3  | Direct Measurement - C-5 Canal (Site 5) |
| 6         | Mixed         | 0.645                          | 0.062   | 3.7  | Direct Measurement - C-6 Canal (Site 6) |
| 7         | Mixed         | 0.969                          | 0.069   | 3.7  | Direct Measurement - C-7 Canal (Site 7) |
| 8         | Mixed         | 0.465                          | 0.037   | 1.8  | Direct Measurement - C-8 Canal (Site 8) |
| 9         | MDR (99%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 10        | MDR (99%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 11        | MDR (89%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 12        | MDR (100%)    | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 13        | MDR (91%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 14        | Inst. (65%)   | 0.696                          | 0.072   | 9.5  | Florida emc Database - Inst.            |
| 15        | MDR (86%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 16        | MDR (99%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 17        | MDR (64%)     | 1.216                          | 0.120   | 5.9  | Florida emc Database - MDR              |
| 18        | MDR (99%)     | 1.870                          | 0.301   | 29.3 | Florida emc Database - MDR              |
| 19        | HDR (97%)     | 2.100                          | 0.497   | 69.5 | Florida emc Database - HDR              |
| 20        | HDR (100%)    | 2.100                          | 0.497   | 47.5 | Florida emc Database - HDR              |
| 21        | Wetland (68%) | 1.000                          | 0.100   | 2.5  | Florida emc Database - Wetland          |
| 22        | HDR (68%)     | 1.365                          | 0.199   | 5.9  | Florida emc Database - HDR              |
| 23        | Rec. (90%)    | 0.910                          | 0.067   | 5.9  | Florida emc Database - LDR              |
| Direct    | Mixed         | 1.488                          | 0.249   | 35.6 | Mean of MDR, HDR, Inst., Wetland, Rec.  |

Receives wet/dry pond treatment - 35% total nitrogen, 60% total phosphorus, 80% TSS

TABLE 5-5

**ANNUAL RUNOFF GENERATED LOADINGS OF TOTAL  
NITROGEN, TOTAL PHOSPHORUS, AND TSS TO LAKE LAWNE**

| SUB-BASIN     | BASIN AREA (acres) | OBSERVED RUNOFF VOLUME (ac-ft/yr) | MASS LOADING (kg/yr) |            |               | PERCENT OF TOTAL (%) |            |            | AREAL LOAD (kg/ac-yr)   |                         |                        |
|---------------|--------------------|-----------------------------------|----------------------|------------|---------------|----------------------|------------|------------|-------------------------|-------------------------|------------------------|
|               |                    |                                   | Total N              | Total P    | TSS           | Total N              | Total P    | TSS        | Total N                 | Total P                 | TSS                    |
| 1             | 1,281.84           | 1,289                             | 1,518                | 82         | 4,807         | 54.7                 | 35.9       | 29.9       | 1.18                    | 0.06                    | 3.7                    |
| 2             | 411.22             | 159                               | 130                  | 14.7       | 302           | 4.7                  | 6.4        | 1.9        | 0.32                    | 0.04                    | 0.7                    |
| 3             | 36.43              | 27.6                              | 22.6                 | 2.6        | 50            | 0.8                  | 1.1        | 0.3        | 0.62                    | 0.07                    | 1.4                    |
| 4             | 81.59              | 94.3                              | 77.3                 | 9.3        | 162           | 2.8                  | 4.0        | 1.0        | 0.95                    | 0.11                    | 2.0                    |
| 5             | 143.40             | 176                               | 226                  | 13.8       | 720           | 8.1                  | 6.0        | 4.5        | 1.57                    | 0.10                    | 5.0                    |
| 6             | 309.88             | 136                               | 108                  | 10.3       | 610           | 3.9                  | 4.5        | 3.8        | 0.35                    | 0.03                    | 2.0                    |
| 7             | 123.64             | 74.3                              | 88.8                 | 6.3        | 342           | 3.2                  | 2.8        | 2.1        | 0.72                    | 0.05                    | 2.8                    |
| 8             | 105.17             | 74.1                              | 42.5                 | 3.4        | 168           | 1.5                  | 1.5        | 1.0        | 0.40                    | 0.03                    | 1.6                    |
| 9             | 6.91               | 5.27                              | 12.2                 | 2.0        | 190           | 0.4                  | 0.9        | 1.2        | 1.76                    | 0.28                    | 27.6                   |
| 10            | 13.47              | 14.2                              | 32.7                 | 5.3        | 513           | 1.2                  | 2.3        | 3.2        | 2.43                    | 0.39                    | 38.1                   |
| 11            | 21.72              | 18.5                              | 42.7                 | 6.9        | 668           | 1.5                  | 3.0        | 4.2        | 1.96                    | 0.32                    | 30.8                   |
| 12            | 6.07               | 4.63                              | 10.7                 | 1.7        | 167           | 0.4                  | 0.7        | 1.0        | 1.76                    | 0.28                    | 27.6                   |
| 13            | 9.45               | 9.67                              | 22.3                 | 3.6        | 349           | 0.8                  | 1.6        | 2.2        | 2.36                    | 0.38                    | 37.0                   |
| 14            | 3.53               | 1.20                              | 1.0                  | 0.1        | 14.1          | 0.0                  | 0.0        | 0.1        | 0.29                    | 0.03                    | 4.0                    |
| 15            | 6.52               | 6.28                              | 14.5                 | 2.3        | 227           | 0.5                  | 1.0        | 1.4        | 2.22                    | 0.36                    | 34.8                   |
| 16            | 20.76              | 20.5                              | 47.3                 | 7.6        | 741           | 1.7                  | 3.3        | 4.6        | 2.28                    | 0.37                    | 35.7                   |
| 17            | 50.55              | 4.40                              | 6.6                  | 0.7        | 32            | 0.2                  | 0.3        | 0.2        | 0.13                    | 0.01                    | 0.6                    |
| 18            | 18.01              | 17.7                              | 40.8                 | 6.6        | 640           | 1.5                  | 2.9        | 4.0        | 2.27                    | 0.36                    | 35.5                   |
| 19            | 4.81               | 7.89                              | 20.4                 | 4.8        | 676           | 0.7                  | 2.1        | 4.2        | 4.25                    | 1.01                    | 141                    |
| 20            | 3.54               | 5.19                              | 13.4                 | 3.2        | 304           | 0.5                  | 1.4        | 1.9        | 3.80                    | 0.90                    | 85.9                   |
| 21            | 61.04              | 63.5                              | 78.3                 | 7.8        | 196           | 2.8                  | 3.4        | 1.2        | 1.28                    | 0.13                    | 3.2                    |
| 22            | 13.30              | 19.6                              | 32.9                 | 4.8        | 141           | 1.2                  | 2.1        | 0.9        | 2.48                    | 0.36                    | 10.6                   |
| 23            | 28.77              | 20.7                              | 23.2                 | 1.7        | 149           | 0.8                  | 0.7        | 0.9        | 0.81                    | 0.06                    | 5.2                    |
| Direct        | 113.70             | 89.5                              | 164                  | 27.5       | 3,932         | 5.9                  | 12.0       | 24.4       | 1.44                    | 0.24                    | 34.6                   |
| <b>TOTAL:</b> | <b>2,875.32</b>    | <b>2,338</b>                      | <b>2,777</b>         | <b>229</b> | <b>16,100</b> | <b>100</b>           | <b>100</b> | <b>100</b> | <b>0.97<sup>1</sup></b> | <b>0.08<sup>1</sup></b> | <b>5.6<sup>1</sup></b> |

1. Average watershed areal loading rate

Estimates of the percentage of annual runoff loadings are also provided for each of the sub-basin areas. Sub-basin areas contributing 5% or more of the annual loadings for each evaluated parameter are highlighted in **blue**. The most significant runoff generated loadings to Lake Lawne occur from Sub-basin 1, which is the largest sub-basin area and contribute approximately 54.7% of the annual nitrogen loadings, 35.9% of the annual phosphorus loadings, and 29.9% of the annual TSS loadings from runoff to Lake Lawne. The magnitude of the loadings discharging from this sub-basin into Lake Lawne is substantially larger than the loadings originating from any other sub-basin area, primarily due to the large size of the contributing basin. The second most significant loadings to Lake Lawne originate from the direct overland flow sub-basin which contributes approximately 5.9% of the total nitrogen loadings, 12.0% of the total phosphorus loadings, and 24.4% of the annual TSS loadings from runoff to Lake Lawne. Sub-basin 5 contributes approximately 8.1% of the total nitrogen and 6.0% of the total phosphorus loadings. Approximately 6.4% of the annual phosphorus loadings are also contributed by Sub-basin 2. Each of the remaining sub-basin areas contribute less than 5% of the annual runoff generated loadings to Lake Lawne.

Calculated areal loadings, in terms of kg/ac-yr, are provided in the final columns of Table 5-5 for each sub-basin area. This calculation provides a comparison of generated runoff loadings in each of the sub-basin areas after normalization for the size of the basin. This process allows an evaluation of runoff loadings which is independent of the size of the watershed and is often used in identifying “hot spots” for loadings within the overall basin. On an annual average basis, total nitrogen loadings within the Lake Lawne watershed are approximately 0.97 kg/ac-yr, with an average phosphorus loading of 0.08 kg/ac-yr, and 5.6 kg/ac-yr of TSS. Sub-basin areas with areal loadings exceeding 50% of the mean areal loadings are highlighted in **yellow** on Table 5-5. Areas of substantially elevated loadings of nitrogen, phosphorus, and TSS are apparent in Sub-basins 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 22, and the direct overland flow basin (with the exception of total nitrogen). Each of the sub-basins identified with elevated loadings are relatively small sub-basin areas which contain little or no existing stormwater treatment. Ordinarily, areas with elevated loading rates reflect good targets for potential stormwater BMP projects. However, combined together, these basins (excluding the direct runoff basin) comprise only 10% of the annual loadings of total nitrogen, 21% of the annual phosphorus loadings, and 29% of the annual TSS loadings to Lake Lawne. As a result, construction of stormwater management systems for each of these 11 basins with elevated loading rates would have relatively minimal impacts on runoff loadings discharging to Lake Lawne on an annual basis.

### **5.1.3 Baseflow**

A discussion of volumetric baseflow inputs to Lake Lawne is provided in Section 4.1.4. Based upon the analyses provided in this section, significant baseflow inputs to Lake Lawne are thought to occur from Sub-basins 1, 2, 4, 6, 7, and 8, and estimates of annual baseflow volumes are summarized in Table 4-10.

Estimates of annual loadings of total nitrogen, total phosphorus, and TSS from baseflow to Lake Lawne were generated by multiplying the observed baseflow volumes (summarized in Table 4-10) times the mean measured inflow concentrations for each sub-basin area. As discussed previously, the mean characteristics of inflows measured in the canal discharges to Lake Lawne for Sub-basins 1, 2, 4, 6, 7, and 8 are assumed to reflect the characteristics of the combined runoff/baseflow inputs from each of these sub-basin areas. The assumed runoff characteristics for these sub-basins (listed in Table 5-4) were used to estimate baseflow concentrations for the sub-basins with measurable baseflow inputs.

A tabular summary of calculated annual baseflow loadings of total nitrogen, total phosphorus, and TSS to Lake Lawne is given on Table 5-6. Baseflow inputs to Lake Lawne are estimated to generate approximately 920 kg/yr of total nitrogen, 87.6 kg/yr of total phosphorus, and 2,469 kg/yr of TSS. The largest baseflow loadings to Lake Lawne appear to originate in Sub-basin 2 which contributes approximately 57-78% of the annual baseflow loadings to Lake Lawne, followed by Sub-basin 1 which contributes 16-32% of the annual loadings. Relatively minimal annual loadings originate from baseflow in the remaining sub-basin areas. Sub-basin 2 also exhibits elevated areal loadings for baseflow inputs to Lake Lawne which are substantially in excess of the overall mean areal loading rates for baseflow inputs.

**TABLE 5-6**

**CALCULATED ANNUAL BASEFLOW LOADINGS OF TOTAL NITROGEN, TOTAL PHOSPHORUS, AND TSS TO LAKE LAWNE**

| SUB-BASIN     | BASIN AREA (acres) | BASEFLOW VOLUME (ac-ft/yr) | MASS LOADING (kg/yr) |             |              | PERCENT OF TOTAL (%) |            |            | AREAL LOAD (kg/ac-yr) |             |             |
|---------------|--------------------|----------------------------|----------------------|-------------|--------------|----------------------|------------|------------|-----------------------|-------------|-------------|
|               |                    |                            | Total N              | Total P     | TSS          | Total N              | Total P    | TSS        | Total N               | Total P     | TSS         |
| 1             | 1,281.84           | 213                        | 251                  | 13.6        | 794          | 27.3                 | 15.5       | 32.2       | 0.20                  | 0.01        | 0.62        |
| 2             | 411.22             | 737                        | 605                  | 68.2        | 1,399        | 65.7                 | 77.8       | 56.7       | 1.47                  | 0.17        | 3.40        |
| 4             | 81.59              | 13.9                       | 11.4                 | 1.4         | 23.8         | 1.2                  | 1.6        | 1.0        | 0.14                  | 0.02        | 0.29        |
| 6             | 309.88             | 32.0                       | 25.7                 | 2.5         | 145          | 2.8                  | 2.8        | 5.9        | 0.08                  | 0.01        | 0.47        |
| 7             | 123.64             | 21.2                       | 25.3                 | 1.8         | 98           | 2.8                  | 2.1        | 4.0        | 0.20                  | 0.01        | 0.79        |
| 8             | 105.17             | 3.5                        | 2.0                  | 0.2         | 7.9          | 0.2                  | 0.2        | 0.3        | 0.02                  | 0.00        | 0.08        |
| <b>TOTAL:</b> | <b>2,313.34</b>    | <b>1,021</b>               | <b>920</b>           | <b>87.6</b> | <b>2,469</b> | <b>100</b>           | <b>100</b> | <b>100</b> | <b>0.40</b>           | <b>0.04</b> | <b>1.07</b> |

A summary of combined annual runoff and baseflow loadings to Lake Lawne is given on Table 5-7. Overall, the combined inputs from runoff and baseflow contribute 3,697 kg/yr of total nitrogen, 317 kg/yr of total phosphorus, and 18,569 kg/yr of TSS to Lake Lawne. The vast majority of the annual runoff generated loadings to Lake Lawne originate in Sub-basins 1 and 2, which combined together contribute 90.2% of the annual total nitrogen loadings, 78.1% of the annual total phosphorus loadings, and 45.4% of the annual TSS loadings to the lake. Loadings which contribute 5% or more of the annual inputs to Lake Lawne are present in Sub-basin 5 for total nitrogen and total phosphorus, Sub-basin 6 for total phosphorus, and in the direct overland flow sub-basin for total nitrogen, total phosphorus, and TSS.



TABLE 5-7

**ANNUAL COMBINED RUNOFF AND BASEFLOW LOADINGS OF  
TOTAL NITROGEN, TOTAL PHOSPHORUS, AND TSS TO LAKE LAWNE**

| SUB-BASIN     | BASIN AREA (acres) | OBSERVED RUNOFF VOLUME (ac-ft/yr) | MASS LOADING (kg/yr) |            |               | PERCENT OF TOTAL (%) |            |            | AREAL LOAD (kg/ac-yr)   |                         |                        |
|---------------|--------------------|-----------------------------------|----------------------|------------|---------------|----------------------|------------|------------|-------------------------|-------------------------|------------------------|
|               |                    |                                   | Total N              | Total P    | TSS           | Total N              | Total P    | TSS        | Total N                 | Total P                 | TSS                    |
| 1             | 1,281.84           | 1,502                             | 1,769                | 96         | 5,601         | 63.7                 | 41.9       | 34.8       | 1.38                    | 0.07                    | 4.4                    |
| 2             | 411.22             | 896                               | 735                  | 82.9       | 1,701         | 26.5                 | 36.2       | 10.6       | 1.79                    | 0.20                    | 4.1                    |
| 3             | 36.43              | 27.6                              | 22.6                 | 2.6        | 50            | 0.8                  | 1.1        | 0.3        | 0.62                    | 0.07                    | 1.4                    |
| 4             | 81.59              | 108.2                             | 88.7                 | 10.6       | 185           | 3.2                  | 4.6        | 1.2        | 1.09                    | 0.13                    | 2.3                    |
| 5             | 143.40             | 176                               | 226                  | 13.8       | 720           | 8.1                  | 6.0        | 4.5        | 1.57                    | 0.10                    | 5.0                    |
| 6             | 309.88             | 168                               | 134                  | 12.8       | 756           | 4.8                  | 5.6        | 4.7        | 0.43                    | 0.04                    | 2.4                    |
| 7             | 123.64             | 95.5                              | 114.1                | 8.2        | 440           | 4.1                  | 3.6        | 2.7        | 0.92                    | 0.07                    | 3.6                    |
| 8             | 105.17             | 77.6                              | 44.5                 | 3.5        | 176           | 1.6                  | 1.5        | 1.1        | 0.42                    | 0.03                    | 1.7                    |
| 9             | 6.91               | 5.27                              | 12.2                 | 2.0        | 190           | 0.4                  | 0.9        | 1.2        | 1.76                    | 0.28                    | 27.6                   |
| 10            | 13.47              | 14.2                              | 32.7                 | 5.3        | 513           | 1.2                  | 2.3        | 3.2        | 2.43                    | 0.39                    | 38.1                   |
| 11            | 21.72              | 18.5                              | 42.7                 | 6.9        | 668           | 1.5                  | 3.0        | 4.2        | 1.96                    | 0.32                    | 30.8                   |
| 12            | 6.07               | 4.63                              | 10.7                 | 1.7        | 167           | 0.4                  | 0.7        | 1.0        | 1.76                    | 0.28                    | 27.6                   |
| 13            | 9.45               | 9.67                              | 22.3                 | 3.6        | 349           | 0.8                  | 1.6        | 2.2        | 2.36                    | 0.38                    | 37.0                   |
| 14            | 3.53               | 1.20                              | 1.0                  | 0.1        | 14            | 0.0                  | 0.0        | 0.1        | 0.29                    | 0.03                    | 4.0                    |
| 15            | 6.52               | 6.28                              | 14.5                 | 2.3        | 227           | 0.5                  | 1.0        | 1.4        | 2.22                    | 0.36                    | 34.8                   |
| 16            | 20.76              | 20.5                              | 47.3                 | 7.6        | 741           | 1.7                  | 3.3        | 4.6        | 2.28                    | 0.37                    | 35.7                   |
| 17            | 50.55              | 4.40                              | 6.6                  | 0.7        | 32            | 0.2                  | 0.3        | 0.2        | 0.13                    | 0.01                    | 0.6                    |
| 18            | 18.01              | 17.7                              | 40.8                 | 6.6        | 640           | 1.5                  | 2.9        | 4.0        | 2.27                    | 0.36                    | 35.5                   |
| 19            | 4.81               | 7.89                              | 20.4                 | 4.8        | 676           | 0.7                  | 2.1        | 4.2        | 4.25                    | 1.01                    | 141                    |
| 20            | 3.54               | 5.19                              | 13.4                 | 3.2        | 304           | 0.5                  | 1.4        | 1.9        | 3.80                    | 0.90                    | 85.9                   |
| 21            | 61.04              | 63.5                              | 78.3                 | 7.8        | 196           | 2.8                  | 3.4        | 1.2        | 1.28                    | 0.13                    | 3.2                    |
| 22            | 13.30              | 19.6                              | 32.9                 | 4.8        | 141           | 1.2                  | 2.1        | 0.9        | 2.48                    | 0.36                    | 10.6                   |
| 23            | 28.77              | 20.7                              | 23.2                 | 1.7        | 149           | 0.8                  | 0.7        | 0.9        | 0.81                    | 0.06                    | 5.2                    |
| Direct        | 113.70             | 89.5                              | 164.2                | 27.5       | 3,932         | 5.9                  | 12.0       | 24.4       | 1.44                    | 0.24                    | 34.6                   |
| <b>TOTAL:</b> | <b>2,875.32</b>    | <b>2,338</b>                      | <b>3,697</b>         | <b>317</b> | <b>18,569</b> | <b>133</b>           | <b>138</b> | <b>115</b> | <b>1.29<sup>1</sup></b> | <b>0.11<sup>1</sup></b> | <b>6.5<sup>1</sup></b> |

1. Average watershed areal loading rate

Calculated areal loadings (in terms of kg/ac-yr) are provided in the final columns of Table 5-7 for each sub-basin area. The sub-basins with higher than average areal loading rates for runoff and baseflow are the relatively small drainage basin areas which contain little or no stormwater management systems. However, combined together, these sub-basins generate a relatively small portion of the annual loadings to the lake.

#### **5.1.4 Groundwater Seepage**

##### **5.1.4.1 Chemical Characteristics**

Nutrient influx from groundwater seepage was quantified using a total of 20 underwater seepage meters in Lake Lawne. A discussion of the hydrologic inputs resulting from groundwater seepage is given in Section 4.1.3. Each of the collected groundwater seepage samples was analyzed in the ERD Laboratory for pH, alkalinity, conductivity, total nitrogen, and total phosphorus. A complete listing of laboratory measurements conducted on seepage samples at each of the 20 seepage monitoring sites is given in Appendix D.2.

A tabular summary of mean volume-weighted chemical characteristics of seepage samples collected in Lake Lawne from March 2011-May 2012 is given on Table 5-8. In general, seepage samples collected from Lake Lawne were found to be approximately neutral in value, with mean flow-weighted pH values at the individual seepage monitoring sites ranging from 7.02-7.38. Mean alkalinity values in the collected seepage samples indicate moderate to well buffered conditions, with mean alkalinity values ranging from 76.1-149 mg/l. Measured alkalinity values in seepage meters located in perimeter portions of the lake generally exhibited higher alkalinity values than seepage meters installed in internal portions of the lake. Mean volume-weighted conductivity values in the seepage samples ranged from 209-377  $\mu\text{mho/cm}$ , reflecting relatively consistent conductivity measurements throughout the lake.

Mean volume-weighted concentrations of total nitrogen in groundwater seepage exhibited a moderate degree of variability, with mean concentrations ranging from 1,109-5,825  $\mu\text{g/l}$ . In general, the degree of variability observed in measured total nitrogen concentrations between the individual monitoring sites in Lake Lawne is somewhat lower than variabilities commonly observed by ERD in seepage samples. Measured seepage concentrations of total nitrogen in Lake Lawne appear to be lower in value than seepage inflows measured by ERD in other Central Florida lakes. However, a somewhat higher degree of variability was observed in mean volume-weighted concentrations of total phosphorus which ranged from 91-702  $\mu\text{g/l}$  at the monitored seepage sites. Seepage phosphorus concentrations entering Lake Lawne appear to be somewhat greater in value than seepage inflows measured by ERD in other Central Florida lakes.

Isopleths of volume-weighted pH values in groundwater seepage entering Lake Lawne from March 2011-May 2012 are illustrated on Figure 5-18. The most elevated seepage pH values were observed in northern and southern-central portions of the lake, with the lower pH values observed in eastern, western, and southern portions of the lake.

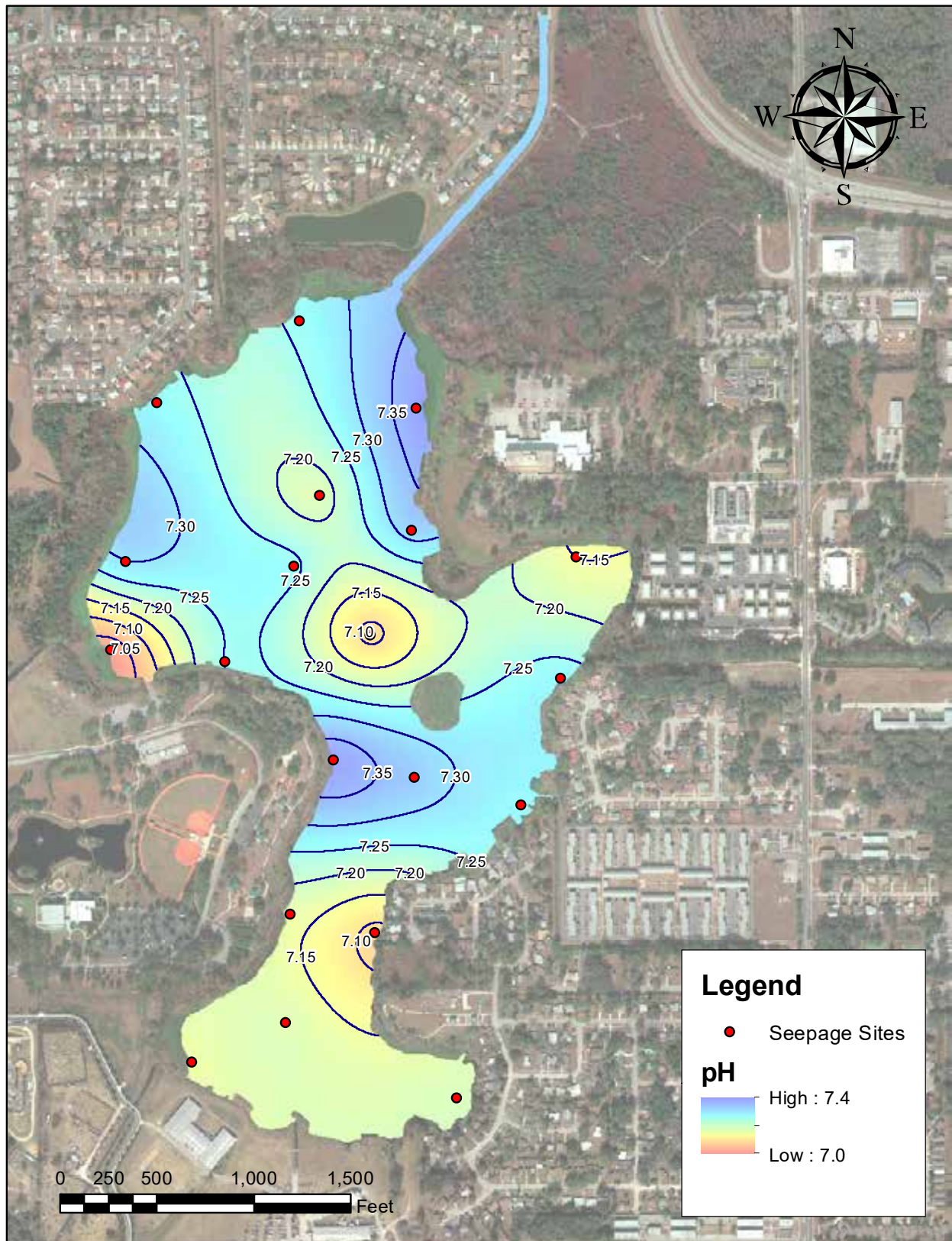


Figure 5-18. Isopleths of Mean Volume-Weighted pH Values in Groundwater Seepage Entering Lake Lawne from March 2011-May 2012.

TABLE 5-8

**MEAN VOLUME-WEIGHTED CHEMICAL CHARACTERISTICS OF  
GROUNDWATER SEEPAGE SAMPLES COLLECTED IN LAKE LAWNE**

| SITE | NUMBER<br>OF<br>SAMPLES | pH<br>(s.u.) | ALKALINITY<br>(mg/l) | CONDUCTIVITY<br>( $\mu$ mho/cm) | TOTAL<br>NITROGEN<br>( $\mu$ g/l) | TOTAL<br>PHOSPHORUS<br>( $\mu$ g/l) |
|------|-------------------------|--------------|----------------------|---------------------------------|-----------------------------------|-------------------------------------|
| 1    | 7                       | 7.02         | 149                  | 377                             | 3,049                             | 702                                 |
| 2    | 7                       | 7.30         | 113                  | 311                             | 3,038                             | 313                                 |
| 3    | 7                       | 7.27         | 89.1                 | 307                             | 2,291                             | 117                                 |
| 4    | 7                       | 7.26         | 99.0                 | 274                             | 3,221                             | 297                                 |
| 5    | 8                       | 7.38         | 102                  | 298                             | 4,059                             | 271                                 |
| 6    | 8                       | 7.32         | 108                  | 319                             | 5,173                             | 433                                 |
| 7    | 8                       | 7.15         | 123                  | 278                             | 2,613                             | 190                                 |
| 8    | 6                       | 7.27         | 85.4                 | 248                             | 1,795                             | 91                                  |
| 9    | 7                       | 7.27         | 119                  | 337                             | 5,825                             | 225                                 |
| 10   | 8                       | 7.09         | 75.0                 | 222                             | 1,636                             | 135                                 |
| 11   | 8                       | 7.19         | 98.1                 | 280                             | 3,335                             | 224                                 |
| 12   | 8                       | 7.16         | 102                  | 283                             | 1,109                             | 115                                 |
| 13   | 8                       | 7.17         | 92.2                 | 266                             | 3,037                             | 200                                 |
| 14   | 8                       | 7.38         | 145                  | 343                             | 3,998                             | 233                                 |
| 15   | 8                       | 7.25         | 139                  | 350                             | 4,324                             | 392                                 |
| 16   | 6                       | 7.18         | 94.5                 | 263                             | 2,900                             | 113                                 |
| 17   | 2                       | 7.26         | 89.6                 | 259                             | 3,925                             | 185                                 |
| 18   | 4                       | 7.09         | 76.1                 | 209                             | 2,211                             | 148                                 |
| 19   | 3                       | 7.33         | 97.1                 | 268                             | 3,257                             | 372                                 |
| 20   | 5                       | 7.18         | 99.1                 | 255                             | 1,766                             | 172                                 |

Isopleths of volume-weighted mean alkalinity values in groundwater seepage entering Lake Lawne from March 2011-May 2012 are illustrated on Figure 5-19. In general, the most elevated alkalinity values were observed in western-central and eastern-central portions of the lake, with lower alkalinity values in central and southern portions of the lake. Elevated alkalinity values are often an indication of groundwater which has been in contact with limerock formations which may be present in sub-surface areas adjacent to the elevated alkalinity measurements.



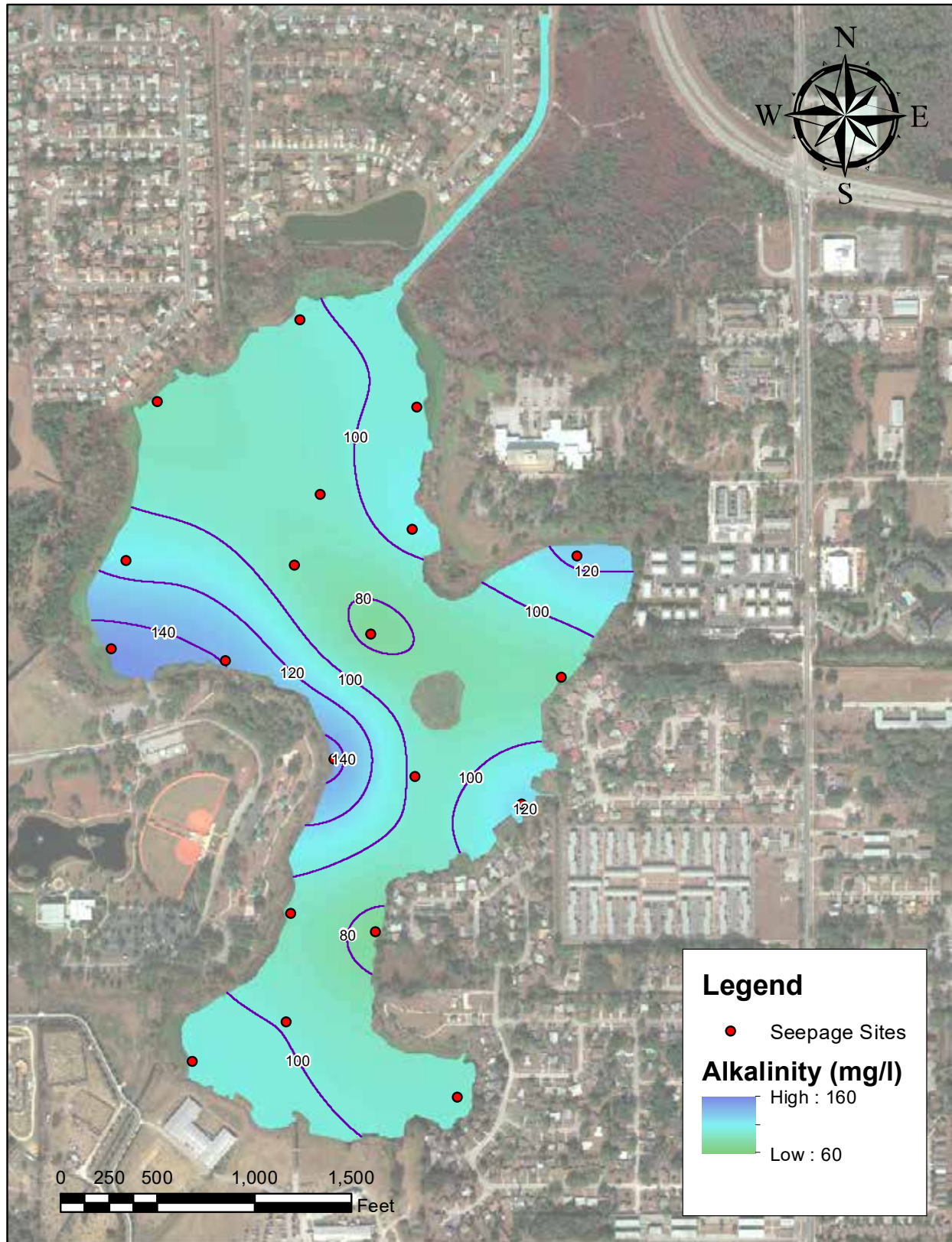


Figure 5-19. Isopleths of Mean Volume-Weighted Alkalinity Values in Groundwater Seepage Entering Lake Lawne from March 2011-May 2012.

Isopleths of volume-weighted mean conductivity values in groundwater seepage entering Lake Lawne from March 2011-May 2012 are illustrated on Figure 5-20. The most elevated conductivity values were observed in western-central and eastern-central portions of the lake, with somewhat lower alkalinity measurements observed in northern, central, and southern portions of the lake. The areas of elevated conductivity values correspond relatively closely with areas of elevated alkalinity measurements, particularly in western portions of the lake.

Isopleths of mean volume-weighted concentrations of total nitrogen in groundwater seepage entering Lake Lawne from March 2011-May 2012 are illustrated on Figure 5-21. The most elevated concentrations of total nitrogen were observed along the northeastern and eastern-central portions of the lake, with lower total nitrogen concentrations observed in the remaining areas. It appears that significant inflows of nitrogen occur from watershed areas primarily along the east side of the lake.

Isopleths of mean volume-weighted concentrations of total phosphorus in groundwater seepage entering Lake Lawne from May 2011-May 2012 are illustrated on Figure 5-22. In contrast to the trends observed for total nitrogen, the most elevated levels of total phosphorus occur in western-central portions of the lake, with substantially lower concentrations along the eastern perimeter where elevated levels of nitrogen were observed.

#### **5.1.4.2 Mass Loadings**

Mean seepage isopleths for total nitrogen and total phosphorus mass loadings (in terms of  $\mu\text{g}/\text{m}^2\text{-day}$ ) were generated by combining the concentration isopleths for total nitrogen and total phosphorus (illustrated on Figures 5-21 and 5-22) with the hydrologic isopleths for groundwater seepage (summarized on Figure 4-5). This procedure results in estimates of nutrient influx in terms of mass per square meter of lake surface per day. For purposes of this analysis, “influx” or “flux” is defined as the areal mass input or loading per unit of time.

Isopleths of mean seepage influx of total nitrogen into Lake Lawne, which combines both volume and concentration measurements, over the period from March 2011-May 2012 are illustrated on Figure 5-23. In general, nitrogen influx from groundwater seepage ranges from approximately 2,000-14,000  $\mu\text{g}/\text{m}^2\text{-day}$ . The most elevated levels of nitrogen influx were observed in southern-central portions of the lake in an area with large deposits of accumulated organic muck. Mass influx of nitrogen in other portions of the lake were typically equal to 2,000-4,000  $\mu\text{g}/\text{m}^2\text{-day}$  or less.

Isopleths of mean seepage influx of total phosphorus into Lake Lawne from March 2011-May 2012 are illustrated on Figure 5-24. Elevated levels of phosphorus influx were observed in southern-central and western portions of Lake Lawne where seepage isopleths ranged from approximately 1,000-1,600  $\mu\text{g}/\text{m}^2\text{-day}$ . Phosphorus influx from groundwater seepage in the remaining portions of Lake Lawne ranges from approximately 200-400  $\mu\text{g}/\text{m}^2\text{-day}$ .



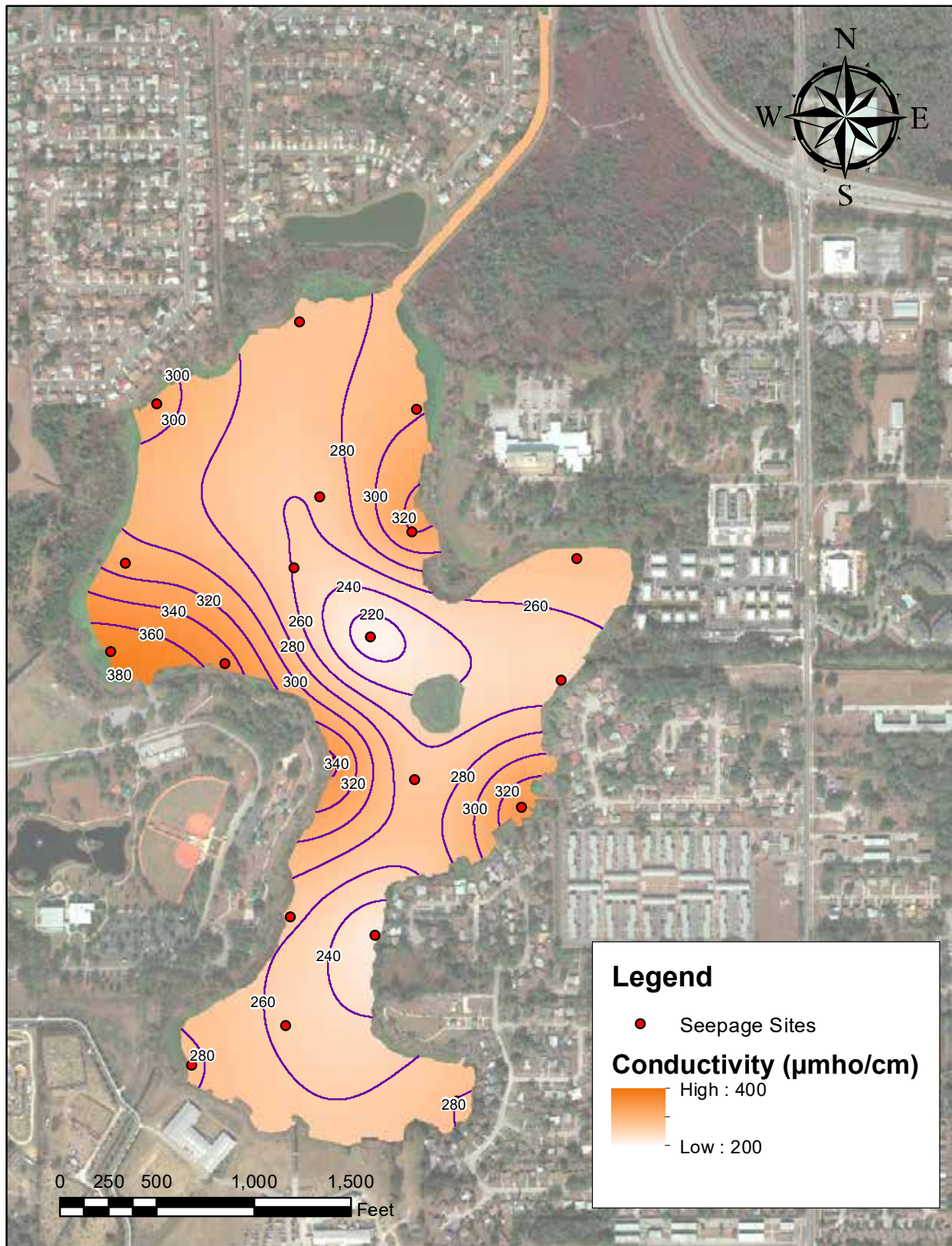


Figure 5-20. Isopleths of Mean Volume-Weighted Conductivity Values in Groundwater Seepage Entering Lake Lawne from March 2011-May 2012.



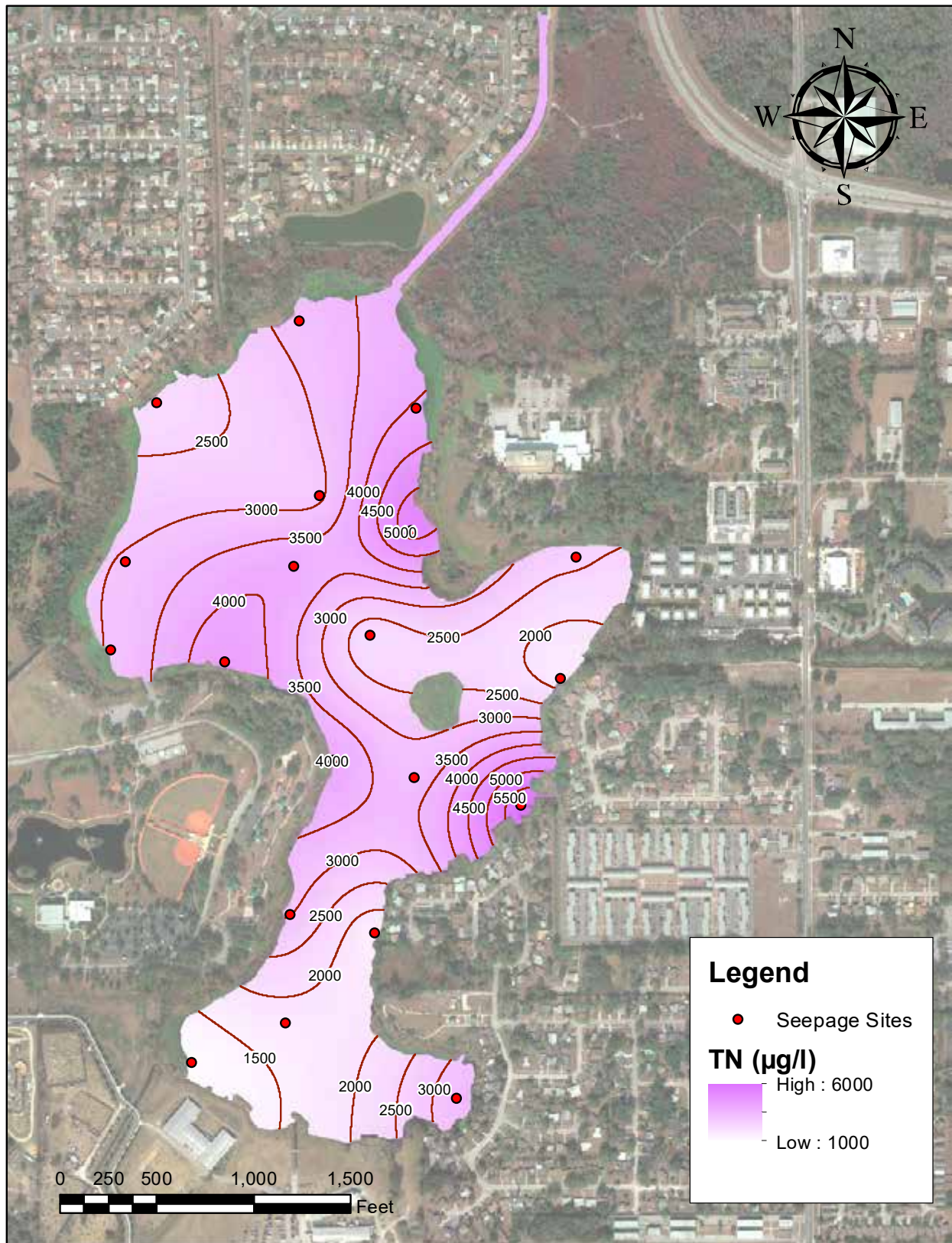


Figure 5-21. Isopleths of Mean Volume-Weighted Total Nitrogen Values in Groundwater Seepage Entering Lake Lawne from March 2011-May 2012.



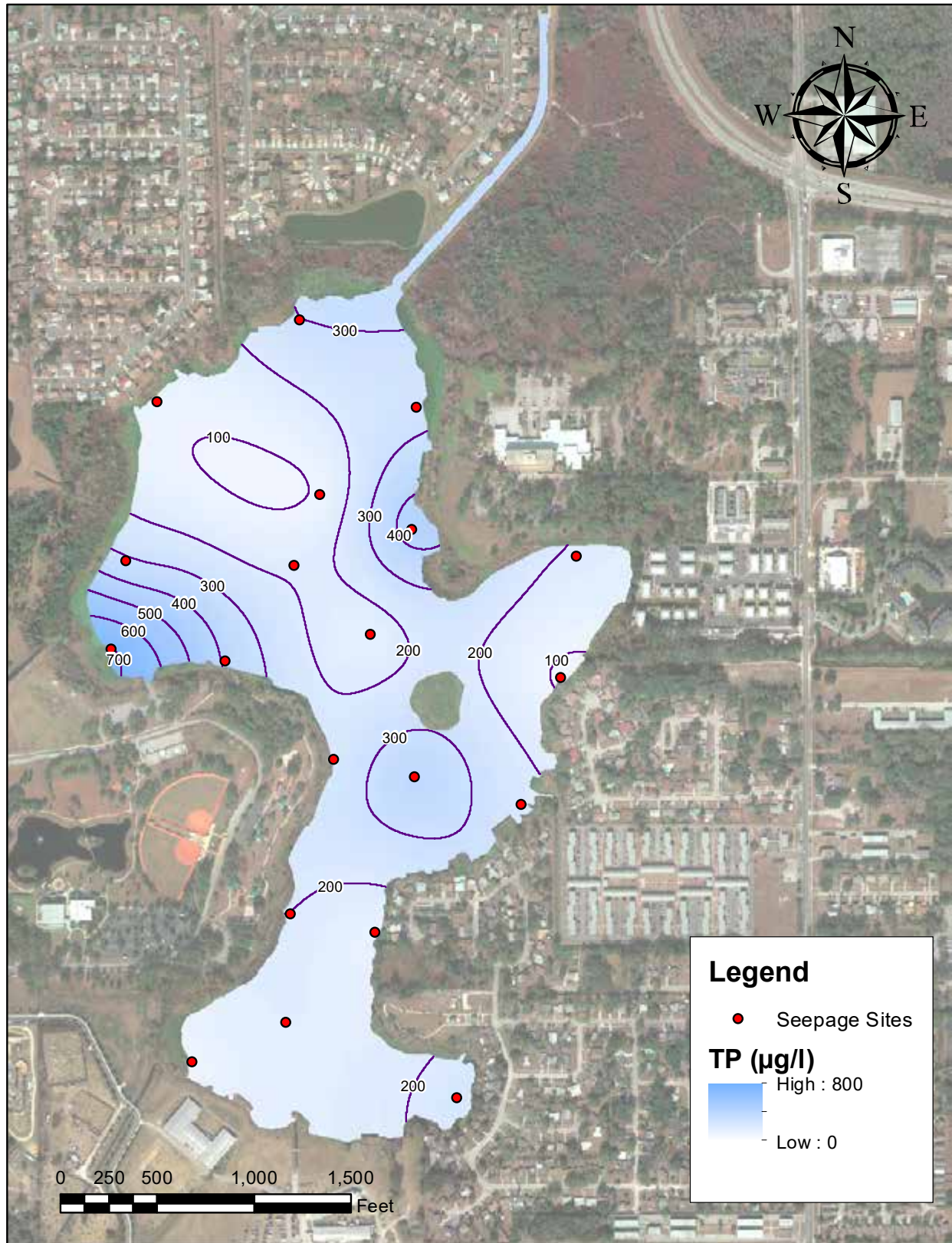


Figure 5-22. Isopleths of Mean Volume-Weighted Total Phosphorus Values in Groundwater Seepage Entering Lake Lawne from March 2011-May 2012.



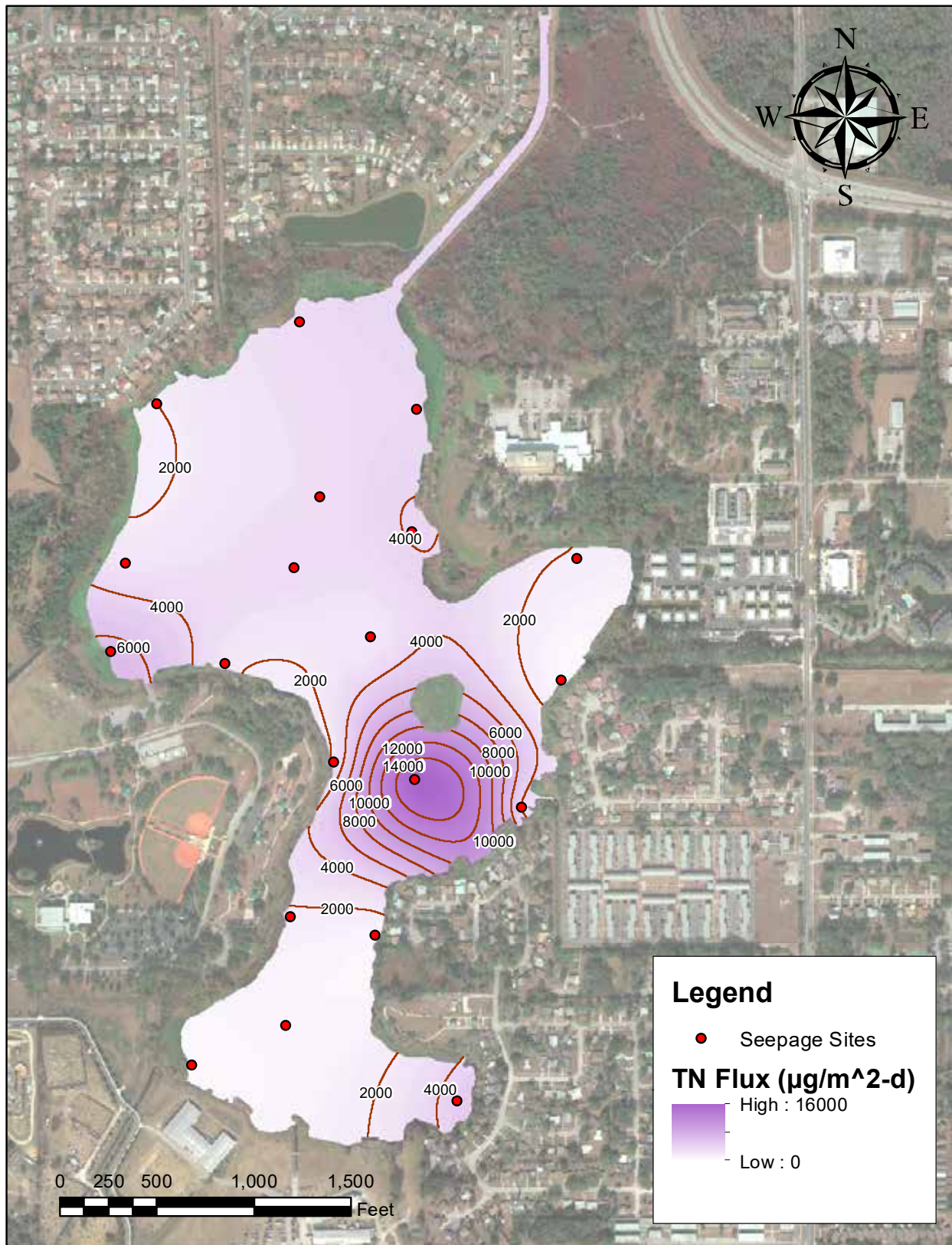


Figure 5-23. Isopleths of Mean Seepage Influx of Total Nitrogen to Lake Lawne from March 2011-May 2012.



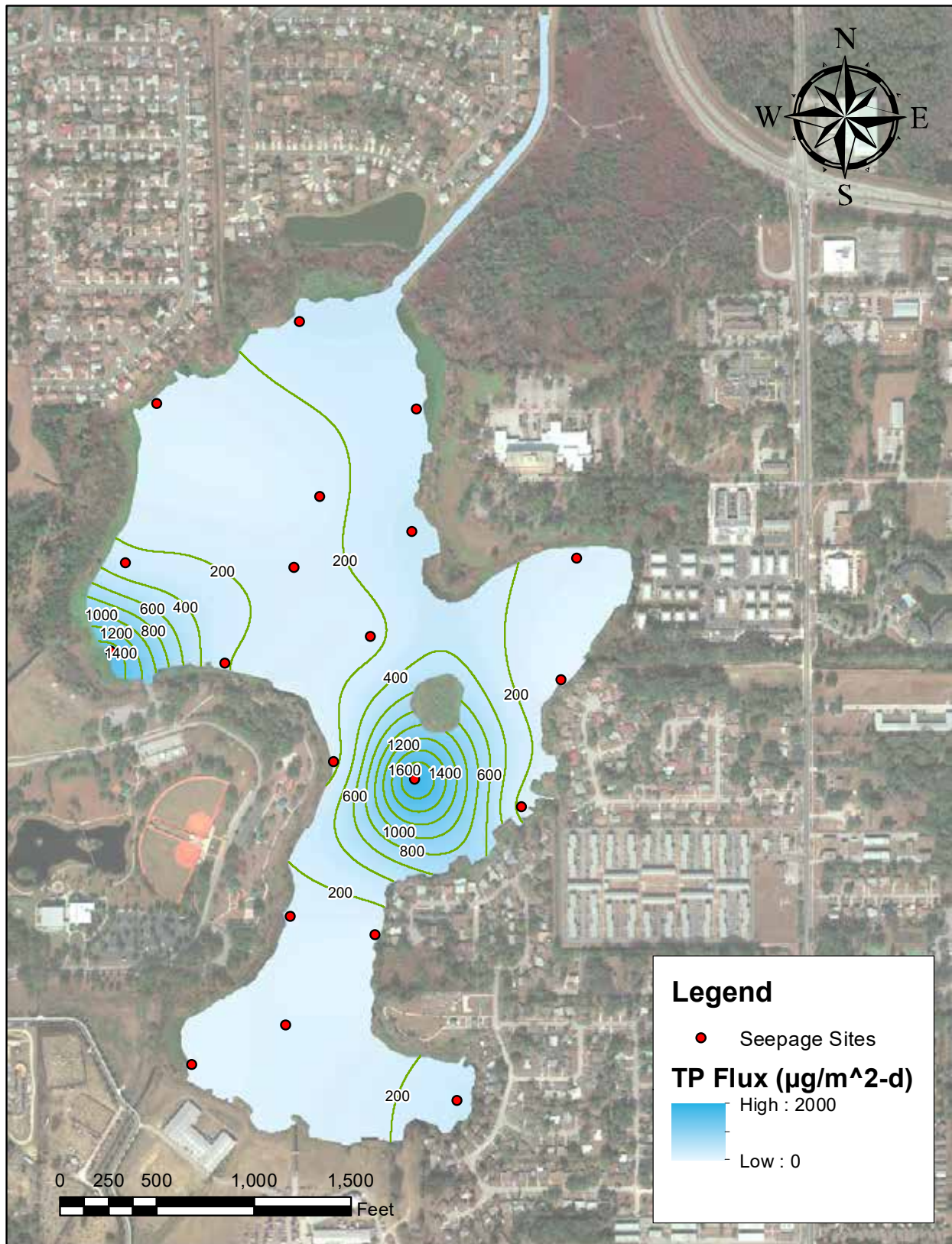


Figure 5-24. Isopleths of Mean Seepage Influx of Total Phosphorus to Lake Lawne from March 2011-May 2012.

The isopleths summarized on Figures 5-23 and 5-24 were integrated to develop estimates of the total influx of nitrogen and phosphorus from groundwater seepage into Lake Lawne during the field monitoring program. A summary of estimated annual mass loadings of total nitrogen and total phosphorus to Lake Lawne from groundwater seepage is given in Table 5-9. Based upon the field monitoring program, groundwater seepage contributes approximately 3,628  $\mu\text{g}/\text{m}^2\text{-day}$  of total nitrogen and 290  $\mu\text{g}/\text{m}^2\text{-day}$  of total phosphorus to Lake Lawne. These values are virtually identical to the measured mass loadings from groundwater seepage to Lake Killarney conducted by ERD during 2012 which indicated a nitrogen influx of 3,538  $\mu\text{g}/\text{m}^2\text{-day}$  and a total phosphorus influx of 288  $\mu\text{g}/\text{m}^2\text{-day}$ .

**TABLE 5-9**  
**ESTIMATED ANNUAL MASS LOADINGS TO**  
**LAKE LAWNE FROM GROUNDWATER SEEPAGE**

| TOTAL N                             |       |       | TOTAL P                             |       |       | AREAL LOADING<br>(kg/ac-yr) |         |
|-------------------------------------|-------|-------|-------------------------------------|-------|-------|-----------------------------|---------|
| $\mu\text{g}/\text{m}^2\text{-day}$ | g/day | kg/yr | $\mu\text{g}/\text{m}^2\text{-day}$ | g/day | kg/yr | Total N                     | Total P |
| 3,628                               | 2,174 | 793   | 290                                 | 174   | 63.4  | 5.36                        | 0.428   |

On an average annual basis, groundwater seepage contributes approximately 793 kg/yr of total nitrogen and 63.4 kg/yr of total phosphorus to Lake Lawne. These influxes correspond to areal loading rates of 5.36 kg/ac-yr for total nitrogen and 0.428 kg/ac-yr for total phosphorus. The areal total nitrogen loading rate is similar to values commonly observed by ERD in Central Florida lakes, while the areal loading rate for total phosphorus appears to be somewhat more elevated.

### 5.1.5 Internal Recycling

Quantification of sediment phosphorus release as a result of internal recycling in lakes is difficult, and a variety of methods have been used by researchers to obtain this estimate. One method which has been used in reservoirs is called the Mass Balance Method. This method is best suited to a waterbody with well defined inputs and outputs. A mass balance is then conducted on the waterbody over a one- to two-week period. An increase of phosphorus mass within the lake, after accounting for inputs and losses, would suggest that a net internal loading has occurred. However, this method appears inappropriate for use in Lake Lawne since the lake is impacted by a wide variety of hydrologic and pollutant sources.



A method which has been used extensively in deep northern lakes is to measure changes in phosphorus content in the hypolimnion of a stratified lake over an extended period of anoxia. The increase in phosphorus mass within the stratified hypolimnion can then be directly correlated with sediment release rates. However, this method also appears inappropriate for use in Lake Lawne since the lake is relatively shallow, and although a well defined hypolimnion may develop, circulation events may be relatively common.

A third method of quantifying the internal loadings is through trophic state modeling. Using this approach, hydrologic and nutrient inputs are estimated from all quantifiable sources. A trophic state model is then developed to predict water column concentrations of total phosphorus. If the model underestimates phosphorus concentrations, then a missing phosphorus load may be present which can be attributed to internal recycling. However, this methodology can be highly inaccurate and is dependent upon the accuracy of the estimated loadings for other variables.

The final method used for quantification of internal loadings is to perform sediment nutrient release experiments. In this method, large diameter sediment cores are collected from various locations within the lake and incubated in the laboratory under a variety of conditions to simulate variability in the lake throughout the year. Changes in phosphorus concentrations are measured in the overlying sediments, and this information is extrapolated to an areal release rate within the lake. This is the only method of estimating internal loadings which provides a direct measurement of phosphorus release. This method has been used by ERD on numerous occasions in previous work efforts and was selected as the quantification method for Lake Lawne.

Field and laboratory investigations were performed by ERD to quantify the mass of phosphorus released as a result of internal recycling from the sediments to the overlying water column in Lake Lawne under both aerobic and anoxic conditions. Large diameter lake sediment core samples were collected at multiple locations in the lake and incubated under anoxic and aerobic conditions. Periodic measurements of orthophosphorus and other water quality parameters were used to estimate sediment phosphorus release under the evaluated conditions. This information is used to provide an estimate of the significance of mass loadings of phosphorus from lake sediments as part of the overall nutrient budget for the lake.

#### **5.1.5.1 Field and Laboratory Procedures**

Sediment core samples were collected at four locations in Lake Lawne on July 17, 2011 using 4-inch diameter clear acrylic core tubes. Locations used for collection of the sediment core tubes are indicated on Figure 5-25. Water depths at each site are also provided for reference purposes. In general, the sample locations reflect the major lobe areas of the lake. Each of the acrylic tubes was driven into the sediments to the maximum possible depth using a large sledge hammer. A 4-inch x 4-inch wooden beam was placed on top of the acrylic core tube to evenly distribute the force of each sledge hammer blow and to prevent direct contact between the sledge hammer and the acrylic tube.

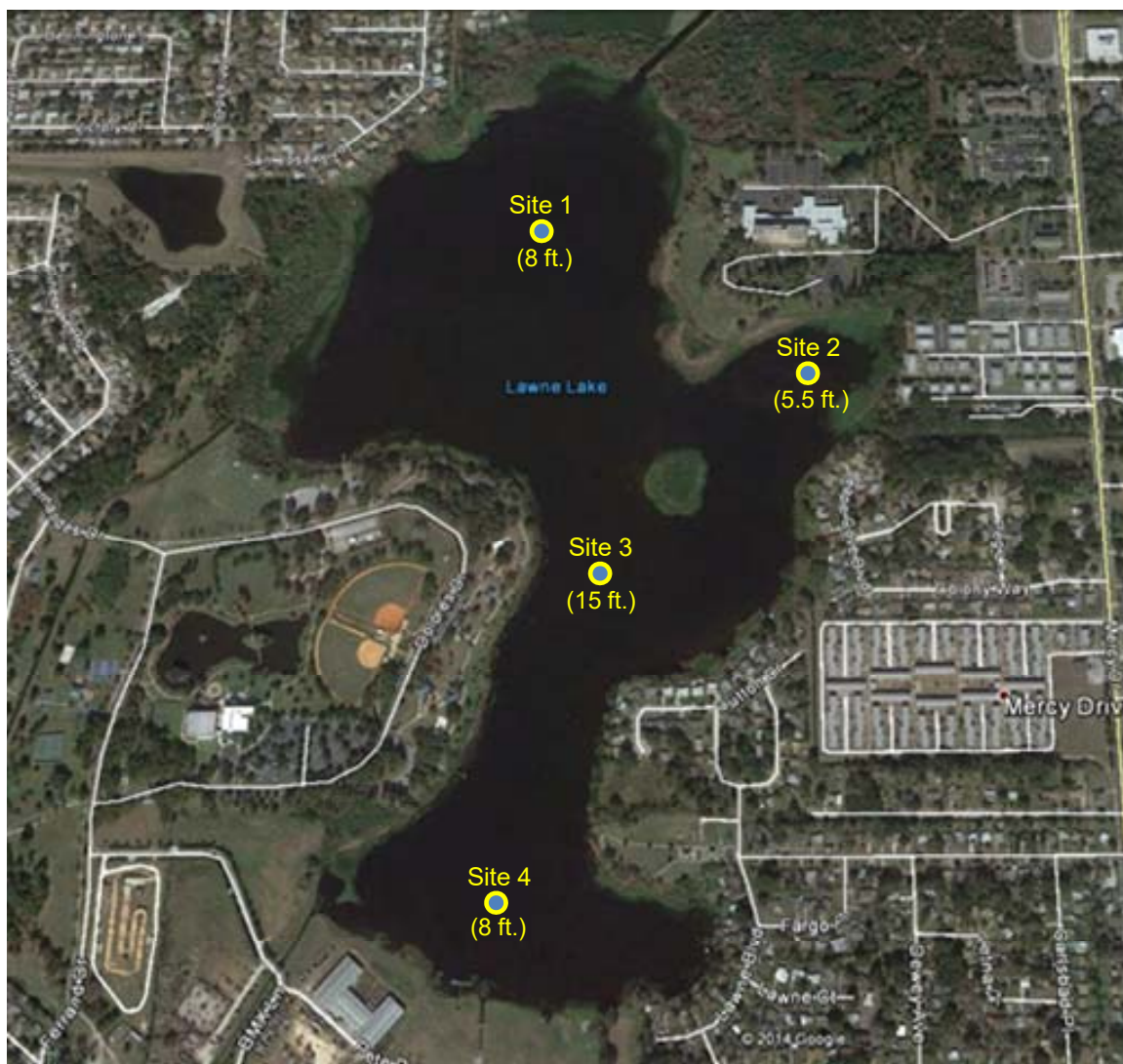


Figure 5-25. Locations for Collection of Large Core Samples in Lake Lawne.  
(Water depths indicated in parentheses)

The acrylic tubes were penetrated into the sediments to depths ranging from approximately 2-6 ft, depending upon the physical characteristics of the sediments at each of the selected monitoring sites or until a firm bottom material was encountered. Each of the core tubes was retrieved intact, along with the overlying water column present at each of the collection sites. Upon retrieval, a rubber cap was attached to the bottom of each core tube to prevent loss of sediments. The collected water volume above the trapped sediments was carefully siphoned off until a water depth of 24 inches remained in each of the collected columns above the sediment-water interface. Each of the acrylic core tubes was then cut at a uniform height of 6 inches above the water level, leaving a 6-inch air space between the water level and the top of the column. A 4-inch PVC cap was then placed on the top of each collected core tube. Each of the collected core tubes was then returned to the ERD laboratory for incubation experimentation. All samples were transported to the ERD laboratory in a vertical position to avoid mixing of the sediment layers.

After return to the laboratory, each of the four core samples was attached to a laboratory work bench in a vertical position. Two separate 0.25-inch diameter holes were then drilled into the PVC cap attached to the top of each core sample. A 0.25-inch diameter semi-rigid polyethylene tube was inserted through one of the holes to a depth of approximately 2-3 inches above the sediment surface. An air stone diffuser was attached to the end of the tubing inside each core tube to introduce selected gases into the core tubes to encourage aerobic or anoxic conditions.

A separate piece of polyethylene tubing was inserted into the second hole in the top of each core tube, approximately 1 inch below the level of the cap, but well above the water level contained in each tube. The other end of the tubing was connected to a water trap to minimize loss of water from each column as a result of evaporation. This tubing also provided a point of exit for gases which were bubbled into each core tube. A schematic of the sediment incubation apparatus is given in Figure 5-26.

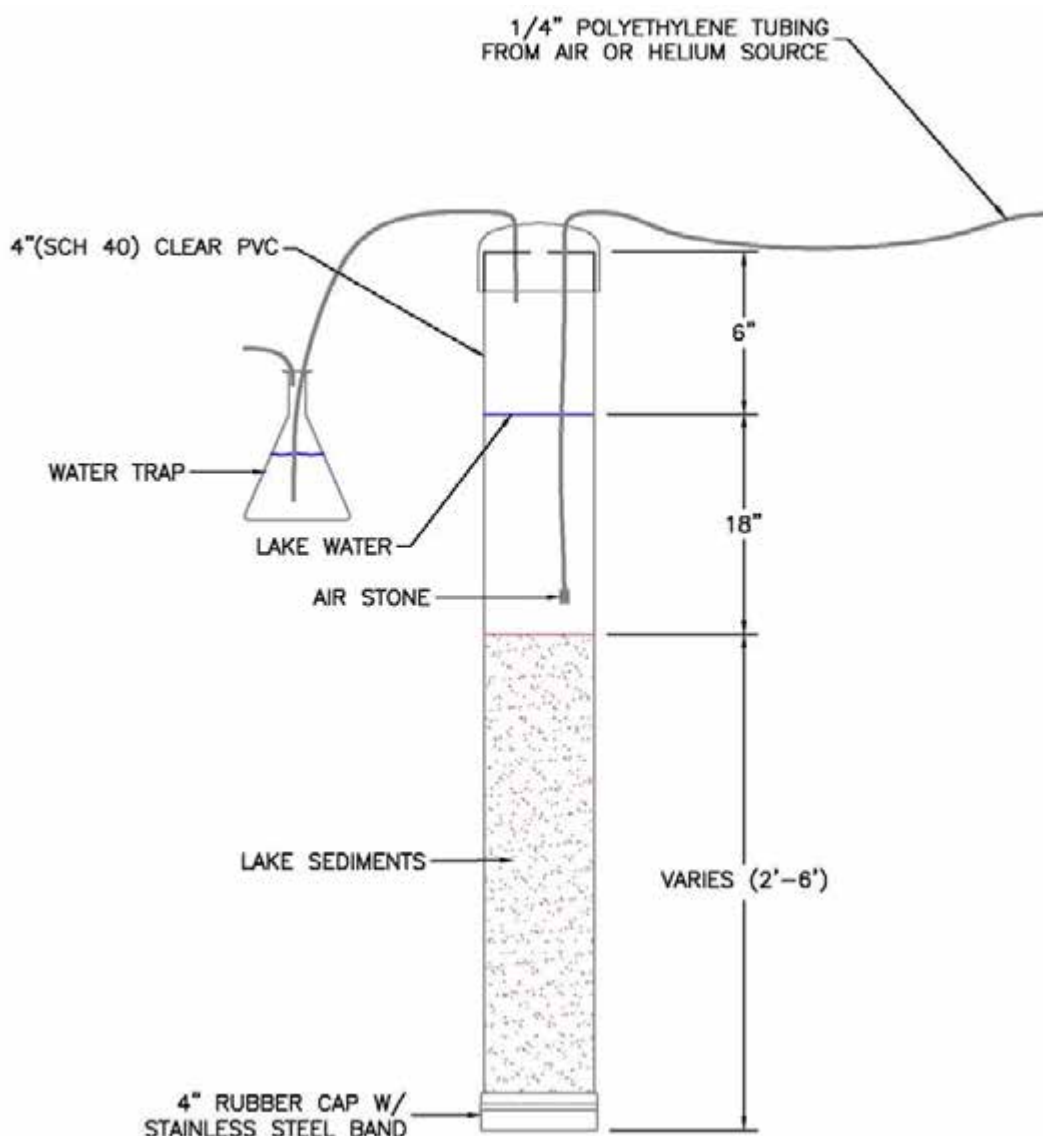


Figure 5-26. Schematic of Sediment Incubation Apparatus.

After initial set-up of the incubation apparatus, a compressed stream of helium gas was introduced into each of the core tubes through the individual air stone diffusers. This process quickly created anoxic conditions within each of the core tubes. After anoxic conditions were established, as verified by an  $\text{H}_2\text{S}$  smell in the outflow from the water trap, the helium gas addition was reduced to 1-2 hours per day, generally in association with a sampling event to ensure completely mixed conditions within the tube. This process was continued in each of the core tubes for a period of 32 days. The gas addition was used to ensure that water within each of the core tubes was well mixed without disturbing the sediments, so that phosphorus released from the sediments could be quantified as a function of changes in phosphorus concentrations within the water column of each core tube. On approximately a 1-2 day interval, 20 ml of water was withdrawn from each of the columns using a 0.25-inch polyethylene tube and a plastic laboratory syringe. Each of the collected samples was immediately filtered using a 0.45 micron syringe type membrane filter and analyzed for orthophosphorus, total phosphorus, total nitrogen, and other significant laboratory parameters for research purposes.

At the conclusion of the experimentation under anoxic conditions, the compressed helium source was replaced with a compressed air source. Compressed air was gently bubbled through each of the columns to increase dissolved oxygen and create aerobic conditions within each tube. In general, creation of aerobic conditions, as indicated by measurements of redox potential ( $> 200$  mv) within each of the columns, occurred after approximately 5-7 days. At the onset of aerobic conditions, sample collection was conducted at a 1-2 day interval from each of the 4 columns for a period of 34 days using the method previously outlined for anoxic conditions.

#### **5.1.5.2 Laboratory Results**

A summary of the laboratory results of samples collected during the testing period is given in Appendix F.1. Graphical comparisons of nitrogen and phosphorus release from the isolation chamber experiments under aerobic and anoxic conditions are given in Appendix F.2. Changes in concentrations over time are provided for each of the isolation chamber experiments under both aerobic and anoxic conditions. Concentrations of SRP, total nitrogen, and total phosphorus increased steadily during the first 20-25 days of the isolation chamber experiments under both aerobic and anoxic conditions, followed by a general decline in concentrations after this time. Release of both phosphorus and nitrogen occurred under both aerobic and anoxic conditions, but the release of SRP and total phosphorus was about 3-5 times higher under anoxic conditions than aerobic conditions, with nitrogen release about 2 times higher under anoxic conditions.



### 5.1.5.3 Mass Release

The results of the nutrient release experiments discussed in the previous section were extrapolated to estimate sediment release of nitrogen and phosphorus from Lake Lawne on an annual basis. The first step in this extrapolation process is to develop estimates of sediment release rates within each of the incubation chambers. The release rate in the incubation experiments is defined as the slope of the rising limb of the SRP, total nitrogen, and total phosphorus release plots presented in Appendix F.2. In some chambers, an initial delay in release occurred as anoxic or aerobic conditions were established within each chamber. In these cases, the release rate is calculated using the data obtained between the start of the upward release trend and the maximum concentrations of phosphorus and nitrogen measured within a sample. In some experiments, concentrations began to decrease after reaching the maximum concentration, presumably due to biological uptake within the chamber. These data are also excluded from estimation of the release rate. Regression relationships developed for estimation of sediment release rates in the incubation experiments under aerobic and anoxic conditions are also included in Appendix F.2.

Estimates of the areal extent and frequency of aerobic and anoxic conditions within the sediments of Lake Lawne were obtained from the vertical field profiles conducted in the lake by ERD from March 2011-February 2012. These profiles (summarized in Figures 2-34 through 2-37) provide seasonal patterns of dissolved oxygen concentrations throughout each lobe of the lake. The percentage of events indicating anoxic conditions at the water-sediment interface, defined as dissolved oxygen concentrations less than approximately 2 mg/l, were calculated for each of the field monitoring sites and used to estimate the seasonal distribution of aerobic and anoxic conditions throughout the lake.

A summary of calculated sediment phosphorus release rates during the isolation chamber experiments is given in Table 5-10. Nutrient release rates are provided for each of the 4 isolation chamber core samples under both aerobic and anoxic conditions, with individual release rates provided for SRP, total phosphorus, and total nitrogen. The release rates reflect the slope of the SRP, total phosphorus, and total nitrogen release rate plots provided in Appendix F.2. The calculated release rates are converted into a mass release per day by multiplying by the volume of water in the isolation chamber at the time of sample collection. This mass release is then converted into an areal mass release in terms of  $\text{mg/m}^2\text{-day}$  by multiplying by the surface area of the 4-inch diameter incubation chambers. Under aerobic conditions, the mass release rates for total phosphorus in the four core tubes ranged from 0.15-0.19  $\text{mg/m}^2\text{-day}$ , with the highest release at Site 3 and lowest at Site 4. Under anoxic conditions, the mass release rates for total phosphorus increased substantially, ranging from 0.45-0.74  $\text{mg/m}^2\text{-day}$ , with the highest release at Site 3 and the lowest release at Site 4. Release of total nitrogen ranged from 1.0-1.8  $\text{mg/m}^2\text{-day}$  under aerobic conditions, increasing to 0.8-4.2  $\text{mg/m}^2\text{-day}$  under anoxic conditions.

**TABLE 5-10**

**CALCULATED SEDIMENT NUTRIENT RELEASE**  
**RATES DURING THE ISOLATION CHAMBER EXPERIMENTS**

| CONDITION   | SITE | AREA      | MASS PHOSPHORUS RELEASE<br>( $\mu\text{g/day}$ ) |             |             | MASS RELEASE<br>( $\text{mg/m}^2\text{-day}$ ) |             |            |
|-------------|------|-----------|--------------------------------------------------|-------------|-------------|------------------------------------------------|-------------|------------|
|             |      |           | SRP                                              | Total P     | Total N     | SRP                                            | Total P     | Total N    |
| Aerobic     | 1    | North     | 0.58                                             | 1.32        | 9.0         | 0.07                                           | 0.16        | 1.11       |
|             | 2    | Northeast | 0.44                                             | 1.46        | 14.5        | 0.05                                           | 0.18        | 1.79       |
|             | 3    | Center    | 0.45                                             | 1.53        | 8.2         | 0.05                                           | 0.19        | 1.01       |
|             | 4    | South     | 0.48                                             | 1.20        | 14.7        | 0.06                                           | 0.15        | 1.82       |
| <b>Mean</b> | --   | --        | <b>0.49</b>                                      | <b>1.38</b> | <b>11.6</b> | <b>0.06</b>                                    | <b>0.17</b> | <b>1.4</b> |
| Anoxic      | 1    | North     | 2.03                                             | 4.58        | 25.0        | 0.25                                           | 0.57        | 3.1        |
|             | 2    | Northeast | 3.26                                             | 3.59        | 6.6         | 0.41                                           | 0.45        | 0.8        |
|             | 3    | Center    | 3.47                                             | 5.09        | 11.7        | 0.43                                           | 0.64        | 1.5        |
|             | 4    | South     | 1.77                                             | 5.88        | 33.6        | 0.22                                           | 0.74        | 4.2        |
| <b>Mean</b> | --   | --        | <b>2.63</b>                                      | <b>4.79</b> | <b>19.2</b> | <b>0.33</b>                                    | <b>0.60</b> | <b>2.4</b> |

A summary of calculated annual mass sediment phosphorus release in each of the large diameter core samples is given in Table 5-11. The release is calculated using the mass release rates summarized on Table 5-10 for each of the 4 isolation chamber sites which is weighted by the fraction of aerobic and anoxic conditions assumed to occur in the vicinity of the collection site for each large diameter core tube, based upon the vertical field profiles collected by ERD from March 2011-February 2012, summarized in Section 2.3.2.2. For example, the core sample collected at Site 1 is located in the northern lobe of the lake which exhibited anoxic or near-anoxic conditions at the water-sediment interface during 6 of the 12 monthly monitoring events conducted by ERD from March 2011-February 2012, reflecting approximately 50% of the annual period, with aerobic conditions observed during the remaining events. A similar pattern was observed in the east lobe which is reflected by the core sample identified as Site 2. Therefore, for Site 2, anoxic conditions in this area are also assumed to occur during approximately 50% of the year with aerobic conditions during 50%.

Core sample Site 3 is located in central portions of Lake Lawne. Surface water monitoring Site 3 exhibited anoxic conditions during 3 of the 12 monitoring events. However, the core sample was collected south of surface water Site 3 in much deeper water which is likely to exhibit anoxic or near-anoxic conditions at the sediment-water interface year-round. Therefore, the frequency of anoxic conditions at Site 3 is assumed to be 100%, with 0% assumed for aerobic conditions. Site 4 is located in the western lobe of Lake Lawne where water depths range from approximately 6-8 ft. Vertical profiles collected near this site indicated anoxic conditions during approximately half of the field monitoring events. Therefore, anoxic conditions are assumed to exist 50% of the time in this portion of the lake, with aerobic conditions assumed during the remaining 50%.

TABLE 5-11

**CALCULATED ANNUAL SEDIMENT RELEASE OF TOTAL  
PHOSPHORUS AND TOTAL NITROGEN IN LAKE LAWNE**

| SITE          | AREA      | FREQUENCY OF<br>CONDITION<br>(%) |        | WEIGHTED RELEASE<br>(mg/m <sup>2</sup> -day) |         |         | ASSUMED<br>AREA<br>(acres) | MASS RELEASE<br>(kg/yr) |             |            |
|---------------|-----------|----------------------------------|--------|----------------------------------------------|---------|---------|----------------------------|-------------------------|-------------|------------|
|               |           | Aerobic                          | Anoxic | SRP                                          | Total P | Total N |                            | SRP                     | Total P     | Total N    |
| 1             | North     | 50                               | 50     | 0.16                                         | 0.37    | 2.1     | 70                         | 16.8                    | 38.0        | 219        |
| 2             | Northeast | 50                               | 50     | 0.23                                         | 0.31    | 1.3     | 13                         | 4.4                     | 6.0         | 25.1       |
| 3             | Center    | 0                                | 100    | 0.43                                         | 0.64    | 1.5     | 40                         | 25.6                    | 37.6        | 86.6       |
| 4             | South     | 50                               | 50     | 0.14                                         | 0.44    | 3.0     | 25                         | 5.2                     | 16.3        | 111        |
| <b>TOTAL:</b> |           |                                  |        |                                              |         |         | <b>148.0</b>               | <b>52.1</b>             | <b>98.0</b> | <b>442</b> |

The measured aerobic and anoxic release rates are weighted by the estimated frequency of occurrence of aerobic and anoxic conditions to get estimates of mean annual release of SRP, total phosphorus, and total nitrogen within each core tube. Overall, the log-normal mean SRP release rate in the large diameter core samples is approximately 0.22 mg/m<sup>2</sup>-day, with a weighted total phosphorus release of 0.42 mg/m<sup>2</sup>-day and a weighted total nitrogen release of 1.9 mg/m<sup>2</sup>-day.

As indicated on Figure 5-25, the large diameter sediment core sample collected at Site 1 is located in the eastern lobe of the lake in an area with accumulated muck depths of 4-5 ft. For purposes of this evaluation, the release rates measured at Site 1 are assumed to be representative of the mean sediment release rates within the northern lobe of the lake which is estimated to be approximately 70 acres in size. Sediment core Site 2 was collected in the eastern lobe of the lake in an area with muck accumulations ranging from 4-5 ft. The sediment release rates measured at Site 2 are assumed to be indicative of release rates which occur in the eastern lobe of Lake Lawne, with an assumed area of 13 acres for this portion of the lake.

Sediment core sample from Site 3 was collected in central portions of the lake in an area with muck accumulations also ranging from approximately 3-4 ft. For purposes of this evaluation, the measured sediment release rates at this site are assumed to reflect sediment release throughout central portions of the lake which are assumed to have an area of approximately 40 acres. The final sediment core sample collected at Site 4 is located in the western lobe of the lake in an area with muck accumulations ranging from 7-8 ft. The area of the western lobe is assumed to be 25 acres for purposes of this evaluation, and the measured sediment release rates at this site are assumed to be indicative of release throughout the southern lobe.

Final estimates of annual mass release of nitrogen and phosphorus from the sediments in Lake Lawne are given in the final columns of Table 5-11 for each of the four lobes. Overall, the sediments of Lake Lawne release approximately 52.1 kg/yr of SRP, 98 kg/yr of total phosphorus, and 442 kg/yr of total nitrogen. However, the measured SRP release rates probably under-estimate the sediment release which occurs within the lake since other forms of phosphorus are released from sediments in addition to SRP, and a portion of the released SRP is likely utilized by biological

activity within the isolation chambers. In contrast, the measured annual total phosphorus release probably overestimates phosphorus release from Lake Lawne since the total phosphorus measured in the core chamber experiments also includes biological growth which occurred within the isolation chambers as a result of uptake of SRP. In reality, the actual sediment phosphorus release in Lake Lawne probably lies somewhere between the listed annual loadings for SRP and total phosphorus. Therefore, for purposes of estimating nutrient loadings to Lake Lawne, the annual sediment phosphorus release is assumed to be the mean of the mass release of SRP (52.1 kg/yr) and total phosphorus (98.0 kg/yr) which is equivalent to approximately 75.1 kg/yr.

### 5.1.6 Water Fowl

As indicated on previous figures, Lake Lawne contains a 1.5-acre densely vegetated island which is located near the center of the lake. Based on field observations conducted during this study, this island appears to be inhabited by numerous large water fowl, primarily wood storks, which roost and nest within the island vegetation. Photographs of the island and typical bird populations are illustrated on Figure 5-27.



a. Overview of bird island



b. Birds around island perimeter



c. Wood storks on vegetation canopy



d. Nesting pair

Figure 5-27. Photographs of the Island and Typical Bird Populations.



ERD has conducted multiple previous studies which have indicated that water fowl can contribute significant nutrient loadings to waterbodies, particularly when the water fowl are present in high numbers. During previous evaluations conducted on East Lake in Tampa and Lake Morton in Lakeland, ERD identified water fowl as the single largest source of nutrient loadings to these lakes. Unfortunately, quantification of nutrient loadings from water fowl was not conducted as part of the assigned work efforts for Lake Lawne. However, the number and size of water fowl utilizing the bird island suggest that the water fowl loadings may be a significant, although unquantified, additional loading to Lake Lawne.

## **5.2 Nutrient Losses**

Nutrient losses from Lake Lawne occur primarily as a result of discharges into the drainage well and through the lake outfall structure. Pollutant mass which is not discharged into the drainage well or through the outfall structure is assumed to accumulate into the sediments of the lake. Estimates of the magnitude of losses through the lake outfall structure are given in the following sections.

### **5.2.1 Outfall Discharges**

#### **5.2.1.1 Chemical Characteristics of Outfall Discharges**

Chemical characteristics of discharges from Lake Lawne into the drainage well and through the outfall structure are assumed to be similar to water quality characteristics measured in Lake Lawne by ERD from March 2011-February 2012 to reflect current conditions in the lake. A summary of water quality characteristics of Lake Lawne measured by ERD is given in Table 5-12 based on the information provided in Table 2-12. For purposes of estimating the chemical characteristics of discharges from Lake Lawne through the outfall structure, mean surface quality characteristics measured in the top samples collected at Site 1 are used since this site is located closest to the point of discharge from the lake. For purposes of estimating the chemical characteristics of discharges to the drainage well, mean surface quality characteristics measured in the top samples collected at Site 4 are used since this site is located closest to the drainage well intake. An assumed TSS concentration of 2.5 mg/l is used since TSS measurements were not conducted on the surface water samples. Characteristics of discharges through the Lake Lawne outfall and drainage well are assumed to be similar to the values summarized in Table 5-12.

**TABLE 5-12**

**MEAN WATER QUALITY CHARACTERISTICS OF LAKE LAWNE  
MONITORING SITES 1 AND 4 FROM MARCH 2011-FEBRUARY 2012**

| <b>DISCHARGE<br/>SOURCE</b> | <b>MONITORING<br/>SITE USED</b> | <b>TOTAL N<br/>(µg/l)</b> | <b>TOTAL P<br/>(µg/l)</b> | <b>TSS<br/>(mg/l)</b> |
|-----------------------------|---------------------------------|---------------------------|---------------------------|-----------------------|
| Outfall                     | Site 1                          | 810                       | 45                        | 2.5 <sup>1</sup>      |
| Drainage Well               | Site 4                          | 864                       | 46                        | 2.5 <sup>1</sup>      |

1. Assumed value

### 5.2.1.2 Mass Loadings

Calculated mass losses to the drainage well and through the outfall structure for Lake Lawne are summarized in Table 5-13. These values were obtained by multiplying the mean water column characteristics for Site 1 and Site 4 (summarized in Table 5-12) times the mean annual volumetric discharges to the drainage well and through the outfall structure (summarized in Table 4-13). Mass losses through the outfall structure remove approximately 2,585 kg of total nitrogen, 145 kg of total phosphorus, and 7,981 kg of TSS from Lake Lawne each year, with an additional 909 kg/yr of total nitrogen, 48.4 kg/yr of total phosphorus, and 2,630 kg/yr of TSS lost to the drainage well.

**TABLE 5-13**

**CALCULATED MEAN ANNUAL MASS LOSSES FROM LAKE LAWNE  
TO THE DRAINAGE WELL AND THROUGH THE OUTFALL STRUCTURE**

| SOURCE            | DISCHARGE<br>VOLUME<br>(ac-ft/yr) | MASS LOSS (kg/yr) |         |       |
|-------------------|-----------------------------------|-------------------|---------|-------|
|                   |                                   | Total N           | Total P | TSS   |
| Outfall Structure | 2,589                             | 2,585             | 145     | 7,981 |
| Drainage Well     | 853                               | 909               | 48.4    | 2,630 |

## 5.2.2 Deep Recharge Losses

### 5.2.2.1 Chemical Characteristics of Deep Recharge

Chemical characteristics of losses from Lake Lawne from deep recharge are assumed to be similar to water quality characteristics measured in Lake Lawne by ERD from March 2011-February 2012 to reflect current conditions in the lake. Since deep recharge occurs throughout the lake, water quality characteristics of deep recharge losses are assumed to be equal to the mean of surface water samples collected by ERD at each of the four sites (as summarized in Table 2-12). A summary of assumed water quality characteristics for deep recharge losses in Lake Lawne is given in Table 5-14.

**TABLE 5-14**

**OVERALL MEAN WATER QUALITY CHARACTERISTICS  
OF LAKE LAWNE FROM MARCH 2011-FEBRUARY 2012**

| DISCHARGE<br>SOURCE | MONITORING<br>SITES USED | TOTAL N<br>(µg/l) | TOTAL P<br>(µg/l) | TSS<br>(mg/l)    |
|---------------------|--------------------------|-------------------|-------------------|------------------|
| Deep Recharge       | All                      | 872               | 50                | 2.5 <sup>1</sup> |

1. Assumed value

### 5.2.2.2 Mass Loadings

Calculated mass losses from deep recharge in Lake Lawne are summarized in Table 5-15. These values were obtained by multiplying the mean water quality characteristics summarized in Table 5-14 times the mean annual volumetric loss of 123 ac-ft/yr to deep recharge. Mass losses from deep recharge remove approximately 133 kg/yr of total nitrogen, 7.5 kg/yr of total phosphorus, and 380 kg/yr of TSS from Lake Lawne.

**TABLE 5-15**  
**CALCULATED ANNUAL MASS LOSSES**  
**FROM LAKE LAWNE FROM DEEP RECHARGE**

| DISCHARGE<br>VOLUME<br>(ac-ft/yr) | MASS LOSS (kg/yr) |         |     |
|-----------------------------------|-------------------|---------|-----|
|                                   | Total N           | Total P | TSS |
| 123                               | 133               | 7.5     | 380 |

## 5.3 Mean Annual Mass Budgets

Estimated mean annual mass budgets were developed for total nitrogen, total phosphorus, and TSS entering Lake Lawne based upon the analyses presented in the previous sections. A summary of estimated mass inputs and losses to Lake Lawne is given in the following sections.

### 5.3.1 Mass Inputs

A summary of estimated mean annual mass loadings of total nitrogen, total phosphorus, and TSS to Lake Lawne is given in Table 5-16 based upon the assumptions and analyses presented in previous sections. The dominant source of nitrogen loadings to Lake Lawne appears to be stormwater runoff which contributes approximately 47% of the annual nitrogen loadings to the lake. Inflows from baseflow contribute approximately 17% of the annual total nitrogen loadings, with 14% contributed by groundwater seepage, 11% by bulk precipitation, 8% by internal recycling, and 3% by overland flow.

Stormwater runoff also appears to be the largest phosphorus input to Lake Lawne on an annual basis, contributing 40% of the estimated annual loadings. Approximately 18% is contributed by baseflow, with 14% by internal recycling and 13% by groundwater seepage. Phosphorus loadings from precipitation and overland flow are relatively minimal.

The dominant source of TSS loadings to Lake Lawne originates from bulk precipitation which contributes 42% of the annual loadings. Approximately 38% of the annual TSS loadings are contributed by runoff, with 12% by overland flow, and 8% from baseflow. This analysis assumes that no significant inputs of TSS are generated as a result of groundwater seepage or internal recycling.

**TABLE 5-16**

**ESTIMATED MEAN ANNUAL MASS LOADINGS OF TOTAL  
NITROGEN, TOTAL PHOSPHORUS, AND TSS TO LAKE LAWNE**

| SOURCE               | TOTAL NITROGEN |            | TOTAL PHOSPHORUS |            | TSS           |            |
|----------------------|----------------|------------|------------------|------------|---------------|------------|
|                      | kg/yr          | % of Total | kg/yr            | % of Total | kg/yr         | % of Total |
| Precipitation        | 586            | 11         | 46.4             | 9          | 13,165        | 42         |
| Runoff               | 2,612          | 47         | 202              | 40         | 12,169        | 38         |
| Direct Overland Flow | 164            | 3          | 27.5             | 6          | 3,932         | 12         |
| Baseflow             | 920            | 17         | 87.6             | 18         | 2,469         | 8          |
| Groundwater Seepage  | 793            | 14         | 63.4             | 13         | ~ 0           | 0          |
| Internal Recycling   | 442            | 8          | 71.4             | 14         | 0             | 0          |
| <b>TOTAL:</b>        | <b>5,517</b>   | <b>100</b> | <b>498</b>       | <b>100</b> | <b>31,734</b> | <b>100</b> |

### 5.3.2 Mass Losses

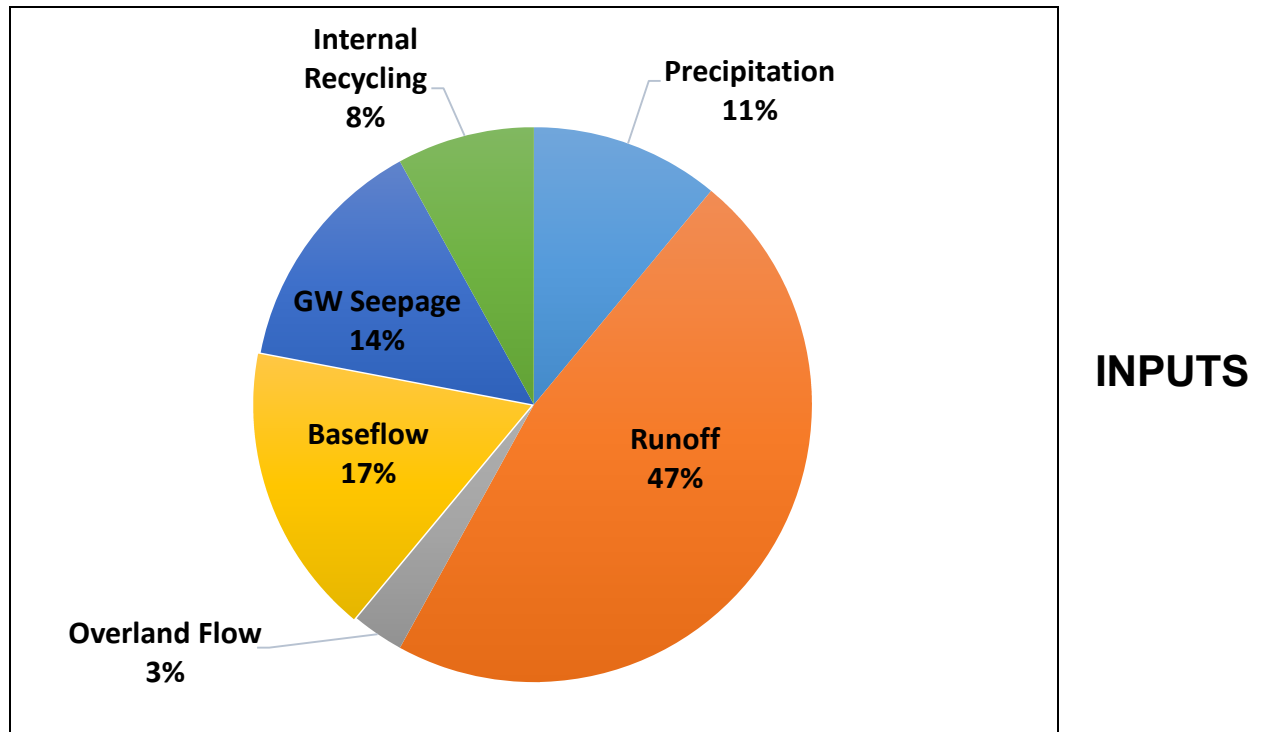
A summary of estimated mass losses of total nitrogen, total phosphorus, and TSS from Lake Lawne is given on Table 5-17. The majority of inputs of phosphorus and TSS accumulate primarily within the sediments of the lake, with 60% of the annual phosphorus loadings and 65% of the annual TSS loadings retained within the sediments. In contrast, only 35% of the nitrogen loadings are retained in the sediments. The remaining loadings of nitrogen, phosphorus, and TSS which are not retained within the sediments are assumed to discharge to the drainage well or through the outfall structure. A graphical comparison of estimated annual mass inputs and losses for total nitrogen, total phosphorus, and TSS in Lake Lawne is given on Figures 5-28, 5-29, and 5-30, respectively.

**TABLE 5-17**

**ESTIMATED MEAN ANNUAL MASS LOSSES OF TOTAL  
NITROGEN, TOTAL PHOSPHORUS, AND TSS FROM LAKE LAWNE**

| SOURCE        | TOTAL NITROGEN |            | TOTAL PHOSPHORUS |            | TSS           |            |
|---------------|----------------|------------|------------------|------------|---------------|------------|
|               | kg/yr          | % of Total | kg/yr            | % of Total | kg/yr         | % of Total |
| Outfall       | 2,585          | 47         | 145              | 28         | 7,981         | 26         |
| Drainage Well | 909            | 16         | 48.4             | 10         | 2,630         | 8          |
| Deep Recharge | 133            | 2          | 7.5              | 2          | 380           | 1          |
| Sediments     | 1,891          | 35         | 297              | 60         | 20,742        | 65         |
| <b>TOTAL:</b> | <b>5,517</b>   | <b>100</b> | <b>498</b>       | <b>100</b> | <b>31,734</b> | <b>100</b> |





**LOSSES**

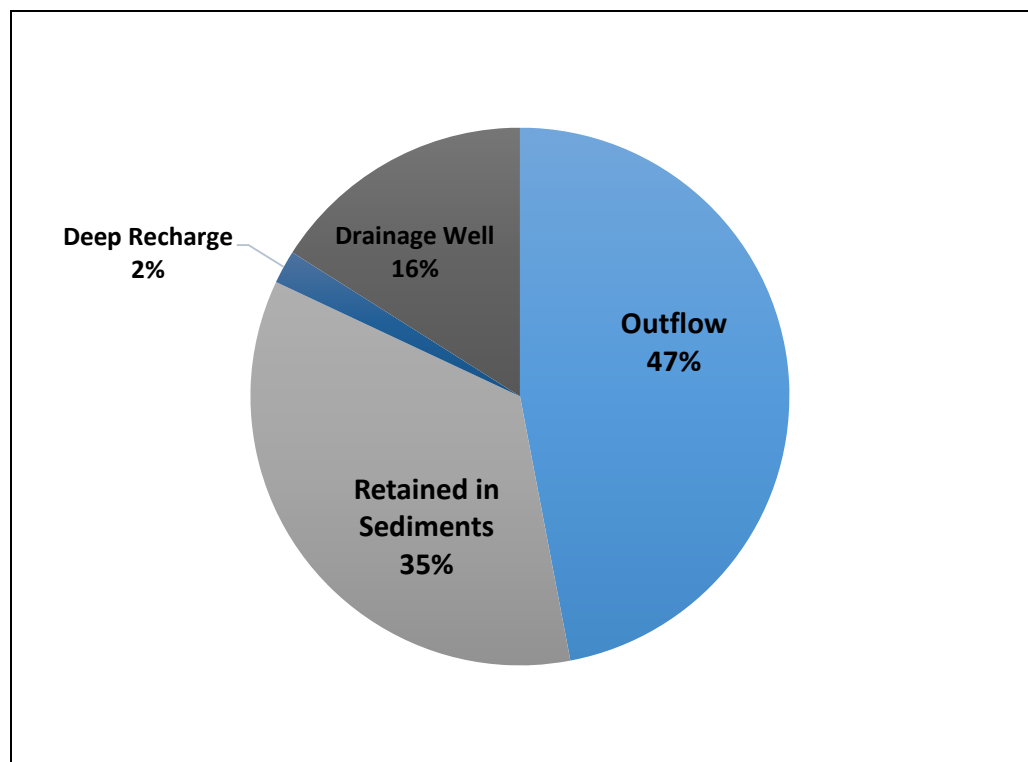
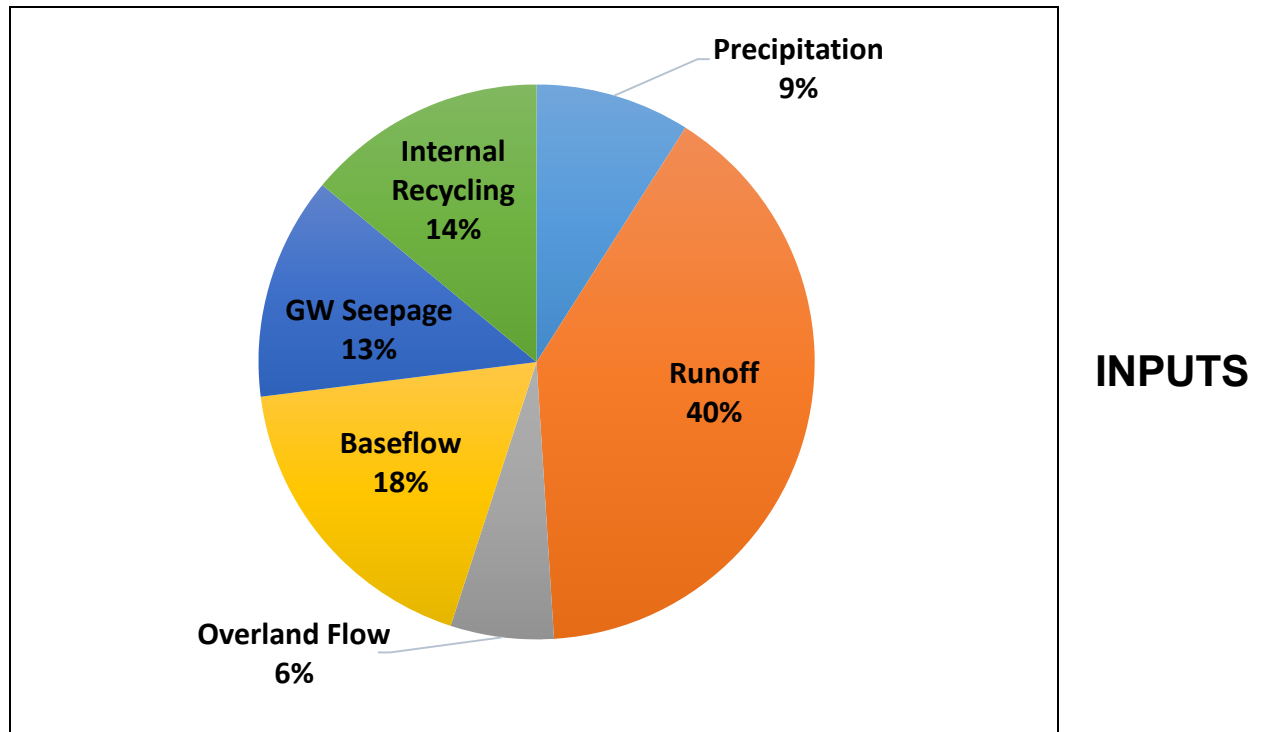


Figure 5-28. Estimated Annual Inputs and Losses of Total Nitrogen for Lake Lawne.



**LOSSES**

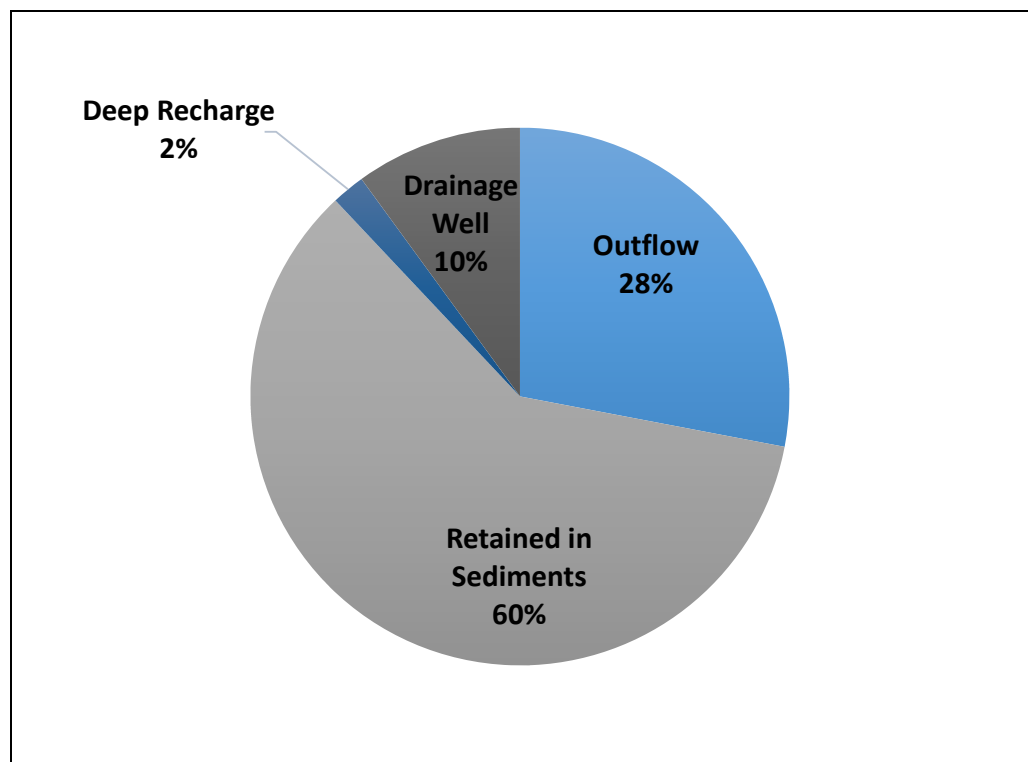


Figure 5-29. Estimated Annual Inputs and Losses of Total Phosphorus for Lake Lawne.

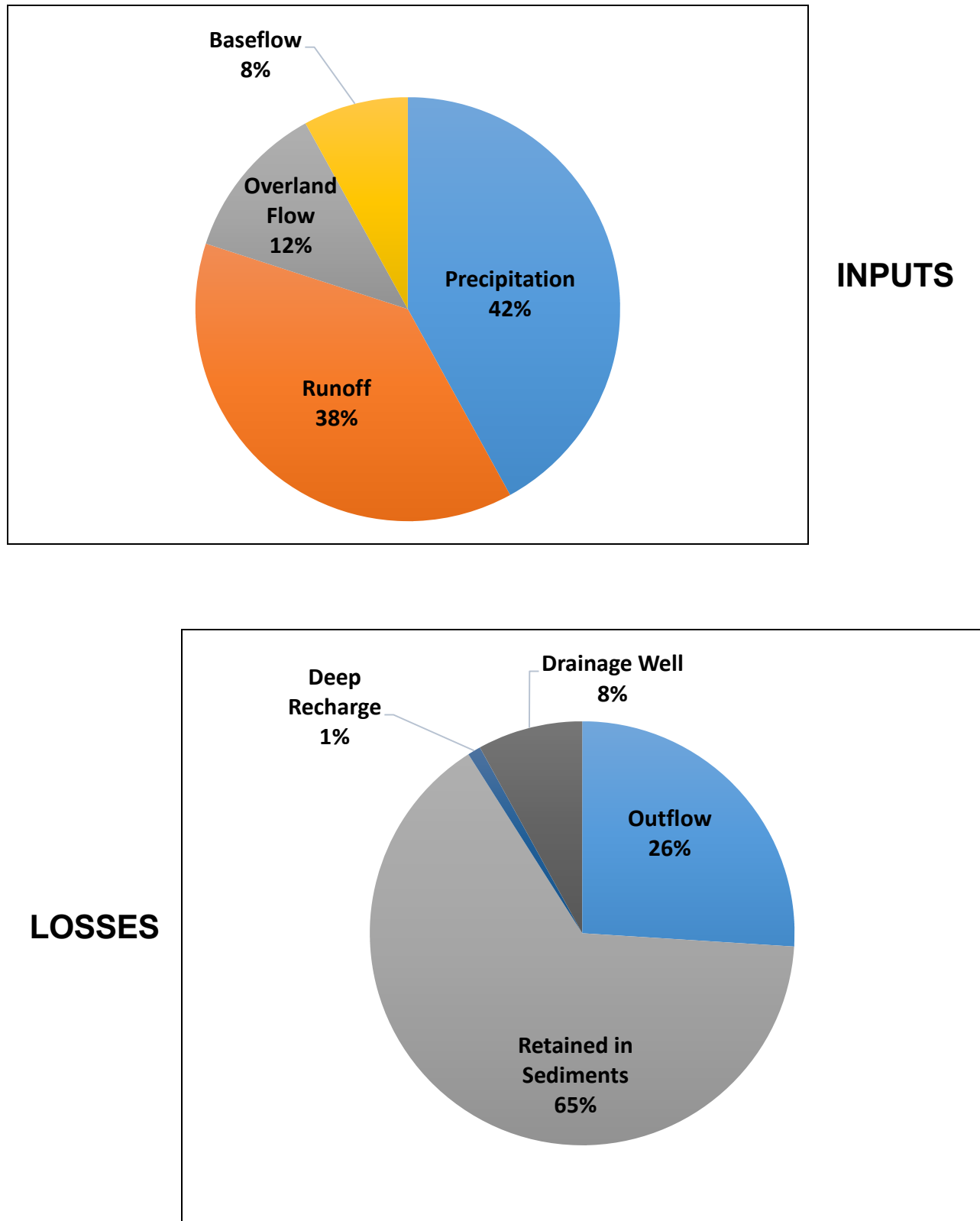


Figure 5-30. Estimated Annual Inputs and Losses of TSS for Lake Lawne.

### 5.3.3 Areal Nutrient Loadings Rates

A comparison of estimated annual total and areal loadings of nitrogen and phosphorus to Lake Lawne, based upon the nutrient budgets summarized in Table 5-16, is given in Table 5-18. Based upon the identified phosphorus inputs, the areal phosphorus loading to Lake Lawne is approximately 0.83 g/m<sup>2</sup>-yr. A summary of permissible nutrient loading levels for lakes up to 15 m deep, developed by Vollenweider (1968), is provided at the bottom of Table 5-18. According to Vollenweider, lakes with areal phosphorus loadings less than 0.1 g/m<sup>2</sup>-yr typically maintain oligotrophic characteristics, while lakes with more than 0.2 g/m<sup>2</sup>-yr will exhibit a trend of accelerated algal growth and potential for seasonal algal blooms. Based upon these criteria, the current phosphorus loading to Lake Lawne substantially exceeds the permissible loading level recommended by Vollenweider.

**TABLE 5-18**

**COMPARISON OF ESTIMATED ANNUAL  
TOTAL AND AREAL LOADINGS OF NITROGEN  
AND PHOSPHORUS TO LAKE LAWNE**

| AREA<br>(acres) | PHOSPHORUS LOADING |                      | NITROGEN LOADING |                      |
|-----------------|--------------------|----------------------|------------------|----------------------|
|                 | kg/yr              | g/m <sup>2</sup> -yr | kg/yr            | g/m <sup>2</sup> -yr |
| 148             | 498                | 0.83                 | 5,517            | 9.2                  |

Permissible Loading Levels (Vollenweider, 1968) for Lakes up to 15 m Deep:

- |                |                 |                           |
|----------------|-----------------|---------------------------|
| 1. Phosphorus: | a. Permissible: | <0.1 g/m <sup>2</sup> -yr |
|                | b. Dangerous:   | >0.2 g/m <sup>2</sup> -yr |
| 2. Nitrogen:   | a. Permissible: | <1.5 g/m <sup>2</sup> -yr |
|                | b. Dangerous:   | >3.0 g/m <sup>2</sup> -yr |

Areal loading rates for total nitrogen in Lake Lawne are also summarized in Table 5-18. Based upon this analysis, Lake Lawne has an estimated annual nitrogen loading of 9.2 g/m<sup>2</sup>-yr which substantially exceeds the dangerous level of 3.0 g/m<sup>2</sup>-yr for nitrogen established by Vollenweider.



## SECTION 6

### WATER QUALITY MODEL

As discussed in previous sections, Lake Lawne is primarily a balanced or phosphorus-limited ecosystem. This implies that all elements necessary for stimulation of algal productivity, such as nitrogen, carbon, magnesium, calcium, silica, sodium, potassium, and sulfur, are abundant within the water column of the lake with the exception of phosphorus. The growth of algae within the lake is directly correlated to the amount of phosphorus added since all other elements necessary for growth are already present in abundance of the needs of the algae. As a result, the primary objective of the water quality management options discussed in this section is to control and limit the introduction of phosphorus into Lake Lawne. However, projects designed to remove phosphorus will remove nitrogen as well, although to a lesser extent.

#### 6.1 Model Components

A water quality model was developed for Lake Lawne for use in evaluating anticipated water quality improvements resulting from evaluated phosphorus management options. The water quality model is developed based upon the average annual hydrologic budget summarized in Section 4 and the average annual phosphorus budget summarized in Section 5. Phosphorus inputs summarized in Table 5-14 are assumed to represent phosphorus loadings into the lake on an annual average basis. The model is calibrated using the results of the ambient water quality monitoring program summarized in Section 2. The model is then used to predict improvements in water quality characteristics resulting from evaluated phosphorus management options.

The water quality model was developed using a modified Vollenweider phosphorus limitation model as proposed by Vollenweider (1976), Vollenweider and Dillon (1974), and Dillon and Rigler (1974). Prediction of in-lake phosphorus concentrations are based upon four parameters, including the estimated annual phosphorus inputs to the lake, a phosphorus retention coefficient which is based upon phosphorus sedimentation dynamics, the mean depth of the lake, and the flushing rate for the lake system.

The first step in modeling involves estimation of the phosphorus retention coefficient,  $R_{TP}$ , which is an estimate of the fraction of phosphorus inputs which are retained within the lake. The phosphorus retention coefficient for any lake can be estimated based upon the lake flushing time and mean depth as proposed by Vollenweider (1976):

$$R_{TP} = \frac{\sigma}{\rho z + \sigma}$$

where:

|           |   |                                                                       |
|-----------|---|-----------------------------------------------------------------------|
| $R_{TP}$  | = | phosphorus retention coefficient (dimensionless)                      |
| $\rho$    | = | lake flushing rate, $Q/V = (\text{inflow/time})/(\text{lake volume})$ |
| $\bar{z}$ | = | lake mean depth = lake volume/surface area (m)                        |
| $\sigma$  | = | sedimentation rate coefficient (1/time)                               |

The sedimentation rate coefficient ( $\sigma$ ) is often considered to be analogous to an apparent settling velocity for total phosphorus. This coefficient is different for each lake and is impacted by parameters such as flushing lake, mean depth, sediment composition degree, impacts of boating activities, and hydraulic factors. Both empirical and theoretical formulations for the phosphorus retention coefficient suggest that this coefficient decreases as the flushing rate of the lake increases. This inverse relationship appears appropriate since, as flushing rate increases, there is less time for phosphorus to settle, resulting in a decrease in the retention coefficient.

Estimates of equilibrium total phosphorus concentrations within the lake are developed based upon the relationship proposed by Vollenweider and Dillon (1974):

$$TP = \frac{L_p (1 - R_{TP})}{\bar{z} * \rho}$$

where:

|           |   |                                                                |
|-----------|---|----------------------------------------------------------------|
| $L_p$     | = | areal total phosphorus loading ( $\text{mg/m}^2\text{-time}$ ) |
| $R_{TP}$  | = | phosphorus retention coefficient (dimensionless)               |
| $\rho$    | = | lake flushing rate (1/time)                                    |
| $\bar{z}$ | = | mean depth (m)                                                 |

Estimates of in-lake equilibrium chlorophyll-concentrations were calculated based on the empirical relationship between chlorophyll-a and total phosphorus developed by Harper and Baker (2007) specifically for Florida lakes:

$$\ln(chl-a) = 1.058 \ln TP - 1.334$$

$$R^2 = 0.815$$

where:

TP = mean total phosphorus concentration ( $\mu\text{g/l}$ )

The model also estimates mean Secchi disk depth based upon the empirical relationship proposed by Harper and Baker (2007), also developed specifically for Florida lakes, which results in an estimated Secchi disk depth in meters, based upon chlorophyll-a input in units of  $\text{mg/m}^3$ :

$$SD = \frac{0.7 [24.2386 + 0.3041 \times \text{chyl-a}]}{(6.0632 + \text{chyl-a})}$$

$$R^2 = 0.807$$

where:

SD = Secchi disk depth (m)

chyl-a = chlorophyll-a concentration ( $\text{mg/m}^3$ )

Trophic State Index (TSI) values are calculated based upon the Florida Trophic State Index proposed by Brezonik (1984) using measured concentrations of chlorophyll-a only. The empirical equation for calculating the Florida Trophic State Index is:

$$TSI (\text{Chyl-a}) = 16.8 + 14.4 \ln (\text{Chyl-a}) \quad (\text{Chyl-a in } \text{mg/m}^3)$$

Average trophic state values less than 50 indicate oligotrophic conditions, values between 50 and 60 indicate mesotrophic conditions, and values from 61 to 70 indicate eutrophic conditions. Values over 70 represent hypereutrophic conditions.

## **6.2 Model Calibration**

A modified Vollenweider mass balance model was developed for Lake Lawne using average annual inputs and loadings. The model includes hydrologic inputs to the lake from direct precipitation, stormwater runoff, baseflow, and groundwater seepage. Nutrient inputs to the lake include estimated loadings from bulk precipitation, stormwater runoff, baseflow, groundwater seepage, and internal recycling.

Hydrologic and mass losses from Lake Lawne are assumed to occur as a result of evaporation, deep recharge, and discharges through the outfall structure and to the drainage well. The net hydrologic inputs into the lake are used to provide an estimate of mean detention time as well as the flushing rate, which is used in calculation of the phosphorus retention coefficient. Phosphorus inputs to the lake are used to generate estimates of the areal phosphorus loading rate and the final in-lake phosphorus concentration. Estimates of equilibrium chlorophyll-a concentrations and Secchi disk depth in the lake are calculated based upon the predicted in-lake phosphorus concentration.

The Vollenweider Model assumes that the lake behaves like a continuously stirred tank reactor (CSTR), and the modeled in-lake phosphorus concentration reflects the weighted phosphorus concentration within the water column of the lake. In lakes which are well mixed, the phosphorus concentration is typically uniform throughout the water column, and the equilibrium total phosphorus concentration can be estimated by samples collected near the water surface. As discussed in Section 2, Lake Lawne exhibits only slight vertical variability in water quality characteristics, so the inherent assumption of a well mixed water column is assumed to apply to Lake Lawne.

After developing the trophic state model, initial model runs were performed to examine predicted water quality characteristics in Lake Lawne based upon the estimated mean annual loadings of total phosphorus to the lake from the identified sources. Model calibration was performed using the sedimentation rate coefficient, ( $\sigma$ ), which is present as a variable in both a numerator and denominator in the equation used for estimation of the phosphorus retention coefficient. The assumed sedimentation rate coefficient was varied for the lake until the model predicted total phosphorus concentration equaled the overall geometric mean total phosphorus concentration of 52  $\mu\text{g/l}$  based upon the historical water quality monitoring program conducted by Orange County from 2006-2011. A summary of the results of this calibration procedure is given in Table 6-1. The required sedimentation rate coefficient to calibrate the model for Lake Lawne is 63. The resulting phosphorus retention coefficient predicted by the model is 0.880. A summary of the results of the calibrated water quality model for Lake Lawne under existing conditions is given in Appendix G.1.

**TABLE 6-1**  
**RESULTS OF MODEL CALIBRATION PROCEDURES**  
**AND ASSUMED SEDIMENTATION RATE COEFFICIENT**

| <b>MEAN TOTAL<br/>PHOSPHORUS<br/>CONCENTRATION<br/>FROM 2006-2011<br/>(<math>\mu\text{g/l}</math>)</b> | <b>MODEL PREDICTED<br/>TOTAL PHOSPHORUS<br/>CONCENTRATION<br/>(<math>\mu\text{g/l}</math>)</b> | <b>SEDIMENTATION<br/>RATE COEFFICIENT<br/>(<math>\sigma</math>)</b> | <b>MODEL<br/>PHOSPHORUS<br/>RETENTION<br/>COEFFICIENT</b> |
|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------|
| 52                                                                                                     | 52                                                                                             | 63                                                                  | 0.880                                                     |



A comparison of measured and model predicted trophic state variables in Lake Lawne is given in Table 6-2. The measured and model predicted values for total phosphorus are identical at 52 µg/l. The model predicted chlorophyll-a concentration in Lake Lawne is 24.8 mg/m<sup>3</sup> compared with a measured geometric mean concentration of 20.7 mg/m<sup>3</sup> from 2006-2011, a difference of 20%. Similarly, a close agreement was also obtained for estimates of Secchi disk depth, with a difference of only 1% between the model predicted and measured Secchi disk depths for the lake.

**TABLE 6-2**  
**COMPARISON OF MEASURED AND MODEL PREDICTED**  
**TROPHIC STATE VARIABLES IN LAKE LAWNE**

| PARAMETER        | UNITS             | MEAN<br>MEASURED<br>VALUE<br>(2006-2011) | MODEL<br>PREDICTED<br>VALUE | PERCENT<br>DIFFERENCE<br>(%) |
|------------------|-------------------|------------------------------------------|-----------------------------|------------------------------|
| Total Phosphorus | µg/l              | 52                                       | 52                          | 0                            |
| Chlorophyll-a    | mg/m <sup>3</sup> | 20.7                                     | 24.8                        | + 20                         |
| Secchi Disk      | m                 | 0.71                                     | 0.72                        | + 1                          |

Based upon the comparison summarized in Table 6-2, it appears that the calibrated water quality model for Lake Lawne provides close agreement with measured trophic state variables within the lake during the monitoring program. The calibrated water quality model is then used to evaluate anticipated water quality responses to evaluated phosphorus reduction strategies discussed in Section 7.

## SECTION 7

### EVALUATION OF WATER QUALITY IMPROVEMENT OPTIONS

A discussion of water quality maintenance and improvement options for Lake Lawne is presented in this section. The evaluated water quality improvement options are designed to target sources which have been identified as significant contributors of nutrient loadings to the lake and include both structural and non-structural approaches to controlling and reducing pollutant inputs into Lake Lawne. A discussion of general management philosophy and recommended water quality improvement projects is given in the following sections.

#### 7.1 Management Philosophy

Based upon the evaluation of historical and current water quality characteristics in Lake Lawne presented in Section 2, it appears that Lake Lawne is primarily a eutrophic/ mesotrophic waterbody which is characterized by moderate to elevated concentrations of total nitrogen and total phosphorus, combined with highly variable concentrations of chlorophyll-a and periodic algal blooms, as a result of decades of untreated nutrient inputs into the lake. Over time, the natural ability of the lake to assimilate these nutrient loadings has been exceeded, resulting in a gradual degradation in water quality and overall health of the aquatic system. Sediment accumulations in the lake have increased over time, and studies conducted as part of this project have indicated that the accumulated sediments within the lake are now releasing nutrients into the overlying water column and further stimulating the growth of algae and aquatic plants. Water quality in Lake Lawne is relatively uniform throughout the 3 lobes of the lake due to multiple inflows around the perimeter of the lake.

As discussed in Section 2, Lake Lawne is primarily a nutrient-balanced to phosphorus-limited ecosystem, with statistically significant trends in each of the 3 lobes toward increasing phosphorus limitation as water quality improvement projects reduce phosphorus loadings to the lake. This implies that all elements necessary for stimulation for algal productivity (such as nitrogen, carbon, magnesium, calcium, silica, sodium, potassium, and sulfur) are abundant within the water column of the lake with the exception of phosphorus. As phosphorus is added to the water column of the lake, the growth of algae responds directly to the amount of phosphorus added since all other elements necessary for growth are already present in abundance of the needs of the algae. As a result, the primary objective of the management options discussed in this section is to control and limit the introduction of phosphorus into Lake Lawne.

Phosphorus inputs into Lake Lawne occur through a wide variety of sources, including bulk precipitation, stormwater runoff, overland flow, groundwater seepage, and internal recycling. Due to the large watershed/lake area ratio for Lake Lawne, pollutant inputs from stormwater runoff and baseflow reflect the largest annual inputs of total phosphorus, representing 59% of the overall annual phosphorus loadings impacting the lake. As a result, stormwater runoff is a significant contributor to overall water quality degradation in Lake Lawne, and the most significant impacts to phosphorus loadings entering Lake Lawne can be achieved by reducing loadings from runoff and baseflow.

The second largest sources of phosphorus loadings to Lake Lawne are internal recycling and groundwater seepage which, combined together, contribute 27% of the annual loadings, and measurable improvements in water quality can be achieved by treatment of these inputs. Other phosphorus sources, such as bulk precipitation and direct overland flow, contribute negligible phosphorus loadings on an annual basis.

## **7.2 Stormwater Treatment Options**

A discussion of hydrologic and nutrient inputs to Lake Lawne from stormwater runoff is given in Sections 4 and 5, respectively. Overall, stormwater runoff and baseflow, excluding the overland flow sub-basin, contribute approximately 64% of the annual nitrogen loadings, 59% of the annual phosphorus loadings, and 46% of the annual TSS loadings to the lake. These loadings are spread out over 23 separate sub-basin areas, although the vast majority of annual loadings are contributed by 3-4 of the sub-basin areas. Due to the significance of runoff and baseflow as nutrient sources to Lake Lawne, treatment systems for these inputs have the potential to substantially improve water quality in Lake Lawne. A discussion of existing and proposed stormwater management activities in the Lake Lawne watershed is given in the following sections. For the proposed stormwater treatment projects, emphasis is given to treatment options that maximize nutrient load reductions at the lowest mass removal costs.

### **7.2.1 Previous Stormwater Management Projects and Activities**

#### **7.2.1.1 C-7 Canal Project**

During 2011, Orange County completed construction for a wet detention pond to provide treatment for inflows into Lake Lawne from the C-7 Canal. An overview of the constructed treatment pond for the C-7 Canal is given on Figure 7-1. Prior to construction of the wet detention facility, the C-7 Canal consisted of a well-defined deep channel with steep side slopes which extended virtually to the shoreline of Lake Lawne. The C-7 Canal pond intercepts the canal discharges and provides additional opportunity for physical and biological processes to occur to reduce pollutant loadings discharging to the lake. In addition, the discharge from the C-7 Canal pond was reconfigured to provide a more diffuse flow pattern and provide rehydration for wetland areas adjacent to the lake shoreline. The conceptual design for the C-7 Canal wet detention pond was developed by ERD during 2007 through a direct contract with Orange County.

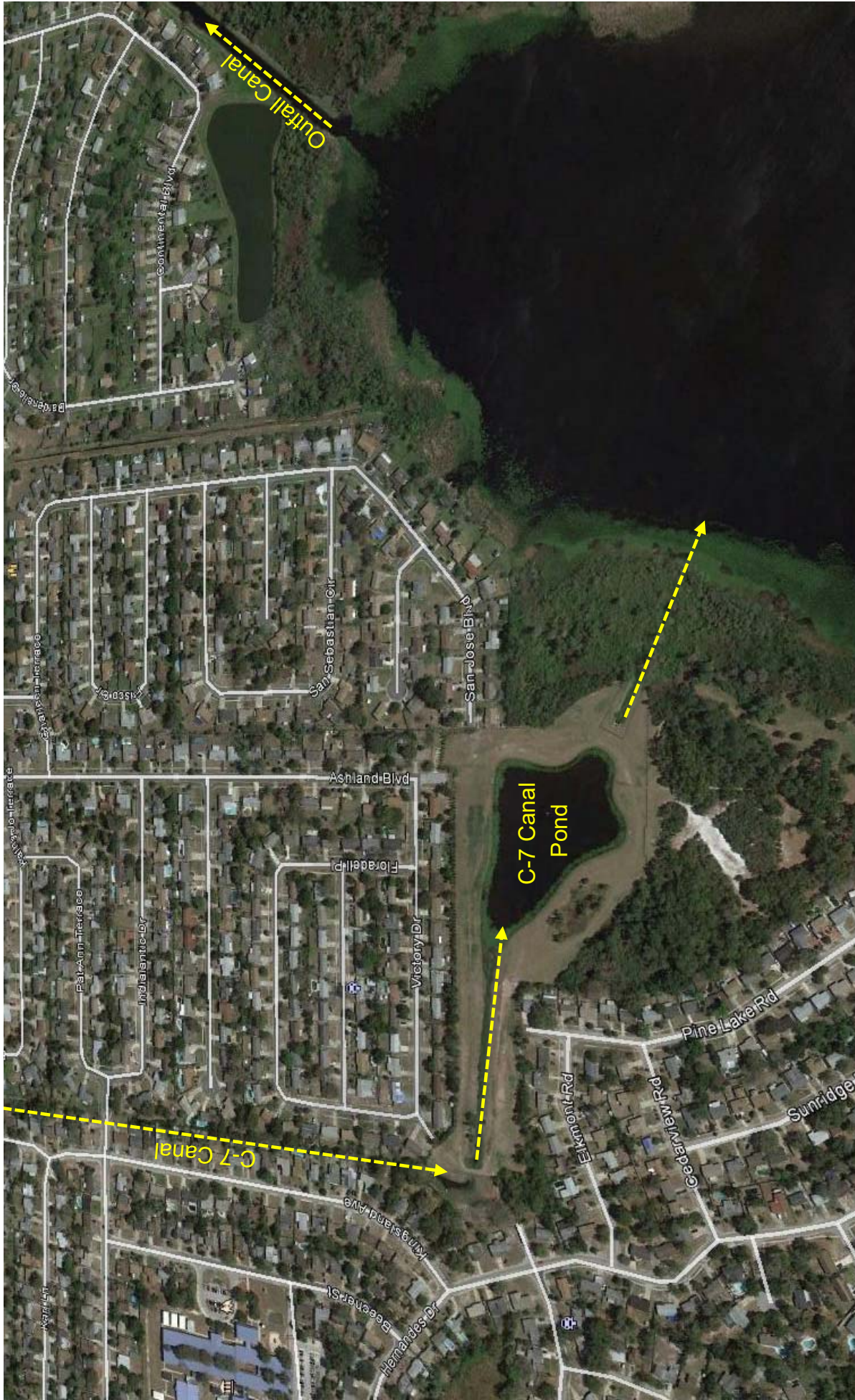


Figure 7-1. Existing Treatment Pond for the Lake Lawne C-7 Canal.



The 12-month field monitoring program which was conducted by ERD from March 2011-March 2012 as part of this current project was initiated after completion of the C-7 Canal pond, and discharges from the C-7 Canal pond were monitored as part of the tributary inflow monitoring program conducted for this project. Therefore, the loading estimates for the C-7 Canal sub-basin included in this report consider the impacts from the constructed stormwater management pond.

#### **7.2.1.2 Curb Inlet**

In addition to the C-7 Canal pond, Orange County has installed approximately 130 active curb and grate inlet filters within Orange County portions of the Lake Lawne watershed to collect leaves, trash, large sand, and other debris present in the generated stormwater runoff prior to discharge into the lake. Curb inlet baskets (CIBs) and grate inlet baskets (GIBs), also referred to as catch basin basket inserts (or inlet baskets), are a retrofit-type BMP designed to filter pollutants, leaf litter, and sediments from stormwater before the pollutants enter the stormsewer system. These units are installed in individual inlets or grate inlets and are made of durable material, such as stainless steel and plastic. The installed units are relatively inexpensive, with an installed cost of approximately \$1000/unit. Maintenance of the systems is relatively simple, requiring approximately 5-10 minutes to clean each unit with a vacuum-type truck. The average volumes for the CIBs and GIBs installed by OCEPD are 3.8 ft<sup>3</sup> and 4.3 ft<sup>3</sup>, respectively. These units are cleaned out on approximately a monthly basis by a local contractor.

Locations of existing curb and grate inlet filters in Orange County portions of the Lake Lawne watershed are illustrated on Figure 7-2. The existing curb and grate inlet filters are concentrated primarily in northern and western portions of the Lake Lawne drainage basin. According to OCEPD, grate and curb inlet filters have been installed in the Lake Lawne drainage basin at virtually all suitable locations in the control of Orange County. Inlet basket locations are selected based on proximity to the lake and the general suitability of the catch basin to accept the insert structure. Catch basins were determined to be unsuitable for installation of an inlet insert if the catch basin was extremely shallow, causing the insert to obstruct the pipe flow, or if the stormwater system was subjected to a significant surcharge at times that would backwash the captured materials from the insert.

### **7.2.2 Proposed Additional Stormwater Management Projects**

The C-1 Canal drainage basin is the largest single sub-basin area discharging to Lake Lawne. As indicated on Table 5-7, the C-1 Canal drainage basin covers approximately 1,282 acres and contributes approximately 1,502 ac-ft/yr of combined runoff and baseflow volume to the lake. This sub-basin is also the single largest source of nutrient loadings to Lake Lawne, contributing approximately 1,769 kg/yr of total nitrogen and 96 kg/yr of total phosphorus to the lake, reflecting 63.7% and 41.9%, respectively, of the combined runoff and baseflow loadings entering Lake Lawne on an annual basis. Due to the significance of this source, a treatment system for the C-1 Canal would have the largest opportunity to reduce runoff and baseflow generated loadings of nutrients to Lake Lawne. Potential treatment options for the C-1 Canal are addressed in a subsequent section.

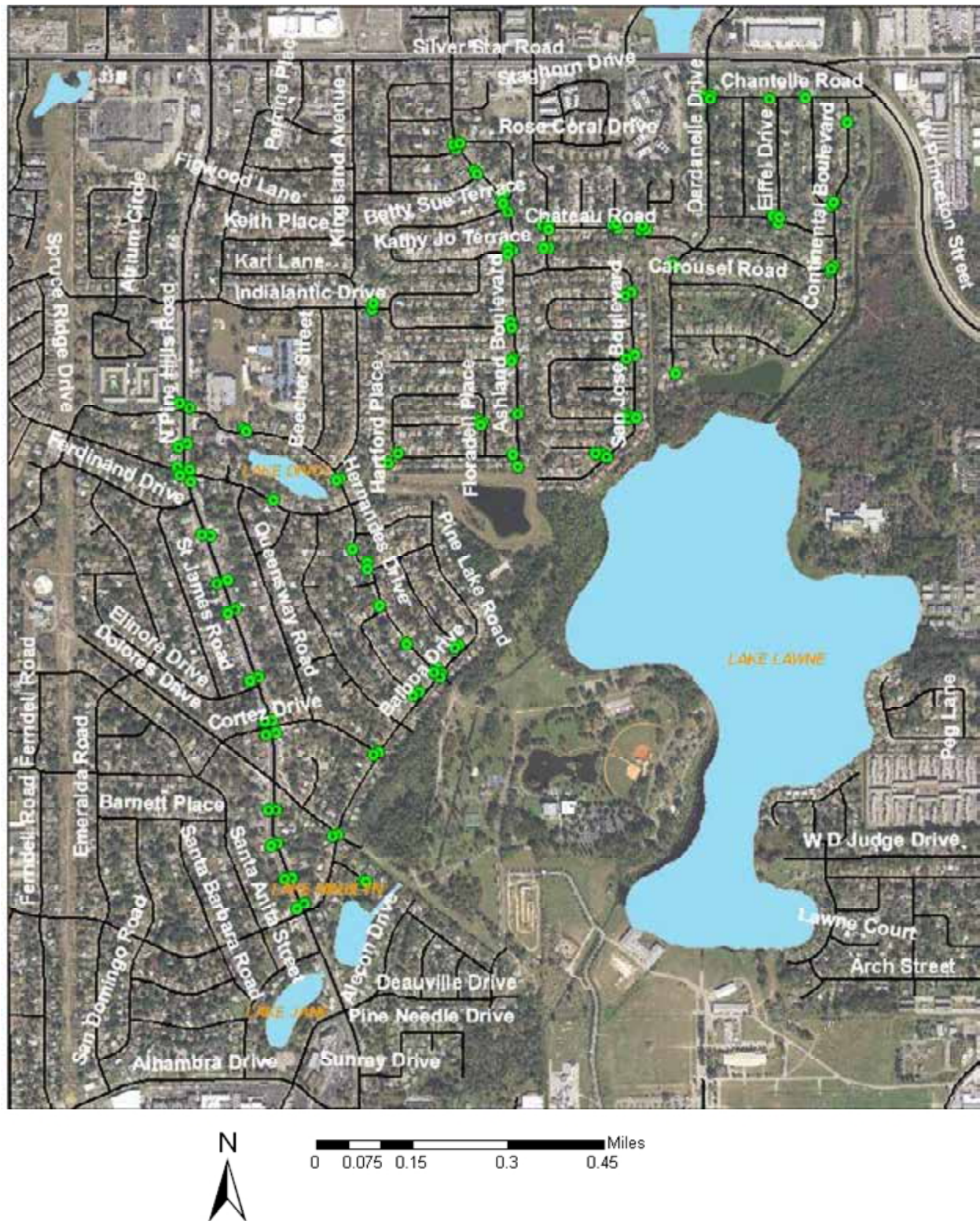


Figure 7-2. Locations of Curb Inlet Baskets (CIB) Installed by Orange County in the Lake Lawne Watershed.

The C-2 Canal drainage basin is the second largest sub-basin area discharging to Lake Lawne. As indicated on Table 5-7, the C-2 Canal drainage basin covers approximately 411.22 acres and contributes approximately 896 ac-ft/yr of combined runoff and baseflow volume to the lake. This sub-basin is the second largest source of nutrient loadings to Lake Lawne, contributing approximately 735 kg/yr of total nitrogen and 82.9 kg/yr of total phosphorus to the lake, reflecting 26.5% and 36.2%, respectively, of the combined runoff and baseflow loadings of nitrogen and phosphorus entering Lake Lawne on an annual basis. Due to the significance of this source, a treatment system for the C-2 Canal would have a large opportunity to reduce runoff and baseflow generated loadings of nutrients to Lake Lawne. Combined together, the C-1 and C-2 Canals contribute approximately 90.2% of the combined runoff and baseflow loadings of total nitrogen to Lake Lawne, 78.1% of the annual loadings of total phosphorus, and 45.4% of the combined loadings of TSS. A potential treatment option for the C-2 Canal is addressed in a subsequent section.

Orange County is currently evaluating a potential treatment project for the C-6 Canal which consists of a combined wet detention and reuse irrigation pond to be constructed along the path of the existing canal in Barnett Park. Orange County requested that ERD assess this potential future project as part of the evaluation of stormwater retrofit options for this project and estimate the anticipated annual nutrient load reductions which could be achieved. However, while evaluating the proposed stormwater treatment facility, it became apparent that the system could be modified to also incorporate inflows through the C-5 Canal as well. The C-6 Canal contributes approximately 134 kg/yr of total nitrogen to Lake Lawne, 12.8 kg/yr of total phosphorus, and 756 kg/yr of TSS. However, the adjacent C-5 Canal contributes 226 kg/yr of total nitrogen, 13.8 kg/yr of total phosphorus, and 720 kg/yr of TSS. Combined together, these two canals contribute 12.9% of the annual loadings of total nitrogen originating from runoff and baseflow, 11.6% of the annual phosphorus loadings, and 9.2% of the annual TSS loadings. Therefore, an evaluation of the proposed C-6 Canal treatment system is provided in a subsequent section, along with a potential modification to also incorporate discharges through the C-5 Canal.

The final treatment option evaluated by ERD is in the C-8 Canal. The C-8 Canal drainage basin is a relatively small sub-basin area, covering approximately 105.2 acres. On an average annual basis, combined inputs from runoff and baseflow contribute approximately 44.5 kg/yr of total nitrogen and 3.5 kg/yr of total phosphorus to Lake Lawne, and loadings originating from this sub-basin are only a small fraction of the loadings originating from Sub-basins 1 and 2. However, the C-8 Canal discharges into Lake Lawne within 350 ft of an existing large wet detention facility, and it would be relatively simple to divert discharges from the C-8 Canal into the existing wet detention pond. Diversion of the C-8 Canal into the wet pond would remove approximately 25% of the nitrogen loading and 50% of the phosphorus loading from the C-8 Canal and virtually eliminate this loading to Lake Lawne since the discharge from the wet detention pond occurs into the outfall canal rather than the lake itself. Therefore, even though this drainage basin represents a relatively small contribution to Lake Lawne, the simplicity and low cost of the proposed retrofit may make this an attractive and less expensive treatment option. An analysis of the proposed diversion for the C-8 Canal is given in a subsequent section.

### **7.2.2.1 C-1 Canal Drainage Basin**

Treatment options are relatively limited when attempting to address the annual volume of runoff and baseflow discharging through the C-1 Canal. The only potential treatment options capable of providing significant load reductions for a basin of this size is either a large regional wet detention facility or an alum treatment system. Based on the estimated annual volumetric loading of 1,502 ac-ft/yr from runoff and baseflow, a regional wet detention facility with a relatively modest 30-day detention time would require a permanent pool volume of approximately 125 ac-ft. Assuming an average water depth of 8 ft, the required pond surface area would be approximately 16 acres. The land costs and construction costs for a pond of this size would likely be prohibitive.

In addition, the C-1 Canal system contains miles of interconnected canals and swales along with hundreds of acres of interconnected wetland areas. These areas would be expected to provide significant pre-treatment for discharges through the C-1 Canal, removing a large portion of the original generated loadings of suspended solids and nutrients along with smaller removal efficiencies for dissolved constituents. The effects of these pre-treatment processes are evident in the mean characteristics of inflows from the secondary canals into Lake Lawne (summarized in Table 5-3) based upon the field monitoring program conducted by ERD. By the time the C-1 Canal discharges reach Lake Lawne, runoff concentrations have been reduced to approximately 52 µg/l for total phosphorus and 955 µg/l for total nitrogen. The inorganic fractions of nitrogen and phosphorus present in the inflows are low in value, and a large portion of the particulate loading has been previously removed. Therefore, the anticipated effectiveness of even a large regional wet detention facility would be relatively low given the substantially lower nutrient concentrations compared with untreated urban runoff.

The second treatment option capable of handling the large volume of flow through the C-1 Canal is an inline alum treatment system similar to the one previously designed by ERD for Lake Down Sub-basin 15. To be most effective, the alum treatment should be located as close as possible to the lake so that the largest amount of contributing areas to the C-1 Canal can be treated.

A screen shot of the Orange County Property Appraiser Map for the C-1 Canal between Mercy Drive and Lake Lawne is given on Figure 7-3. A 2.2 acre parcel exists west of Mercy Drive which bisects the C-1 Canal and is currently in public ownership by the City of Orlando. This parcel could easily be transformed into an inline alum treatment system with a dedicated settling pond to provide for floc collection. An alum treatment system would be capable of reducing the existing concentrations of total phosphorus by approximately 75-80%, from 52 µg/l in the C-1 Canal to approximately 10 mg/l in the treated water discharges.





A conceptual design for a proposed C-1 Canal alum treatment system is given on Figure 7-4. The parcel owned by the City of Orlando is approximately 400 ft in length and 242 ft in width, equivalent to approximately 2.2 acres. The majority of the site would be used to construct a 1.5-acre floc settling pond which would intersect the C-1 Canal inflows. This pond would be constructed with a water depth of approximately 20 ft and used to provide an area for floc settling and long-term floc storage. A portion of the proposed floc settling pond would be constructed in the footprint of an existing dry detention pond used to provide treatment for portions of Mercy Drive. A 25-ft maintenance berm is proposed between the property boundary and top-of-bank (TOB) of the pond.

Inflows into the pond would occur through the existing culvert which passes beneath Mercy Drive, and the water level in the canal would become the normal water level within the floc settling pond. Measurement of discharges through the C-1 Canal would occur within the existing culvert using an acoustic Doppler flow meter, with a point of alum addition located just downstream from the culvert discharge. A pump/control building would be constructed adjacent to Mercy Drive to house the chemical storage tank, feed pumps, and electronic controls. The existing driveway off Mercy Drive which provides access to the dry detention pond could be used as the point of access to the site.

The proposed alum treatment system would operate on a flow-weighted basis, with alum addition occurring at a rate equivalent to the discharge through the canal at any given time. Alum would be added to the canal inflow using a carrier water system which would draw water from the pond, inject alum, and discharge the water/alum mixture into the canal flow under high pressure to create sufficient turbulence to mix the alum with the canal water to be treated. The mixture of alum and canal water would enter the settling pond where floc formation and settling would occur. Discharges from the pond would occur through a pond outfall structure which is off-set from the center of the pond to maximize the distance between the point of inflow and outflow for the pond, and the treated water would be directed back into downstream portions of the C-1 Canal for discharge to Lake Lawne.

A summary of depth-area-volume relationships for the proposed C-1 Canal floc settling pond is given on Table 7-1. The total excavation depth is estimated to be approximately 25 ft from the existing land surface. At an assumed water depth of approximately 5 ft below the ground surface, the floc settling pond would have an available water depth of 20 ft. The total excavated volume is approximately 18.4 ac-ft, with a permanent pool volume of approximately 12.2 ac-ft for the floc settling pond. The depth-area-volume relationships summarized in Table 7-1 assume a 4:1 side slope to an excavation depth of 8 ft, followed by a 2:1 slope from 8 ft to the pond bottom at 25 ft.

Based upon previous studies conducted by ERD, the consolidated floc volume generated as a result of alum treatment of stormwater runoff at a typical alum treatment dose of approximately 7.5 mg Al/liter is equal to approximately 0.1% of the treated runoff volume. Assuming that the alum stormwater treatment system would provide treatment for the entire annual combined volume of runoff and baseflow of approximately 1,502 ac-ft/yr, the generated floc volume would be approximately 1.5 ac-ft/yr. Based upon the available pond storage volume of 12.2 ac-ft, floc removal would be required at approximately 7-year intervals when the floc accumulation reaches to within 2-3 ft of the water surface.





Figure 7-4. Conceptual Design for the Proposed C-1 Canal Alum Treatment System.



**TABLE 7-1**

**DEPTH-AREA-VOLUME RELATIONSHIPS FOR  
THE PROPOSED C-1 CANAL FLOC SETTLING POND**

| DEPTH<br>(ft) | AREA<br>(acres) | VOLUME<br>(ac-ft) | DEPTH<br>(ft) | AREA<br>(acres) | VOLUME<br>(ac-ft) |
|---------------|-----------------|-------------------|---------------|-----------------|-------------------|
| 0             | 1.50            | 18.4              | 13            | 0.65            | 5.7               |
| 1             | 1.39            | 16.9              | 14            | 0.62            | 5.1               |
| 2             | 1.30            | 15.6              | 15            | 0.59            | 4.5               |
| 3             | 1.20            | 14.4              | 16            | 0.56            | 3.9               |
| 4             | 1.10            | 13.2              | 17            | 0.53            | 3.4               |
| 5             | 0.99            | 12.2              | 18            | 0.50            | 2.8               |
| 6             | 0.94            | 11.2              | 19            | 0.47            | 2.4               |
| 7             | 0.90            | 10.3              | 20            | 0.44            | 1.9               |
| 8             | 0.85            | 9.4               | 21            | 0.42            | 1.5               |
| 9             | 0.81            | 8.6               | 22            | 0.39            | 1.1               |
| 10            | 0.74            | 7.8               | 23            | 0.37            | 0.7               |
| 11            | 0.71            | 7.1               | 24            | 0.34            | 0.3               |
| 12            | 0.68            | 6.4               | 25            | 0.32            | 0.0               |

Assumed pond normal water level

Conceptual construction costs for the proposed alum treatment system are given on Table 7-2. Conceptual costs are provided for each of the primary elements necessary to construct a typical alum treatment system at this location, including pond excavation and grading, construction of the control building, instrumentation for flow measurement and alum addition, the alum storage tank, a carrier water pump station and piping, outfall structure, outfall piping, junction manholes, and a mitered end section. The estimated construction cost for the proposed system, including a 20% contingency, is \$1,251,205.

A summary of estimated operational and maintenance costs for the proposed C-1 Canal alum treatment system is given in Table 7-3. The proposed system would provide treatment for approximately 1,502 ac-ft/yr of combined runoff and baseflow. At an assumed alum addition of 7.5 mg Al/liter, the treatment system would require approximately 62,655 gallons of alum per year, and using an estimated unit cost of \$0.45/gallon, the annual chemical cost would be approximately \$28,195. Labor costs are also included for routine maintenance of the facility based upon an assumed 15 hours/week. Utilities for the system are estimated at approximately \$2000/month, with an additional lump sum amount of approximately \$25,000 for repairs and miscellaneous items. The overall total estimated O&M cost is approximately \$100,595/year.



TABLE 7-2

**CONCEPTUAL COST ESTIMATE FOR  
THE C-1 CANAL ALUM TREATMENT SYSTEM  
COMPONENTS WITH A FLOC SETTLING POND**

| NO.                  | ITEM DESCRIPTION                                                 | UNITS | QUANTITY | UNIT PRICE (\$) | COST (\$)           |
|----------------------|------------------------------------------------------------------|-------|----------|-----------------|---------------------|
| 1.                   | Mobilization (8% of total)                                       | LS    | 1        | 100,000         | \$ 100,000          |
| 2.                   | Maintenance of traffic                                           | LS    | 1        | 10,000          | 10,000              |
| 3.                   | Clearing/grubbing                                                | LS    | 1        | 20,000          | 20,000              |
| 4.                   | Pond excavation and grading                                      | SY    | 31,166   | 15.00           | 467,491             |
| 5.                   | Performance turf                                                 | SY    | 4,500    | 5.00            | 22,500              |
| 6.                   | Concrete driveway                                                | SF    | 644      | 30.00           | 19,320              |
| 7.                   | Fencing, type B, 6-ft, non-coated                                | LF    | 1,280    | 12.00           | 15,360              |
| 8.                   | Control building (716 sq ft)                                     | LS    | 1        | 100,000         | 100,000             |
| 9.                   | Electrical service, conduits, wiring, etc.                       | LS    | 1        | 20,000          | 20,000              |
| 10.                  | Instrumentation (flow monitoring, pumps, controls, piping, etc.) | EA    | 1        | 135,000         | 135,000             |
| 11.                  | Alum storage tank (8,000 gallons) with piping                    | EA    | 1        | 28,000          | 28,000              |
| 12.                  | Carrier water pump station and piping                            | LS    | 1        | 40,000          | 40,000              |
| 13.                  | pH monitoring system                                             | LS    | 1        | 6,500           | 6,500               |
| 14.                  | Miscellaneous piping and boxes                                   | LS    | 1        | 10,000          | 10,000              |
| 15.                  | Outfall structure – Type D inlet                                 | EA    | 1        | 10,000          | 10,000              |
| 16.                  | RCP piping (36-inch)                                             | LF    | 150      | 125.00          | 18,750              |
| 17.                  | Connecting manhole – Type J                                      | EA    | 2        | 8,000           | 16,000              |
| 18.                  | Mitered end section (36-inch RCP)                                | EA    | 1        | 3,750           | 3,750               |
| <b>Sub-total:</b>    |                                                                  |       |          |                 | <b>\$ 1,042,671</b> |
| Contingency (\$20%): |                                                                  |       |          |                 | 208,534             |
| <b>TOTAL:</b>        |                                                                  |       |          |                 | <b>\$ 1,251,205</b> |

TABLE 7-3

**ESTIMATED ANNUAL O&M COSTS FOR  
THE C-1 CANAL ALUM TREATMENT SYSTEM**

| OPTION                          | UNITS     | ANNUAL QUANTITY | UNIT COST (\$) | ANNUAL COST (\$)  |
|---------------------------------|-----------|-----------------|----------------|-------------------|
| Liquid alum                     | gallons   | 62,655          | 0.45           | 28,195            |
| Labor (15 hours/week)           | man-hours | 780             | 30             | 23,400            |
| Utilities                       | LS        | --              | --             | 24,000            |
| Repairs and Miscellaneous Items | LS        | --              | --             | 25,000            |
| <b>ANNUAL TOTAL:</b>            |           |                 |                | <b>\$ 100,595</b> |

A summary of estimated mass load reductions for the C-1 Canal treatment system is given in Table 7-4. The C-1 Canal treatment will provide approximately 30% removal for total nitrogen, 80% removal for total phosphorus, and 80% removal for TSS. The assumed removal efficiencies for the C-1 Canal treatment system are slightly lower than values normally associated with alum treatment systems due to the low concentrations which exist in discharges through the canal. Based on the assumed removal efficiencies, the proposed C-1 Canal treatment system will remove approximately 531 kg/yr of total nitrogen, 76.8 kg/yr of total phosphorus, and 4,481 kg/yr of TSS from Lake Lawne.

**TABLE 7-4**  
**ESTIMATED MASS LOAD REDUCTIONS FOR**  
**THE C-1 CANAL ALUM TREATMENT SYSTEM**

| <b>PARAMETER</b> | <b>EXISTING<br/>LOADING TO LAKE<br/>(kg/yr)</b> | <b>MASS REMOVAL<br/>IN TREATMENT SYSTEM<br/>(%)</b> | <b>MASS<br/>LOAD REMOVED<br/>(kg/yr)</b> |
|------------------|-------------------------------------------------|-----------------------------------------------------|------------------------------------------|
| Total Nitrogen   | 1,769                                           | 30                                                  | 531                                      |
| Total Phosphorus | 96.0                                            | 80                                                  | 76.8                                     |
| TSS              | 5,601                                           | 80                                                  | 4,481                                    |

A summary of calculated present worth phosphorus mass removal costs for the proposed C-1 Canal alum treatment system is given in Table 7-5. As discussed previously, the annual phosphorus loading from runoff and baseflow through the C-1 Canal is approximately 96 kg/yr. Assuming a removal efficiency of approximately 80% by the proposed treatment system, the resulting load reduction would be approximately 76.8 kg/yr or 1,536 kg over a 20-year cycle. The overall 20-year present worth phosphorus removal cost for the system, based upon a 20-year return period with an interest rate of 4%, is \$2,618,287 or \$1,705/kg. This mass removal cost is somewhat higher than removal costs commonly associated with alum stormwater treatment systems which are typically near \$200-300/kg (\$90-150/lb). The more elevated mass removal cost associated with this system is due to the relatively low phosphorus concentrations measured in the C-1 Canal and large annual volume which must be treated.

The proposed C-1 Canal alum treatment system could also be constructed without the 1.5-acre floc settling pond, with the generated alum floc allowed to settle into Lake Lawne. This method of direct injection of the alum floc into the receiving water is currently used in virtually all of the existing alum stormwater treatment systems located in Central Florida, which includes Lake Dot, Lake Concord, Lake Holden, Clear Lake, Lake Rowena, Lake Lucerne, Lake Virginia, Lake Mizell, and Lake Osceola. In fact, the only alum treatment system in Central Florida which includes a floc settling pond is the recently-constructed treatment system for Lake Down Sub-basin 15, with all of the remaining treatment systems discharging floc directly into the lakes. This option substantially reduces the initial construction cost and on-going maintenance costs since periodic removal of the alum floc is not required. Most of the existing systems which provide for direct injection of the alum floc have been operating for long periods of time, with alum stormwater treatment in Lake Holden on-going for more than 20 years.

**TABLE 7-5**

**ESTIMATED PHOSPHORUS MASS REMOVAL  
COSTS FOR THE C-1 CANAL ALUM TREATMENT  
SYSTEM WITH A FLOC SETTLING POND**

| PARAMETER                             |                                     | UNITS | TOTAL<br>PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|---------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 76.8                |
|                                       | 20-year Mass Removal                | kg    | 1,536               |
| Project Costs                         | Construction                        | \$    | 1,251,205           |
|                                       | Annual O&M                          | \$    | 100,595             |
|                                       | 20-year Present Worth (4% interest) | \$    | 2,618,287           |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 1,705               |
|                                       |                                     | \$/lb | 773                 |

A summary of conceptual construction costs for the C-1 Canal alum treatment system without a settling pond is given in Table 7-6. This estimate includes each of the components previously included in Table 7-2 with the exception of the 1.5-acre pond and associated cost elements. The estimated conceptual cost for the C-1 Canal alum treatment system without a settling pond is approximately \$490,584, including a 20% contingency. This cost is approximately 39% of the estimated construction cost for the system with a dedicated settling pond. Estimated annual O&M costs for the C-1 Canal alum treatment system without a settling pond are identical to the costs provided in Table 7-3.

A summary of estimated phosphorus mass removal costs for the C-1 Canal alum treatment system without the floc settling pond is given in Table 7-7. The estimated annual phosphorus load reduction is assumed to be the same for the treatment system with or without the floc settling option. The annual O&M costs are also assumed to be identical between the two alternatives. The 20-year present worth cost associated with the C-1 Canal treatment system without the floc settling pond is \$1,857,666 or \$1,209/kg (\$548/lb). This mass removal cost is substantially more attractive than the relatively elevated mass removal cost of \$1,705/kg calculated for the settling pond option.

A summary of floc generation and accumulation calculations for the direct injection option at the C-1 Canal is given in Table 7-8. Based upon treatment of an annual average of 1,502 ac-ft/yr of combined runoff and baseflow, the floc generation rate will be approximately 0.1% of the treated flow or 1.5 ac-ft/yr. If this floc volume were to enter Lake Lawne and settle over an assumed area of 40 acres, the resulting accumulation rate would be approximately 0.45 inches/yr. Based upon this rate of accumulation, it would require approximately 27 years for the floc accumulation to reach a depth of 1 ft within the lake. In addition, the floc provides additional benefits of sequestering phosphorus within the sediments and reducing sediment toxicity for benthic organisms.

**TABLE 7-6**

**CONCEPTUAL COST ESTIMATE FOR  
THE C-1 CANAL ALUM TREATMENT SYSTEM  
COMPONENTS WITHOUT A FLOC SETTLING POND**

| NO.                  | ITEM DESCRIPTION                                                 | UNITS | QUANTITY | UNIT PRICE (\$) | COST (\$)         |
|----------------------|------------------------------------------------------------------|-------|----------|-----------------|-------------------|
| 1.                   | Mobilization (8% of total)                                       | LS    | 1        | 45,000          | \$ 45,000         |
| 2.                   | Maintenance of traffic                                           | LS    | 1        | 2,500           | 2,500             |
| 3.                   | Performance turf                                                 | SY    | 500      | 5.00            | 2,500             |
| 4.                   | Concrete driveway                                                | SF    | 644      | 30.00           | 19,320            |
| 5.                   | Control building (716 sq ft)                                     | LS    | 1        | 100,000         | 100,000           |
| 6.                   | Electrical service, conduits, wiring, etc.                       | LS    | 1        | 20,000          | 20,000            |
| 7.                   | Instrumentation (flow monitoring, pumps, controls, piping, etc.) | EA    | 1        | 135,000         | 135,000           |
| 8.                   | Alum storage tank (8,000 gallons) with piping                    | EA    | 1        | 28,000          | 28,000            |
| 9.                   | Carrier water pump station and piping                            | LS    | 1        | 40,000          | 40,000            |
| 10.                  | pH monitoring system                                             | LS    | 1        | 6,500           | 6,500             |
| 11.                  | Miscellaneous piping and boxes                                   | LS    | 1        | 10,000          | 10,000            |
| <b>Sub-total:</b>    |                                                                  |       |          |                 | <b>\$ 408,820</b> |
| Contingency (\$20%): |                                                                  |       |          |                 | 81,764            |
| <b>TOTAL:</b>        |                                                                  |       |          |                 | <b>\$ 490,584</b> |

**TABLE 7-7**

**ESTIMATED PHOSPHORUS MASS REMOVAL  
COSTS FOR THE C-1 CANAL ALUM TREATMENT  
SYSTEM WITHOUT A FLOC SETTLING POND**

| PARAMETER                             |                                     | UNITS | TOTAL PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 76.8             |
|                                       | 20-year Mass Removal                | kg    | 1,536            |
| Project Costs                         | Construction                        | \$    | 490,584          |
|                                       | Annual O&M                          | \$    | 100,595          |
|                                       | 20-year Present Worth (4% interest) | \$    | 1,857,666        |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 1,209            |
|                                       |                                     | \$/lb | 548              |



TABLE 7-8

**FLOC GENERATION AND ACCUMULATION  
ESTIMATES FOR THE C-1 CANAL DIRECT INJECTION OPTION**

| PARAMETER                  | UNITS       | VALUE    |
|----------------------------|-------------|----------|
| Watershed Area             | acres       | 1,281.84 |
| Calculated C Value         | --          | 0.281    |
| Annual Rainfall            | inches      | 50.03    |
| Annual Runoff + Baseflow   | ac-aft      | 1,502    |
| Assumed Alum Dose          | mg Al/liter | 7.5      |
| Floc Generation            | % of Flow   | 0.1      |
|                            | ac-ft       | 1.50     |
|                            | cubic-ft    | 65,427   |
| Lake Area                  | acres       | 148      |
| Assumed Floc Settling Area | acres       | 40       |
| Accumulation Rate          | inches/year | 0.45     |

#### **7.2.2.2 C-2 Canal Alum Treatment System**

As discussed in previous sections, the C-2 Canal is the second largest sub-basin area discharging to Lake Lawne and contributes approximately 26.5% and 36.2%, respectively, of the combined runoff and baseflow loadings of total nitrogen and total phosphorus entering Lake Lawne on an annual basis. The C-2 Canal is located approximately 1,500 ft south of the C-1 Canal. Due to the close proximity of the C-2 Canal to the proposed alum treatment system for the C-1 Canal, a point of flow measurement and alum addition could easily be extended from the C-1 Canal alum treatment facility to provide treatment for the C-2 Canal.

A conceptual design for the proposed C-2 Canal alum treatment system is given on Figure 7-5. The proposed point of alum addition is located just downstream from the stormsewer piping which conveys the C-2 Canal beneath Mercy Drive. An acoustic Doppler flow meter would be installed inside the culvert which passes beneath Mercy Drive which would send a signal to the control/pump building for the C-1 Canal system. This flow signal would instruct an additional chemical pump to inject liquid alum at a rate proportional to the discharge rate of runoff and baseflow through the C-2 Canal. The carrier water system proposed for the C-1 Canal system could also be used to transport carrier water and alum to the point of alum addition in the C-2 Canal. A series of nozzles would be installed on the bottom of the C-2 Canal channel, and the alum/water mixture would be injected into the canal flow under high pressure to provide mixing of the alum and the canal flow. Floc formation would occur as the treated water migrates through the C-2 Canal prior to discharge into Lake Lawne. The floc generated from the treatment process would be allowed to settle directly into Lake Lawne, similar to virtually all of the existing systems in Central Florida.





Figure 7-5. Conceptual Design for the Proposed C-2 Canal Alum Treatment System.



The addition of the C-2 Canal treatment system would be a relatively simple add-on to the proposed C-1 Canal system. The control cables, power cables, and a 4-inch HDPE carrier water line could all be installed in the same trench which would be constructed within the existing right-of-way along Mercy Drive. A conceptual cost estimate for the C-2 Canal alum treatment system is given on Table 7-9. The costs listed in this table reflect additional costs above the costs summarized for the C-1 Canal system and assume that the C-1 Canal system is constructed either previously or simultaneously with the C-2 Canal system. Additional costs will be required for a second alum feed pump and control, HDPE piping to the point of alum addition, an additional flow meter and flow meter controls, electrical and signal cables and wiring, and the alum addition system on the bottom of the C-2 Canal. This analysis assumes that the additional piping, signal cables, and wiring will be installed beneath the existing sidewalk, so additional costs are included for replacement of approximately 1,500 ft of existing sidewalk. The overall estimated conceptual construction cost for the C-2 Canal alum treatment system addition is \$138,240 which includes a 20% contingency.

**TABLE 7-9**  
**CONCEPTUAL COST ESTIMATE FOR THE**  
**C-2 CANAL ALUM TREATMENT SYSTEM ADDITION**

| NO.                | ITEM DESCRIPTION                               | UNITS | QUANTITY | UNIT PRICE (\$) | COST (\$)         |
|--------------------|------------------------------------------------|-------|----------|-----------------|-------------------|
| 1.                 | Additional alum feed pump and controls         | LS    | 1        | 40,000          | \$ 40,000         |
| 2.                 | Flow meter controls and cabinet                | LS    | 1        | 10,000          | 10,000            |
| 3.                 | HDPE piping to point of alum addition (4-inch) | LF    | 1,500    | 15.00           | 22,500            |
| 4.                 | Sontec flow meter                              | EA    | 1        | 15,000          | 15,000            |
| 5.                 | Alum addition system in canal                  | LS    | 1        | 10,000          | 10,000            |
| 6.                 | Sidewalk replacement (4-inch)                  | SY    | 220      | 35.00           | 7,700             |
| 7.                 | Electrical and signal cables and wiring        | EA    | 1        | 10,000          | 10,000            |
| <b>Sub-total:</b>  |                                                |       |          |                 | <b>\$ 115,200</b> |
| Contingency (20%): |                                                |       |          |                 | 23,040            |
| <b>TOTAL:</b>      |                                                |       |          |                 | <b>\$ 138,240</b> |

A summary of estimated annual O&M costs for the C-2 Canal alum treatment system is given in Table 7-10. At a typical treatment dose of 7.5 mg Al/liter, treatment of the combined runoff and baseflow volume of 896 ac-ft/yr would require approximately 37,376 gallons of alum. At a unit cost of \$0.45/gallon, the estimated annual chemical cost for treatment of inflows from the C-2 Canal would be approximately \$16,819. An additional \$5,000/year is included for repairs and maintenance, resulting in an estimated O&M cost of \$21,819. This cost assumes that any routine maintenance and calibration for the C-2 Canal system would be included in the man-hours already provided for the C-1 Canal treatment system.

**TABLE 7-10**

**ESTIMATED ANNUAL O&M COSTS FOR  
THE C-2 CANAL ALUM TREATMENT SYSTEM**

| <b>OPTION</b>                   | <b>UNITS</b> | <b>ANNUAL<br/>QUANTITY</b> | <b>UNIT COST<br/>(\$)</b> | <b>ANNUAL COST<br/>(\$)</b> |
|---------------------------------|--------------|----------------------------|---------------------------|-----------------------------|
| Liquid Alum                     | gallons      | 37,376                     | 0.45                      | \$ 16,819                   |
| Repairs and miscellaneous items | LS           | --                         | --                        | 5,000                       |
| <b>ANNUAL TOTAL:</b>            |              |                            |                           | <b>\$ 21,819</b>            |

A summary of estimated C-2 Canal treatment system mass removals is given in Table 7-11. The C-2 Canal treatment system is estimated to provide approximately 30% removal for total nitrogen, 80% removal for total phosphorus, and 80% removal for TSS. The assumed removal efficiencies for the C-2 Canal treatment system are slightly lower than values normally associated with alum treatment systems due to the low concentrations which exist in discharges through the canal. The proposed C-2 Canal treatment system will remove approximately 221 kg/yr of total nitrogen, 66.3 kg/yr of total phosphorus, and 1,361 kg/yr of TSS from Lake Lawne.

**TABLE 7-11**

**ESTIMATED MASS LOAD REDUCTIONS FOR  
THE C-2 CANAL ALUM TREATMENT SYSTEM**

| <b>PARAMETER</b> | <b>EXISTING<br/>LOADING TO LAKE<br/>(kg/yr)</b> | <b>MASS REMOVAL<br/>IN TREATMENT SYSTEM<br/>(%)</b> | <b>MASS<br/>LOAD REMOVED<br/>(kg/yr)</b> |
|------------------|-------------------------------------------------|-----------------------------------------------------|------------------------------------------|
| Total Nitrogen   | 735                                             | 30                                                  | 221                                      |
| Total Phosphorus | 82.9                                            | 80                                                  | 66.3                                     |
| TSS              | 1,701                                           | 80                                                  | 1,361                                    |

A summary of estimated mass phosphorus removal costs for the proposed C-2 Canal alum treatment system is given in Table 7-12. As indicated on Table 7-9, the proposed C-2 Canal treatment system will remove approximately 66.3 kg/yr of total phosphorus or approximately 1,326 kg over the 20-year analysis cycle. The resulting 20-year present worth cost for the treatment system is \$434,763 which results in a phosphorus removal cost of approximately \$328/kg (\$149/lb).



**TABLE 7-12**

**ESTIMATED PHOSPHORUS MASS REMOVAL COSTS  
FOR THE PROPOSED C-2 CANAL ALUM TREATMENT SYSTEM**

| PARAMETER                             |                                     | UNITS | TOTAL<br>PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|---------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 66.3                |
|                                       | 20-year Mass Removal                | kg    | 1,326               |
| Project Costs                         | Construction                        | \$    | 138,240             |
|                                       | Annual O&M                          | \$    | 21,819              |
|                                       | 20-year Present Worth (4% interest) | \$    | 434,763             |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 328                 |
|                                       |                                     | \$/lb | 149                 |

A summary of estimated mass phosphorus removal costs for the combined C-1 and C-2 Canals treatment systems with the C-1 Canal settling pond is given in Table 7-13. Combined together, treatment systems for the C-1 and C-2 Canals would remove approximately 143 kg/yr of total phosphorus or 2,862 kg over the 20-year analysis period. The combined construction costs for the C-1 and C-2 Canals system would be approximately \$1,389,445, with a corresponding combined O&M cost of \$122,414, resulting in a 20-year present worth cost of \$3,053,050. The overall 20-year present worth phosphorus removal cost for this combined system is \$1,067/kg or \$484/lb.

**TABLE 7-13**

**ESTIMATED PHOSPHORUS MASS REMOVAL COSTS  
FOR THE COMBINED C-1 AND C-2 CANAL ALUM TREATMENT  
SYSTEMS WITH THE C-1 CANAL SETTLING POND**

| PARAMETER                             |                                     | UNITS | TOTAL<br>PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|---------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 143                 |
|                                       | 20-year Mass Removal                | kg    | 2,862               |
| Project Costs                         | Construction                        | \$    | 1,389,445           |
|                                       | Annual O&M                          | \$    | 122,414             |
|                                       | 20-year Present Worth (4% interest) | \$    | 3,053,050           |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 1,067               |
|                                       |                                     | \$/lb | 484                 |

A summary of estimated mass phosphorus removal costs for the combined C-1 and C-2 Canals treatment systems without the C-1 Canal settling pond is given in Table 7-14. The annual load reductions for this option are the same as the load reductions previously assumed for the option with the C-1 Canal settling pond. However, the option without the settling pond has a substantially lower construction cost, although the annual O&M cost remains the same. Overall, the 20-year present worth cost for a combined C-1 and C-2 Canals treatment system without a settling pond is \$2,292,429, equivalent to \$801/kg or \$363/lb. The phosphorus removal costs are substantially lower for this option due to the removal of costs associated with the floc settling pond.

**TABLE 7-14**

**ESTIMATED PHOSPHORUS MASS REMOVAL COSTS  
FOR THE COMBINED C-1 AND C-2 CANAL ALUM TREATMENT  
SYSTEMS WITHOUT THE C-1 CANAL SETTLING POND**

| PARAMETER                             |                                     | UNITS | TOTAL<br>PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|---------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 143                 |
|                                       | 20-year Mass Removal                | kg    | 2,862               |
| Project Costs                         | Construction                        | \$    | 628,824             |
|                                       | Annual O&M                          | \$    | 122,414             |
|                                       | 20-year Present Worth (4% interest) | \$    | 2,292,429           |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 801                 |
|                                       |                                     | \$/lb | 363                 |

A summary of estimated floc generation and accumulation in Lake Lawne for the C-2 Canal direct injection option is given on Table 7-15. At the assumed alum dose of 7.5 mg Al/liter, the final consolidated floc volume is equivalent to approximately 0.1% of the treated flow. Therefore, alum treatment of 896 ac-ft/yr of inflow will generate approximately 0.9 ac-ft/yr of alum floc. If this floc were to settle over an area of approximately 40 acres in Lake Lawne, the resulting accumulation would be approximately 0.27 inches/yr which would require 44 years to achieve an accumulation of 12 inches of floc.

**TABLE 7-15**

**FLOC GENERATION AND ACCUMULATION  
ESTIMATES FOR THE C-2 CANAL DIRECT INJECTION OPTION**

| PARAMETER                  | UNITS       | VALUE  |
|----------------------------|-------------|--------|
| Watershed Area             | acres       | 411.22 |
| Calculated C Value         | --          | 0.523  |
| Annual Rainfall            | inches      | 50.03  |
| Annual Runoff + Baseflow   | ac-aft      | 896    |
| Assumed Alum Dose          | mg Al/liter | 7.5    |
| Floc Generation            | % of Flow   | 0.1    |
|                            | ac-ft       | 0.90   |
|                            | cubic-ft    | 39,204 |
| Lake Area                  | acres       | 148    |
| Assumed Floc Settling Area | acres       | 40     |
| Accumulation Rate          | inches/year | 0.27   |

### **7.2.2.3 Combined C-5 and C-6 Canals Treatment System**

A proposed regional stormwater facility for the C-6 Canal was developed by Inwood Consulting Engineers and CPWG for Orange County during 2012. The proposed regional treatment facility will expand the surface area of the C-6 Canal within portions of Barnett Park, creating a series of shallow vegetated pools. Water will be withdrawn from the shallow pools to provide irrigation for approximately 100 acres of park and recreational areas within Barnett Park.

An overview of the proposed regional stormwater facility for the C-6 Canal is given on Figure 7-6. In addition to the series of shallow meandering ponds, the facility will also include pedestrian walkways, additional parking, and walking trails.

Water levels elevations in the proposed stormwater facility will be controlled by a 40-ft long weir structure constructed at the northern end of the proposed expansion of the C-6 Canal. Based upon independent calculations conducted by ERD, the volume of water that can be stored within the treatment facility at a normal water level elevation of 90.0 ft is approximately 26.88 ac-ft. The annual volumetric discharge through the C-6 Canal from the combined inputs of runoff and baseflow is approximately 168 ac-ft/yr.

Water will be pumped from the proposed pond system for irrigation of approximately 100 acres of park area. Assuming an annual rainfall of 50.2 inches and a typical annual evapotranspiration rate of 34.7 inches/yr for Bahia grass, the proposed irrigation system will provide disposal for approximately 15.5 inches/yr over the proposed 100-acre area. This irrigation loss corresponds to approximately 129 ac-ft/yr or approximately 77% of the estimated annual inflow of 168 ac-ft/yr, with only 39 ac-ft of the incoming 168 ac-ft actually discharging to Lake Lawne on an average annual basis.

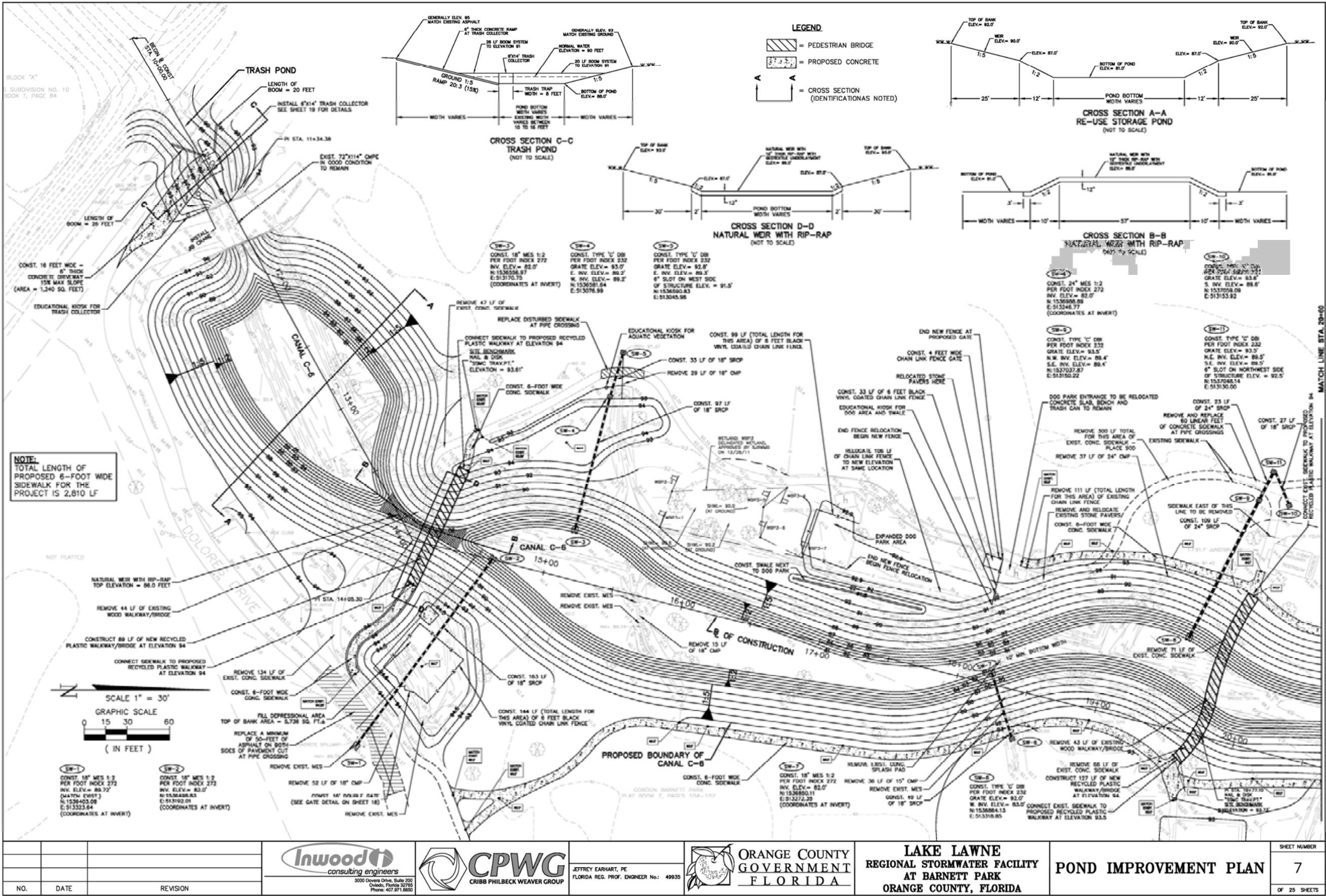
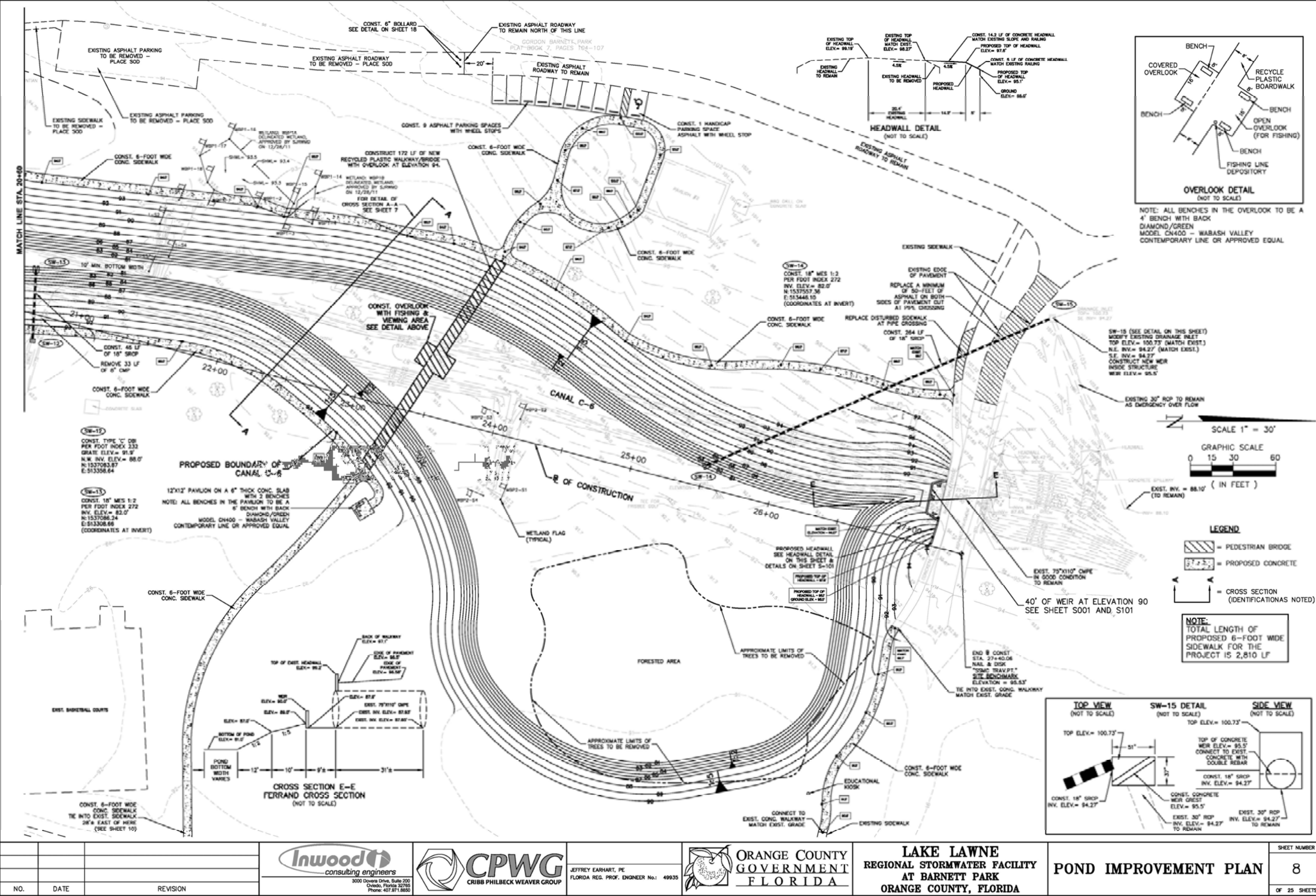


Figure 7-6. Proposed Regional Stormwater Facility for the C-6 Canal.





The average residence time within the treatment system, based upon the net water volume of 39 ac-ft/yr will be approximately 209 days, and discharges from the pond will receive additional load reductions as a result of biological uptake within the proposed treatment system. However, since the inflow to the treatment system has already received significant load reductions in the extensive canal system, the anticipated removal efficiencies for nitrogen and phosphorus within the water column of the pond will be somewhat reduced from removal efficiencies typically observed in wet detention ponds. For purposes of this analysis, a water column removal efficiency of approximately 20% is assumed for total nitrogen and a 50% annual load reduction is assumed for total phosphorus and TSS.

A summary of estimated annual load reductions for the proposed C-6 Canal treatment system is given on Table 7-16. Under current conditions, the C-6 Canal contributes 168 ac-ft of inflows to Lake Lawne each year, along with 134 kg/yr of total nitrogen, 12.8 kg/yr of total phosphorus, and 756 kg/yr of TSS. Removal by the reuse irrigation system is equal to approximately 77% of the annual inputs, resulting in a loss of 129 ac-ft/yr of volume and 103 kg/yr of total nitrogen, 9.9 kg/yr of total phosphorus, and 582 kg/yr of TSS. In addition to losses by reuse irrigation, mass removal will also occur as a result of biological uptake in the wet detention pond. Assuming an additional 20% removal for total nitrogen and 50% for total phosphorus and TSS, the biological uptake will remove approximately 6.2 kg/yr of total nitrogen, 1.45 kg/yr of total phosphorus, and 87 kg/yr of TSS. Overall, the proposed C-6 Canal treatment system will remove 129 ac-ft of water, 109 kg/yr of total nitrogen, 11.4 kg/yr of total phosphorus, and 669 kg/yr of TSS.

**TABLE 7-16**

**ESTIMATED ANNUAL LOAD REDUCTIONS FOR  
THE PROPOSED C-6 CANAL TREATMENT SYSTEM**

| <b>PARAMETER</b>                 | <b>VOLUME<br/>(ac-ft/yr)</b> | <b>TOTAL<br/>NITROGEN<br/>(kg/yr)</b> | <b>TOTAL<br/>PHOSPHORUS<br/>(kg/yr)</b> | <b>TSS<br/>(kg/yr)</b> |
|----------------------------------|------------------------------|---------------------------------------|-----------------------------------------|------------------------|
| Annual Inflow-Current Conditions | 168                          | 134                                   | 12.8                                    | 756                    |
| Removal by Reuse Irrigation      | 129                          | 103                                   | 9.9                                     | 582                    |
| Removal in Wet Detention Pond    | --                           | 6.2                                   | 1.45                                    | 87                     |
| Total Annual Removals            | 129                          | 109                                   | 11.4                                    | 669                    |

Due to the close proximity of the C-5 Canal to the C-6 Canal, it may be feasible to divert portions of discharges through the C-5 Canal into the proposed C-6 Canal treatment system. An overview of a proposed interconnection system for Canal C-5 is given on Figure 7-7. The diversion would be controlled by a sheetpile diversion weir which would be constructed in the C-5 Canal. This diversion structure would raise water elevations, causing water to divert through an installed stormsewer culvert to an existing drainage ditch located behind residential homes along Burgundy Road which would need to be deepened and enlarged to handle the additional flows. The drainage ditch behind the homes intersects with the C-6 Canal, and the combined discharges from the C-5 and C-6 Canals would then discharge into the proposed treatment system.



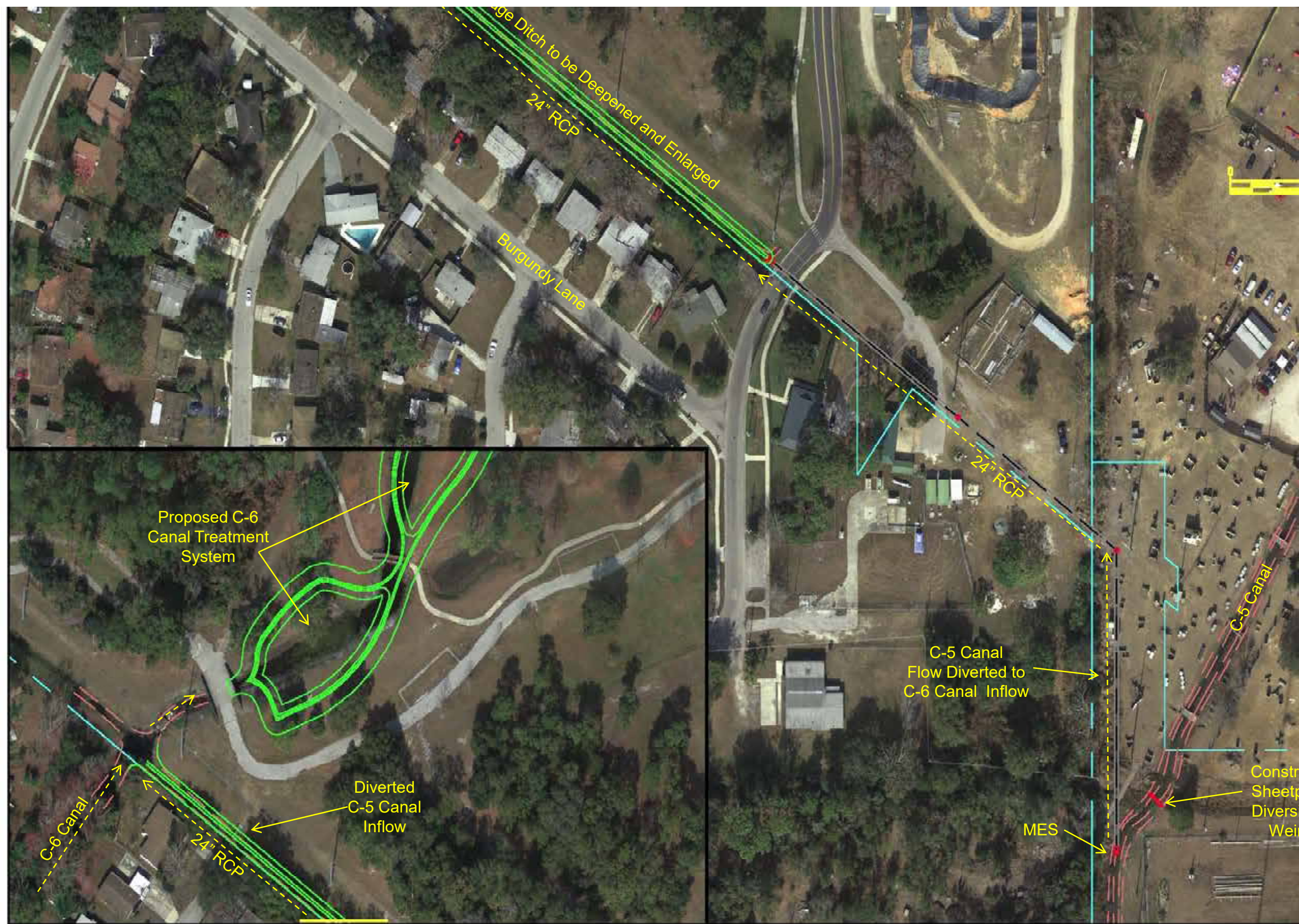


Figure 7-7. Proposed C-5 Canal Interconnect System.



A screen shot of the Orange County Property Appraiser map for areas in the vicinity of the C-5 and C-6 Canals is given on Figure 7-8, and the location of the proposed interconnection piping is indicated. Virtually all of the recommended pathway for the interconnection piping is currently in the ownership of Orange County and is located within Barnett Park. However, the proposed weir structure and beginning portions of the interconnection piping are located on the fairgrounds property, and permission or an easement would need to be obtained for the proposed activities in this area.

A summary of combined annual volumes and mass loadings from runoff and baseflow in Lake Lawne sub-basins 5 and 6 is given in Table 7-17. Annual volumetric inflows and mass loadings of total nitrogen and total phosphorus discharging through the C-5 Canal are actually greater in magnitude than discharges through the C-6 Canal in spite of the smaller sub-basin associated with the C-5 Canal. A summary of combined loadings from the two canal systems is given at the bottom of Table 7-17.

**TABLE 7-17**  
**SUMMARY OF COMBINED ANNUAL VOLUMETRIC**  
**AND MASS LOADINGS FROM RUNOFF AND BASEFLOW**  
**IN LAKE LAWNE SUB-BASINS 5 AND 6**

| SUB-BASIN      | WATERSHED<br>AREA<br>(acres) | ANNUAL<br>VOLUME<br>(ac-ft) | MASS LOADINGS (kg/yr)     |                        |                        |
|----------------|------------------------------|-----------------------------|---------------------------|------------------------|------------------------|
|                |                              |                             | Total<br>Nitrogen         | Total<br>Phosphorus    | TSS                    |
| 5              | 143.40                       | 176                         | 226<br>(8.1) <sup>1</sup> | 13.8<br>(6.0)          | 720<br>(4.5)           |
| 6              | 309.88                       | 168                         | 134<br>(4.8)              | 12.8<br>(5.6)          | 756<br>(4.7)           |
| <b>TOTALS:</b> | <b>453.28</b>                | <b>344</b>                  | <b>360<br/>(12.9)</b>     | <b>26.6<br/>(11.6)</b> | <b>1,476<br/>(9.2)</b> |

1. Percentage of total runoff and baseflow loadings in parentheses

A tabular summary of estimated annual load reductions for a proposed C-5/C-6 Canal treatment system is given on Table 7-18. The combined annual inputs for the two canals are based upon information provided in Table 7-17. Volumetric and load reductions removed by the reuse irrigation system are assumed to be the same as those estimated for the C-6 Canal treatment system. However, mass removal in the wet pond increases for nitrogen, phosphorus, and TSS due to the additional inputs from the C-5 Canal. Overall, the combined system will remove approximately 154 kg/yr of total nitrogen, 18.3 kg/yr of total phosphorus, and 1,029 kg/yr of TSS.



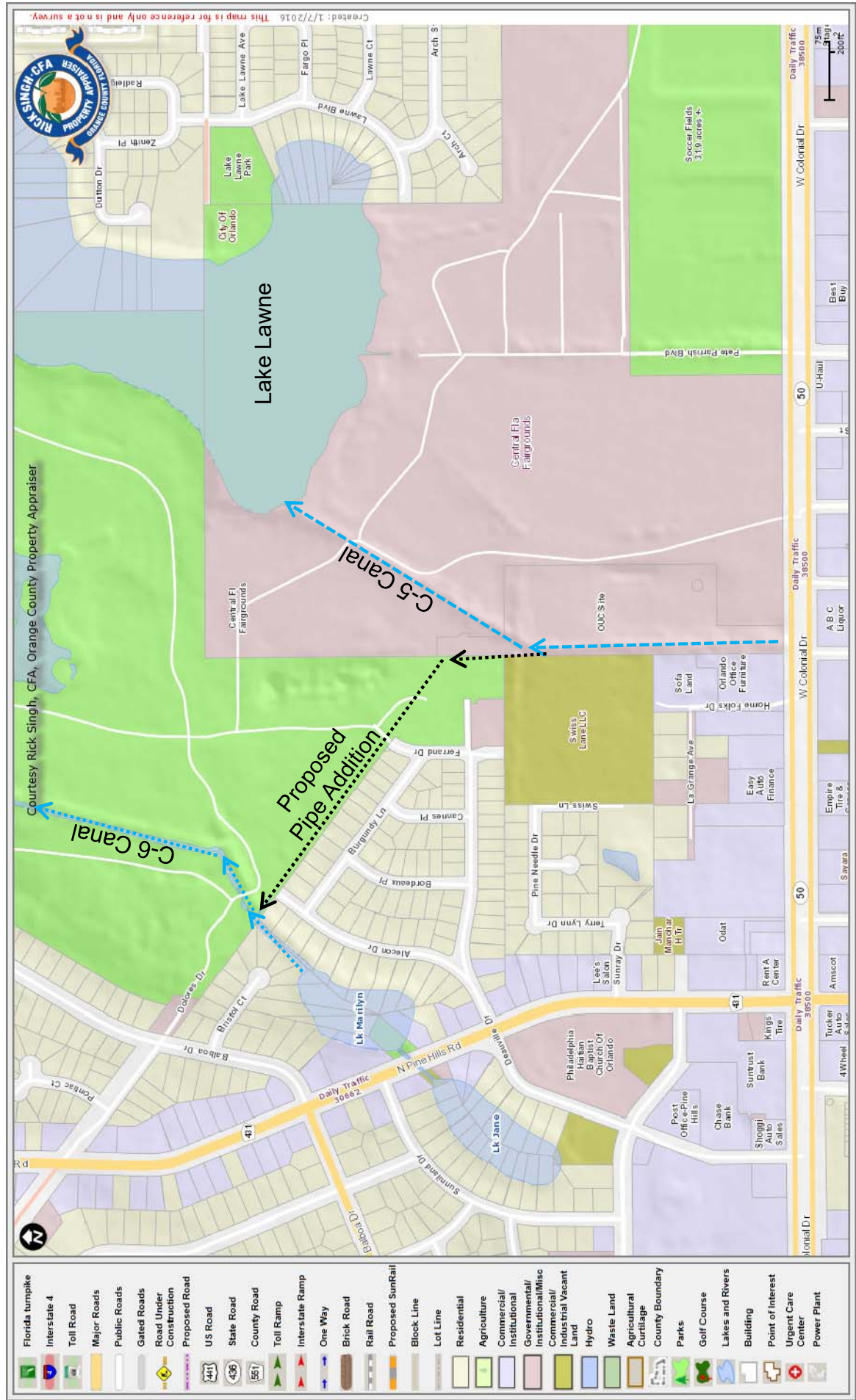


Figure 7-8. Property Appraiser Map in the Vicinity of the C-5 and C-6 Canals.

**TABLE 7-18**

**ESTIMATED ANNUAL LOAD REDUCTIONS FOR  
THE PROPOSED C-5/C-6 CANAL TREATMENT SYSTEM**

| <b>PARAMETER</b>                 | <b>VOLUME<br/>(ac-ft/yr)</b> | <b>TOTAL<br/>NITROGEN<br/>(kg/yr)</b> | <b>TOTAL<br/>PHOSPHORUS<br/>(kg/yr)</b> | <b>TSS<br/>(kg/yr)</b> |
|----------------------------------|------------------------------|---------------------------------------|-----------------------------------------|------------------------|
| Annual Inflow-Current Conditions | 344                          | 360                                   | 26.6                                    | 1,476                  |
| Removal by Reuse Irrigation      | 129                          | 103                                   | 9.9                                     | 582                    |
| Removal in Wet Detention Pond    | --                           | 51.4                                  | 8.4                                     | 447                    |
| Total Annual Removals            | 129                          | 154                                   | 18.3                                    | 1,029                  |

A conceptual cost estimate for the C-5 Canal interconnect system is given in Table 7-19. Cost estimates are included for mobilization, clearing/grubbing for areas of the proposed stormsewer, a 20-ft sheetpile weir, 24-inch RCP, connecting manholes, and replacement turf. The overall estimated conceptual cost for the C-5 Canal interconnect is \$104,400 which includes a 20% contingency.

**TABLE 7-19**

**CONCEPTUAL COST ESTIMATE  
FOR THE C-5 CANAL INTERCONNECT**

| <b>NO.</b>           | <b>ITEM DESCRIPTION</b>                  | <b>UNITS</b> | <b>QUANTITY</b> | <b>UNIT<br/>PRICE<br/>(\$)</b> | <b>COST<br/>(\$)</b> |
|----------------------|------------------------------------------|--------------|-----------------|--------------------------------|----------------------|
| 1.                   | Mobilization (8% of total)               | LS           | 1               | 8,000                          | \$ 8,000             |
| 2.                   | Clearing/grubbing                        | LS           | 1               | 5,000                          | 5,000                |
| 3.                   | Sheetpile weir with concrete cap (20 ft) | LS           | 1               | 30,000                         | 30,000               |
| 4.                   | RCP (24-inch)                            | LF           | 360             | 75.00                          | 27,000               |
| 5.                   | Connecting manhole (Type J)              | EA           | 1               | 10,000                         | 10,000               |
| 6.                   | Performance turf                         | SY           | 400             | 5.00                           | 2,000                |
| 7.                   | MES (24-inch round)                      | EA           | 2               | 2,500                          | 5,000                |
| <b>Sub-total:</b>    |                                          |              |                 |                                | <b>\$ 87,000</b>     |
| Contingency (\$20%): |                                          |              |                 |                                | 17,400               |
| <b>TOTAL:</b>        |                                          |              |                 |                                | <b>\$ 104,400</b>    |

#### 7.2.2.4 C-8 Canal Sub-basin

The C-8 Canal discharges into Lake Lawne on the northwest side of the lake and provides drainage for a primarily residential drainage basin. As the C-8 Canal approaches Lake Lawne, it comes within 350 ft of an existing wet detention pond for a single-family residential subdivision located north of the pond. Discharges from the pond occur into the outfall canal rather than Lake Lawne.

An overview of the proposed C-8 Canal interconnect system is given on Figure 7-9. The system consists of a low-head weir constructed across the C-8 channel which creates sufficient water level elevations to force water from the C-8 Canal through approximately 350 ft of 24-inch RCP into the adjacent wet detention pond. This treatment system is extremely simple in nature and is appropriate for a low-cost treatment option.

A screen shot of the Orange County Property Appraiser map for the C-8 Canal in the vicinity of Lake Lawne is given on Figure 7-10. The proposed pathway for the interconnection piping from the C-8 Canal to the wet detention pond is currently in the ownership of Orange County, and no land purchase would be required for implementation of this option.

A conceptual cost estimate for the C-8 Canal interconnect system is given on Table 7-20. Cost estimates are included for mobilization, clearing/grubbing, excavation and grading, a 20-ft sheetpile weir, 24-inch RCP stormsewer piping, connecting manholes, mitered end sections, and replacement turf. The overall estimated cost for the C-8 Canal interconnect, including a 20% contingency, is \$133,200.

**TABLE 7-20**  
**CONCEPTUAL COST ESTIMATE**  
**FOR THE C-8 CANAL INTERCONNECT**

| NO.                  | ITEM DESCRIPTION                         | UNITS | QUANTITY | UNIT PRICE (\$) | COST (\$)         |
|----------------------|------------------------------------------|-------|----------|-----------------|-------------------|
| 1.                   | Mobilization (8% of total)               | LS    | 1        | 8,000           | \$ 8,000          |
| 2.                   | Clearing/grubbing                        | LS    | 1        | 10,000          | 10,000            |
| 3.                   | Excavation and grading                   | CY    | 950      | 20.00           | 19,000            |
| 4.                   | Sheetpile weir with concrete cap (20 ft) | LS    | 1        | 25,000          | 25,000            |
| 5.                   | RCP (24-inch)                            | LF    | 360      | 75.00           | 27,000            |
| 6.                   | Connecting manhole (Type J)              | EA    | 2        | 8,000           | 16,000            |
| 7.                   | Performance turf                         | SY    | 400      | 5.00            | 2,000             |
| 8.                   | MES (24-inch round)                      | EA    | 2        | 2,000           | 4,000             |
| <b>Sub-total:</b>    |                                          |       |          |                 | <b>\$ 111,000</b> |
| Contingency (\$20%): |                                          |       |          |                 | \$ 22,200         |
| <b>TOTAL:</b>        |                                          |       |          |                 | <b>\$ 133,200</b> |





Figure 7-9. Proposed C-8 Canal Interconnect System.



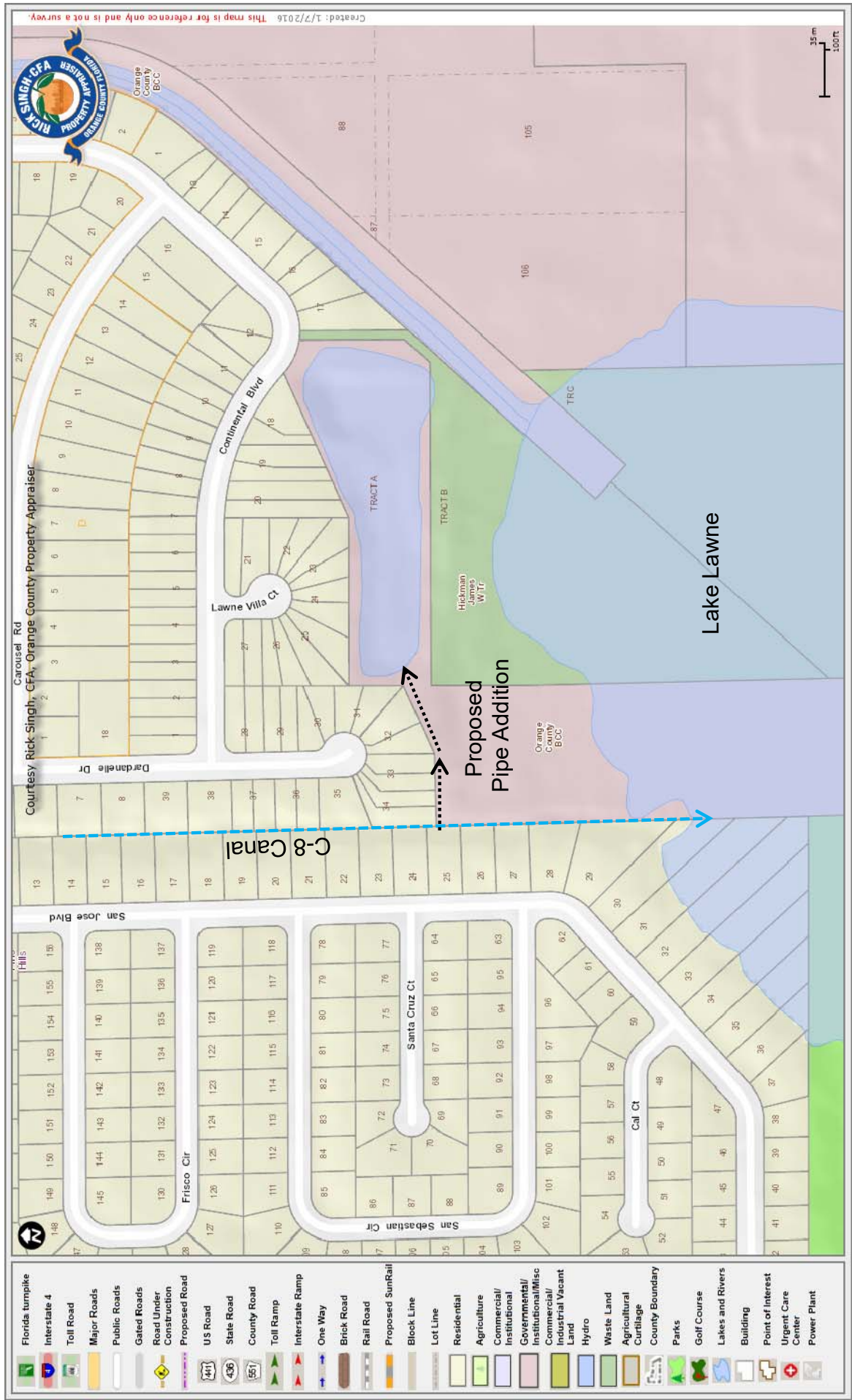


Figure 7-10. Property Appraiser Map in the Vicinity of the C-8 Canal and Lake Lawne.

Under current conditions, the discharges from the C-8 Canal occur directly into the northwest portion of Lake Lawne. However, discharges from the wet detention pond occur into the outfall canal and most likely never reach Lake Lawne. Therefore, the removal effectiveness for the C-8 Canal system would be 100% for all discharges diverted into the wet detention pond since these inflows will never reach Lake Lawne.

A summary of estimated mass load reductions for the C-8 Canal treatment system is given on Table 7-21. This analysis assumes that approximately 80% of the annual volume of discharges through the C-8 Canal will be diverted into the adjacent wet detention pond. Since the pond discharges to the outfall canal rather than the lake, a removal efficiency of 100% is assumed for all water which is diverted into the pond. The proposed system will result in a mass load reduction of 35.6 kg/yr of total nitrogen, 2.8 kg/yr of total phosphorus, and 141 kg/yr of TSS.

**TABLE 7-21**  
**ESTIMATED MASS LOAD REDUCTIONS FOR**  
**THE C-8 CANAL ALUM TREATMENT SYSTEM**

| <b>PARAMETER</b> | <b>EXISTING<br/>LOADING TO LAKE<br/>(kg/yr)</b> | <b>MASS REMOVAL<br/>IN TREATMENT SYSTEM<br/>(%)</b> | <b>MASS<br/>LOAD REMOVED<br/>(kg/yr)</b> |
|------------------|-------------------------------------------------|-----------------------------------------------------|------------------------------------------|
| Total Nitrogen   | 44.5                                            | 80                                                  | 35.6                                     |
| Total Phosphorus | 3.5                                             | 80                                                  | 2.8                                      |
| TSS              | 176                                             | 80                                                  | 141                                      |

A summary of calculated present worth mass removal costs for the proposed C-8 Canal treatment system is given in Table 7-22. As indicated in Table 7-21, the treatment system will remove approximately 2.8 kg/yr of total phosphorus from Lake Lawne or 56 kg over the 20-year analysis cycle. Annual O&M costs are assumed to be zero since maintenance activities are already funded for the existing wet detention pond. The calculated total phosphorus mass removal costs for this system is \$2,379/kg (\$1,079/lb) which makes this option the most expensive mass removal option evaluated for Lake Lawne. However, the attractiveness for this option is the low initial capital cost compared with the other treatment options.

TABLE 7-22

**ESTIMATED PHOSPHORUS MASS REMOVAL  
COSTS FOR THE C-8 CANAL TREATMENT SYSTEM**

| PARAMETER                             |                                     | UNITS | TOTAL<br>PHOSPHORUS |
|---------------------------------------|-------------------------------------|-------|---------------------|
| Total Phosphorus Load Reduction       | Annual Mass Removal                 | kg/yr | 2.8                 |
|                                       | 20-year Mass Removal                | kg    | 56.0                |
| Project Costs                         | Construction                        | \$    | 133,200             |
|                                       | Annual O&M                          | \$    | 0                   |
|                                       | 20-year Present Worth (4% interest) | \$    | 133,200             |
| Total Phosphorus Removal Cost (\$/kg) |                                     | \$/kg | 2,379               |
|                                       |                                     | \$/lb | 1,079               |

### **7.3 Sediment Inactivation**

#### **7.3.1 General Considerations**

Sediment phosphorus inactivation is a lake restoration technique which is designed to substantially reduce sediment phosphorus release by combining available phosphorus in the sediments with a metal salt to form an insoluble inert precipitate, rendering the sediment phosphorus unavailable for release into the overlying water column. Although salts of aluminum calcium and iron have been used for sediment inactivation in previous projects, aluminum salts are the clear compounds of choice for this application. Inactivation of sediment phosphorus using aluminum is often a substantially less expensive option for reducing sediment phosphorus release since removal of the existing sediments is not required.

Sediment phosphorus inactivation is most often performed using aluminum sulfate, commonly called alum, which is applied at the surface in a liquid form using a boat or barge. Upon entering the water column, the alum forms an insoluble precipitate of aluminum hydroxide which attracts phosphorus, bacteria, algae, and suspended solids within the water column, settling these constituents into the bottom sediments. Upon reaching the bottom sediments, the residual aluminum binds tightly with phosphorus within the sediments, forming an inert precipitate which will not be re-released under any conceivable condition of pH or redox potential which could occur in a natural lake system. These sediment treatments have been shown to be effective from 2-20 years, depending upon the sediment accumulation rate within the lake from the remaining phosphorus sources.

Based on the nutrient budget for Lake Lawne, summarized in Table 5-14, internal recycling contributes approximately 14% of the annual phosphorus loading to the lake, with an additional 13% contributed by groundwater seepage and together, these sources contribute approximately 27% of the total phosphorus loading to the lake. It is possible to control both internal recycling and groundwater seepage through a carefully planned alum treatment application. Therefore, the goal of a sediment inactivation alum treatment for Lake Lawne is to provide simultaneous control for both internal recycling and groundwater seepage. Control of these inputs has the potential to result in measurable improvements in water quality within Lake Lawne.

### 7.3.2 Chemical Requirements and Costs

Sediment inactivation in Lake Lawne would involve addition of liquid aluminum sulfate at the water surface. Upon entering the water, the alum would form insoluble precipitates which would settle onto the bottom while also clarifying the existing water column within the lake. After entering the sediments, the alum will combine with existing phosphorus within the sediments, primarily saloid- and iron-bound associations, forming insoluble inert precipitates which will bind the phosphorus, making it unavailable for release into the overlying water column. It is generally recognized that the top 10 cm layer of the sediments is the most active in terms of release of phosphorus under anoxic conditions. Therefore, the objective of a sediment inactivation project is to provide sufficient alum to bind the saloid- and iron-bound phosphorus associations in the top 10 cm of the sediments.

Estimates of the mass of total available phosphorus within the top 0-10 cm layer of the sediments in Lake Lawne were generated by graphically integrating the total available phosphorus isopleths presented on Figure 2-16. The top 0-10 cm layer of the sediments is considered to be the active layer with respect to exchange of phosphorus between the sediments and the overlying water column. Inactivation of phosphorus within the 0-10 cm layer is typically sufficient to inactivate sediment release of phosphorus within a lake. Prior research involving sediment inactivation has indicated that an excess of aluminum is required within the sediments to cause phosphorus to preferentially bind with aluminum rather than other available competing agents. Previous sediment inactivation projects performed by ERD have been conducted at molar Al:P ratios of 2, 3, 5, and 10, with most recent sediment inactivation projects performed using a 10:1 ratio. Recent data collected by ERD suggests that the Al:P ratio is impacted by the concentration of available phosphorus in the sediments, with higher Al:P ratios required for lower available sediment phosphorus concentrations, generally in the range of  $50 \mu\text{g}/\text{cm}^3$  or less.

A summary of estimated total available phosphorus in the sediments of Lake Lawne is given in Table 7-23. On a mass basis, the sediments of Lake Lawne contain approximately 3,710 kg of available phosphorus in the top 10 cm which equates to approximately 119,693 moles of available phosphorus to be inactivated as part of the sediment inactivation process. A summary of alum requirements for sediment inactivation is also provided in Table 7-6. Since the overall mean sediment available phosphorus concentration in Lake Lawne of  $56 \mu\text{g}/\text{cm}^3$  is near the concentration where a higher Al:P ratio may be required, the assumed Al:P ratio for Lake Lawne is increased from 10:1 to 12.5:1. Using an Al:P ratio of 12.5:1, sediment inactivation in Lake Lawne would require approximately 182,184 gallons of alum, equivalent to 40.5 tankers of alum. The equivalent aerial aluminum dose for this application would be  $67.1 \text{ g Al}/\text{m}^2$ .

Additional aluminum can be added to the sediments to create an active absorption mechanism for other phosphorus inputs into the water column as a result of groundwater seepage. Inputs of phosphorus from groundwater seepage into a lake can easily exceed inputs from internal recycling in only a few annual cycles. Carefully planned applications of alum can provide an abundance of aluminum which can intercept groundwater inputs of phosphorus, regardless of source, over a period of many years. As a result, alum applications can be used to eliminate phosphorus from the combined inputs resulting from internal recycling as well as groundwater seepage.



TABLE 7-23

## LAKE LAWNE SEDIMENT INACTIVATION REQUIREMENTS

| AVAILABLE<br>P CONTOUR<br>INTERVAL<br>( $\mu\text{g}/\text{cm}^3$ ) | CONTOUR<br>INTERVAL<br>MID-POINT<br>( $\mu\text{g}/\text{cm}^3$ ) | CONTOUR<br>AREA<br>(acres) | AVAILABLE<br>PHOSPHORUS |         | ALUM REQUIREMENTS<br>(Al:P Ratio = 12.5:1) |              |
|---------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------|-------------------------|---------|--------------------------------------------|--------------|
|                                                                     |                                                                   |                            | kg                      | moles   | moles Al                                   | gallons alum |
| 10-20                                                               | 15                                                                | 2.09                       | 13                      | 410     | 5,124                                      | 624          |
| 20-30                                                               | 25                                                                | 7.23                       | 73                      | 2,361   | 29,517                                     | 3,594        |
| 30-40                                                               | 35                                                                | 10.92                      | 155                     | 4,992   | 62,405                                     | 7,599        |
| 40-50                                                               | 45                                                                | 25.58                      | 466                     | 15,032  | 187,903                                    | 22,881       |
| 50-60                                                               | 55                                                                | 32.11                      | 715                     | 23,068  | 288,354                                    | 35,112       |
| 60-70                                                               | 65                                                                | 22.12                      | 582                     | 18,783  | 234,783                                    | 28,589       |
| 70-80                                                               | 75                                                                | 21.05                      | 639                     | 20,621  | 257,763                                    | 31,387       |
| 80-90                                                               | 85                                                                | 11.07                      | 381                     | 12,293  | 153,668                                    | 18,712       |
| 90-100                                                              | 95                                                                | 6.64                       | 255                     | 8,233   | 102,915                                    | 12,532       |
| 100-110                                                             | 105                                                               | 8.06                       | 343                     | 11,049  | 138,116                                    | 16,818       |
| 110-120                                                             | 115                                                               | 0.81                       | 38                      | 1,222   | 15,278                                     | 1,860        |
| 120-130                                                             | 125                                                               | 0.46                       | 23                      | 752     | 9,405                                      | 1,145        |
| 130-140                                                             | 135                                                               | 0.31                       | 17                      | 549     | 6,857                                      | 835          |
| 140-150                                                             | 145                                                               | 0.16                       | 10                      | 310     | 3,874                                      | 472          |
| 150-160                                                             | 155                                                               | 0.01                       | 0                       | 16      | 196                                        | 24           |
| <b>Overall Totals:</b>                                              |                                                                   | 148.6                      | 3,710                   | 119,693 | 1,496,159                                  | 182,184      |

Areal Aluminum Dose: 67.1 (g Al/m<sup>2</sup>)  
Number of Tankers: 40.5

A summary of calculations of alum requirements for control of phosphorus loading from groundwater seepage entering Lake Lawne is given in Table 7-24. Based on the field seepage monitoring program conducted by ERD, phosphorus inflow to Lake Lawne from groundwater seepage is estimated to be approximately 63.4 kg/yr. This analysis assumes that control of groundwater seepage is desired for a period of approximately 10 years. Therefore, the total mass of phosphorus from groundwater seepage which must be inactivated is approximately 634 kg over the 10-year period which equates to approximately 20,452 moles of total phosphorus. Assuming an Al:P ratio of 12.5:1 for adequate inactivation, control of 20,452 moles of total phosphorus will require approximately 255,645 moles of aluminum which equates to an equivalent alum volume of 31,129 gallons.

**TABLE 7-24**

**CALCULATION OF ALUM REQUIREMENTS FOR CONTROL  
OF PHOSPHORUS LOADING FROM GROUNDWATER SEEPAGE**

| PARAMETER                                  | UNITS   | VALUE   |
|--------------------------------------------|---------|---------|
| Annual Mass Total Phosphorus Inflow        | kg/yr   | 63.4    |
| Desired Length of Control                  | years   | 10      |
| Total Phosphorus Mass to be Controlled     | kg      | 634     |
| Moles of Total Phosphorus to be Controlled | moles   | 20,452  |
| Moles of Aluminum for Control <sup>1</sup> | moles   | 255,645 |
| Equivalent Quantity of Alum                | gallons | 31,129  |

1. Based on an Al:P ratio of 12.5:1

The proposed alum treatment to Lake Lawne would add sufficient alum to control both internal recycling and intercept phosphorus loadings from groundwater seepage. Assuming that approximately 182,184 gallons of alum are needed for sediment inactivation and 31,129 gallons of alum are needed for interception of groundwater seepage, the total amount of alum to be added to Lake Lawne would be 213,313 gallons. This equates to a whole-lake alum dose of approximately 41.1 mg Al/liter which far exceeds the available buffering capacity in the lake to withstand potential reductions in water column pH. As a result, the proposed treatment would need to be divided into a series of multiple applications.

Previous alum surface applications performed for inactivation of sediment phosphorus release by ERD have indicated that the greatest degree of improvement in surface water characteristics and the highest degree of inactivation of sediment phosphorus release are achieved through multiple applications of aluminum to the waterbody spaced at intervals of approximately 4-6 months. Each subsequent application results in additional improvements in water column quality and additional aluminum floc added to the sediments for long-term inactivation of sediment phosphorus release.

The highest whole-lake alum dose which could be safely added to Lake Lawne during a single application without causing an undesirable pH reduction is 7-8 mg Al/liter. In general, an application of 1 mg Al/liter consumes approximately 3 mg/l of alkalinity, so a proposed alum dose of 8 mg Al/liter would consume approximately 24 mg/l of alkalinity from the lake. According to the lake monitoring conducted by ERD from March 2011-February 2012, the ambient alkalinity in Lake Lawne is approximately 65 mg/l, and an alum dose of 8 mg Al/liter would reduce the in-lake alkalinity to about 40 mg/l. Due to the short hydraulic residence time of 81 days, the normal alkalinity within the lake would be restored in approximately 3 months.

If the proposed alum application were to be divided into 5 treatments, the alum dose per treatment would be 8.2 mg Al/liter (41.1 mg Al/liter divided by 5 treatments) which is within the range of maximum recommended doses per application. If the applications were scheduled at 4-6 month intervals, then the normal alkalinity within the lake would be restored between treatments, avoiding the need and expense of a buffering compound such as sodium aluminate. Based on the overall requirement of 47.4 tankers, the alum volume per application would be 9.5 tankers. Since partial tanker shipments of alum are virtually the same cost as full tankers due to shipping costs, the recommended alum volume is rounded up to 10 tankers (4,500 gallons each) per treatment or 50 tankers total.

A summary of proposed alum requirements to control internal recycling and groundwater seepage in Lake Lawne is given in Table 7-25. The treatment should be divided into a minimum of 5 separate applications, with approximately one-fifth of the required alum volume applied during each application. Each treatment would be applied using a boat or barge to spread the chemicals over the lake surface. The recommended chemical volumes are indicated in the final column of Table 7-25.

**TABLE 7-25**

**SUMMARY OF ALUM REQUIREMENTS FOR  
CONTROL OF SEDIMENT PHOSPHORUS RELEASE AND  
GROUNDWATER SEEPAGE ENTERING LAKE LAWNE**

| <b>SOURCE</b>       | <b>UNITS</b> | <b>CALCULATED<br/>AMOUNT</b>      |
|---------------------|--------------|-----------------------------------|
| Internal Recycling  | gallons      | 182,184<br>(40.5 tankers)         |
| Groundwater Seepage | gallons      | 31,129<br>(6.9 tankers)           |
| <b>TOTAL:</b>       |              | <b>213,313<br/>(47.4 tankers)</b> |

A summary of estimated application costs for sediment inactivation and control of groundwater seepage in Lake Lawne is given in Table 7-26. This estimate assumes an alum volume of 225,000 gallons (50 tankers) will be applied during a total of 5 separate applications. It is assumed that the alum is purchased directly by the County at the contract price of \$0.44/gallon. Planning and mobilization costs are estimated to be approximately \$5000 per application, which includes initial planning, mobilization of equipment to the site, demobilization at the completion of the application process, and clean-up. A unit application rate of \$1,300/tanker is assumed which includes labor costs, daily water quality monitoring during the application, expenses, equipment rental, insurance, mileage, and application equipment fees. The estimated cost for sediment inactivation and control of groundwater seepage in Lake Lawne is \$201,500 or approximately \$40,300 per application. Since the treatment will be spread out over several years, the treatment costs can be distributed over multiple fiscal years.

**TABLE 7-26**

**ESTIMATED APPLICATION COSTS FOR SEDIMENT INACTIVATION  
AND CONTROL OF GROUNDWATER SEEPAGE IN LAKE LAWNE  
(Based on 5 separate treatments)**

| PARAMETER                        |                           | AMOUNT<br>REQUIRED/<br>APPLICATION | UNIT COST/<br>APPLICATION   | COST/<br>APPLICATION | TOTAL COST<br>(5 applications) |
|----------------------------------|---------------------------|------------------------------------|-----------------------------|----------------------|--------------------------------|
| Chemicals                        | Alum                      | 45,000 gallons                     | \$0.44/gallon <sup>1</sup>  | \$ 19,800            | \$ 99,000 (5 treatments)       |
| Labor                            | Planning and Mobilization | 1 each                             | \$5,000/application         | \$ 5,000             | \$ 25,000                      |
|                                  | Chemical Application      | 10 tankers                         | \$1,300/tanker <sup>2</sup> | \$ 13,000            | \$ 65,000                      |
| Field Monitoring and Lab Testing |                           | Pre-/Post-samples                  | \$2,500/event               | \$ 2,500             | \$ 12,500                      |
| <b>TOTAL:</b>                    |                           |                                    |                             | <b>\$ 40,300</b>     | <b>\$ 201,500</b>              |

1. Assumed contract cost

2. Includes raw labor, water quality monitoring, insurance, expenses, application equipment, mileage, and rentals

Estimates of phosphorus mass removal costs were also calculated for the proposed alum treatment. A summary of this analysis is given in Table 7-27. This analysis assumes that the sediment inactivation will be effective in reducing internal recycling for a minimum period of 10 years. Therefore, over the 10-year period of effectiveness, internal recycling will contribute approximately 714 kg (71.4 kg/yr x 10 years) of total phosphorus to Lake Lawne. As presented in Table 7-7, inputs of total phosphorus from groundwater seepage have the potential to contribute 634 (63.4 kg/yr x 10 years) kg over the same 10-year period of control. Over the anticipated 10-year period of control, the combined inputs of internal recycling and groundwater seepage have the potential to contribute approximately 1,348 kg of total phosphorus to Lake Lawne.

**TABLE 7-27**

**CALCULATED PHOSPHORUS REMOVAL  
COSTS FOR ALUM TREATMENT**

| TOTAL PHOSPHORUS LOAD OVER<br>10-YEAR EFFECTIVE PERIOD (kg) |                      |       | TOTAL<br>PHOSPHORUS<br>LOAD<br>REMOVED <sup>2</sup><br>(kg) | TREATMENT<br>COST | COST/kg<br>TOTAL<br>PHOSPHORUS<br>REMOVED |
|-------------------------------------------------------------|----------------------|-------|-------------------------------------------------------------|-------------------|-------------------------------------------|
| INTERNAL<br>RECYCLING <sup>1</sup>                          | SEEPAGE <sup>1</sup> | TOTAL |                                                             |                   |                                           |
| 714                                                         | 634                  | 1,348 | 1,078                                                       | 201,500           | \$ 187                                    |

1. Assumes a 10-year period of effective control

2. Assumes that 80% of the internal recycling and seepage load is removed



Based on previous research performed by ERD, phosphorus inactivation is approximately 80% effective in retaining available phosphorus within sediments. Therefore, it is assumed that approximately 80% of the potential 1,348 kg of total phosphorus is attenuated by the proposed alum treatment. As a result, the proposed alum treatment has the potential to remove approximately 1,078 kg of total phosphorus from Lake Lawne over the 10-year anticipated life or approximately 107.8 kg/yr. Based upon the estimated treatment cost of \$201,500, the cost per kg of phosphorus removed for the proposed alum treatment is \$187/kg of \$85/lb. This is an extremely attractive phosphorus removal cost, particularly when compared with the traditional stormwater retrofit options.

### **7.3.3 Longevity of Treatment**

After initial application, the alum precipitate will form a visible floc layer on the surface of the sediments within the lake. This floc layer will continue to consolidate for approximately 30-90 days, reaching maximum consolidation during that time. Due to the unconsolidated nature of the sediments in much of the lake, it is anticipated that a large portion of the floc will migrate into the existing sediments rather than accumulate on the surface as a distinct layer. This process is beneficial since it allows the floc to sorb soluble phosphorus during migration through the surficial sediments. Any floc remaining on the surface will provide a chemical barrier for adsorption of phosphorus which may be released from the sediments.

At least 30 previous sediment inactivation projects have been conducted by ERD in the State of Florida since 1992. Approximately half of these waterbodies have sufficient pre- and post-water quality data to evaluate the effectiveness of the alum sediment inactivation process. None of the 13 waterbodies for which water quality data are available have shown any signs of a decrease in the effectiveness of the sediment inactivation project, some of which were conducted more than 15 years ago. As a result, it appears that a properly planned and executed alum treatment project for Lake Lawne would maintain a continuous level of effectiveness for a minimum of approximately 10-15 years.

## **7.4 Rear Yard Swales and Berms**

Runoff originating from lawn and landscaped areas has the potential to contribute significant loadings of both nutrients and pesticides into surface waters. Untreated stormwater runoff from lawns and landscaped areas contains total phosphorus concentrations which can be 10-20 times greater than concentrations commonly observed in urban lakes. As a result, a relatively small volume of untreated rear yard runoff can impact a large quantity of adjacent water. As indicated on Table 5-16, runoff originating from direct overland flow into Lake Lawne contributes approximately 6% of the annual phosphorus loadings to the lake.

#### **7.4.1 Existing Conditions and Issues**

A requirement for rear yard berms and swales to contain overland runoff is contained in Section 34-132 of the Orange County Municipal Code, titled “Subdivision Construction Plans”. The requirement for berms and swales consists of a single sentence located in paragraph c(2) which states that “... Pollution abatement swales shall be provided upland of streams and canals and the normal high water elevation in all lakes. ...” However, this section provides no design criteria or guidelines for the required systems. Since the reference to berms and swales is located in a section titled “Subdivision Construction Plans”, the requirement applies only to construction of new subdivisions and does not apply to pre-existing homes or new single-family homes constructed on individual lots which are not part of a designated subdivision. This provision also does not apply to redevelopment (demolition and reconstruction) of an existing single-family lot.

Under existing conditions, the vast majority of shoreline areas adjacent to Lake Lawne consist of undeveloped land uses such as parks, recreational areas, and open space. None of these areas appear to be intensively managed and do not appear to represent a significant source of nutrient loadings to the lake. In addition, virtually the entire shoreline of Lake Lawne, along with much of the upland areas adjacent to the shoreline, is covered with dense patches of vegetation which provide both a significant physical barrier and a biological uptake mechanism for runoff generated by overland flow. Single-family residential homes, which are generally considered to have a significant runoff potential into surface waters, are located only on central and southern portions of the east side of the lake. Combined together, these areas have approximately 2,330 ft of shoreline which is 14% of the total shoreline length of 16,490 ft (summarized in Table 2-2). Many of these residential areas also have significant patches of emergent vegetation which provides both a physical barrier as well as a significant nutrient uptake mechanism for loadings generated in rear yard areas.

#### **7.4.2 Recommendations**

ERD routinely recommends construction of rear yard swales and berms as part of lake management programs. However, the vast majority of the shoreline of Lake Lawne is currently undeveloped, and the small amount of residential homes which currently exist appear to have multiple mechanisms for removal of both runoff volume and mass loadings of nutrients before entering Lake Lawne. The existing rear yard areas, which would likely have the highest areal nutrient loading rate for the overland flow areas, represent only a small portion of the shoreline areas of Lake Lawne. Therefore, at this time, construction of swales and berms in these areas does not appear to be warranted due to the negligible impact on the overall nutrient loadings to the lake and the multitude of existing opportunities for nutrient uptake for runoff discharges from these areas. However, rear yard swales and berms should be a component of the overall stormwater management plan for any future development which occurs on the shoreline of the lake.

## **7.5 Vegetated Shorelines**

### **7.5.1 Existing Conditions and Issues**

As discussed in previous sections, shoreline areas surrounding Lake Lawne exhibit a wide variety of both species and density of aquatic vegetation. Virtually all of the shoreline areas of Lake Lawne are heavily vegetated with both emergent and submerged species. The current degree of vegetation growth is unique compared with shoreline areas commonly observed in urban lakes. Based on a review of areal photography of Lake Lawne, only 1-2% of the shoreline is currently without littoral zone vegetation.

A recent study conducted by ERD on the Butler Chain-of-Lakes indicated that shoreline areas which are non-vegetated are susceptible to erosion and resuspension of sediment material as a result of wave activity caused by boats or wind. Water samples collected from non-vegetated shorelines were found to have significantly higher water column concentrations of particulate phosphorus, total phosphorus, and total suspended solids. In addition to providing protection from erosion and sediment resuspension, shoreline vegetation also contributes to a diverse ecological community which is an important factor in maintaining good water quality characteristics within the water column. Shoreline vegetation provides an extremely beneficial function in lake ecosystems and should be maintained to the maximum extent possible.

Regulations related to shoreline vegetation are addressed in Article VII of the Orange County Municipal Code, titled "Lake Shore Protection". This section requires that a permit be obtained prior to performing any clearance of shoreline vegetation. Information on the percentage of shoreline vegetation removal proposed, means for minimizing and controlling erosion, methods of filtering runoff, methods for reducing the nutrient concentrations in both surface runoff and lake waters, methods for stabilizing soils, and justification for the replacement vegetation must be provided and approved before a permit can be obtained. However, these criteria are subject to a number of exemptions, as outlined in Section 15-255. Exemptions to permit requirements are provided for:

1. Clearing of shoreline vegetation in an area which is less than 20% or 30 ft, which ever is greater, of the shoreline area;
2. Mowing and maintenance activities; and
3. Property owners whose shoreline has been previously cleared and where the clearing is continuously maintained

### **7.5.2 Recommendations**

Shoreline vegetation is essential for maintaining water quality characteristics, preventing shoreline erosion, and providing a diversity of habitat for aquatic organisms. ERD routinely recommends that the extent of aquatic vegetation in lakes be increased and enhanced as part of lake management plans. However, the existing shoreline vegetation in Lake Lawne is excellent in both the number of species represented and population densities. Therefore, further artificial enhancement of the shoreline vegetation in Lake Lawne is not warranted at this time.

## **7.6 Landscape Activities**

### **7.6.1 Existing Conditions and Issues**

While performing field activities, ERD personnel routinely observe instances of improper landscape and lawn maintenance activities which include blowing lawn clippings, leaves, and other vegetation debris onto paved or roadway surfaces, as well as improper application of both granular and liquid fertilizers to impervious surfaces and roadways. When grass clippings and fertilizers are introduced onto impervious surfaces, they become available for mobilization by stormwater runoff during rain events, causing them to be deposited into the nearest waterbody during storm events. These type of lawn maintenance practices are needless and irresponsible activities which have the potential to significantly increase nutrient loadings to any waterbody where these activities occur. At best, these activities occur as a result of lack of information and education, while at worst, they represent a disregard for water quality consequences in a misguided attempt to reduce labor time and costs.

During 2009, Orange County enacted Ordinance No. 2009-26 titled “Fertilizer Management Ordinance” which regulates application of fertilizer to lawns and turf in Orange County. The Ordinance was codified in Chapter 15, Article XVII of the Orange County Code, Sections 15-801 through 15-812. A copy of this Ordinance is included in Appendix G.

The newly adopted Fertilizer Management Ordinance places restrictions on the timing and amount of fertilizer which can be applied to turf grasses in Orange County. Fertilizer containing nitrogen or phosphorus cannot be applied to turf during a period when weather advisories have been issued or at any time during the period from June 1-September 30 of each year. Applications may not exceed 0.25 lbs of phosphorus per 1000 ft<sup>2</sup> per application or exceed 0.5 lbs of phosphorus per 1000 ft<sup>2</sup> per year. Fertilizer-free zones are established within 10 ft of any waterbody or wetland, and it is strictly prohibited to apply fertilizer onto impervious surfaces.

Section 15-807 titled “Grass Clippings and Vegetated Material/Debris” prohibits depositing, washing, sweeping, or blowing grass clipping or any vegetated material/debris onto any impervious surface, public right-of-way, stormwater drain, ditch, conveyance, or waterbody. This section is an important addition to the Fertilizer Management Ordinance since previous research conducted by ERD has indicated that soluble nutrients are released rapidly from yard wastes upon entering a receiving waterbody within a period of approximately 7-10 days. Discharge of yard wastes onto paved surfaces is a clear violation of surface water quality standards.



### **7.6.2 Recommendations**

Deliberate discharge of yard wastes, leaves, and other vegetation debris onto paved surfaces, particularly roadways, is a needless practice since it is just as easy to blow the yard waste back onto the landscaped surfaces as it is to discharge it into the street. Although the Fertilizer Management Ordinance has been adopted and implemented in Orange County, there appear to be many homeowners and lawn care professionals who are either unaware or ignore the existing Ordinance, particularly commercial landscaping companies. This Ordinance does not appear to impose a significant hardship on landscape companies since it appears to be just as easy to blow the clippings and vegetation back onto the lawn surface rather than into the adjacent roadway or drainage system. When the yard waste is returned into the landscaped areas, it will decompose and provide additional sources of nutrients to the vegetation rather than the receiving waterbody.

The existing Fertilizer Management Ordinance, if fully observed, would substantially reduce water quality impacts from fertilizer and landscaping activities. However, in spite of the Ordinance, instances of improper fertilizer application and discharge of vegetation debris onto paved surfaces appear to be relatively routine activities. Therefore, ERD recommends that OCEPD, and other designated agencies, be given authority to enforce the Ordinance and issue citations when violations are observed during routine job-related activities. An educational pamphlet or brochure should be prepared and distributed to all homeowners and lawn maintenance companies within the Lake Lawne watershed to inform them of the current regulation, and consequences for violations.

## **7.7 Non-Structural Techniques**

A number of non-structural techniques are also available which have the potential to reduce phosphorus loadings entering waterbodies. Examples of non-structural techniques include enhanced regulations for erosion and sediment control, as well as enhanced stormwater management design criteria. However, virtually all of the Lake Lawne drainage basin is currently developed, in public ownership, or wetland areas, and opportunities for enhancing sediment and erosion control and stormwater management regulations are severely limited within the basin. Another non-structural technique is a source reduction program which attempts to reduce pollutant accumulation within the watershed, and these programs have a potential for improving the characteristics of stormwater runoff in the Lake Lawne drainage basin.

Source reduction programs have the potential to provide effective reductions in stormwater loadings and concentrations, particularly for nutrients and suspended solids. Source reduction techniques, such as street sweeping and public education, are capable of reducing loadings of pollutants entering receiving waterbodies by reducing pollutant accumulation within the watershed and preventing the pollutants from entering runoff. If properly conducted, source reduction programs can be almost as effective as changes in stormwater regulations for reducing pollutant loadings to lakes. The two most common source reduction techniques are street sweeping and public education which are discussed in the following sections.

## **7.7.1 Street Sweeping**

### **7.7.1.1 Introduction**

Street sweeping is an effective best management practice (BMP) for reducing total suspended solids and associated pollutant wash-off from urban streets. Street sweeping is well suited to an urban environment where little land is available for installation of structural controls. Street sweeping can be extremely effective in commercial business districts, industrial sites, and intensely developed areas in close proximity to receiving waters.

Street sweeping involves the use of machines which basically pick-up contaminants from the street surface and deposit them in a self-contained bin or hopper. Mechanical sweepers are the most commonly used sweeping devices and consist of a series of brooms which rotate at high speeds, forcing debris from the street and gutter into a collection hopper. Water is often sprayed on the surface for dust control during the sweeping process. The effectiveness of mechanical sweepers is a function of a number of factors, including: (1) particle size distribution of accumulated surface contaminants; (2) sweeping frequency; (3) number of passes during each sweeping event; (4) equipment speed; and (5) pavement conditions. Unfortunately, mechanical sweepers perform relatively poorly for collection of particle sizes <100 microns which are commonly associated with total phosphorus loadings in stormwater runoff.

Over the past decade, improvements have been made to street sweeping devices which substantially enhance the performance efficiency. Vacuum-type sweepers, which literally vacuum the roadway surface, have become increasingly more popular, particularly for parking lots and residential roadways. The overall efficiency of vacuum-type sweepers is generally higher than that of mechanical cleaners, especially for particles larger than 3 mm. Estimated efficiencies of mechanical and vacuum-assisted sweepers are summarized in Table 7-28 based upon information provided by Young, et al. (1996). Mechanical sweepers can provide approximately 40% removal of phosphorus in roadway dust and debris, while vacuum-assisted sweepers can provide removals up to 74%.

Recent studies in Hamilton County, Ohio indicated a significant reduction in runoff concentrations of nutrients after implementation of a vacuum sweeper program in residential areas. A recent study conducted by ERD for FDEP concluded that commercial sites with routine vacuum sweeping activities had runoff concentrations of nitrogen and phosphorus which were approximately half of the runoff concentrations on commercial sites without vacuum sweeping.

A USGS-funded study performed by Breault, et al. (2005) conducted a side-by-side comparison of mechanical and vacuum-type sweepers in New Bedford, Massachusetts. A summary of the results of the street sweeper efficiency experiments is given on Table 7-29. The mechanical sweeper obtained weighted removal efficiencies of 31% and 20% in the two duplicate experiments compared with 60-92% using the vacuum sweeper. The study concluded that the vacuum sweeper efficiency was consistently greater than that of the mechanical sweeper, with the vacuum sweeper at least 1.6 times, and as much as 10 times, more efficient than the mechanical sweeper for all particle sizes. However, even though the vacuum sweeper exhibited substantially higher removal efficiencies, particularly for smaller diameter particles often associated with elevated nutrient concentrations, the mechanical sweepers still resulted in measurable removal efficiencies for all particle sizes encountered on roadway surfaces.

**TABLE 7-28**

**EFFICIENCIES OF MECHANICAL  
(BROOM) AND VACUUM-ASSISTED SWEEPERS**

| CONSTITUENT      | MECHANICAL<br>SWEEPER EFFICIENCY<br>(%) | VACUUM-ASSISTED<br>SWEEPER EFFICIENCY<br>(%) |
|------------------|-----------------------------------------|----------------------------------------------|
| Total Solids     | 55                                      | 93                                           |
| Total Phosphorus | 40                                      | 74                                           |
| Total Nitrogen   | 42                                      | 77                                           |
| COD              | 31                                      | 63                                           |
| BOD              | 43                                      | 77                                           |
| Lead             | 35                                      | 76                                           |

SOURCE: Young, et al. (1996)

**TABLE 7-29**

**RESULTS OF STREET SWEEPER EFFICIENCY EXPERIMENTS  
WITH A PELICAN SERIES P MECHANICAL SWEEPER AND A  
JOHNSTON 605 SERIES VACUUM SWEEPER, BY PARTICLE SIZE**  
(Source: Breault, et al., 2005)

| PARTICLE<br>SIZE            | SWEEPER EFFICIENCIES (%) |               |               |               |
|-----------------------------|--------------------------|---------------|---------------|---------------|
|                             | MECHANICAL               |               | VACUUM        |               |
|                             | Experiment 1a            | Experiment 1b | Experiment 1a | Experiment 1b |
| Gravel <sup>1</sup>         | 38                       | 31            | 86            | 94            |
| Coarse Sand <sup>2</sup>    | 40                       | 18            | 62            | 93            |
| Fine Sand <sup>3</sup>      | 9                        | 11            | 38            | 75            |
| Very Fine Sand <sup>4</sup> | 9                        | 10            | 31            | 93            |
| Silt and Clay <sup>5</sup>  | 13                       | 13            | 39            | 81            |
| Weighted Average:           | 31                       | 20            | 60            | 92            |

1. Gravel: Larger than 2.0 mm
2. Coarse Sand: Smaller than 2.0 mm, larger than or equal to 250  $\mu\text{m}$
3. Fine Sand: Smaller than 250  $\mu\text{m}$ , larger than or equal to 125  $\mu\text{m}$
4. Very Fine Sand: Smaller than 125  $\mu\text{m}$ , larger than or equal to 63  $\mu\text{m}$
5. Silt and Clay: Smaller than 63  $\mu\text{m}$

The efficiency of street sweepers is highly dependent upon the sweeping interval. To achieve a 30% annual removal of street dirt, the sweeping interval should be less than two times the average interval between storms. Since the average interval between storms in the Central Florida area is approximately three days, a sweeping frequency of once every six days is necessary to achieve a 30% removal of street dirt. To achieve a 50% annual removal, sweeping must occur at least once between storm events. In the Central Florida area, a 50% removal would require street sweeping to occur approximately once every three days.

Street sweeping activities can be particularly effective during periods of high leaf fall by removing solid leaf material and the associated nutrient loadings from roadside areas where they can easily become transported by stormwater flow. Previous research has indicated that leaves release large quantities of both nitrogen and phosphorus into surface water within 24-48 hours after becoming saturated in an aquatic environment. Loadings to waterbodies from leaf fall are often the most significant loadings to receiving waters during the fall and winter months. Street sweeping operations are typically performed on a monthly basis, with increased frequency during periods of high leaf fall.

Capital costs for street sweepers range from approximately \$70,000-150,000, with the lower end of the range associated with mechanical street sweepers and the higher end of the range associated with vacuum-type sweepers. The useful life span is typically 4-8 years, with an operating cost of approximately \$70/hour.

An overview of areas included in the existing street sweeping programs in the Lake Lawne drainage basin is given on Figure 7-11 based on information provided by Orange County EPD. Street sweeping is currently conducted by Orange County on a monthly basis in each of the areas indicated on Figure 7-11 which primarily include areas located in eastern portions of the Lake Lawne drainage basin. The current Orange County street sweeping activities appear to include approximately 50% of the total roadways located within the overall drainage basin. Most of the watershed areas outside of the sweeping areas indicated on Figure 7-11 are located within the City of Orlando.

#### **7.7.1.2 Recommendations**

ERD recommends that the existing street sweeping operations be expanded to include all roadway areas within the Lake Lawne drainage basin. However, virtually all roadway areas within the Orange County portion of the watershed (see Figure 3-3) are already included in a routine street sweeping program, and an increase in street sweeping within the Lake Lawne watershed would require implementation of street sweeping by the City of Orlando. Increases in street sweeping will further reduce discharges of litter, dirt, and vegetation into Lake Lawne and reduce the nutrient loadings associated with runoff inflows. Some of the areas not currently included in the existing street sweeping program did not have curb and gutter systems and use roadside swales for drainage. Mechanical broom sweepers require a curb and gutter system for proper operation, and therefore, vacuum-type sweepers will need to be used on areas without curb and gutter systems.



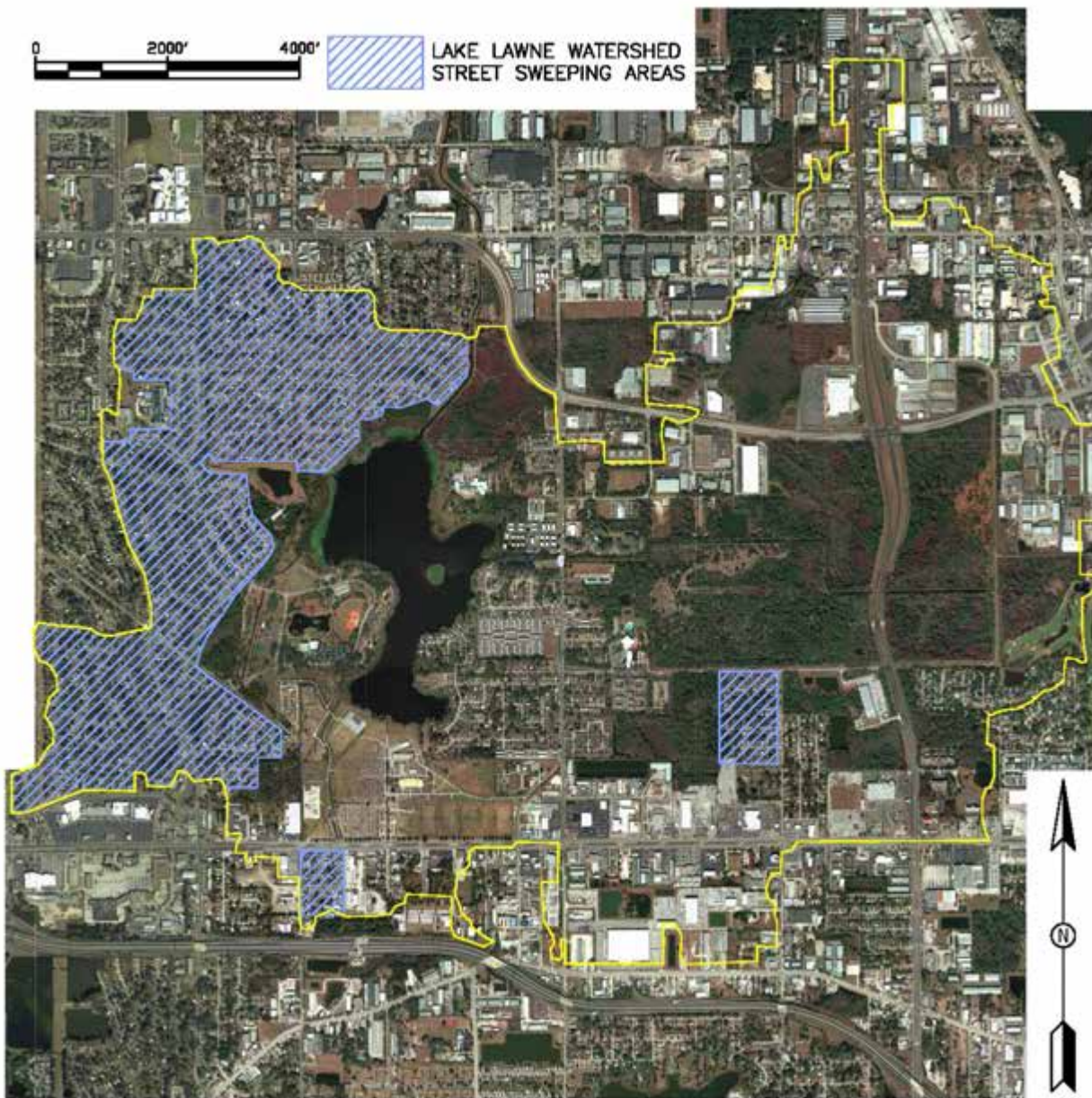


Figure 7-11. Current Street Sweeping Areas by Orange County in the Lake Lawne Drainage Basin.

The effectiveness of street sweeping operations is highly dependent upon the sweeping interval. As discussed previously, a 30% removal of street dirt can be achieved with a sweeping frequency of approximately two times the average inter-event dry period, equivalent to approximately six days in the Central Florida area. A 50% removal of street solids would require street sweeping to occur approximately once every three days, which appears to be both physically and economically infeasible. Therefore, street sweeping operations are recommended to occur at a frequency of once every six days or approximately once each week. This frequency will result in an annual reduction of approximately 30% of the mass of street dirt which accumulates within the watershed.

### **7.7.2 Public Education**

Public education is one of the most important nonpoint source controls which can be used in a watershed. Many residents appear to be unaware of the direct link between watershed activities and the water quality in adjacent waterbodies. The more a resident or business owner understands the relationship between nonpoint source loadings and receiving water quality, the more that person may be willing to implement source controls.

Several national studies have indicated that it is an extremely worthwhile and cost-effective activity to periodically remind property owners of the potential for water quality degradation which can occur due to misapplication of fertilizers and pesticides. Periodic information pamphlets can be distributed by hand or enclosed with water and sewer bills which will reach virtually all residents within the watershed. These educational brochures should emphasize the fact that taxpayer funds are currently being utilized to treat nonpoint source water pollution, and the homeowners have the opportunity to reduce this tax burden by modifying their daily activities. A comprehensive public education program should concentrate, at a minimum, on the following topics:

1. Relationship between land use, stormwater runoff, and pollutants
2. Functions of stormwater treatment systems
3. How to reduce stormwater runoff volume
4. Impacts of water fowl and pets on runoff characteristics and surface water quality
5. County stormwater program goals and regulations
6. Responsible use of fertilizer, pesticides and herbicides
7. Elimination of illicit connections to the stormwater system
8. Controlling erosion and turbidity
9. Proper operation and maintenance of stormwater systems

The public education program can be implemented in a variety of ways, including homeowner and business seminars, newsletters, performing special projects with local schools (elementary, middle and high schools), Earth Day celebrations, brochures, and special signage at stormwater treatment construction sites. Many people do not realize that stormsewers eventually drain to area lakes. Many cities and counties in Florida have implemented a signage program which places a small engraved plaque on each stormsewer inlet indicating "Do Not Dump, Drains to Lake". ERD recommends that an aggressive public education program be implemented in the Lake Lawne watershed which incorporates all of the elements discussed previously. Several of these recommendations have been already implemented in the Lake Lawne watershed, and ERD recommends that these worthwhile activities continue.

Anticipated load reductions for implementation of public education programs are difficult to predict and depend highly upon the degree of implementation by the homeowners within the basin. The impacts of public education programs also depend, to a large extent, on the degree to which water quality within the Lake Lawne basin is currently being impacted by uneducated and uninformed activities by current homeowners. Several regional and national studies are currently being performed which will attempt to document the pollutant removal effectiveness of public education programs.

## **7.8 Boating Impacts**

### **7.8.1 Existing Conditions and Issues**

Lake Lawne is used sporadically for boating and recreational activities, primarily on weekends and during summer months. Very few boats are stored on the lake, and much of the boating activity occurs from non-residents who use the County boat launch facility at Barnett Park. Based on observations by ERD field personnel, most of the people using the boat launch facility are involved in fishing rather than water sports.

Several previous studies have been conducted to evaluate the impacts of boating and recreational activities on water quality in lakes. One of the first studies on the impacts of motor boats on water quality in shallow lakes was conducted by Yousef, et al. (1980). The maximum engine size used in this study was 165 HP which was one of the largest engines available at that time. The study concluded that operation of this boat and engine combination caused resuspension of bottom sediments in water as deep as 10-15 ft. Virtually all motor boats operating on inland lakes today have engine horsepower equal to or greater than the 165 HP units tested by Yousef, et al.

During the period from 2004-2006, ERD conducted an evaluation of water quality impacts from boating activities on the Butler Chain-of-Lakes as part of a hydrologic and nutrient budget evaluation on the Chain-of-Lakes. Boating activities on the Chain-of-Lakes were found to exhibit significant water quality impacts, particularly with respect to increases in particulate and total nutrients, as well as TSS. Statistically significant impacts of boating activities on water quality were observed in virtually all of the lakes. These impacts are presumably due to resuspension of bottom sediments during boating activities when the wake and prop disturbances created by the boat extend through the water column to the bottom sediments. Obviously, this impact is greater in shallow water and becomes less significant as the depth of water increases.

### 7.8.2 Recommendations

Based upon the results of the boating impact evaluation performed by ERD and the study performed by Yousef, et al., it is recommended that normal full-speed motor boating activities within Lake Lawne be restricted to water depths of approximately 10 ft or more. These areas should be clearly outlined within the lake using buoys, with no wake restrictions in force between the buoys and the shoreline. Evidence of chopping and uprooting of vegetation was observed by ERD in Lake Lawne on multiple occasions during this study, resulting from boating activities in shallow water with littoral zone vegetation. The proposed 10-ft depth restriction for full-speed activities will also assist in minimizing impacts to the existing beneficial vegetation within the lake.

A new generation of ski and wakeboard boats have emerged in the past decade which have onboard ballast tanks that can be filled with water to enhance the wake generated behind the boat. These types of boats have the potential to create water column disturbances to deeper depths than occur as a result of typical motor boating activities. Therefore, it is generally recommended that normal operation using these types of boats be limited to areas where the water depth is approximately 15 ft or more. No boats of this type were observed by ERD during this study, although this could change in the future.

A diagram indicating areas within Lake Lawne which are approximately 10 ft in depth or less are indicated on Figure 7-12. This represents the areas where normal full-speed boating activities would be allowed based upon these new recommendations. Areas appropriate for normal boating are located primarily in central-southern portions of the lake. Using the 10-ft minimum depth for full-speed boating, large portions of each of the northern and middle lobes are not suited for this type of boating. Areas outside of the 10-ft contours should be designated as “slow speed” or “no wake” zones.

Areas of water depth of approximately 15 ft or more are indicated on Figure 7-13. The areas indicated on this figure are those which would be suitable for use by enhanced-wake boats. Only a small portion of the southern lobe appears to have water depths suitable for this type of activity. As mentioned previously, few of these types of boats currently exist on Lake Lawne.

ERD recommends a minimum water depth of 10 ft in Lake Lawne for normal boating activities, with a minimum water depth of 15 ft for enhanced wake boating activities. Boating activities in water depths less than 10 ft would be limited to slow speed or no-wake conditions only. Areas designated for boating activities could be marked with buoys. Although the no wake restrictions could not be formally enforced, the buoys would provide boundaries for self-regulation of boating zones.

The recommendations outlined previously are intended to apply to motor boats only. Personal water craft use a jet propulsion system which discharges water horizontally just below the water surface. These types of water craft create very little vertical disturbance within the water column and do not necessarily need to be limited to the same water depths recommended for traditional boats. However, even personal water crafts should not be operated in water with depths less than 5-6 ft for both water quality and safety reasons. Therefore, it is recommended that operation of personal water craft be restricted to water depths in excess of 6 ft.



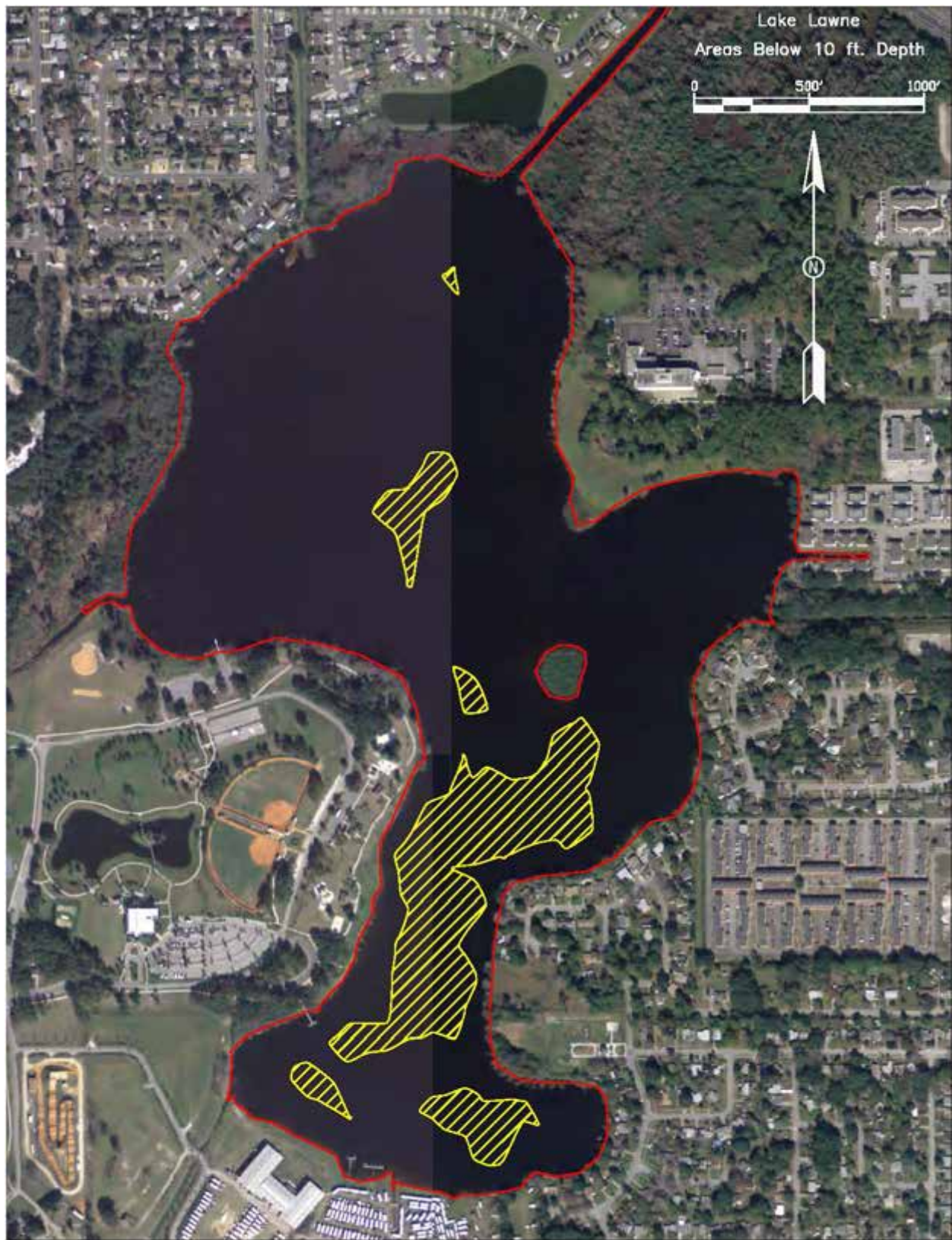


Figure 7-12. Areas of Lake Lawne with Water Depths Less Than or Equal to 10 ft.





Figure 7-13. Areas of Lake Lawne with Water Depths 10 ft to Less than 15 ft.

### 7.9 Water Quality Benefits from Evaluated Management Options

Analyses were conducted to evaluate the potential water quality improvements which could be achieved by the proposed water quality management and improvement options discussed in previous sections. This analysis was conducted using the calibrated water quality model for Lake Lawne discussed in Section 6 and is based upon the anticipated total phosphorus load reductions for the evaluated water quality improvement options. A summary of anticipated phosphorus load reductions for the evaluated water quality improvement projects is given in Table 7-30.

**TABLE 7-30**

#### **SUMMARY OF LOAD REDUCTIONS FOR EVALUATED WATER QUALITY IMPROVEMENT PROJECTS**

| TREATMENT OPTION                         |                        | CURRENT<br>PHOSPHORUS<br>LOAD<br>(kg) | ASSUMED<br>LOAD<br>REDUCTION<br>(%) | PHOSPHORUS<br>LOAD<br>REDUCTION<br>(kg) | MODIFIED<br>PHOSPHORUS<br>LOAD<br>(kg) |
|------------------------------------------|------------------------|---------------------------------------|-------------------------------------|-----------------------------------------|----------------------------------------|
| Alum Treatment of C-1 Canal              |                        | 96.0                                  | 80                                  | 76.8                                    | 19.2                                   |
| Alum Treatment of C-2 Canal              |                        | 82.9                                  | 80                                  | 66.3                                    | 16.6                                   |
| C-6 Canal Treatment System               |                        | 12.8                                  | 89                                  | 11.4                                    | 1.40                                   |
| Combined C-5/C-6 Canals Treatment System |                        | 26.6                                  | 69                                  | 18.3                                    | 8.3                                    |
| C-8 Canal Interconnect                   |                        | 3.5                                   | 80                                  | 2.8                                     | 0.7                                    |
| Alum Surface<br>Treatment                | a. Internal Recycling  | 71.4                                  | 80                                  | 57.1                                    | 14.3                                   |
|                                          | b. Groundwater Seepage | 63.4                                  | 80                                  | 50.7                                    | 12.7                                   |

An overview of the water quality models used to evaluate anticipated water quality improvements from the evaluated treatment options is given in Appendix G.2, and a summary of these results is given in Table 7-31. Implementation of the proposed alum treatment system for the C-1 Canal will reduce ambient water quality concentrations of total phosphorus from 52 µg/l under current conditions to 44 µg/l following treatment. Chlorophyll-a concentrations will be reduced from 24.8 mg/m<sup>3</sup> under existing conditions to 20.2 mg/m<sup>3</sup> following treatment, and Secchi disk depth within the lake will improve from 0.72 m to 0.81 m, with a reduction in TSI value from 63 to 60. Implementation of the combined C-1 and C-2 Canal alum treatment systems will further reduce total phosphorus concentrations to 37 µg/l while reducing the TSI value to 57, reflecting mesotrophic conditions.

Implementation of the C-6 Canal treatment system will have relatively minimal impact on mean concentrations of total phosphorus, reducing concentrations from 52 µg/l under existing conditions to 51 µg/l following implementation. Construction of the combined C-5 and C-6 Canal treatment system will further reduce phosphorus concentrations within the lake to 50 µg/l, while improving TSI from 63 to 62, while implementation of the C-8 Canal interconnect system will have virtually no impact on water quality within Lake Lawne.

TABLE 7-31

**MODELED WATER QUALITY BENEFITS  
FROM THE EVALUATED TREATMENT OPTIONS**

| <b>OPTION</b>                                               | <b>MEAN TOTAL<br/>PHOSPHORUS<br/>CONCENTRATION<br/>(<math>\mu\text{g/l}</math>)</b> | <b>MEAN<br/>CHLOROPHYLL-A<br/>CONCENTRATION<br/>(<math>\text{mg/m}^3</math>)</b> | <b>MEAN<br/>SECCHI<br/>DISK<br/>DEPTH<br/>(m)</b> | <b>TSI<br/>VALUE</b> |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------|----------------------|
| Existing Conditions <sup>1</sup>                            | 52                                                                                  | 24.8                                                                             | 0.72                                              | 63                   |
| Alum Treatment of C-1 Canal Inflows                         | 44                                                                                  | 20.2                                                                             | 0.81                                              | 60                   |
| Alum Treatment of C-1 and<br>C-2 Canal Inflows              | 37                                                                                  | 16.3                                                                             | 0.91                                              | 57                   |
| C-6 Canal Treatment System                                  | 51                                                                                  | 24.1                                                                             | 0.73                                              | 63                   |
| Combined C-5/C-6<br>Canal Treatment System                  | 50                                                                                  | 23.7                                                                             | 0.74                                              | 62                   |
| C-8 Canal Treatment System                                  | 52                                                                                  | 24.7                                                                             | 0.72                                              | 63                   |
| Alum Sediment Inactivation                                  | 41                                                                                  | 18.3                                                                             | 0.86                                              | 59                   |
| Alum Sediment Inactivation +<br>C-1 Canal Alum Treatment    | 33                                                                                  | 14.0                                                                             | 0.99                                              | 55                   |
| Alum Sediment Inactivation +<br>C-1 and C-2 Canal Treatment | 26                                                                                  | 10.4                                                                             | 1.16                                              | 51                   |

1. Calibrated water quality characteristics in Lake Lawne from 2006-2011

Water quality improvements were also modeled for combinations of treatment options involving the treatment system for the C-1 and C-2 Canals and sediment inactivation. Implementation of the C-1 Canal treatment system combined with sediment inactivation will reduce total phosphorus concentrations in Lake Lawne substantially, from 52  $\mu\text{g/l}$  to 33  $\mu\text{g/l}$ , with a reduction in chlorophyll-a from 24.8  $\text{mg/m}^3$  to 14.0  $\text{mg/m}^3$ . In addition, TSI values within the lake will be reduced from the current eutrophic conditions to middle mesotrophic characteristics. The combination of treatment for C-1 and C-2 Canals and alum sediment inactivation will further reduce total phosphorus concentrations in Lake Lawne to 26  $\mu\text{g/l}$ , chlorophyll-a to 10.4  $\text{mg/m}^3$ , and the TSI value to 51, reflecting borderline mesotrophic/oligotrophic characteristics.

### 7.10 Recommendations

A summary of recommended management options for Lake Lawne is given in Table 7-32. The most effective stormwater treatment options for the lake are the proposed treatment system for the C-1 and C-2 Canals, and ERD recommends that these treatment systems be implemented as feasible.



**TABLE 7-32****RECOMMENDED MANAGEMENT OPTIONS FOR LAKE LAWNE**

| <b>ISSUE</b>                                      | <b>RECOMMENDATION</b>                                                                                                                                                                        |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Treatment of Stormwater Inputs                    | Consider implementation of the proposed C-1 and C-2 Canal treatment systems as feasible                                                                                                      |
| Rear Yard Berms and Swales                        | Constructing rear yard berms and swales is not recommended at this time due to the extensive shoreline vegetation and low degree of developed shoreline areas                                |
| Vegetated Shorelines                              | Due to the extensive existing littoral zone vegetation, no additional shoreline re-vegetation is needed at this time                                                                         |
| Internal Recycling/<br>Groundwater Seepage Inputs | Conduct alum treatment to control internal recycling and remove phosphorus from seepage inflows                                                                                              |
| Lawn Maintenance Activities                       | Strictly enforce existing Ordinance prohibiting discharge of yard waste onto impervious surfaces                                                                                             |
| Street Sweeping                                   | Expand street sweeping operations to all roads in the Lake Lawne watershed within Orange County, conduct sweeping at weekly interval, upgrade from mechanical to vacuum sweepers as feasible |
| Public Education                                  | Establish a comprehensive public education program to inform residents of link between watershed activities and water quality                                                                |
| Boating                                           | Restrict normal boating activities to areas >10 ft in depth; enhanced wake boats to areas >15 ft in depth; idle speed in all other areas                                                     |

## SECTION 8

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# APPENDICES



**APPENDIX A**

**HISTORICAL WATER QUALITY  
DATA FOR LAKE LAWNE**

Historical Water Quality Data for Lake Lawne

| DataSource      | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|-----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| FDEP            | 20010303     | 2/7/07          | 8.00      |                   | 208             | 10.5                        |                |            |                  | 740        | 744            |            | 27             | 50            | 6.1         | 7.1        | 25.4                        | 108                   |                       | 1.97        |
| FDEP            | 20010303     | 5/1/07          |           |                   | 210             | 8.6                         |                |            |                  | 1,400      | 1,404          |            | 68             | 50            | 4.7         | 9.0        | 36.9                        | 142                   |                       | 2.30        |
| FDEP            | 20010303     | 7/12/07         | 8.20      |                   | 219             | 7.2                         |                |            |                  | 1,400      | 1,404          |            | 60             | 50            | 5.4         | 12.0       | 32.1                        | 143                   |                       | 1.97        |
| FDEP            | 20010303     | 9/26/07         | 7.90      |                   | 187             | 7.9                         |                |            |                  | 1,000      | 1,004          |            | 64             | 50            | 3.4         | 10.0       | 32.0                        | 80                    |                       | 1.97        |
| FDEP            | 20010794     | 2/7/07          | 7.80      |                   | 207             | 9.6                         |                |            |                  | 860        | 906            |            | 39             | 50            | 3.7         | 7.6        | 22.3                        | 16                    |                       | 1.97        |
| FDEP            | 20010794     | 5/1/07          | 8.50      |                   | 236             | 9.7                         |                |            |                  | 1,400      | 1,411          |            | 71             | 50            | 4.6         | 9.0        | 21.4                        | 4                     |                       | 2.62        |
| FDEP            | 20010794     | 7/12/07         | 8.30      |                   | 219             | 7.5                         |                |            |                  | 1,200      | 1,304          |            | 43             | 50            | 4.6         | 9.0        | 33.7                        | 116                   |                       | 1.97        |
| FDEP            | 20010794     | 9/26/07         | 7.70      |                   | 187             | 7.3                         |                |            |                  | 1,100      | 1,104          |            | 58             | 50            | 3.0         | 10.0       | 33.0                        | 137                   |                       | 2.62        |
| FDEP            | 20010794     | 12/11/07        | 7.70      |                   | 221             | 9.5                         |                |            |                  | 1,200      | 1,204          |            | 63             | 60            | 3.0         | 11.0       | 28.0                        | 32                    |                       | 2.30        |
| FDEP            | 20010795     | 2/7/07          | 7.90      |                   | 207             | 10.1                        |                |            |                  | 800        | 804            |            | 37             | 50            | 7.0         | 7.6        | 21.4                        | 17                    |                       | 1.97        |
| FDEP            | 20010795     | 5/1/07          |           |                   | 210             | 8.6                         |                |            |                  | 1,400      | 1,408          |            | 71             | 50            | 4.6         | 8.0        | 44.6                        | 2                     |                       | 2.30        |
| FDEP            | 20010795     | 7/12/07         | 8.50      |                   | 218             | 8.3                         |                |            |                  | 1,300      | 1,304          |            | 56             | 50            | 5.3         | 10.0       | 36.1                        | 80                    |                       | 1.97        |
| FDEP            | 20010795     | 9/26/07         | 7.60      |                   | 188             | 6.0                         |                |            |                  | 1,100      | 1,104          |            | 70             | 50            | 3.2         | 10.0       | 36.0                        | 22                    |                       | 1.97        |
| FDEP            | 20010795     | 12/11/07        | 7.60      |                   | 221             | 9.2                         |                |            |                  | 1,200      | 1,204          |            | 55             | 60            | 3.3         | 11.0       | 27.0                        | 11                    |                       | 1.31        |
| FDEP            | 20010796     | 2/7/07          | 7.90      |                   | 208             | 10.0                        |                |            |                  | 760        | 768            |            | 37             | 50            | 4.3         | 7.1        | 25.4                        | 28                    |                       | 2.62        |
| FDEP            | 20010796     | 5/1/07          |           |                   | 209             | 8.4                         |                |            |                  | 1,300      | 1,341          |            |                | 50            | 4.1         | 9.0        | 40.0                        | 52                    |                       | 2.62        |
| FDEP            | 20010796     | 7/12/07         | 8.20      |                   | 220             | 7.3                         |                |            |                  | 1,400      | 1,404          |            | 59             | 50            | 4.4         | 11.0       | 25.7                        | 43                    |                       | 1.64        |
| FDEP            | 20010796     | 9/26/07         | 8.20      |                   | 188             | 8.3                         |                |            |                  | 1,000      | 1,004          |            | 65             | 50            | 3.3         | 8.0        | 36.0                        | 94                    |                       | 1.97        |
| FDEP            | 20010797     | 2/7/07          | 7.80      |                   | 208             | 9.4                         |                |            |                  | 660        | 669            |            |                | 50            | 4.1         | 6.9        | 24.1                        | 20                    |                       | 2.30        |
| FDEP            | 20010797     | 5/1/07          |           |                   | 219             | 8.3                         |                |            |                  | 1,400      | 1,404          |            | 72             | 50            | 4.4         | 8.0        | 43.0                        | 1,020                 |                       | 2.30        |
| FDEP            | 20010797     | 7/12/07         | 8.50      |                   | 217             | 7.8                         |                |            |                  | 1,300      | 1,304          |            | 54             | 50            | 4.7         | 12.0       | 30.5                        | 30                    |                       | 1.64        |
| FDEP            | 20010797     | 9/26/07         | 8.20      |                   | 191             | 8.5                         |                |            |                  | 1,100      | 1,104          |            | 63             | 50            | 3.7         | 9.0        | 37.0                        | 52                    |                       | 1.97        |
| STORET_21FLORAN | AAL71        | 1/26/05         |           | 70.0              |                 |                             | 20             | 97         | 1,100            | 1,100      | 1,330          | 4          | 8              | 105           |             | 8.0        |                             |                       |                       |             |
| STORET_21FLORAN | AAL71        | 1/5/06          | 6.90      | 64.0              |                 | 9.4                         |                |            |                  | 1,270      | 1,330          |            | 62             |               |             |            | 30.0                        | 60                    | 460                   | 2.62        |
| STORET_21FLORAN | AAL71        | 2/2/06          | 6.50      | 66.0              |                 | 7.0                         |                |            |                  | 1,040      | 1,070          |            | 58             |               |             |            | 16.7                        | 150                   | 320                   | 2.30        |
| STORET_21FLORAN | AAL71        | 3/2/06          | 6.80      |                   |                 | 7.5                         |                |            |                  |            |                |            |                |               |             |            | 17.3                        | 48                    | 530                   | 2.30        |
| STORET_21FLORAN | AAL71        | 4/6/06          | 7.80      | 74.0              |                 | 8.2                         |                |            |                  | 2,040      | 2,040          |            | 95             |               |             |            | 66.0                        | 100                   | 130                   | 1.64        |

Historical Water Quality Data for Lake Lawne

| DataSource | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
|            |              |                 |           |                   |                 |                             |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       |             |
| Orlando    | LAWNE NORTH  | 2/13/90         | 7.17      |                   | 274             | 7.8                         |                | 130        |                  | 1,080      | 1,210          | 50         | 240            |               |             | 9.0        | 19.0                        |                       |                       | 3.28        |
| Orlando    | LAWNE NORTH  | 10/9/90         |           |                   |                 |                             |                |            |                  | 1,080      | 1,080          |            | 150            |               |             | 15.0       | 25.0                        | 141                   |                       | 2.30        |
| Orlando    | LAWNE NORTH  | 9/8/92          | 7.24      |                   | 200             | 6.0                         |                |            |                  | 1,730      | 1,730          |            | 140            |               |             | 14.0       | 62.0                        | 52                    |                       | 1.64        |
| Orlando    | LAWNE NORTH  | 12/14/92        | 8.04      |                   | 235             | 8.6                         |                |            |                  | 1,550      | 1,550          | 7          | 115            |               |             | 13.0       | 15.0                        | 14                    |                       | 2.07        |
| Orlando    | LAWNE NORTH  | 2/16/93         |           |                   |                 |                             |                |            |                  | 1,470      | 1,470          |            | 105            |               |             | 13.0       | 30.0                        | 64                    |                       | 2.00        |
| Orlando    | LAWNE NORTH  | 5/26/93         | 7.67      |                   | 246             | 6.4                         |                |            |                  | 1,890      | 1,890          | 16         | 167            |               |             | 14.0       | 50.0                        | 8                     |                       | 1.67        |
| Orlando    | LAWNE NORTH  | 8/25/93         | 7.12      |                   | 221             | 5.3                         |                |            |                  | 1,740      | 1,740          |            | 145            |               |             | 17.0       | 83.0                        | 25                    |                       | 1.84        |
| Orlando    | LAWNE NORTH  | 11/29/93        | 7.39      |                   | 214             | 8.0                         |                |            |                  | 1,290      | 1,290          | 10         | 126            |               |             | 13.0       | 43.0                        | 10                    |                       | 2.20        |
| Orlando    | LAWNE NORTH  | 2/3/94          | 7.51      |                   | 215             | 9.0                         |                |            |                  | 1,070      | 1,070          | 7          | 127            |               |             | 12.0       | 37.0                        | 310                   |                       | 2.36        |
| Orlando    | LAWNE NORTH  | 4/12/94         | 8.44      |                   | 251             | 7.3                         | 40             |            |                  | 1,670      | 1,670          | 7          | 158            |               |             | 18.0       | 61.0                        | 2                     |                       | 1.57        |
| Orlando    | LAWNE NORTH  | 7/26/94         | 7.11      |                   | 228             | 5.6                         |                |            |                  | 1,920      | 1,920          |            | 120            |               |             | 15.0       | 59.0                        | 210                   |                       | 1.87        |
| Orlando    | LAWNE NORTH  | 11/28/94        | 7.11      |                   | 185             | 7.8                         |                | 460        |                  | 1,480      | 1,970          |            | 72             |               |             | 5.0        | 27.0                        | 18                    |                       | 2.69        |
| Orlando    | LAWNE NORTH  | 1/19/95         | 7.69      |                   | 215             | 9.6                         |                | 240        |                  | 1,440      | 1,690          |            | 55             |               |             | 4.0        | 25.0                        | 5                     |                       | 2.56        |
| Orlando    | LAWNE NORTH  | 4/27/95         | 7.45      |                   | 244             | 6.4                         |                |            |                  | 1,310      | 1,310          | 12         | 98             |               |             | 7.0        | 23.0                        | 2                     |                       | 2.69        |
| Orlando    | LAWNE NORTH  | 5/13/97         | 7.36      |                   | 220             | 5.7                         |                |            |                  | 1,300      | 1,300          |            | 114            |               |             | 9.0        | 27.0                        | 70                    |                       | 2.07        |
| Orlando    | LAWNE NORTH  | 7/15/97         | 8.28      |                   | 164             | 6.9                         | 290            |            |                  | 1,440      | 1,450          |            | 134            |               |             |            | 47.7                        | 220                   |                       | 1.80        |
| Orlando    | LAWNE NORTH  | 10/14/97        | 7.34      |                   | 157             | 6.5                         |                |            |                  | 1,300      | 1,300          |            | 94             |               |             | 14.0       | 35.6                        | 42                    |                       | 2.00        |
| Orlando    | LAWNE NORTH  | 2/10/98         | 7.58      |                   | 199             | 10.3                        |                | 140        |                  | 1,100      | 1,100          | 9          | 49             |               |             | 8.0        | 25.3                        | 22                    |                       | 2.23        |
| Orlando    | LAWNE NORTH  | 4/30/98         | 7.27      |                   | 183             | 7.3                         |                |            |                  | 1,660      | 1,660          |            | 128            |               |             | 12.5       | 39.8                        | 7                     |                       | 2.00        |
| Orlando    | LAWNE NORTH  | 7/16/98         | 7.45      |                   | 177             | 5.7                         |                |            |                  | 1,560      | 1,560          |            | 119            |               |             | 13.5       | 55.7                        | 460                   |                       | 5.22        |
| Orlando    | LAWNE NORTH  | 10/15/98        | 7.60      |                   | 171             | 5.2                         |                |            |                  | 630        | 630            | 5          | 123            |               |             | 12.0       | 45.7                        | 34                    |                       | 2.07        |
| Orlando    | LAWNE NORTH  | 3/2/99          | 7.63      |                   | 191             | 8.9                         |                |            |                  | 1,080      | 1,080          |            | 65             |               |             | 11.5       | 23.7                        |                       |                       | 2.13        |
| Orlando    | LAWNE NORTH  | 6/2/99          | 7.81      |                   | 198             | 5.5                         | 30             |            |                  | 650        | 650            |            | 28             |               | 5.2         | 7.0        | 60.7                        | 28                    |                       | 1.74        |
| Orlando    | LAWNE NORTH  | 9/7/99          | 8.26      |                   | 166             | 7.0                         | 100            |            |                  | 1,320      | 1,320          |            | 89             |               | 4.8         | 15.0       | 6.5                         | 100                   |                       | 1.87        |
| Orlando    | LAWNE NORTH  | 11/16/99        | 7.55      |                   | 175             | 7.9                         |                |            |                  | 1,600      | 1,620          |            | 79             |               | 2.9         | 18.0       | 31.3                        | 21                    |                       | 1.74        |
| Orlando    | LAWNE NORTH  | 2/29/00         | 7.38      |                   | 211             | 6.3                         |                |            |                  | 1,260      | 1,260          |            | 65             |               | 2.4         | 4.0        | 10.4                        | 8                     |                       | 2.43        |
| Orlando    | LAWNE NORTH  | 6/1/00          | 8.24      |                   | 256             | 7.8                         |                |            |                  | 1,590      | 1,590          | 4          | 107            |               | 3.4         | 8.0        | 17.9                        | 50                    |                       | 1.90        |
| Orlando    | LAWNE NORTH  | 8/24/00         | 8.07      |                   | 169             | 5.9                         |                |            |                  | 1,400      | 1,400          | 6          | 105            |               | 4.3         | 9.0        | 37.9                        | 154                   |                       | 1.77        |
| Orlando    | LAWNE NORTH  | 12/19/00        | 7.83      |                   | 219             | 8.4                         |                |            |                  | 1,500      | 1,500          |            | 70             |               | 2.0         | 11.0       | 29.7                        | 84                    |                       | 1.94        |
| Orlando    | LAWNE NORTH  | 1/30/01         | 8.04      |                   | 176             | 9.4                         |                |            |                  | 1,100      | 1,100          |            | 40             |               | 3.0         | 14.0       | 24.6                        | 84                    |                       | 1.77        |
| Orlando    | LAWNE NORTH  | 4/26/01         | 7.78      |                   | 218             | 6.9                         |                |            |                  | 780        | 780            |            | 101            |               | 8.0         | 10.5       | 10.3                        | 20                    |                       | 2.20        |
| Orlando    | LAWNE NORTH  | 7/17/01         | 8.51      |                   | 194             | 8.6                         |                |            |                  | 1,830      | 1,860          |            | 17             |               | 4.1         | 13.0       | 54.7                        | 5                     |                       | 1.51        |
| Orlando    | LAWNE NORTH  | 10/11/01        | 7.82      |                   | 194             | 7.3                         |                |            |                  | 1,330      | 1,330          | 4          | 102            |               | 4.0         | 13.5       | 42.6                        |                       |                       | 1.31        |
| Orlando    | LAWNE NORTH  | 2/7/02          | 7.62      |                   | 215             | 8.7                         |                |            |                  | 1,360      | 1,360          | 4          | 100            |               | 2.5         | 11.5       | 24.3                        | 76                    |                       | 1.67        |
| Orlando    | LAWNE NORTH  | 4/11/02         | 8.46      |                   | 224             | 9.9                         | 23             |            |                  | 1,440      | 1,440          | 21         | 122            |               | 7.6         | 10.5       | 62.1                        | 4                     |                       | 1.97        |
| Orlando    | LAWNE NORTH  | 7/18/02         | 8.84      |                   | 227             | 8.7                         |                |            |                  | 1,770      | 1,770          |            | 94             |               | 5.1         | 10.5       | 26.7                        | 72                    |                       | 1.35        |
| Orlando    | LAWNE NORTH  | 10/25/02        | 7.64      |                   | 195             | 6.7                         |                |            |                  | 2,090      | 2,090          |            | 112            | 150           | 5.4         | 13.0       | 48.3                        | 1,380                 |                       | 1.71        |
| Orlando    | LAWNE NORTH  | 1/28/03         | 7.71      |                   | 179             | 11.4                        |                | 579        |                  | 1,560      | 2,170          |            | 59             |               | 2.1         | 7.0        | 15.8                        |                       |                       | 2.00        |
| Orlando    | LAWNE NORTH  | 4/22/03         | 7.71      |                   | 205             | 7.9                         |                |            |                  | 1,470      | 1,470          |            | 73             |               | 3.6         | 5.0        | 6.7                         |                       |                       | 2.23        |
| Orlando    | LAWNE NORTH  | 7/17/03         | 8.57      |                   | 187             | 8.9                         |                |            |                  | 1,590      | 1,590          | 6          | 79             |               | 5.2         | 14.7       | 40.3                        | 66                    |                       | 1.90        |
| Orlando    | LAWNE NORTH  | 10/9/03         | 7.48      |                   | 202             | 7.3                         | 20             |            |                  | 1,670      | 1,670          | 3          | 71             |               | 3.2         | 12.5       | 22.6                        | 196                   |                       | 2.13        |

## Historical Water Quality Data for Lake Lawne

| DataSource                 | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orlando                    | LAWNE NORTH  | 1/13/04         | 8.37      |                   | 217             | 10.4                        | 30             | 20         |                  | 1,280      | 1,300          | 4          | 75             |               | 2.5         | 10.0       | 3.7                         | 32                    |                       | 2.20        |
| Orlando                    | LAWNE NORTH  | 4/15/04         | 7.95      |                   | 231             | 9.6                         | 30             |            |                  | 1,660      | 1,660          | 3          | 89             |               | 4.6         | 13.0       | 39.5                        | 48                    |                       | 2.23        |
| Orlando                    | LAWNE NORTH  | 7/15/04         | 8.85      |                   | 208             | 8.4                         | 20             |            |                  | 1,570      | 1,570          | 5          | 111            |               | 5.0         | 17.2       | 25.5                        | 18                    |                       | 2.23        |
| Orlando                    | LAWNE NORTH  | 1/11/05         | 8.06      | 71.0              | 221             | 9.6                         |                |            |                  | 1,660      | 1,660          | 5          | 69             |               |             |            | 34.0                        |                       |                       | 2.20        |
| Orlando                    | LAWNE NORTH  | 4/13/05         | 7.85      | 65.6              | 222             | 8.3                         |                |            |                  | 1,470      | 1,470          | 3          | 78             |               |             |            | 11.2                        |                       |                       | 2.82        |
| Orlando                    | LAWNE NORTH  | 7/12/05         | 8.12      | 59.6              | 189             | 8.3                         | 160            | 10         |                  | 1,750      | 1,760          | 3          | 76             |               |             |            | 28.2                        |                       |                       | 2.00        |
| Orlando                    | LAWNE NORTH  | 10/20/05        | 7.75      | 62.4              | 199             | 7.3                         |                | 20         |                  | 1,410      | 1,430          | 5          | 62             |               |             |            | 24.0                        |                       |                       | 1.44        |
| Orlando                    | LAWNE NORTH  | 1/17/06         | 7.82      | 64.4              | 203             | 9.9                         | 10             | 74         |                  | 1,480      | 1,560          | 3          | 60             |               |             | 8.2        | 24.1                        |                       |                       | 2.07        |
| Orlando                    | LAWNE NORTH  | 5/4/06          | 8.30      | 76.2              | 246             | 8.4                         | 20             | 10         |                  | 1,660      | 1,660          | 5          | 81             |               |             | 14.0       | 14.9                        |                       |                       | 1.71        |
| Orlando                    | LAWNE NORTH  | 7/11/06         | 8.37      | 65.4              | 196             | 8.5                         | 10             | 10         |                  | 1,320      | 1,320          | 5          | 74             |               |             | 12.4       | 39.5                        |                       |                       | 2.07        |
| Orlando                    | LAWNE NORTH  | 10/17/06        | 7.93      | 63.6              | 196             | 7.7                         | 10             | 10         |                  | 1,280      | 1,290          | 5          | 72             |               |             | 14.4       | 33.6                        |                       |                       | 1.80        |
| Orlando                    | LAWNE NORTH  | 1/3/07          | 8.44      | 68.5              | 205             | 8.6                         | 850            | 10         |                  | 990        | 990            | 3          | 60             |               |             | 10.6       | 22.4                        |                       |                       | 2.23        |
| Orlando                    | LAWNE NORTH  | 4/10/07         | 7.98      | 83.0              | 234             | 7.2                         | 20             | 10         |                  | 1,410      | 1,410          | 3          | 61             |               |             | 9.6        | 19.4                        |                       |                       | 2.10        |
| Orlando                    | LAWNE NORTH  | 7/3/07          | 8.53      | 82.2              | 234             | 8.8                         | 20             | 30         |                  | 1,440      | 1,470          | 4          | 69             |               |             | 11.8       | 20.3                        |                       |                       | 2.17        |
| Orlando                    | LAWNE NORTH  | 10/4/07         | 8.85      | 65.9              | 198             | 8.9                         | 30             | 60         |                  | 950        | 1,010          | 3          | 47             |               |             | 9.2        | 21.0                        |                       |                       | 2.13        |
| Orlando                    | LAWNE NORTH  | 1/17/08         | 8.16      |                   | 223             | 8.8                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.25        |
| Orlando                    | LAWNE NORTH  | 4/10/08         | 7.82      |                   | 199             | 8.2                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.56        |
| Orlando                    | LAWNE NORTH  | 7/15/08         | 8.07      |                   | 190             | 7.8                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.99        |
| Orlando                    | LAWNE NORTH  | 10/7/08         | 7.60      |                   | 197             | 6.9                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 1.80        |
| Orlando                    | LAWNE NORTH  | 1/15/09         | 7.78      |                   | 226             | 6.2                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.15        |
| Orlando                    | LAWNE NORTH  | 4/15/09         | 8.45      |                   | 230             | 8.1                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.00        |
| Orlando                    | LAWNE NORTH  | 7/21/09         | 7.31      |                   | 184             | 5.8                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.22        |
| Orlando                    | LAWNE NORTH  | 10/13/09        | 8.54      |                   | 205             | 6.1                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.15        |
| Orlando                    | LAWNE NORTH  | 1/20/10         | 7.87      |                   | 203             | 10.3                        |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.79        |
| Orlando                    | LAWNE NORTH  | 4/13/10         | 7.20      |                   | 214             | 3.9                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.56        |
| Orlando                    | LAWNE NORTH  | 7/15/10         | 7.32      |                   | 190             | 5.6                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.36        |
| Orlando                    | LAWNE NORTH  | 10/14/10        | 8.27      |                   | 184             | 7.2                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.72        |
| Orlando                    | LAWNE NORTH  | 1/13/11         | 7.74      |                   | 206             | 9.3                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.48        |
| Orlando                    | LAWNE NORTH  | 4/14/11         | 8.08      |                   | 197             | 7.2                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.03        |
| Orlando                    | LAWNE NORTH  | 7/21/11         | 8.63      |                   | 163             | 9.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.13        |
| Orlando                    | LAWNE NORTH  | 10/19/11        | 7.31      |                   | 164             | 6.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.13        |
| Orlando                    | LAWNE NORTH  | 1/19/12         | 8.18      |                   | 194             | 8.0                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.12        |
| Orlando                    | LAWNE NORTH  | 4/17/12         | 7.65      |                   | 220             | 8.1                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.28        |
| Minimum Value              |              |                 | 7.11      | 59.6              | 157             | 3.9                         | 10             | 10         | --               | 630        | 630            | 3          | 17             | 150           | 2           | 4          | 3.7                         | 2                     | --                    | 1.3         |
| Maximum Value              |              |                 | 8.85      | 83.0              | 274             | 11.4                        | 850            | 579        | --               | 2,090      | 2,170          | 50         | 240            | 150           | 8           | 18         | 83.0                        | 1,380                 | --                    | 5.2         |
| Geometric Mean (1990-1999) |              |                 | 7.56      | --                | 203             | 7.0                         | 77             | 212        | --               | 1,328      | 1,359          | 10         | 104            | --            | 4           | 11         | 33.8                        | 31                    | --                    | 2.1         |
| Geometric Mean (2000-2005) |              |                 | 8.02      | 64.5              | 206             | 8.2                         | 33             | 39         | --               | 1,476      | 1,501          | 5          | 76             | 150           | 4           | 10         | 23.1                        | 46                    | --                    | 1.9         |
| Geometric Mean (2006-2011) |              |                 | 8.00      | 70.8              | 203             | 7.6                         | 26             | 18         | --               | 1,295      | 1,319          | 4          | 65             | --            | --          | 11         | 23.3                        | --                    | --                    | 2.4         |



Historical Water Quality Data for Lake Lawne

| DataSource | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orlando    | LAWNE SOUTH  | 2/13/90         |           |                   |                 |                             | 20             | 130        |                  | 990        | 1,120          | 60         | 240            |               |             | 8.0        | 9.8                         | 310                   |                       | 3.44        |
| Orlando    | LAWNE SOUTH  | 10/9/90         | 6.76      |                   | 222             | 5.9                         |                | 20         |                  | 1,070      | 1,090          | 40         | 160            |               |             | 12.0       | 26.0                        | 66                    |                       | 2.23        |
| Orlando    | LAWNE SOUTH  | 9/8/92          | 7.32      |                   | 200             | 7.9                         |                |            |                  | 1,700      | 1,700          | 5          | 120            |               |             | 10.0       | 100.0                       | 14                    |                       | 2.13        |
| Orlando    | LAWNE SOUTH  | 12/14/92        | 8.29      |                   | 237             | 9.4                         | 40             |            |                  | 1,550      | 1,550          | 12         | 114            |               |             | 10.0       | 66.0                        | 40                    |                       | 2.26        |
| Orlando    | LAWNE SOUTH  | 2/16/93         |           |                   |                 |                             |                |            |                  | 1,480      | 1,480          |            | 98             |               |             | 10.0       | 30.0                        | 42                    |                       | 2.10        |
| Orlando    | LAWNE SOUTH  | 5/26/93         | 8.00      |                   | 244             | 6.2                         |                |            |                  | 2,050      | 2,050          | 12         | 157            |               |             | 10.0       | 52.0                        | 8                     |                       | 1.64        |
| Orlando    | LAWNE SOUTH  | 8/25/93         | 7.35      |                   | 223             | 3.5                         |                |            |                  | 1,830      | 1,830          | 12         | 164            |               |             | 16.0       | 72.0                        | 54                    |                       | 1.84        |
| Orlando    | LAWNE SOUTH  | 11/29/93        | 7.89      |                   | 216             | 8.0                         | 40             | 30         |                  | 1,320      | 1,350          | 10         | 123            |               |             | 10.0       | 40.0                        | 28                    |                       | 2.53        |
| Orlando    | LAWNE SOUTH  | 2/3/94          | 7.47      |                   | 216             | 8.7                         |                |            |                  | 1,160      | 1,160          | 9          | 109            |               |             | 10.0       | 43.0                        | 84                    |                       | 2.95        |
| Orlando    | LAWNE SOUTH  | 4/12/94         | 8.54      |                   | 262             | 7.5                         | 40             |            |                  | 1,710      | 1,710          |            | 158            |               |             | 18.0       | 49.0                        | 20                    |                       | 1.77        |
| Orlando    | LAWNE SOUTH  | 7/26/94         | 6.94      |                   | 231             | 3.2                         | 40             |            |                  | 1,890      | 1,890          | 7          | 109            |               |             | 15.0       | 37.0                        | 620                   |                       | 2.10        |
| Orlando    | LAWNE SOUTH  | 11/28/94        | 7.32      |                   | 188             | 6.5                         | 90             | 470        |                  | 1,420      | 1,940          | 7          | 72             |               |             | 3.0        | 20.0                        | 13                    |                       | 2.36        |
| Orlando    | LAWNE SOUTH  | 1/19/95         | 7.59      |                   | 218             | 8.9                         |                | 250        |                  | 1,350      | 1,610          |            | 58             |               |             | 5.0        |                             | 20                    |                       | 2.46        |
| Orlando    | LAWNE SOUTH  | 4/27/95         | 7.39      |                   | 245             | 7.1                         |                |            |                  | 1,320      | 1,320          | 16         | 102            |               |             | 6.0        | 22.0                        | 15                    |                       | 2.79        |
| Orlando    | LAWNE SOUTH  | 8/8/95          | 7.43      |                   | 177             | 7.1                         |                |            |                  | 1,420      | 1,420          |            | 107            |               |             | 15.0       | 28.0                        | 30                    |                       | 2.00        |
| Orlando    | LAWNE SOUTH  | 5/13/97         | 7.29      |                   | 222             | 4.9                         | 90             |            |                  | 1,320      | 1,320          | 6          | 121            |               |             | 16.0       | 24.0                        | 120                   |                       | 2.17        |
| Orlando    | LAWNE SOUTH  | 7/15/97         | 7.06      |                   | 170             | 3.5                         |                |            |                  | 1,830      | 1,840          |            | 73             |               |             |            | 51.7                        | 116                   |                       | 1.84        |
| Orlando    | LAWNE SOUTH  | 10/14/97        | 7.03      |                   | 158             | 6.5                         | 40             |            |                  | 1,330      | 1,330          |            | 102            |               |             | 16.0       | 37.9                        | 35                    |                       | 1.90        |
| Orlando    | LAWNE SOUTH  | 2/10/98         | 7.29      |                   | 201             | 10.5                        |                | 150        |                  | 1,050      | 1,050          | 11         |                |               |             | 7.2        | 28.9                        | 25                    |                       | 2.59        |
| Orlando    | LAWNE SOUTH  | 4/30/98         | 6.99      |                   | 184             | 7.1                         |                |            |                  | 1,690      | 1,690          |            | 43             |               |             | 9.5        | 32.7                        | 40                    |                       | 2.17        |
| Orlando    | LAWNE SOUTH  | 7/16/98         | 7.12      |                   | 174             | 4.4                         | 60             | 20         |                  | 1,500      | 1,500          | 6          | 119            |               |             | 11.0       | 37.5                        | 490                   |                       | 2.53        |
| Orlando    | LAWNE SOUTH  | 10/15/98        | 7.56      |                   | 170             | 5.6                         |                |            |                  | 1,570      | 1,570          |            | 95             |               |             | 10.0       | 87.1                        | 18                    |                       | 1.87        |
| Orlando    | LAWNE SOUTH  | 3/2/99          | 7.79      |                   | 191             | 9.4                         |                |            |                  | 1,150      | 1,150          |            | 53             |               |             | 11.0       | 25.3                        |                       |                       | 2.33        |
| Orlando    | LAWNE SOUTH  | 6/2/99          | 7.91      |                   | 198             | 5.8                         |                |            |                  | 1,180      | 1,180          |            | 117            |               | 5.8         | 14.0       | 46.9                        | 78                    |                       | 1.97        |
| Orlando    | LAWNE SOUTH  | 9/7/99          | 7.78      |                   | 168             | 5.6                         | 90             | 30         |                  | 1,560      | 1,590          |            | 110            |               | 6.1         | 10.0       | 26.7                        | 280                   |                       | 1.74        |
| Orlando    | LAWNE SOUTH  | 11/16/99        | 7.57      |                   | 177             | 7.8                         |                |            |                  | 1,690      | 1,690          |            | 75             |               | 2.3         | 15.0       | 34.7                        | 68                    |                       | 1.67        |
| Orlando    | LAWNE SOUTH  | 2/29/00         | 7.66      |                   | 211             | 8.2                         |                |            |                  | 1,250      | 1,250          |            | 61             |               | 2.5         | 6.7        | 7.3                         | 42                    |                       | 2.39        |
| Orlando    | LAWNE SOUTH  | 6/1/00          | 8.60      |                   | 253             | 9.3                         |                |            |                  | 1,790      | 1,790          |            | 114            |               | 5.2         | 12.0       | 36.8                        | 30                    |                       | 1.90        |
| Orlando    | LAWNE SOUTH  | 8/24/00         | 7.95      |                   | 170             | 5.3                         |                |            |                  | 1,550      | 1,550          |            | 98             |               | 4.1         | 9.0        | 42.1                        | 2,000                 |                       | 2.03        |
| Orlando    | LAWNE SOUTH  | 12/19/00        | 8.10      |                   | 218             | 8.4                         |                |            |                  | 1,300      | 1,300          |            | 70             |               | 3.0         | 10.0       | 29.6                        | 200                   |                       | 1.80        |
| Orlando    | LAWNE SOUTH  | 1/30/01         | 8.00      |                   | 176             | 9.9                         |                |            |                  | 1,700      | 1,700          |            | 90             |               | 3.0         | 24.0       | 25.4                        | 220                   |                       | 2.76        |
| Orlando    | LAWNE SOUTH  | 4/26/01         | 8.07      |                   | 218             | 7.1                         |                |            |                  |            |                |            | 97             |               | 7.6         | 10.0       | 21.0                        | 30                    |                       | 1.97        |
| Orlando    | LAWNE SOUTH  | 7/17/01         | 8.80      |                   | 193             | 10.1                        |                |            |                  | 1,900      | 1,920          |            | 73             |               | 12.0        | 12.0       | 65.2                        | 35                    |                       | 1.61        |
| Orlando    | LAWNE SOUTH  | 10/11/01        | 8.04      |                   | 194             | 7.5                         |                |            |                  | 1,540      | 1,540          |            | 102            |               | 3.6         | 13.5       | 45.1                        | 116                   |                       | 1.64        |
| Orlando    | LAWNE SOUTH  | 2/7/02          | 7.61      |                   | 215             | 8.4                         |                |            |                  | 1,380      | 1,380          | 20         | 100            |               | 2.6         | 11.0       | 32.0                        | 48                    |                       | 1.71        |
| Orlando    | LAWNE SOUTH  | 4/11/02         | 8.39      |                   | 222             | 10.7                        |                |            |                  | 1,330      | 1,330          |            | 116            |               | 5.4         | 9.0        | 21.0                        | 6                     |                       | 2.17        |
| Orlando    | LAWNE SOUTH  | 7/18/02         | 8.75      |                   | 226             | 8.8                         |                |            |                  | 1,640      | 1,640          |            | 100            |               | 4.8         | 8.0        | 35.5                        | 110                   |                       | 1.48        |

## Historical Water Quality Data for Lake Lawne

| DataSource                 | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orlando                    | LAWNE SOUTH  | 10/25/02        | 8.03      |                   | 199             | 8.9                         |                |            |                  | 2,200      | 2,200          |            | 102            | 150           | 5.1         | 11.0       | 42.1                        | 1,710                 |                       | 1.48        |
| Orlando                    | LAWNE SOUTH  | 1/28/03         | 7.77      |                   | 180             | 10.5                        |                | 578        |                  | 1,570      | 2,148          |            | 63             |               | 2.2         | 7.0        | 16.3                        |                       |                       | 2.03        |
| Orlando                    | LAWNE SOUTH  | 4/22/03         | 7.97      |                   | 206             | 7.7                         |                |            |                  | 1,370      | 1,370          |            | 70             |               | 3.5         | 3.5        | 14.2                        |                       |                       | 2.03        |
| Orlando                    | LAWNE SOUTH  | 7/17/03         | 8.14      |                   | 190             | 7.3                         |                |            |                  | 1,500      | 1,500          | 7          | 67             |               | 4.8         | 12.6       | 39.5                        | 68                    |                       | 2.00        |
| Orlando                    | LAWNE SOUTH  | 10/9/03         | 7.72      |                   | 203             | 8.0                         |                |            |                  | 1,680      | 1,680          | 4          | 70             |               | 3.7         | 13.5       | 34.0                        | 216                   |                       | 2.10        |
| Orlando                    | LAWNE SOUTH  | 1/13/04         | 8.11      |                   | 218             | 11.0                        | 30             | 20         |                  | 1,180      | 1,200          | 3          | 65             |               | 3.0         | 6.4        | 15.8                        | 36                    |                       | 2.62        |
| Orlando                    | LAWNE SOUTH  | 4/15/04         | 8.30      |                   | 231             | 9.3                         | 20             |            |                  | 1,680      | 1,680          | 2          | 78             |               | 3.4         | 12.0       | 39.4                        | 82                    |                       | 2.39        |
| Orlando                    | LAWNE SOUTH  | 7/15/04         | 8.83      |                   | 210             | 9.5                         | 20             |            |                  | 1,430      | 1,430          | 6          | 88             |               | 5.0         | 14.4       | 30.7                        | 40                    |                       | 2.20        |
| Orlando                    | LAWNE SOUTH  | 1/11/05         | 8.31      | 69.6              | 222             | 10.8                        |                |            |                  | 1,610      | 1,610          | 4          | 71             |               |             |            | 24.9                        |                       |                       | 2.53        |
| Orlando                    | LAWNE SOUTH  | 4/13/05         | 8.06      | 68.5              | 223             | 8.5                         |                |            |                  | 1,340      | 1,340          | 4          | 72             |               |             |            | 13.0                        |                       |                       | 3.12        |
| Orlando                    | LAWNE SOUTH  | 7/12/05         | 7.93      | 59.7              | 189             | 8.6                         | 200            | 10         |                  | 1,770      | 1,780          | 4          | 60             |               |             |            | 24.8                        |                       |                       | 1.87        |
| Orlando                    | LAWNE SOUTH  | 10/20/05        | 7.68      | 64.3              | 199             | 8.1                         |                | 20         |                  | 1,640      | 1,660          | 5          | 34             |               |             |            | 39.9                        |                       |                       | 2.00        |
| Orlando                    | LAWNE SOUTH  | 1/17/06         | 8.10      | 63.8              | 203             | 9.1                         | 40             | 84         |                  | 1,470      | 1,554          | 3          | 55             |               |             | 6.0        | 18.7                        |                       |                       | 2.66        |
| Orlando                    | LAWNE SOUTH  | 5/4/06          | 8.57      | 79.0              | 245             | 9.2                         | 20             | 10         |                  | 1,620      | 1,630          | 6          | 84             |               |             | 13.0       | 17.0                        |                       |                       | 1.87        |
| Orlando                    | LAWNE SOUTH  | 7/11/06         | 8.08      | 68.3              | 202             | 7.2                         | 10             | 10         |                  | 1,340      | 1,350          | 6          | 74             |               |             | 10.6       | 35.0                        |                       |                       | 1.90        |
| Orlando                    | LAWNE SOUTH  | 10/17/06        |           | 64.2              |                 |                             | 20             | 10         |                  | 1,360      | 1,370          | 5          | 76             |               |             | 14.2       | 36.6                        |                       |                       | 2.10        |
| Orlando                    | LAWNE SOUTH  | 1/3/07          | 7.69      | 69.9              | 204             | 9.1                         | 20             | 10         |                  | 1,000      | 1,010          | 3          | 55             |               |             | 8.6        | 24.7                        |                       |                       | 2.92        |
| Orlando                    | LAWNE SOUTH  | 4/10/07         | 7.96      | 83.2              | 234             | 8.8                         | 10             | 10         |                  | 1,210      | 1,220          | 4          | 61             |               |             | 9.4        | 20.0                        |                       |                       | 2.13        |
| Orlando                    | LAWNE SOUTH  | 7/3/07          | 8.43      | 82.4              | 235             | 8.3                         | 10             | 10         |                  | 1,300      | 1,310          | 4          | 54             |               |             | 12.4       | 26.0                        |                       |                       | 1.97        |
| Orlando                    | LAWNE SOUTH  | 10/4/07         | 7.92      | 66.7              | 194             | 8.8                         | 10             | 30         |                  | 960        | 990            | 3          | 48             |               |             | 8.4        | 22.1                        |                       |                       | 4.23        |
| Orlando                    | LAWNE SOUTH  | 1/17/08         | 7.81      |                   | 224             | 9.4                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.71        |
| Orlando                    | LAWNE SOUTH  | 4/10/08         | 8.15      |                   | 203             | 9.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.43        |
| Orlando                    | LAWNE SOUTH  | 7/15/08         | 7.87      |                   | 190             | 7.9                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.44        |
| Orlando                    | LAWNE SOUTH  | 10/7/08         | 9.11      |                   | 200             | 7.3                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 1.90        |
| Orlando                    | LAWNE SOUTH  | 1/15/09         | 9.13      |                   | 122             | 6.2                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.58        |
| Orlando                    | LAWNE SOUTH  | 4/15/09         | 7.51      |                   | 232             | 7.7                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 4.63        |
| Orlando                    | LAWNE SOUTH  | 7/21/09         | 8.18      |                   | 186             | 4.7                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.90        |
| Orlando                    | LAWNE SOUTH  | 10/13/09        | 7.50      |                   | 205             | 4.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 4.49        |
| Orlando                    | LAWNE SOUTH  | 1/20/10         | 8.13      |                   | 204             | 10.9                        |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.15        |
| Orlando                    | LAWNE SOUTH  | 4/13/10         | 7.27      |                   | 216             | 3.9                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 1.74        |
| Orlando                    | LAWNE SOUTH  | 7/15/10         | 7.43      |                   | 192             | 5.3                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.39        |
| Orlando                    | LAWNE SOUTH  | 10/14/10        | 7.57      |                   | 183             | 7.8                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.66        |
| Orlando                    | LAWNE SOUTH  | 1/13/11         | 7.55      |                   | 208             | 8.0                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.31        |
| Orlando                    | LAWNE SOUTH  | 4/14/11         | 7.71      |                   | 195             | 7.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.02        |
| Orlando                    | LAWNE SOUTH  | 7/21/11         | 8.11      |                   | 164             | 8.5                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.13        |
| Orlando                    | LAWNE SOUTH  | 10/19/11        | 7.71      |                   | 168             | 5.3                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 2.36        |
| Orlando                    | LAWNE SOUTH  | 1/19/12         | 7.68      |                   | 194             | 8.1                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.38        |
| Orlando                    | LAWNE SOUTH  | 4/17/12         | 7.60      |                   | 220             | 7.3                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 3.28        |
|                            |              |                 |           |                   |                 |                             |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       |             |
| Minimum Value              |              |                 | 6.76      | 59.7              | 122             | 3.2                         | 10             | 10         | --               | 960        | 990            | 2          | 34             | 150           | 2.2         | 3.0        | 7.3                         | 6                     | --                    | 1.5         |
| Maximum Value              |              |                 | 9.13      | 83.2              | 262             | 11.0                        | 200            | 578        | --               | 2,200      | 2,200          | 60         | 240            | 150           | 12.0        | 24.0       | 100.0                       | 2,000                 | --                    | 4.6         |
| Geometric Mean (1990-1999) |              |                 | 7.47      | --                | 202             | 6.4                         | 50             | 73         | --               | 1,441      | 1,479          | 11         | 105            | --            | 4.3         | 10.4       | 36.5                        | 51                    | --                    | 2.2         |
| Geometric Mean (2000-2005) |              |                 | 8.12      | 65.4              | 206             | 8.7                         | 39             | 39         | --               | 1,545      | 1,570          | 5          | 78             | 150           | 4.1         | 10.1       | 27.2                        | 89                    | --                    | 2.0         |
| Geometric Mean (2006-2011) |              |                 | 7.94      | 71.8              | 199             | 7.4                         | 15             | 15         | --               | 1,265      | 1,286          | 4          | 62             | --            | --          | 10.0       | 24.1                        | --                    | --                    | 2.7         |

Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10M        | 10/13/66        | 9.00      | 47.3              |                 | 8.7                         | 150            |            |                  |            |                | 3,630      | 4,050          |               | 20.1        |            |                             |                       | 1,000                 |             |
| Orange Co. EPD | LW10M        | 10/18/66        | 8.20      | 50.6              |                 | 2.6                         | 95             |            |                  |            |                | 4,530      | 4,530          |               |             |            |                             |                       | 600                   |             |
| Orange Co. EPD | LW10M        | 10/20/66        | 9.00      | 52.0              |                 | 5.9                         | 270            |            |                  |            |                | 4,940      | 5,020          |               | 12.8        |            |                             |                       | 3,900                 |             |
| Orange Co. EPD | LW10M        | 10/21/66        | 8.30      | 47.1              |                 | 28.9                        | 0              |            |                  |            |                | 450        | 580            |               | 23.6        |            |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 1/12/67         | 7.40      | 72.0              |                 | 6.7                         | 10             |            | 70               |            |                | 1,710      |                |               | 20.0        |            |                             |                       | 200                   |             |
| Orange Co. EPD | LW10M        | 9/6/67          | 8.60      | 62.0              |                 | 3.6                         | 0              |            | 6,130            |            |                | 8,800      | 8,800          |               | 32.0        |            |                             |                       | 100                   |             |
| Orange Co. EPD | LW10M        | 3/19/68         | 8.30      | 64.0              |                 | 8.7                         | 4,310          |            | 4,300            |            |                | 25,000     | 25,500         |               | 13.0        |            |                             |                       | 2,000                 |             |
| Orange Co. EPD | LW10M        | 5/20/68         | 9.40      | 58.0              |                 | 10.9                        | 0              |            | 2,900            |            |                | 2,690      | 4,470          |               | 8.5         |            |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 10/21/68        | 8.30      | 47.0              |                 | 28.9                        | 0              |            | 6,090            |            |                | 450        | 580            |               | 23.6        |            |                             |                       | 30,000                |             |
| Orange Co. EPD | LW10M        | 3/11/69         | 7.20      | 61.0              | 220             | 23.2                        | 600            |            | 6,360            |            |                | 4,400      | 10,900         |               | 12.6        |            |                             |                       | 280,000               |             |
| Orange Co. EPD | LW10M        | 5/22/69         | 9.40      | 70.0              | 300             | 6.7                         | 1,490          |            | 8,450            |            |                | 8,900      |                |               | 6.7         |            |                             |                       | 2,100                 |             |
| Orange Co. EPD | LW10M        | 6/11/69         | 7.15      | 111.0             | 390             | 8.7                         | 1,000          |            | 3,200            |            |                | 170        | 170            |               | 8.6         |            |                             |                       | 5,000                 |             |
| Orange Co. EPD | LW10M        | 7/22/69         | 8.90      | 59.0              | 480             | 12.8                        | 0              |            | 6,300            |            |                | 8,200      | 9,500          |               | 6.9         |            |                             |                       | 0                     |             |
| Orange Co. EPD | LW10M        | 4/13/70         | 7.50      | 55.0              | 320             | 11.4                        | 850            |            | 2,760            |            |                | 15,600     | 15,600         |               | 7.7         |            |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10M        | 1/26/71         | 7.20      | 55.0              | 451             | 2.6                         | 0              |            | 1,080            |            |                | 1          | 1,880          |               | 2.5         |            |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 4/20/71         | 8.70      | 99.0              | 405             | 19.2                        | 90             |            | 4,260            |            |                | 15,760     | 16,250         |               |             |            |                             |                       |                       | 1.50        |
| Orange Co. EPD | LW10M        | 7/20/71         | 5.15      | 6.0               | 362             |                             | 810            | 0          | 4,190            |            |                | 17,700     | 26,260         |               | 3.0         |            |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 12/22/71        |           |                   | 459             |                             | 60             |            | 6,730            |            |                | 12,100     | 13,600         |               |             |            |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10M        | 8/21/72         | 7.30      | 80.0              | 250             | 5.5                         | 13             | 50         | 2,100            |            | 2,163          | 5,360      | 5,600          |               | 5.4         |            |                             |                       |                       | 2.00        |
| Orange Co. EPD | LW10M        | 11/27/72        |           |                   | 231             | 6.6                         | 80             | 530        | 1,480            |            | 2,090          | 720        | 900            |               | 2.9         | 196        |                             |                       |                       | 1.50        |
| Orange Co. EPD | LW10M        | 12/4/72         | 8.20      | 118.0             | 296             | 11.0                        | 80             | 640        | 1,100            |            | 1,820          | 660        | 760            |               | 7.6         | 174        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10M        | 1/3/73          | 8.50      | 47.4              |                 | 13.5                        | 0              | 70         | 2,750            |            | 2,820          | 460        | 460            |               | 9.8         | 206        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10M        | 2/5/73          |           |                   |                 | 13.2                        |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       | 1.50        |
| Orange Co. EPD | LW10M        | 3/20/73         | 9.00      | 78.0              |                 | 9.7                         |                |            |                  |            |                |            |                |               | 9.7         |            |                             |                       |                       | 0.50        |
| Orange Co. EPD | LW10M        | 3/26/73         | 7.80      | 63.0              |                 | 7.6                         | 230            | 70         | 2,660            |            | 2,960          | 320        | 440            |               | 7.6         | 260        |                             |                       |                       | 0.50        |
| Orange Co. EPD | LW10M        | 4/2/73          | 7.30      | 62.0              |                 | 7.2                         | 1              | 20         | 4,330            |            | 4,351          | 360        | 640            |               | 10.2        | 341        |                             |                       |                       | 0.33        |
| Orange Co. EPD | LW10M        | 4/9/73          | 7.30      | 59.0              | 214             | 6.0                         | 30             | 110        | 2,700            |            | 2,840          | 400        | 840            |               | 14.0        | 232        |                             |                       |                       | 0.40        |
| Orange Co. EPD | LW10M        | 4/16/73         | 7.10      | 56.0              | 220             | 6.7                         | 0              | 150        | 830              |            | 980            | 680        | 1,080          |               | 5.0         | 476        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10M        | 5/8/73          | 7.80      | 38.0              | 270             | 4.0                         | 90             | 1,960      | 470              |            | 2,520          | 720        | 3,720          |               | 1.4         | 1195       |                             |                       |                       | 0.15        |
| Orange Co. EPD | LW10M        | 5/27/73         | 6.70      | 46.0              | 235             | 4.2                         | 130            |            | 4,260            |            |                | 1,550      | 10,090         |               | 3.8         | 1275       |                             |                       |                       | 0.10        |
| Orange Co. EPD | LW10M        | 6/3/73          | 6.50      | 36.0              | 185             | 2.4                         | 0              |            | 1,570            |            |                |            |                |               | 0.9         | 1537       |                             |                       |                       | 0.10        |
| Orange Co. EPD | LW10M        | 6/9/73          |           |                   | 240             | 2.2                         |                |            |                  |            |                |            |                |               | 1.8         | 1624       |                             |                       |                       | 0.50        |
| Orange Co. EPD | LW10M        | 7/4/73          |           | 42.5              | 240             | 3.4                         | 150            |            | 3,590            |            |                | 1,140      | 7,390          |               | 1.9         | 76.0       |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 9/25/73         |           |                   |                 | 3.3                         |                |            |                  |            |                |            |                |               | 0.3         | 1868       |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 10/9/73         |           |                   | 265             | 4.0                         |                |            |                  |            |                |            |                |               | 2.2         | 1565       |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 11/13/73        | 6.90      | 28.0              | 255             | 6.1                         |                |            | 570              |            |                | 800        | 4,760          |               | 1.0         | 1637       |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 12/11/73        | 6.90      | 32.8              |                 | 7.8                         |                |            |                  |            |                | 929        | 3,640          |               | 4.3         | 366        |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 1/8/74          | 6.90      | 35.0              | 296             | 5.8                         |                |            |                  |            |                | 730        | 3,780          |               | 0.7         | 1164       |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 2/11/74         |           |                   | 255             |                             |                |            |                  |            |                | 670        | 3,210          |               |             |            |                             |                       |                       |             |
| Orange Co. EPD | LW10M        | 4/22/74         | 7.10      | 54.5              | 250             | 6.0                         | 110            | 30         | 1,690            |            | 1,830          | 470        | 1,580          |               | 0.0         | 533        |                             |                       |                       | 0.10        |
| Orange Co. EPD | LW10M        | 6/18/74         | 7.00      | 49.0              | 250             | 5.0                         | 60             | 120        | 1,000            |            | 1,180          | 440        | 540            |               | 3.4         | 275        |                             |                       |                       | 0.75        |
| Orange Co. EPD | LW10M        | 7/9/74          | 6.40      | 40.0              | 260             | 3.5                         | 90             | 790        | 1,700            |            | 2,580          | 130        | 170            |               | 2.6         | 209        |                             |                       |                       | 1.33        |
| Orange Co. EPD | LW10M        | 6/30/87         | 7.80      | 51.0              | 230             | 8.9                         |                | 22         |                  |            |                | 20         | 26             |               |             | 151        |                             |                       |                       | 3.94        |
| Orange Co. EPD | LW10M        | 1/9/91          | 7.80      | 78.0              | 280             | 9.1                         | 10             | 10         | 1,030            | 1,030      | 1,050          | 95         | 175            |               | 2.8         | 160        |                             |                       |                       | 2.46        |
| Orange Co. EPD | LW10M        | 1/29/91         | 7.70      | 87.6              | 225             | 8.6                         | 10             | 10         | 1,060            | 1,060      | 1,080          | 72         | 142            |               | 2.1         | 173        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 2/18/91         | 8.00      | 80.4              | 194             | 9.8                         | 20             | 10         | 1,150            | 1,170      | 1,180          | 57         | 132            |               | 2.1         | 164        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 4/3/91          | 8.00      | 74.1              | 264             | 5.9                         | 10             | 10         | 1,180            | 1,180      | 1,200          | 25         | 137            |               | 4.1         | 159        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10M        | 4/12/91         | 7.70      | 52.3              | 230             | 7.8                         | 160            | 10         | 870              | 1,030      | 1,040          | 19         | 103            |               | 4.2         | 153        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 5/15/91         | 7.70      | 60.0              | 225             | 7.2                         | 60             | 10         | 1,540            | 1,600      | 1,610          | 22         | 119            |               | 3.7         | 216        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 6/3/91          | 7.60      | 64.0              | 232             | 6.7                         | 40             | 10         | 1,370            | 1,410      | 1,420          | 61         | 182            |               | 3.6         | 174        |                             |                       |                       | 1.97        |

Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10M        | 7/28/91         | 7.10      | 56.0              | 169             | 6.2                         | 30             | 20         | 1,400            | 1,430      | 1,450          | 30         | 160            |               | 3.8         | 143        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 8/26/91         | 7.70      | 60.0              | 215             | 7.6                         | 50             | 10         | 1,370            | 1,420      | 1,430          | 53         | 145            |               | 4.0         | 157        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 9/17/91         | 7.80      | 67.0              | 236             | 4.4                         | 20             | 10         | 1,630            | 1,650      | 1,660          | 25         | 112            |               | 6.3         | 215        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 9/28/91         | 7.40      | 51.0              | 223             | 6.2                         | 40             | 10         | 1,770            | 1,810      | 1,820          | 19         | 124            |               | 4.3         |            |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 10/21/91        | 7.60      | 65.0              | 229             | 8.1                         | 30             | 10         | 1,590            | 1,620      | 1,630          | 10         | 115            |               | 3.3         | 145        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 11/13/91        | 7.80      | 68.0              | 230             | 8.8                         | 90             | 10         | 1,370            | 1,460      | 1,470          | 29         | 111            |               | 0.9         | 203        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 12/3/91         | 7.60      | 71.0              | 262             | 8.1                         | 20             | 10         | 1,650            | 1,670      | 1,680          | 49         | 107            |               | 2.0         | 197        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10M        | 1/28/92         | 7.70      | 68.0              | 231             | 8.1                         | 30             | 20         | 1,360            | 1,390      | 1,410          | 9          | 126            |               |             | 201        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 3/24/92         | 7.50      | 77.0              | 277             | 7.9                         | 170            | 10         | 1,180            | 1,350      | 1,360          | 18         | 116            |               | 3.5         | 202        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 4/29/92         | 7.90      | 53.0              | 225             | 8.9                         | 10             | 10         | 2,000            | 2,000      | 2,020          | 12         | 128            |               | 5.7         | 187        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 5/13/92         | 8.20      | 60.0              | 224             | 8.7                         | 90             | 10         | 2,070            | 2,160      | 2,170          | 13         | 138            |               | 7.4         | 192        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 6/15/92         | 7.60      | 64.0              | 223             | 5.5                         | 30             | 20         | 1,820            | 1,850      | 1,870          | 43         | 200            |               | 15.2        | 188        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 7/2/92          | 8.20      | 61.0              | 208             | 7.4                         | 40             | 20         | 1,600            | 1,640      | 1,660          | 40         | 146            |               | 3.9         | 169        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10M        | 7/15/92         | 7.60      | 65.0              | 191             | 4.8                         | 10             | 10         | 1,330            | 1,330      | 1,350          | 38         | 179            |               | 4.3         | 182        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10M        | 8/14/92         | 8.40      | 62.0              | 194             | 5.2                         | 10             | 10         | 1,990            | 1,990      | 2,010          | 9          |                |               | 5.1         | 160        |                             |                       |                       | 0.98        |
| Orange Co. EPD | LW10M        | 8/27/92         | 7.70      | 51.0              | 181             | 8.2                         | 10             | 10         | 1,450            | 1,450      | 1,470          | 8          | 91             |               | 4.2         | 162        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 9/15/92         | 7.40      | 56.0              | 182             | 5.7                         | 10             | 10         | 1,780            | 1,780      | 1,800          | 14         | 107            |               | 5.7         | 182        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10M        | 10/14/92        | 7.40      | 57.0              | 205             | 7.1                         | 10             | 20         | 1,750            | 1,750      | 1,780          | 15         | 99             |               | 4.0         |            |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 11/16/92        | 7.50      | 58.0              | 213             | 6.9                         | 130            | 40         | 1,480            | 1,610      | 1,650          | 31         | 124            |               | 2.0         |            |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 12/7/92         | 7.80      | 58.0              | 211             | 10.4                        | 40             | 10         | 1,070            | 1,110      | 1,120          | 12         | 96             |               | 3.6         | 166        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 1/4/93          | 8.00      | 64.0              | 254             | 6.6                         | 40             | 10         | 1,370            | 1,410      | 1,420          | 24         | 110            |               | 3.9         | 225        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 1/25/93         | 7.60      | 59.0              | 221             | 6.8                         | 80             | 10         | 990              | 1,070      | 1,080          | 17         | 124            |               | 3.4         | 184        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 1/27/93         | 7.40      | 58.0              | 220             | 7.5                         |                | 40         | 1,440            | 1,550      | 1,590          | 20         | 105            |               | 2.4         | 178        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 2/16/93         | 7.60      | 58.0              | 227             | 9.0                         | 20             | 10         | 1,370            | 1,390      | 1,400          | 11         | 104            |               | 3.3         | 195        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 3/8/93          | 7.60      | 58.0              | 214             | 8.4                         | 10             | 10         | 1,250            | 1,250      | 1,270          | 2          | 87             |               | 4.3         | 192        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10M        | 3/29/93         | 7.70      | 52.0              | 215             | 9.7                         | 20             | 10         | 1,350            | 1,370      | 1,380          | 12         | 98             |               | 4.4         | 188        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 4/14/93         | 7.70      | 57.0              | 222             | 8.8                         | 10             | 10         | 1,390            | 1,390      | 1,410          | 13         | 87             |               | 4.2         | 198        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10M        | 5/3/93          | 7.50      | 57.0              | 215             | 6.9                         | 60             | 20         | 1,410            | 1,470      | 1,490          | 27         | 112            |               | 3.6         | 194        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 5/25/93         | 7.60      | 57.0              | 232             | 6.4                         | 20             | 10         | 1,570            | 1,590      | 1,600          | 11         | 136            |               | 3.6         | 186        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 6/16/93         | 7.80      | 61.0              | 215             | 6.3                         | 70             | 20         | 1,800            | 1,870      | 1,890          | 27         | 134            |               | 5.0         | 186        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 7/8/93          | 7.90      | 64.0              | 221             | 7.2                         | 20             | 20         | 1,550            | 1,570      | 1,590          | 50         | 170            |               | 4.9         | 173        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10M        | 7/28/93         | 8.90      | 58.0              | 196             | 12.3                        | 80             | 10         | 1,260            | 1,340      | 1,350          | 30         | 120            |               | 5.5         | 188        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 8/18/93         | 8.50      | 64.0              | 206             | 9.1                         | 10             | 10         | 1,480            | 1,330      | 1,500          | 20         | 130            |               | 4.3         | 160        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 9/8/93          | 7.90      | 63.0              | 189             | 6.3                         | 10             | 10         | 1,320            | 1,120      | 1,340          | 16         | 118            |               | 5.7         | 148        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 12/29/93        | 8.40      | 64.0              | 211             | 11.5                        | 50             | 10         | 1,070            |            | 1,130          | 5          | 78             |               | 3.4         | 140        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10M        | 3/21/94         | 8.70      | 65.0              | 227             | 10.1                        | 30             | 20         | 1,310            | 1,340      | 1,360          | 17         | 117            |               | 7.0         | 182        |                             | 50                    | 98                    | 1.97        |
| Orange Co. EPD | LW10M        | 6/20/94         | 6.50      | 42.0              | 155             | 6.2                         | 100            | 20         | 1,510            | 1,610      | 1,630          | 29         | 175            |               | 7.1         | 160        |                             | 180                   | 300                   | 1.64        |
| Orange Co. EPD | LW10M        | 9/21/94         | 6.80      | 43.0              | 158             | 5.3                         | 240            | 120        | 1,270            | 1,510      | 1,630          | 13         | 84             |               |             | 172        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10M        | 12/14/94        | 7.10      | 48.0              | 210             | 6.4                         | 250            | 550        | 930              | 1,160      | 1,730          | 5          | 57             |               | 0.8         | 164        |                             | 96                    |                       | 3.28        |
| Orange Co. EPD | LW10M        | 3/20/95         | 7.32      | 60.2              | 216             | 7.2                         | 20             | 10         | 1,200            | 1,250      | 1,230          | 24         | 79             |               | 2.3         | 178        |                             | 280                   |                       | 2.46        |
| Orange Co. EPD | LW10M        | 9/18/95         | 6.79      |                   | 253             | 5.0                         |                | 10         |                  | 1,980      | 1,990          |            | 72             |               | 2.4         |            |                             | 70                    | 220                   | 1.64        |
| Orange Co. EPD | LW10M        | 12/21/95        | 6.88      | 68.0              | 219             | 7.6                         |                | 60         |                  | 1,600      | 1,660          |            | 61             |               | 2.0         | 6.0        |                             | 100                   | 620                   | 4.92        |
| Orange Co. EPD | LW10M        | 3/12/96         | 7.04      | 67.0              | 193             | 6.9                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 26             | 110           | 4.0         | 11.0       |                             | 146                   | 600                   | 2.46        |
| Orange Co. EPD | LW10M        | 6/10/96         | 7.04      | 48.0              | 225             | 8.2                         | 10             | 10         | 1,600            | 1,600      | 1,620          |            | 18             | 90            | 3.5         | 20.0       |                             | 24                    | 44                    | 2.46        |
| Orange Co. EPD | LW10M        | 9/9/96          | 5.91      |                   | 201             | 5.5                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 27             | 70            | 6.0         | 18.0       |                             | 560                   | 620                   | 6.56        |
| Orange Co. EPD | LW10M        | 12/16/96        | 7.67      | 42.8              | 183             | 8.7                         | 20             | 10         | 1,200            | 1,200      | 1,230          |            | 14             | 90            | 2.8         | 12.0       |                             | 20                    | 160                   | 3.28        |
| Orange Co. EPD | LW10M        | 2/11/97         | 7.25      | 65.0              | 202             | 6.3                         | 30             | 10         | 1,000            | 1,000      | 1,040          |            | 7              | 60            | 2.2         | 8.0        |                             | 8                     | 48                    | 3.28        |
| Orange Co. EPD | LW10M        | 5/5/97          | 7.58      | 56.0              | 190             | 6.5                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 22             | 70            | 2.8         | 8.0        |                             | 154                   | 178                   | 1.64        |
| Orange Co. EPD | LW10M        | 9/24/97         | 7.29      | 62.0              | 189             | 5.6                         | 20             | 10         | 1,100            | 1,100      | 1,130          |            | 13             | 45            | 2.7         | 8.5        |                             | 126                   | 146                   | 4.10        |
| Orange Co. EPD | LW10M        | 3/31/98         | 6.76      | 50.4              | 185             | 6.5                         | 10             | 10         | 1,200            | 1,200      | 1,220          |            | 22             | 140           | 2.4         | 9.0        |                             | 70                    | 100                   | 1.97        |



## Historical Water Quality Data for Lake Lawne

| DataSource                 | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD             | LW10M        | 6/16/98         | 8.53      | 66.2              | 224             | 7.7                         | 20             | 10         | 1,700            | 1,700      | 1,730          |            | 35             | 80            | 5.2         | 18.0       |                             | 34                    | 110                   | 1.44        |
| Orange Co. EPD             | LW10M        | 9/22/98         | 7.19      | 63.0              | 187             | 5.3                         | 20             | 20         | 1,200            | 1,200      | 1,240          |            | 31             | 45            | 2.2         | 8.0        |                             | 160                   |                       | 1.31        |
| Orange Co. EPD             | LW10M        | 12/9/98         | 7.93      | 72.5              | 214             | 7.3                         | 10             | 10         | 1,100            | 1,100      | 1,120          |            | 10             | 50            | 3.1         | 11.0       |                             | 16                    | 86                    | 1.64        |
| Orange Co. EPD             | LW10M        | 4/12/99         | 8.40      | 77.0              | 245             | 6.9                         | 19             | 10         | 1,500            | 1,500      | 1,529          |            | 15             | 40            | 4.5         | 10.0       |                             | 118                   | 200                   | 1.31        |
| Orange Co. EPD             | LW10M        | 7/20/99         | 8.29      | 59.0              | 173             | 7.0                         |                |            |                  |            |                |            |                | 40            | 3.2         | 12.0       |                             | 34                    | 42                    | 1.31        |
| Orange Co. EPD             | LW10M        | 10/11/99        | 7.32      | 51.0              | 176             | 8.3                         | 17             | 75         | 1,600            | 1,600      | 1,692          |            | 16             | 100           | 5.0         | 9.0        |                             | 430                   | 730                   | 1.64        |
| Orange Co. EPD             | LW10M        | 3/8/00          | 7.68      | 61.0              | 231             | 7.8                         | 29             | 10         | 820              | 850        | 859            |            | 12             | 70            | 2.0         | 2.0        |                             | 46                    | 180                   | 2.46        |
| Orange Co. EPD             | LW10M        | 9/21/00         | 8.49      | 76.9              | 213             | 9.4                         | 19             | 10         | 1,400            | 1,400      | 1,429          |            | 5              | 45            | 4.1         | 13.0       | 38.5                        | 254                   | 162                   | 0.98        |
| Orange Co. EPD             | LW10M        | 12/13/00        | 6.80      | 82.4              | 208             | 7.8                         | 32             | 10         | 1,100            | 1,100      | 1,142          |            | 6              | 35            | 3.1         | 10.0       |                             | 480                   |                       | 1.31        |
| Orange Co. EPD             | LW10M        | 2/20/01         | 7.24      | 84.1              | 247             | 9.5                         | 10             | 10         | 990              | 1,000      | 1,010          |            | 5              | 35            | 2.8         | 12.0       |                             | 110                   | 52                    | 1.64        |
| Orange Co. EPD             | LW10M        | 5/29/01         | 8.14      | 73.9              | 208             | 6.3                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 5              | 40            | 4.4         | 12.0       |                             |                       | 190                   | 1.64        |
| Orange Co. EPD             | LW10M        | 12/18/01        | 7.03      | 81.9              | 107             | 6.2                         | 34             | 10         | 1,300            | 1,300      | 1,344          |            | 9              | 30            | 2.3         | 9.0        | 47.8                        | 96                    | 320                   | 2.46        |
| Orange Co. EPD             | LW10M        | 2/22/02         | 7.68      | 77.5              | 223             | 9.6                         | 25             | 10         | 1,100            | 1,100      | 1,135          |            | 5              | 35            | 4.2         | 12.0       |                             |                       |                       | 1.31        |
| Orange Co. EPD             | LW10M        | 11/14/02        |           |                   |                 |                             |                |            |                  |            |                |            |                |               |             |            | 21.7                        |                       |                       |             |
| Orange Co. EPD             | LW10M        | 11/18/04        | 6.95      | 64.0              | 212             | 7.3                         |                | 4          | 1,680            | 1,700      | 1,684          |            | 6              |               |             | 186.0      |                             |                       | 1,260                 | 1.64        |
| Orange Co. EPD             | LW10M        | 1/26/05         |           | 63.0              |                 |                             | 20             | 3          | 1,220            | 1,220      | 1,243          | 4          | 4              | 105           |             | 7.0        | 21.0                        |                       |                       |             |
| Orange Co. EPD             | LW10M        | 2/1/05          |           |                   |                 |                             |                |            |                  |            |                |            |                |               |             |            |                             | 46                    |                       |             |
| Orange Co. EPD             | LW10M        | 6/22/05         |           | 65.0              |                 |                             | 20             | 7          | 1,400            | 1,400      | 1,427          | 3          | 9              | 90            |             | 10.0       | 34.0                        |                       |                       |             |
| Orange Co. EPD             | LW10M        | 8/18/05         |           | 60.0              |                 |                             | 20             | 20         | 1,400            | 1,400      | 1,440          | 3          | 8              | 115           |             | 9.0        | 42.0                        |                       |                       |             |
| Orange Co. EPD             | LW10M        | 12/7/05         |           | 66.0              |                 |                             | 70             | 28         | 1,370            | 1,440      | 1,468          | 3          | 7              | 100           |             | 11.0       | 38.0                        |                       |                       |             |
| Orange Co. EPD             | LW10M        | 1/26/06         | 7.60      |                   | 205             | 8.3                         |                |            |                  |            |                |            |                |               |             |            | 25.0                        | 98                    | 136                   | 1.64        |
| Orange Co. EPD             | LW10M        | 5/4/06          | 8.50      | 77.0              | 241             | 8.6                         | 20             | 4          | 1,530            | 1,530      | 1,554          | 4          | 12             |               |             | 10.0       | 37.7                        | 86                    | 144                   | 1.64        |
| Orange Co. EPD             | LW10M        | 7/26/06         | 8.60      | 70.0              | 188             | 9.6                         | 20             | 3          | 1,230            | 1,230      | 1,253          | 4          | 5              |               |             | 15.0       | 25.5                        | 131                   | 50                    | 1.64        |
| Orange Co. EPD             | LW10M        | 12/4/06         |           | 88.0              |                 | 8.4                         |                | 2          | 1,190            | 1,190      | 1,192          | 4          | 4              |               |             | 13.0       |                             |                       |                       |             |
| Orange Co. EPD             | LW10M        | 1/30/07         | 7.30      | 74.0              | 209             | 9.8                         | 20             | 4          | 990              | 990        | 1,014          | 4          | 5              |               | 2.0         | 9.0        | 23.1                        | 48                    | 98                    | 2.62        |
| Orange Co. EPD             | LW10M        | 5/31/07         | 7.90      | 90.0              | 246             | 6.7                         | 20             | 2          | 1,440            | 1,440      | 1,462          | 4          | 5              | 25            | 3.0         | 16.0       | 20.0                        | 10                    |                       | 1.31        |
| Orange Co. EPD             | LW10M        | 7/30/07         | 8.40      | 80.0              | 217             | 8.9                         | 20             | 2          | 1,090            | 1,090      | 1,112          | 4          | 6              | 30            |             | 14.0       | 34.8                        | 440                   |                       | 1.97        |
| Orange Co. EPD             | LW10M        | 10/23/07        | 7.20      | 75.0              | 203             | 6.7                         | 20             | 2          | 1,000            | 1,000      | 1,022          | 3          | 6              | 41            | 2.0         | 8.0        | 29.4                        | 510                   |                       | 2.13        |
| Orange Co. EPD             | LW10M        | 2/6/08          | 7.40      | 79.0              | 218             | 8.5                         | 20             | 3          | 1,010            | 1,010      | 1,033          | 3          | 3              | 33            |             | 6.0        | 12.3                        | 30                    |                       | 2.20        |
| Orange Co. EPD             | LW10M        | 4/23/08         | 7.70      | 76.0              | 215             | 7.4                         | 20             | 3          | 1,050            | 1,050      | 1,073          | 3          | 5              | 57            |             | 5.0        | 19.6                        | 100                   |                       | 2.30        |
| Orange Co. EPD             | LW10M        | 8/7/08          | 7.40      | 62.0              | 180             | 6.0                         | 30             | 3          | 1,220            | 1,220      | 1,253          | 4          | 5              | 72            |             | 6.0        | 38.0                        | 550                   |                       | 1.30        |
| Orange Co. EPD             | LW10M        | 10/23/08        | 6.98      | 62.0              | 195             | 6.1                         | 30             | 26         | 1,520            | 1,520      | 1,576          | 3          | 7              | 125           |             | 1.0        | 18.2                        | 36                    |                       | 2.30        |
| Orange Co. EPD             | LW10M        | 2/10/09         | 7.80      | 71.0              | 220             | 9.5                         | 30             | 2          | 1,420            | 1,420      | 1,452          | 2          | 6              | 59            |             | 2.0        | 15.2                        | 18                    |                       | 3.28        |
| Orange Co. EPD             | LW10M        | 6/30/09         | 7.10      | 61.0              | 192             | 5.3                         | 30             | 5          | 1,670            | 1,670      | 1,705          | 2          | 15             | 114           |             | 5.0        | 27.5                        | 42                    |                       | 2.79        |
| Orange Co. EPD             | LW10M        | 9/8/09          | 7.20      | 65.0              | 188             | 4.9                         | 20             | 2          | 1,310            | 1,310      | 1,332          | 2          | 4              | 46            |             | 10.0       | 7.2                         | 190                   |                       | 3.28        |
| Orange Co. EPD             | LW10M        | 12/3/09         | 7.30      | 75.0              | 213             | 7.6                         | 20             | 27         | 1,180            | 1,180      | 1,227          | 2          | 8              | 60            |             | 2.0        | 5.4                         | 4                     |                       | 2.95        |
| Orange Co. EPD             | LW10M        | 2/8/10          | 7.60      | 72.0              | 207             | 8.8                         |                | 19         | 1,200            | 1,200      | 1,219          | 2          | 14             | 51            |             | 2.0        | 9.7                         | 8                     |                       | 1.97        |
| Orange Co. EPD             | LW10M        | 5/11/10         | 7.40      | 66.0              | 210             | 6.0                         |                | 7          | 1,750            | 1,750      | 1,757          | 2          | 19             | 90            |             | 10.0       | 38.7                        | 86                    |                       | 1.97        |
| Orange Co. EPD             | LW10M        | 7/27/10         | 7.59      | 69.0              | 195             | 5.7                         |                | 3          | 1,050            | 1,060      | 1,063          | 8          | 6              | 66            |             | 8.0        | 18.9                        | 304                   |                       | 2.79        |
| Orange Co. EPD             | LW10M        | 11/23/10        | 7.30      | 73.0              | 192             | 7.3                         |                | 4          | 1,240            | 1,240      | 1,244          | 3          | 11             | 55            |             | 8.0        | 21.9                        | 26                    |                       | 2.46        |
| Minimum Value              |              |                 | 5.91      | 42.0              | 107             | 4.4                         | 10             | 2          | 820              | 850        | 859            | 2          | 3              | 25            | 0.8         | 1.0        | 5.4                         | 4                     | 42                    | 1.0         |
| Maximum Value              |              |                 | 8.90      | 90.0              | 280             | 12.3                        | 250            | 550        | 2,070            | 2,160      | 2,170          | 95         | 200            | 140           | 15.2        | 225.0      | 47.8                        | 560                   | 1,260                 | 6.6         |
| Geometric Mean (1990-1999) |              |                 | 7.61      | 60.4              | 212             | 7.2                         | 26             | 14         | 1,381            | 1,432      | 1,463          | 20         | 78             | 68            | 3.6         | 86.6       | - -                         | 80                    | 169                   | 2.1         |
| Geometric Mean (2000-2005) |              |                 | 7.48      | 70.8              | 201             | 7.9                         | 23             | 9          | 1,251            | 1,263      | 1,287          | 3          | 6              | 56            | 3.1         | 11.5       | 33.3                        | 118                   | 221                   | 1.6         |
| Geometric Mean (2006-2011) |              |                 | 7.58      | 72.5              | 206             | 7.4                         | 22             | 4          | 1,249            | 1,250      | 1,273          | 3          | 7              | 56            | 2.3         | 6.3        | 19.9                        | 64                    | 99                    | 2.2         |

Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10N        | 12/10/74        | 7.60      | 67.0              | 310             | 8.0                         | 10             | 810        | 1,850            |            | 2,670          | 340        | 630            |               | 0.4         | 358        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 2/4/75          | 7.70      | 66.0              | 300             | 6.4                         | 0              | 490        | 1,440            |            | 1,930          | 280        | 470            |               | 1.8         | 287        |                             |                       |                       | 0.55        |
| Orange Co. EPD | LW10N        | 3/24/75         | 8.00      | 72.0              | 310             | 7.1                         | 80             | 330        | 1,440            |            | 1,850          | 400        |                |               | 1.4         | 322        |                             |                       |                       | 2.50        |
| Orange Co. EPD | LW10N        | 7/15/75         |           |                   | 190             | 2.8                         | 0              | 50         | 730              |            | 780            | 540        | 610            |               | 0.7         | 157        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 1/20/76         | 6.70      | 56.0              | 290             | 7.5                         | 50             | 100        | 894              |            | 1,044          | 320        | 340            |               | 1.3         | 204        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 3/3/76          | 7.30      | 70.0              | 270             | 6.8                         | 24             | 100        | 1,100            |            | 1,224          | 450        | 500            |               | 0.9         | 179        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 4/12/76         | 7.50      | 69.0              | 260             | 7.0                         | 50             | 100        | 1,100            |            | 1,250          | 410        | 440            |               | 1.9         | 191        |                             |                       |                       | 3.50        |
| Orange Co. EPD | LW10N        | 5/18/76         | 7.30      | 60.0              | 200             | 4.0                         | 50             | 100        | 810              |            | 960            | 280        | 300            |               | 1.0         | 155        |                             |                       |                       | 4.50        |
| Orange Co. EPD | LW10N        | 6/8/76          | 7.10      | 61.0              | 210             | 4.4                         | 50             | 100        | 1,200            |            | 1,350          | 210        | 230            |               | 2.8         | 140        |                             |                       |                       | 3.50        |
| Orange Co. EPD | LW10N        | 9/7/76          | 6.40      | 60.0              | 210             | 8.7                         | 66             | 100        | 1,500            |            | 1,666          | 130        | 190            |               | 2.5         | 211        |                             |                       |                       | 1.50        |
| Orange Co. EPD | LW10N        | 12/21/76        | 7.60      | 69.0              | 240             | 7.0                         | 120            | 780        | 1,700            | 1,820      | 2,600          | 320        | 390            |               |             | 173        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10N        | 1/10/77         | 7.70      | 67.0              | 260             | 8.0                         | 50             | 110        | 1,600            | 1,650      | 1,760          | 340        | 420            |               | 3.1         | 194        |                             |                       |                       | 0.80        |
| Orange Co. EPD | LW10N        | 4/13/77         | 7.00      | 71.0              | 240             | 6.6                         | 50             | 100        | 1,500            | 1,550      | 1,650          | 420        | 510            |               | 3.6         | 228        |                             |                       |                       | 0.66        |
| Orange Co. EPD | LW10N        | 7/11/77         | 7.50      | 76.0              | 250             | 4.4                         | 54             | 100        | 1,600            | 1,650      | 1,754          | 36         | 420            |               | 3.8         | 190        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 10/10/77        | 7.60      | 68.0              | 220             | 5.7                         | 50             | 100        | 1,200            | 1,250      | 1,350          | 17         | 220            |               | 0.8         | 169        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 1/9/78          | 7.00      | 70.0              | 240             | 8.6                         | 50             | 10         | 1,000            | 1,050      | 1,060          | 17         | 220            |               | 1.9         | 152        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 2/6/78          | 7.70      | 69.0              | 260             | 8.7                         | 50             | 20         | 930              | 1,980      | 1,000          | 14         | 170            |               | 2.0         | 198        |                             |                       |                       | 3.28        |
| Orange Co. EPD | LW10N        | 3/7/78          | 7.70      | 60.0              | 260             | 10.7                        | 50             | 330        | 1,700            | 1,750      | 2,080          | 54         | 100            |               | 5.0         | 200        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 4/10/78         | 6.90      | 63.0              | 300             | 5.6                         | 50             | 10         | 1,500            | 1,550      | 1,560          | 170        | 230            |               | 2.6         | 210        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 5/8/78          | 7.60      | 69.0              | 280             | 6.4                         | 60             | 10         | 1,600            | 1,660      | 1,670          | 180        | 220            |               | 3.0         | 212        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 6/5/78          | 6.20      | 73.0              | 270             | 5.0                         | 50             | 10         | 1,500            | 1,550      | 1,560          | 290        | 360            |               | 2.4         | 160        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 9/5/78          | 7.40      | 59.0              | 220             | 3.2                         | 50             | 10         | 1,980            | 1,940      | 2,040          | 140        | 190            |               | 2.0         | 205        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 12/4/78         | 7.90      | 73.0              | 260             | 5.5                         | 130            | 40         | 1,300            | 1,430      | 1,470          | 260        | 330            |               | 2.4         | 200        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 1/2/79          | 7.70      | 69.0              | 240             | 6.6                         | 90             | 40         | 2,300            | 2,340      | 2,430          | 270        | 310            |               | 1.7         | 151        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10N        | 2/5/79          | 7.80      | 61.0              | 280             | 9.8                         | 60             | 10         | 1,700            | 1,760      | 1,770          | 140        | 210            |               | 2.8         | 179        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 3/5/79          | 7.90      | 62.0              | 280             | 7.7                         | 70             | 10         | 1,200            | 1,270      | 1,280          | 140        | 210            |               | 2.1         | 180        |                             |                       |                       | 0.98        |
| Orange Co. EPD | LW10N        | 4/2/79          | 7.80      | 60.0              | 25              | 7.2                         | 50             | 10         | 1,200            | 1,250      | 1,260          | 120        | 180            |               | 2.2         | 200        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 4/30/79         | 7.80      | 64.0              | 280             | 7.2                         | 50             | 10         | 1,400            | 1,450      | 1,460          | 160        | 200            |               | 3.3         | 201        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10N        | 6/4/79          | 6.90      | 58.0              | 230             | 6.1                         | 50             | 10         | 1,400            | 1,450      | 1,460          | 150        | 210            |               | 3.3         | 175        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 8/6/79          | 6.50      | 85.0              | 200             | 4.2                         | 100            | 10         | 1,200            | 1,300      | 1,310          | 190        | 240            |               | 2.0         | 172        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 9/5/79          | 7.30      | 51.0              | 225             | 5.3                         | 320            | 70         | 1,200            | 1,520      | 1,590          | 150        | 180            |               | 2.8         | 170        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 10/1/79         | 7.20      | 51.0              | 215             | 4.1                         | 130            | 70         | 1,600            | 1,730      | 1,800          | 100        | 150            |               | 2.6         | 170        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10N        | 11/5/79         | 7.80      | 57.0              | 225             | 6.5                         | 80             | 80         | 1,500            | 1,580      | 1,660          | 120        | 160            |               | 5.7         | 200        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10N        | 12/3/79         | 7.30      | 57.0              | 255             | 7.3                         | 60             | 120        | 1,300            | 1,360      | 1,480          | 160        | 180            |               | 3.0         | 189        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 1/7/80          | 7.50      | 61.0              | 254             | 9.0                         | 410            | 40         | 1,100            | 1,510      | 1,550          | 130        | 170            |               | 2.8         | 198        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 2/4/80          | 7.30      | 58.0              | 275             | 9.5                         | 110            | 10         | 1,200            | 1,310      | 1,320          | 160        | 180            |               | 1.5         | 191        |                             |                       |                       | 0.98        |
| Orange Co. EPD | LW10N        | 3/3/80          | 7.50      | 60.0              | 260             | 9.0                         | 60             | 220        | 1,400            | 1,460      | 1,680          | 140        | 180            |               | 3.3         | 181        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 3/31/80         | 7.70      | 59.0              | 270             | 7.2                         | 50             | 10         | 1,300            | 1,350      | 1,360          | 160        | 190            |               | 1.2         | 181        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 6/2/80          | 8.00      | 62.0              | 225             | 7.7                         | 110            | 10         | 1,600            | 1,710      | 1,720          | 190        | 230            |               | 5.4         | 218        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 6/30/80         | 6.70      | 39.0              | 220             | 5.8                         | 110            | 10         | 1,300            | 1,410      | 1,420          | 200        | 270            |               | 2.0         | 188        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 9/8/80          | 7.20      | 55.0              | 190             | 5.2                         | 50             | 10         | 740              | 790        | 800            | 170        | 210            |               | 2.5         | 132        |                             |                       |                       | 3.61        |
| Orange Co. EPD | LW10N        | 10/6/80         | 7.20      | 57.0              | 195             | 5.9                         | 70             | 10         | 1,000            | 1,070      | 1,080          | 220        | 240            |               | 2.3         | 148        |                             |                       |                       | 3.28        |
| Orange Co. EPD | LW10N        | 10/29/80        | 7.30      | 57.0              | 222             | 6.5                         | 60             | 10         | 1,240            | 1,300      | 1,310          | 200        | 220            |               | 3.6         | 150        |                             |                       |                       | 2.95        |
| Orange Co. EPD | LW10N        | 12/1/80         | 7.30      | 52.0              | 177             | 7.5                         | 80             | 10         | 860              | 940        | 950            | 210        | 210            |               | 1.7         | 140        |                             |                       |                       | 3.61        |
| Orange Co. EPD | LW10N        | 3/9/81          | 7.40      | 53.0              | 195             | 7.2                         | 50             | 30         | 1,650            | 1,700      | 1,730          | 160        | 170            |               | 3.6         | 135        |                             |                       |                       | 3.61        |
| Orange Co. EPD | LW10N        | 5/15/81         | 7.40      | 48.0              | 160             | 5.4                         | 70             | 10         | 1,230            | 1,300      | 1,310          | 130        | 190            |               | 5.6         | 121        |                             |                       |                       | 6.56        |
| Orange Co. EPD | LW10N        | 3/22/82         | 6.70      | 61.0              | 195             | 4.2                         | 90             | 40         | 1,210            | 1,300      | 1,340          | 167        | 199            |               | 11.0        | 137        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10N        | 6/22/82         | 6.20      | 52.0              | 180             | 4.4                         | 130            | 120        | 740              | 870        | 990            | 102        | 137            |               | 5.6         | 128        |                             |                       |                       | 3.28        |
| Orange Co. EPD | LW10N        | 8/19/82         | 6.20      | 62.0              | 205             | 2.1                         | 50             | 40         | 1,400            | 1,400      | 1,490          | 67         | 96             |               | 16.0        | 163        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 11/1/82         | 7.00      | 63.0              | 300             | 6.2                         | 160            | 40         | 1,200            | 1,400      | 1,400          | 78         | 116            |               | 2.1         | 197        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 3/20/84         | 7.20      | 71.0              | 280             | 7.2                         | 73             | 14         | 614              | 687        | 701            | 56         | 91             |               | 0.3         | 193        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10N        | 6/12/84         | 7.50      | 69.0              | 322             | 5.8                         | 28             | 27         | 1,298            | 1,326      | 1,353          | 84         | 104            |               | 3.1         | 210        |                             |                       |                       | 6.23        |
| Orange Co. EPD | LW10N        | 1/28/86         | 6.60      | 50.6              | 260             | 7.6                         | 140            | 1,020      | 1,390            | 1,530      | 2,550          | 60         | 119            |               | 4.4         | 188        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 4/1/86          | 7.60      | 75.6              | 250             |                             | 90             | 360        | 1,230            | 1,320      | 1,680          | 46         | 99             |               | 1.9         | 220        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10N        | 9/1/86          | 7.60      | 47.9              | 193             | 7.5                         | 110            | 40         | 850              | 960        | 1,000          | 100        | 103            |               | 1.4         | 152        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10N        | 10/7/86         | 7.30      | 42.9              | 200             | 4.0                         | 110            | 40         | 730              | 840        | 880            | 52         | 95             |               | 3.9         | 182        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10N        | 1/28/87         | 8.10      | 68.0              | 270             | 9.2                         | 50             |            | 1,140            | 1,140      | 1,190          | 69         | 126            |               | 3.9         | 170        |                             |                       |                       | 1.64        |

Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (μmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (μg/L) | NOx (μg/L) | Organic N (μg/L) | TKN (μg/L) | Total N (μg/L) | SRP (μg/L) | Total P (μg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10N        | 4/7/87          | 7.60      | 40.0              | 220             | 8.7                         | 40             | 1,549      | 635              | 635        | 2,224          | 16         | 95             |               | 6.8         | 187        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10N        | 10/5/87         | 7.30      | 51.0              | 150             |                             | 49             | 61         | 889              | 938        | 999            | 22         | 100            |               | 3.4         | 139        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10N        | 3/28/88         | 7.50      | 51.0              | 260             | 8.9                         | 46             | 59         | 638              | 684        | 743            | 20         | 59             |               | 2.0         | 176        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 6/13/88         | 7.40      | 51.0              | 210             | 6.5                         | 40             | 20         | 143              | 143        | 203            | 28         | 66             |               | 5.0         | 179        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 9/14/88         | 7.80      | 49.0              | 200             | 7.1                         | 40             | 20         | 500              | 500        | 560            | 23         | 83             |               | 3.0         | 152        |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 3/20/89         | 7.20      | 71.0              | 280             | 7.2                         | 73             | 14         | 614              | 687        | 701            |            | 56             |               | 0.3         | 1.0        |                             | 6                     | 16                    | 5.58        |
| Orange Co. EPD | LW10N        | 6/12/89         | 7.50      | 69.0              | 322             | 5.8                         | 28             | 27         | 1,298            | 1,326      | 1,353          |            | 84             |               | 3.1         | 1.0        |                             | 2                     | 42                    | 6.23        |
| Orange Co. EPD | LW10N        | 9/19/89         | 7.40      | 67.0              | 214             | 4.2                         | 10             | 32         | 1,360            | 1,360      | 1,402          | 136        | 136            |               | 3.9         | 5.0        |                             | 26                    | 96                    | 4.92        |
| Orange Co. EPD | LW10N        | 12/15/89        | 6.90      | 56.0              | 355             | 8.1                         | 89             | 165        | 291              | 380        | 545            | 48         | 73             |               | 1.5         | 140        |                             |                       |                       | 7.87        |
| Orange Co. EPD | LW10N        | 3/21/90         | 7.80      | 83.5              | 276             | 8.6                         | 47             | 11         | 1,072            | 1,119      | 1,130          | 59         | 125            | 55            | 2.6         | 185        |                             |                       | 62                    | 3.28        |
| Orange Co. EPD | LW10N        | 9/26/90         | 7.10      | 67.0              | 218             |                             | 30             | 10         | 1,210            | 1,240      | 1,250          |            | 53             | 55            |             | 14.0       |                             | 10                    | 10                    | 1.97        |
| Orange Co. EPD | LW10N        | 12/3/90         | 7.50      | 72.0              | 238             | 8.0                         | 10             | 10         | 1,240            | 1,244      | 1,260          | 67         | 67             | 65            | 2.8         | 14.0       |                             | 16                    | 36                    | 2.30        |
| Orange Co. EPD | LW10N        | 1/9/91          | 7.80      | 80.0              | 250             | 10.2                        | 10             | 10         | 1,170            | 1,170      | 1,190          | 112        | 112            | 80            | 2.6         | 12.0       |                             | 8                     | 14                    | 1.64        |
| Orange Co. EPD | LW10N        | 1/29/91         | 7.50      | 81.6              | 227             | 8.3                         | 10             | 10         | 1,070            | 1,070      | 1,090          | 70         | 70             | 80            | 2.2         | 9.0        |                             | 10                    | 10                    | 2.30        |
| Orange Co. EPD | LW10N        | 2/18/91         | 7.90      | 79.2              | 198             | 9.9                         | 30             | 10         | 1,200            | 1,230      | 1,240          |            | 64             | 80            | 2.1         | 20.0       |                             | 8                     | 14                    | 2.62        |
| Orange Co. EPD | LW10N        | 4/3/91          | 8.00      | 71.0              | 264             | 9.0                         | 10             | 10         | 1,140            | 1,140      | 1,160          | 21         | 21             |               | 4.1         | 10.0       |                             | 62                    | 122                   | 2.62        |
| Orange Co. EPD | LW10N        | 4/11/91         | 7.80      | 71.7              | 231             | 7.4                         | 140            | 10         | 890              | 1,030      | 1,040          | 33         | 120            |               | 3.9         | 152        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10N        | 4/22/91         | 7.80      | 50.7              | 231             | 7.4                         | 140            | 10         | 890              | 1,030      | 1,040          |            | 33             | 80            | 3.9         | 8.0        |                             | 22                    | 62                    | 2.30        |
| Orange Co. EPD | LW10N        | 5/15/91         | 7.90      | 60.0              | 221             | 7.5                         | 50             | 10         | 1,560            | 1,610      | 1,620          |            | 37             | 125           | 3.8         | 21.8       |                             | 16                    | 34                    | 1.64        |
| Orange Co. EPD | LW10N        | 6/3/91          | 7.70      | 60.0              | 231             | 7.2                         | 20             | 10         | 1,420            | 1,440      | 1,450          |            | 55             | 120           | 4.0         | 13.0       |                             | 6                     | 40                    | 1.97        |
| Orange Co. EPD | LW10N        | 6/26/91         | 7.80      | 58.0              | 218             | 6.8                         | 50             | 10         | 1,330            | 1,380      | 1,390          |            | 52             | 110           | 3.7         | 11.0       |                             | 34                    | 144                   | 2.30        |
| Orange Co. EPD | LW10N        | 7/17/91         | 7.20      | 49.0              | 181             | 7.0                         | 60             | 10         | 1,410            | 1,470      | 1,480          | 26         | 26             | 140           | 3.4         | 8.0        |                             | 32                    | 480                   | 2.30        |
| Orange Co. EPD | LW10N        | 8/28/91         | 7.20      | 46.0              | 219             | 4.9                         | 40             | 10         | 1,860            | 1,900      | 1,910          | 24         | 24             | 175           | 5.1         | 10.0       |                             | 140                   |                       | 1.64        |
| Orange Co. EPD | LW10N        | 9/17/91         | 7.60      | 67.0              | 233             | 4.4                         | 30             | 10         | 1,750            | 1,780      | 1,790          | 58         | 58             | 220           | 5.7         | 4.0        |                             | 30                    | 830                   | 1.97        |
| Orange Co. EPD | LW10N        | 9/21/91         | 7.20      | 46.0              | 319             | 4.9                         | 40             | 10         | 1,860            | 1,900      | 1,910          | 24         |                |               | 5.1         |            |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10N        | 10/21/91        | 7.50      | 63.0              | 227             | 7.4                         | 50             | 10         | 1,680            | 1,730      | 1,740          |            | 17             | 180           | 3.5         | 15.0       |                             | 22                    | 50                    | 2.62        |
| Orange Co. EPD | LW10N        | 11/13/91        | 7.60      | 69.0              | 222             | 8.0                         | 130            | 10         | 1,220            | 1,350      | 1,360          |            | 31             | 150           | 1.3         | 10.0       |                             | 12                    | 100                   | 1.64        |
| Orange Co. EPD | LW10N        | 12/3/91         | 7.60      | 70.0              | 261             | 8.0                         | 20             | 10         | 1,750            | 1,770      | 1,780          | 31         | 51             | 150           | 2.4         | 16.0       |                             | 26                    | 124                   | 1.97        |
| Orange Co. EPD | LW10N        | 1/28/92         | 7.70      | 69.0              | 229             | 7.6                         | 70             | 30         | 1,530            | 1,600      | 1,630          | 14         | 14             | 110           |             | 196        |                             | 60                    | 90                    | 2.95        |
| Orange Co. EPD | LW10N        | 3/24/92         | 7.50      | 77.0              | 277             | 8.0                         | 90             | 10         | 1,290            | 1,380      | 1,390          | 34         | 34             | 80            | 2.0         | 203        |                             | 6                     | 70                    | 1.97        |
| Orange Co. EPD | LW10N        | 4/29/92         | 7.90      | 54.0              | 221             | 8.4                         | 10             | 10         | 1,970            | 1,970      | 1,990          | 7          | 17             | 160           | 5.0         | 183        |                             | 6                     | 40                    | 1.97        |
| Orange Co. EPD | LW10N        | 5/13/92         | 8.40      | 65.0              | 222             | 9.1                         | 40             | 10         | 1,900            | 1,940      | 1,950          | 21         | 21             | 120           | 6.4         | 180        |                             | 6                     | 22                    | 1.97        |
| Orange Co. EPD | LW10N        | 6/15/92         | 7.60      | 64.0              | 223             | 5.8                         | 30             | 110        | 1,710            | 1,740      | 1,850          | 49         | 49             | 70            | 12.0        | 180        |                             | 14                    | 36                    | 2.30        |
| Orange Co. EPD | LW10N        | 7/2/92          | 7.90      | 62.0              | 209             | 6.7                         | 50             | 10         | 1,600            | 1,650      | 1,660          | 49         | 51             | 80            | 4.4         | 172        |                             | 36                    | 112                   | 1.31        |
| Orange Co. EPD | LW10N        | 7/15/92         | 7.90      | 61.0              | 191             | 6.3                         | 10             | 10         | 1,470            | 1,470      | 1,490          | 38         | 38             | 65            | 4.4         | 171        |                             | 1,420                 | 2,280                 | 1.31        |
| Orange Co. EPD | LW10N        | 8/4/92          | 8.40      | 62.0              | 196             | 5.1                         | 10             | 10         | 2,180            | 2,180      | 2,200          | 16         | 179            | 70            | 6.0         | 160        |                             | 40                    |                       | 1.31        |
| Orange Co. EPD | LW10N        | 8/27/92         | 7.80      | 50.0              | 178             | 7.6                         | 10             | 10         | 1,480            | 1,480      | 1,500          | 11         | 171            | 175           | 4.5         | 158        |                             | 10                    |                       | 1.64        |
| Orange Co. EPD | LW10N        | 9/15/92         | 7.50      | 54.0              | 166             | 6.2                         | 10             | 20         | 1,340            | 1,340      | 1,370          | 16         | 107            | 120           | 5.4         | 170        |                             | 12                    |                       | 2.62        |
| Orange Co. EPD | LW10N        | 10/19/92        | 7.50      | 55.0              | 203             | 7.3                         | 60             | 20         | 1,540            | 1,600      | 1,620          | 20         | 112            | 100           | 3.1         |            |                             | 700                   |                       | 1.97        |
| Orange Co. EPD | LW10N        | 11/10/92        | 7.50      | 58.0              | 214             | 6.9                         | 80             | 50         | 1,530            | 1,610      | 1,660          | 18         | 125            | 120           | 2.3         |            |                             | 30                    |                       | 2.30        |
| Orange Co. EPD | LW10N        | 12/7/92         | 7.10      | 59.0              | 209             | 10.3                        | 60             | 10         | 1,130            | 1,190      | 1,200          | 12         | 99             | 100           | 2.8         | 170        |                             | 2                     |                       | 1.97        |
| Orange Co. EPD | LW10N        | 1/4/93          | 7.90      | 62.0              | 253             | 6.4                         | 30             | 340        | 1,420            | 1,450      | 1,790          | 27         | 34             | 90            | 4.0         | 210        |                             | 8                     | 28                    | 2.30        |
| Orange Co. EPD | LW10N        | 1/25/93         | 7.30      | 58.0              | 217             | 8.9                         | 80             | 20         | 1,190            | 1,270      | 1,290          | 19         | 19             | 100           | 3.4         | 196        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10N        | 1/27/93         | 7.30      | 58.0              | 220             | 7.4                         | 40             | 120        | 1,460            | 1,510      | 1,620          | 20         | 20             | 100           | 2.2         | 182        |                             | 2                     | 80                    | 1.97        |
| Orange Co. EPD | LW10N        | 2/16/93         | 7.60      | 57.0              | 223             | 9.0                         | 20             | 10         | 1,360            | 1,380      | 1,390          | 16         | 16             | 100           | 2.6         | 188        |                             | 42                    | 304                   | 2.30        |
| Orange Co. EPD | LW10N        | 3/8/93          | 7.50      | 59.0              | 213             | 7.4                         | 10             | 10         | 1,250            | 1,250      | 1,270          | 12         | 12             | 90            |             | 196        |                             | 84                    | 710                   | 1.97        |
| Orange Co. EPD | LW10N        | 3/29/93         | 7.60      | 51.0              | 213             | 9.4                         | 120            | 10         | 1,280            | 1,400      | 1,410          | 11         | 11             | 120           |             | 7.0        |                             | 230                   | 144                   | 1.97        |
| Orange Co. EPD | LW10N        | 4/5/93          |           |                   |                 |                             | 40             | 20         | 1,380            | 1,420      | 1,440          | 11         | 11             |               |             |            |                             |                       |                       |             |
| Orange Co. EPD | LW10N        | 4/14/93         | 7.70      | 58.0              | 221             | 9.0                         | 10             | 10         | 1,370            | 1,370      | 1,390          | 16         | 16             | 140           | 4.7         | 196        |                             | 16                    | 26                    | 1.97        |
| Orange Co. EPD | LW10N        | 5/3/93          | 7.50      | 53.0              | 215             | 8.4                         | 70             | 20         | 1,490            | 1,560      | 1,580          | 41         | 41             | 160           | 3.8         | 200        |                             | 4                     | 36                    | 2.30        |
| Orange Co. EPD | LW10N        | 5/25/93         | 7.70      | 56.0              | 231             | 6.7                         | 30             | 10         | 1,810            | 1,840      | 1,850          | 14         | 14             | 160           | 3.5         | 194        |                             | 14                    | 34                    | 1.97        |
| Orange Co. EPD | LW10N        | 6/16/93         | 7.40      | 65.0              | 215             | 5.5                         | 120            | 20         | 1,850            | 1,970      | 1,990          | 41         | 41             |               | 7.8         | 192        |                             | 6                     | 38                    | 2.30        |
| Orange Co. EPD | LW10N        | 7/8/93          | 7.60      | 62.0              | 222             | 6.0                         | 20             | 20         | 1,640            | 1,660      | 1,680          | 51         | 51             |               | 4.0         | 182        |                             | 8                     | 40                    | 1.97        |
| Orange Co. EPD | LW10N        | 7/28/93         | 8.80      | 68.0              | 196             | 12.6                        | 30             | 10         | 1,410            | 1,440      | 1,450          | 27         | 27             |               | 5.3         | 160        |                             | 10                    | 24                    | 1.64        |
| Orange Co. EPD | LW10N        | 8/18/93         | 8.30      | 63.0              | 206             | 9.0                         | 110            | 10         | 1,670            | 1,780      | 1,790          | 28         | 34             |               | 4.4         | 154        |                             | 60                    | 24                    | 1.97        |
| Orange Co. EPD | LW10N        | 9/8/93          | 7.90      | 63.0              | 188             | 6.7                         | 20             | 30         | 1,470            | 1,490      | 1,520          | 20         | 20             |               | 5.0         | 158        |                             | 10                    | 42                    | 1.97        |
| Orange Co. EPD | LW10N        | 12/29/93        | 8.30      | 71.0              | 211             | 10.5                        | 40             | 10         | 1,150            | 1,190      | 1,200          | 7          | 7              |               | 3.3         | 142        |                             | 16                    | 290                   |             |

Historical Water Quality Data for Lake Lawne

| DataSource                 | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD             | LW10N        | 3/21/94         | 8.80      | 66.0              | 224             | 10.7                        | 70             | 20         | 1,100            | 1,170      | 1,190          | 17         | 17             |               | 7.1         | 180        |                             | 2                     | 24                    | 1.64        |
| Orange Co. EPD             | LW10N        | 6/20/94         | 6.90      | 43.0              | 167             | 5.6                         | 110            | 20         | 1,150            | 1,260      | 1,280          |            | 50             |               | 5.1         | 154        |                             | 170                   | 560                   | 1.64        |
| Orange Co. EPD             | LW10N        | 9/21/94         | 6.90      | 48.0              | 159             | 5.9                         | 330            | 110        | 1,050            | 1,380      | 1,490          | 38         | 38             |               |             | 158        |                             | 650                   | 600                   | 1.64        |
| Orange Co. EPD             | LW10N        | 12/14/94        | 7.30      | 47.0              | 202             | 6.9                         | 160            | 560        | 960              | 1,120      | 1,680          | 5          | 5              |               | 1.3         | 188        |                             | 28                    | 230                   | 3.28        |
| Orange Co. EPD             | LW10N        | 3/20/95         | 7.36      | 59.2              | 215             | 7.4                         | 10             | 10         | 1,100            | 1,100      | 1,120          | 9          | 9              |               | 2.4         | 7.0        |                             | 130                   | 570                   | 2.46        |
| Orange Co. EPD             | LW10N        | 9/18/95         | 6.75      |                   | 252             | 4.5                         |                | 10         |                  | 2,160      | 2,170          |            | 52             |               | 2.7         |            |                             | 80                    | 160                   | 1.64        |
| Orange Co. EPD             | LW10N        | 12/21/95        | 6.78      | 73.0              | 219             | 8.1                         |                | 10         |                  | 1,900      | 1,910          |            | 51             |               | 2.1         | 7.0        |                             | 190                   | 620                   | 4.92        |
| Orange Co. EPD             | LW10N        | 3/12/96         | 7.17      | 66.0              | 196             | 8.8                         | 10             | 10         | 2,500            | 1,500      | 2,520          |            | 22             | 120           | 4.0         | 11.0       |                             | 128                   | 600                   | 2.46        |
| Orange Co. EPD             | LW10N        | 6/10/96         | 7.14      | 46.0              | 221             | 7.9                         | 10             | 10         | 1,800            | 1,800      | 1,820          |            | 19             | 80            | 2.8         | 29.0       |                             | 24                    | 32                    | 2.46        |
| Orange Co. EPD             | LW10N        | 9/9/96          | 6.44      | 46.0              | 198             | 6.4                         | 10             | 10         | 1,600            | 1,600      | 1,620          |            | 33             | 80            | 4.1         | 20.0       |                             | 90                    | 130                   | 3.56        |
| Orange Co. EPD             | LW10N        | 12/16/96        | 7.41      | 33.7              | 183             | 7.6                         | 20             | 10         | 1,400            | 1,400      | 1,430          |            | 14             | 100           | 2.5         | 6.0        |                             | 20                    | 100                   | 3.28        |
| Orange Co. EPD             | LW10N        | 2/11/97         | 7.04      | 67.0              | 202             | 5.9                         | 40             | 10         | 1,000            | 1,000      | 1,050          |            | 7              | 60            | 3.0         | 1.0        |                             | 2                     | 66                    | 3.28        |
| Orange Co. EPD             | LW10N        | 5/5/97          | 7.28      | 54.0              | 190             | 5.4                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 21             | 70            | 5.1         | 8.0        |                             | 26                    | 176                   | 2.46        |
| Orange Co. EPD             | LW10N        | 9/24/97         | 7.45      | 61.0              | 189             | 6.0                         | 20             | 10         | 1,400            | 1,400      | 1,430          |            | 7              | 50            | 2.7         | 12.5       |                             | 20                    | 122                   | 3.28        |
| Orange Co. EPD             | LW10N        | 3/31/98         | 6.86      | 50.4              | 185             | 6.6                         | 10             | 10         | 1,300            | 1,300      | 1,320          |            | 22             | 120           | 2.4         | 13.5       |                             |                       | 80                    | 1.97        |
| Orange Co. EPD             | LW10N        | 6/16/98         | 8.64      | 68.2              | 223             | 7.8                         | 20             | 10         | 1,800            | 1,800      | 1,830          |            | 34             | 80            | 5.6         | 21.0       |                             | 18                    | 80                    | 1.48        |
| Orange Co. EPD             | LW10N        | 9/22/98         | 7.21      | 63.0              | 191             | 4.6                         | 20             | 10         | 1,200            | 1,200      | 1,230          |            | 28             | 50            | 2.3         | 14.0       |                             | 218                   | 760                   | 1.31        |
| Orange Co. EPD             | LW10N        | 12/9/98         | 7.76      | 73.5              | 213             | 6.6                         | 10             | 10         | 1,200            | 1,200      | 1,220          |            | 10             | 50            | 4.1         | 16.0       |                             | 6                     | 62                    | 1.64        |
| Orange Co. EPD             | LW10N        | 4/12/99         | 8.22      | 77.0              | 245             | 6.5                         | 17             | 10         | 1,600            | 1,600      | 1,627          |            | 10             | 40            | 4.4         | 15.0       |                             | 18                    | 40                    | 1.31        |
| Orange Co. EPD             | LW10N        | 7/20/99         | 8.44      | 57.0              | 173             | 7.0                         | 15             | 10         | 1,700            | 1,700      | 1,725          |            | 70             | 40            | 3.0         | 12.0       |                             | 34                    | 36                    | 1.31        |
| Orange Co. EPD             | LW10N        | 10/11/99        | 7.22      | 50.0              | 172             | 7.0                         | 19             | 10         | 1,500            | 1,500      | 1,529          |            | 15             | 100           | 3.7         | 8.0        |                             | 340                   | 700                   | 1.64        |
| Orange Co. EPD             | LW10N        | 3/8/00          | 7.73      | 61.0              | 231             | 8.3                         | 22             | 10         | 860              | 880        | 892            |            | 6              | 70            | 2.2         | 7.0        |                             | 46                    | 86                    | 2.46        |
| Orange Co. EPD             | LW10N        | 9/21/00         | 8.28      | 76.9              | 213             | 9.0                         | 15             | 10         | 1,400            | 1,400      | 1,425          |            | 5              | 35            | 4.3         | 13.0       |                             | 118                   | 84                    | 0.98        |
| Orange Co. EPD             | LW10N        | 12/13/00        | 6.67      | 82.9              | 208             | 7.2                         | 29             | 10         | 1,200            | 1,200      | 1,239          |            | 5              | 35            | 3.5         | 8.0        |                             |                       |                       | 1.31        |
| Orange Co. EPD             | LW10N        | 12/18/00        | 7.49      | 78.8              | 159             | 6.2                         | 28             | 10         | 1,300            | 1,300      | 1,338          |            | 8              | 35            | 2.5         | 8.5        |                             | 56                    | 200                   | 2.46        |
| Orange Co. EPD             | LW10N        | 12/18/01        | 7.49      | 78.8              | 159             | 6.2                         |                |            |                  |            | 910            |            |                |               | 2.6         | 8.5        | 48.8                        | 56                    | 160                   | 2.46        |
| Orange Co. EPD             | LW10N        | 2/22/02         | 7.69      | 78.0              | 224             | 10.8                        | 25             | 10         | 880              | 900        | 915            |            | 5              | 35            | 4.0         | 11.0       |                             |                       |                       | 1.31        |
| Orange Co. EPD             | LW10N        | 11/18/04        | 7.22      | 67.0              | 211             | 6.5                         |                | 4          | 1,530            | 1,570      | 1,534          |            | 6              |               |             | 186        | 36.8                        |                       | 6                     | 1.64        |
| Orange Co. EPD             | LW10N        | 1/26/05         |           | 65.0              |                 |                             | 20             | 12         | 1,330            | 1,330      | 1,362          | 4          | 4              | 120           |             | 8.0        | 20.0                        |                       |                       |             |
| Orange Co. EPD             | LW10N        | 6/22/05         |           | 64.0              |                 |                             | 20             | 7          | 1,350            | 1,350      | 1,377          | 8          | 8              | 100           |             | 11.0       | 34.0                        |                       |                       |             |
| Orange Co. EPD             | LW10N        | 8/18/05         |           | 60.0              |                 |                             | 20             | 2          | 1,490            | 1,490      | 1,512          | 3          | 8              | 120           |             | 8.0        | 33.0                        |                       |                       |             |
| Orange Co. EPD             | LW10N        | 12/7/05         |           | 64.0              |                 |                             | 20             | 21         | 1,450            | 1,450      | 1,491          | 3          | 6              | 110           |             | 8.0        | 32.0                        |                       |                       |             |
| Orange Co. EPD             | LW10N        | 1/26/06         | 7.50      |                   | 204             | 7.8                         |                |            |                  |            |                |            |                |               |             |            | 23.7                        | 29                    | 66                    | 1.64        |
| Orange Co. EPD             | LW10N        | 5/4/06          | 8.40      | 2.0               | 240             | 8.5                         | 20             | 4          |                  |            |                | 4          | 3              |               |             | 1.0        | 0.8                         | 39                    | 88                    | 1.64        |
| Orange Co. EPD             | LW10N        | 7/26/06         | 8.50      | 2.0               | 188             | 9.0                         | 20             | 3          |                  |            |                | 4          | 3              |               |             | 1.0        | 0.8                         | 55                    | 100                   | 1.64        |
| Orange Co. EPD             | LW10N        | 12/4/06         |           |                   |                 | 7.4                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       |             |
| Orange Co. EPD             | LW10N        | 1/30/07         | 7.10      | 74.0              | 208             | 9.3                         | 20             | 2          | 1,070            | 1,090      | 1,092          | 4          | 4              |               | 4.0         | 7.0        | 20.9                        | 28                    | 70                    | 2.46        |
| Orange Co. EPD             | LW10N        | 5/31/07         | 7.80      | 90.0              | 247             | 6.4                         | 20             | 2          | 1,550            | 1,550      | 1,572          | 4          | 6              | 24            | 2.0         | 16.0       | 19.4                        | 8                     |                       | 1.31        |
| Orange Co. EPD             | LW10N        | 7/30/07         | 8.40      | 81.0              | 216             | 8.6                         | 20             | 2          | 1,290            | 1,290      | 1,312          | 4          | 14             | 30            |             | 14.0       | 38.2                        | 500                   |                       | 2.30        |
| Orange Co. EPD             | LW10N        | 10/23/07        | 7.40      | 74.0              | 203             | 6.4                         | 50             | 2          | 920              | 970        | 972            | 3          | 3              | 39            | 3.0         | 10.0       | 27.1                        | 240                   |                       | 1.97        |
| Orange Co. EPD             | LW10N        | 2/6/08          | 7.40      | 80.0              | 218             | 8.4                         | 20             | 3          | 960              | 960        | 983            | 3          | 3              | 32            |             | 6.0        | 13.0                        | 60                    |                       | 2.22        |
| Orange Co. EPD             | LW10N        | 4/23/08         | 7.30      | 75.0              | 215             | 6.7                         | 20             | 3          | 1,110            | 1,110      | 1,133          | 3          | 5              | 55            |             | 8.0        | 19.2                        | 20                    |                       | 1.97        |
| Orange Co. EPD             | LW10N        | 8/7/08          | 7.40      | 63.0              | 179             | 6.4                         | 30             | 3          | 1,220            | 1,220      | 1,253          | 3          | 5              | 74            |             | 7.0        | 31.7                        | 190                   |                       | 2.30        |
| Orange Co. EPD             | LW10N        | 10/23/08        | 7.00      | 60.0              | 192             | 6.5                         | 30             | 3          | 1,440            | 1,440      | 1,473          | 3          | 6              | 111           |             | 1.0        | 20.6                        | 42                    |                       | 2.30        |
| Orange Co. EPD             | LW10N        | 2/10/09         | 7.60      | 71.0              | 220             | 9.2                         | 30             | 2          | 1,370            | 1,370      | 1,402          | 2          | 3              | 59            |             | 2.0        | 12.5                        | 8                     |                       | 3.12        |
| Orange Co. EPD             | LW10N        | 6/30/09         | 7.20      | 58.0              | 186             | 4.9                         | 30             | 6          | 1,600            | 1,600      | 1,636          | 3          | 15             | 86            |             | 7.0        | 24.3                        | 27                    |                       | 2.62        |
| Orange Co. EPD             | LW10N        | 9/8/09          | 7.10      | 63.0              | 186             | 4.5                         | 20             | 2          | 1,500            | 1,500      | 1,522          | 2          | 4              | 44            |             | 2.0        | 9.8                         | 226                   |                       | 2.62        |
| Orange Co. EPD             | LW10N        | 12/3/09         | 7.50      | 75.0              | 213             | 8.2                         | 20             | 19         | 1,800            | 1,800      | 1,839          | 2          | 7              | 59            |             | 2.0        | 19.5                        | 8                     |                       | 3.28        |
| Orange Co. EPD             | LW10N        | 2/8/10          | 7.80      | 72.0              | 205             | 9.9                         |                | 11         | 1,310            | 1,310      | 1,321          | 2          | 11             | 50            |             | 2.0        | 11.6                        | 1                     |                       | 2.95        |
| Orange Co. EPD             | LW10N        | 5/11/10         | 7.20      | 67.0              | 210             | 6.7                         |                | 8          | 1,690            | 1,690      | 1,698          | 2          | 18             | 87            |             | 12.0       | 44.8                        | 128                   |                       | 1.80        |
| Orange Co. EPD             | LW10N        | 7/27/10         | 7.47      | 69.0              | 194             | 5.8                         |                | 7          | 1,030            | 1,040      | 1,037          | 4          | 5              | 67            |             | 9.0        | 22.2                        | 440                   |                       | 2.66        |
| Orange Co. EPD             | LW10N        | 11/23/10        | 7.30      | 73.0              | 192             | 7.3                         |                | 3          | 1,070            | 1,080      | 1,073          | 3          | 7              | 57            |             | 5.0        | 19.9                        | 16                    |                       | 2.30        |
| Minimum Value              |              |                 | 6.44      | 2.0               | 159             | 4.4                         | 10             | 2          | 860              | 880        | 892            | 2          | 3              | 24            | 1.3         | 1.0        | 0.8                         | 1                     | 6                     | 1.0         |
| Maximum Value              |              |                 | 8.80      | 90.0              | 319             | 12.6                        | 330            | 560        | 2,500            | 2,180      | 2,520          | 112        | 179            | 220           | 12.0        | 210.0      | 48.8                        | 1,420                 | 2,280                 | 4.9         |
| Geometric Mean (1990-1999) |              |                 | 7.58      | 60.1              | 214             | 7.2                         | 30             | 14         | 1,408            | 1,457      | 1,503          | 23         | 31             | 95            | 3.6         | 41.7       | - -                         | 25                    | 90                    | 2.1         |
| Geometric Mean (2000-2005) |              |                 | 7.50      | 70.1              | 199             | 7.6                         | 22             | 8          | 1,257            | 1,265      | 1,247          | 4          | 6              | 63            | 3.1         | 11.8       | 33.0                        | 64                    | 67                    | 1.7         |
| Geometric Mean (2006-2011) |              |                 | 7.53      | 47.8              | 205             | 7.2                         | 24             | 4          | 1,282            | 1,289      | 1,307          | 3          | 6              | 54            | 2.9         | 4.4        | 14.6                        | 42                    | 80                    | 2.2         |



Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10S        | 2/4/75          | 7.70      | 69.0              | 310             | 6.9                         | 0              | 450        | 1,410            |            | 1,860          | 270        | 480            |               | 1.4         | 282        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10S        | 3/24/75         | 7.70      | 73.0              | 330             | 7.0                         | 80             | 530        | 1,310            |            | 1,920          | 400        |                |               | 1.2         | 305        |                             |                       |                       | 2.50        |
| Orange Co. EPD | LW10S        | 7/15/75         |           |                   | 225             | 4.7                         | 0              | 30         | 800              |            | 830            | 690        | 710            |               | 1.8         | 170        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 1/20/76         | 6.40      | 64.0              | 280             | 8.0                         | 50             | 100        | 1,000            |            | 1,150          | 340        | 370            |               | 1.2         | 205        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 3/3/76          | 7.50      | 69.0              | 270             | 7.7                         | 110            | 100        | 1,300            |            | 1,510          | 420        | 470            |               | 1.8         | 194        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 4/12/76         | 7.40      | 71.0              | 260             | 6.4                         | 50             | 100        | 1,000            |            | 1,150          | 400        | 470            |               | 1.4         | 195        |                             |                       |                       | 2.50        |
| Orange Co. EPD | LW10S        | 5/18/76         | 7.20      | 59.0              | 210             | 4.9                         | 50             | 100        | 830              |            | 980            | 310        | 340            |               | 1.5         | 152        |                             |                       |                       | 4.00        |
| Orange Co. EPD | LW10S        | 6/8/76          | 7.60      | 62.0              | 210             | 8.4                         | 50             | 100        | 1,500            |            | 1,650          | 210        | 240            |               | 5.0         | 150        |                             |                       |                       | 2.00        |
| Orange Co. EPD | LW10S        | 9/7/76          | 6.30      | 61.0              | 210             | 6.7                         | 120            | 100        | 1,400            |            | 1,620          | 150        | 210            |               | 4.5         | 216        |                             |                       |                       | 1.50        |
| Orange Co. EPD | LW10S        | 12/21/76        | 7.60      | 68.0              | 260             | 6.3                         | 15             | 100        | 1,500            |            | 1,615          | 310        | 370            |               |             | 185        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10S        | 1/10/77         | 7.70      | 68.0              | 260             | 7.6                         | 52             | 110        | 1,500            |            | 1,662          | 320        | 390            |               | 2.7         | 189        |                             |                       |                       | 1.00        |
| Orange Co. EPD | LW10S        | 4/13/77         | 7.30      | 72.0              | 250             | 6.7                         | 50             | 100        | 1,400            |            | 1,550          | 410        | 530            |               | 2.6         | 206        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 7/11/77         | 7.40      | 76.0              | 240             | 7.8                         | 50             | 100        | 2,600            |            | 2,750          | 320        | 380            |               | 7.6         | 210        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 10/10/77        | 7.60      | 68.0              | 230             | 5.5                         | 55             | 100        | 1,100            |            | 1,255          | 170        | 210            |               | 1.2         | 173        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 1/9/78          | 7.20      | 72.0              | 240             | 9.0                         | 50             | 10         | 980              |            | 1,040          | 160        | 200            |               | 2.0         | 152        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 2/6/78          | 7.70      | 69.0              | 260             | 8.4                         | 50             | 20         | 900              |            | 970            | 140        | 160            |               | 1.9         | 183        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 3/7/78          | 7.90      | 61.0              | 260             | 10.6                        | 50             | 330        | 1,600            |            | 1,980          | 51         | 94             |               | 4.9         | 200        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 4/10/78         | 7.10      | 63.0              | 280             | 4.4                         | 50             | 10         | 1,600            |            | 1,660          | 140        | 200            |               | 2.7         | 210        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 5/8/78          | 7.60      | 70.0              | 280             | 5.7                         | 160            | 10         | 1,500            |            | 1,670          | 170        | 230            |               | 2.5         | 211        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 6/5/78          | 6.30      | 75.0              | 270             | 5.9                         | 50             | 10         | 1,400            |            | 1,460          | 350        | 280            |               | 2.4         | 180        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 9/5/78          | 7.30      | 61.0              | 230             | 2.6                         | 130            | 10         | 850              |            | 990            | 140        | 180            |               | 1.6         | 216        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10S        | 12/4/78         | 7.80      | 72.0              | 250             | 4.6                         | 120            | 60         | 1,300            |            | 1,480          | 260        | 340            |               | 2.4         | 210        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 1/2/79          | 7.80      | 69.0              | 320             | 7.5                         | 530            | 30         | 1,100            |            | 1,660          | 290        | 280            |               | 1.6         | 149        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10S        | 2/5/79          | 7.80      | 62.0              | 260             | 10.0                        | 50             | 10         | 1,400            |            | 1,460          | 140        | 190            |               | 2.5         | 196        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10S        | 3/5/79          | 7.80      | 63.0              | 270             | 7.6                         | 90             | 10         | 1,200            |            | 1,300          | 120        | 180            |               | 2.2         | 170        |                             |                       |                       | 0.98        |
| Orange Co. EPD | LW10S        | 4/2/79          | 7.80      | 60.0              | 250             | 7.2                         | 50             | 10         | 1,300            |            | 1,360          | 110        | 170            |               | 2.3         | 190        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 4/30/79         | 7.80      | 64.0              | 270             | 6.9                         | 50             | 10         | 1,300            |            | 1,360          | 160        | 200            |               | 2.6         | 203        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 6/4/79          | 6.60      | 59.0              | 215             | 6.1                         | 50             | 10         | 1,140            |            | 1,200          | 160        | 220            |               | 3.6         | 163        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10S        | 8/6/79          | 7.20      | 57.0              | 180             | 3.5                         | 260            | 20         | 1,140            |            | 1,420          | 180        | 210            |               | 2.7         | 166        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10S        | 9/5/79          | 7.40      | 51.0              | 230             | 5.1                         | 340            | 70         | 1,300            |            | 1,710          | 170        | 210            |               | 2.6         | 178        |                             |                       |                       | 1.97        |
| Orange Co. EPD | LW10S        | 10/1/79         | 7.10      | 50.0              | 220             | 5.1                         | 80             | 40         | 1,400            |            | 1,520          | 100        | 130            |               | 2.4         | 160        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10S        | 11/5/79         | 7.40      | 57.0              | 230             | 6.2                         | 190            | 130        | 1,500            |            | 1,820          | 130        | 170            |               | 3.8         | 196        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 12/3/79         | 7.40      | 57.0              | 240             | 6.9                         | 80             | 120        | 1,400            |            | 1,600          | 160        | 190            |               | 2.5         | 188        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10S        | 1/7/80          | 7.60      | 59.0              | 259             | 8.9                         | 100            | 30         | 1,300            |            | 1,430          | 130        | 170            |               | 3.3         | 191        |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10S        | 2/4/80          | 7.30      | 59.0              | 280             | 9.2                         | 60             | 70         | 1,300            |            | 1,430          | 150        | 180            |               | 1.4         | 188        |                             |                       |                       | 0.98        |
| Orange Co. EPD | LW10S        | 3/3/80          | 7.40      | 59.0              | 280             | 9.3                         | 70             | 160        | 1,300            |            | 1,530          | 160        | 190            |               | 2.5         | 194        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10S        | 3/31/80         | 7.70      | 61.0              | 270             | 6.6                         | 50             | 20         | 1,000            |            | 1,070          | 160        | 190            |               | 1.3         | 188        |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10S        | 6/2/80          | 8.30      | 63.0              | 215             | 8.5                         | 70             | 10         | 2,100            |            | 2,180          | 180        | 260            |               | 8.9         | 234        |                             |                       |                       | 2.95        |
| Orange Co. EPD | LW10S        | 6/30/80         | 7.20      | 60.0              | 210             | 6.2                         | 50             | 10         | 1,400            |            | 1,460          | 200        | 250            |               | 2.4         | 175        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 9/8/80          | 7.10      | 56.0              | 185             | 5.4                         | 50             | 10         | 1,200            |            | 1,260          | 170        | 220            |               | 6.8         | 138        |                             |                       |                       | 3.61        |
| Orange Co. EPD | LW10S        | 10/6/80         | 7.20      | 58.0              | 190             | 4.9                         | 80             | 10         | 1,100            |            | 1,190          | 230        | 260            |               | 4.6         | 123        |                             |                       |                       | 3.28        |
| Orange Co. EPD | LW10S        | 10/29/80        | 7.10      | 58.0              | 208             | 5.7                         | 170            | 10         | 1,000            |            | 1,180          | 220        | 210            |               | 2.8         | 136        |                             |                       |                       | 2.95        |
| Orange Co. EPD | LW10S        | 3/9/81          | 7.10      | 51.0              | 189             | 6.0                         | 50             | 10         | 1,150            |            | 1,210          | 170        | 150            |               | 1.8         | 124        |                             |                       |                       | 3.61        |
| Orange Co. EPD | LW10S        | 6/15/81         | 7.30      | 48.0              | 145             | 6.2                         | 80             | 10         | 3,020            | 3,100      | 3,110          | 130        | 130            |               | 3.0         | 123        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 3/22/82         | 6.60      | 58.0              | 195             | 4.1                         | 210            | 40         | 1,290            | 1,500      | 1,540          | 164        | 198            |               | 6.0         | 137        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10S        | 6/22/82         | 6.20      | 52.0              | 170             | 3.7                         | 180            | 230        | 1,560            | 1,740      | 1,970          | 111        | 147            |               | 3.2         | 134        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 8/10/82         | 6.30      | 62.0              | 205             | 2.5                         | 50             | 40         | 1,050            | 1,100      | 1,140          | 81         | 106            |               | 16.0        | 159        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 1/28/86         | 6.70      | 54.2              | 260             | 8.4                         | 140            | 1,010      | 1,390            | 1,530      | 2,540          | 59         | 125            |               | 2.8         | 172        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 4/1/86          | 7.50      | 77.0              | 250             |                             | 150            | 310        | 1,140            | 1,290      | 1,600          | 32         | 94             |               | 3.5         | 224        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 5/4/86          | 7.90      | 52.5              | 200             | 7.1                         | 390            | 40         | 810              | 1,200      | 1,240          | 106        | 127            |               | 2.2         | 158        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 10/7/86         | 7.30      | 42.9              | 230             | 4.6                         | 70             | 40         | 830              | 900        | 940            | 42         | 88             |               | 2.1         | 172        |                             |                       |                       | 5.58        |
| Orange Co. EPD | LW10S        | 12/1/86         | 7.20      | 53.0              | 177             | 6.6                         | 70             | 10         | 1,000            |            | 1,080          | 210        | 210            |               | 2.7         | 140        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 4/7/87          | 7.50      | 41.0              | 220             | 9.0                         | 40             | 1,570      | 1,150            | 1,150      | 2,760          | 18         |                |               | 4.8         | 195        |                             |                       |                       | 1.31        |
| Orange Co. EPD | LW10S        | 10/5/87         | 7.40      | 54.0              | 170             |                             | 40             | 64         | 1,505            | 1,505      | 1,609          | 20         | 101            |               | 3.1         | 145        |                             |                       |                       | 2.62        |
| Orange Co. EPD | LW10S        | 3/28/88         | 7.30      | 54.0              | 260             | 9.7                         | 40             | 58         | 633              | 633        | 731            | 20         | 76             |               | 2.8         | 178        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 6/13/88         | 7.30      | 54.0              | 230             | 5.2                         | 40             | 49         | 142              | 142        | 231            | 25         | 71             |               | 2.9         | 177        |                             |                       |                       |             |

Historical Water Quality Data for Lake Lawne

| DataSource     | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD | LW10S        | 9/14/88         | 7.90      | 47.0              | 210             | 5.6                         | 40             | 20         | 622              | 622        | 682            | 31         | 127            |               | 5.1         | 160        |                             |                       |                       |             |
| Orange Co. EPD | LW10S        | 12/14/88        | 6.70      | 59.0              | 355             | 7.1                         | 122            | 311        | 554              | 676        | 987            | 87         | 133            |               | 1.2         | 142        |                             |                       |                       | 6.56        |
| Orange Co. EPD | LW10S        | 3/20/89         | 6.90      | 56.0              | 290             | 7.0                         | 82             | 11         | 700              | 782        | 793            | 58         | 58             |               | 1.0         | 1.0        |                             | 2                     | 40                    | 4.59        |
| Orange Co. EPD | LW10S        | 6/12/89         | 7.20      | 61.0              | 327             | 5.2                         | 32             | 39         | 1,101            | 1,164      | 1,172          | 90         | 90             |               | 4.2         | 4.0        |                             | 20                    | 64                    | 5.91        |
| Orange Co. EPD | LW10S        | 9/19/89         | 7.40      | 78.0              | 209             | 5.5                         | 38             | 40         | 984              | 1,022      | 1,062          | 127        | 129            |               | 4.3         | 4.0        |                             | 54                    | 82                    | 4.59        |
| Orange Co. EPD | LW10S        | 3/21/90         | 7.80      | 84.5              | 276             | 8.3                         | 51             | 6          | 726              | 777        | 783            | 60         | 60             | 50            | 2.7         | 4.5        |                             | 106                   | 126                   | 4.92        |
| Orange Co. EPD | LW10S        | 9/26/90         | 7.10      | 55.0              | 217             |                             | 50             | 10         | 1,260            | 1,310      | 1,320          |            | 50             | 50            | 6.3         | 12.0       |                             |                       | 156                   | 1.97        |
| Orange Co. EPD | LW10S        | 12/3/90         | 7.70      | 73.0              | 237             | 8.1                         | 40             | 10         | 1,000            | 1,040      | 1,050          |            | 79             | 65            | 2.7         | 15.0       |                             | 16                    | 26                    | 1.97        |
| Orange Co. EPD | LW10S        | 1/9/91          | 7.80      | 78.0              | 250             | 7.9                         | 10             | 10         | 1,070            | 1,070      | 1,090          |            | 96             | 70            | 2.9         | 8.0        |                             | 6                     | 38                    | 1.64        |
| Orange Co. EPD | LW10S        | 1/29/91         | 7.70      | 80.4              | 226             | 8.5                         | 10             | 10         | 1,050            | 1,050      | 1,070          |            | 70             | 80            | 2.6         | 7.0        |                             | 26                    | 46                    | 2.62        |
| Orange Co. EPD | LW10S        | 2/18/91         | 7.90      | 79.2              | 193             | 9.5                         | 30             | 10         | 1,230            | 1,260      | 1,270          |            | 70             | 80            | 2.9         | 14.0       |                             | 46                    | 68                    | 2.30        |
| Orange Co. EPD | LW10S        | 4/3/91          | 8.10      | 71.8              | 265             | 9.3                         | 20             | 10         | 1,210            | 1,230      | 1,240          |            | 50             |               | 4.0         | 14.5       |                             | 16                    | 38                    | 1.64        |
| Orange Co. EPD | LW10S        | 4/22/91         | 7.70      | 50.7              | 234             | 8.2                         | 190            | 10         | 800              | 990        | 1,000          | 33         | 56             | 80            | 5.4         | 10.0       |                             | 22                    | 106                   | 1.97        |
| Orange Co. EPD | LW10S        | 5/15/91         | 7.80      | 60.0              | 221             | 6.7                         | 60             | 10         | 1,410            | 1,470      | 1,480          | 29         | 29             | 125           | 3.1         | 18.0       |                             | 38                    | 62                    | 1.64        |
| Orange Co. EPD | LW10S        | 6/3/91          | 7.40      | 60.0              | 229             | 5.4                         | 20             | 10         | 1,230            | 1,250      | 1,260          | 69         | 69             | 120           | 5.1         | 11.0       |                             | 132                   | 164                   | 2.30        |
| Orange Co. EPD | LW10S        | 6/26/91         | 8.10      | 62.0              | 218             | 8.0                         | 40             | 10         | 1,290            | 1,330      | 1,340          | 43         | 43             | 100           | 5.0         | 7.0        |                             | 6                     | 64                    | 1.64        |
| Orange Co. EPD | LW10S        | 7/17/91         | 7.20      | 47.0              | 180             | 7.2                         | 20             | 10         | 1,210            | 1,280      | 1,240          | 34         | 36             | 140           | 3.2         | 7.0        |                             | 350                   | 890                   | 1.97        |
| Orange Co. EPD | LW10S        | 8/28/91         | 7.40      | 53.0              | 223             | 7.1                         | 10             | 10         | 1,730            | 1,790      | 1,750          | 19         | 19             | 175           | 4.1         | 9.0        |                             | 70                    |                       | 1.64        |
| Orange Co. EPD | LW10S        | 9/17/91         | 6.60      | 67.0              | 236             | 4.3                         | 10             | 10         | 2,150            | 2,150      | 2,170          | 31         | 31             | 130           | 7.8         | 9.0        |                             | 20                    |                       | 1.64        |
| Orange Co. EPD | LW10S        | 10/21/91        | 7.80      | 66.0              | 228             | 8.6                         | 20             | 10         | 1,650            | 1,670      | 1,680          | 10         | 10             | 180           | 3.9         | 12.0       |                             | 10                    |                       | 1.97        |
| Orange Co. EPD | LW10S        | 11/13/91        | 7.70      | 68.0              | 240             | 9.2                         | 200            | 10         | 1,340            | 1,540      | 1,550          | 34         | 34             | 130           | 2.4         | 13.0       |                             | 20                    |                       | 1.64        |
| Orange Co. EPD | LW10S        | 12/3/91         | 7.50      | 70.0              | 261             | 7.5                         | 20             | 10         | 1,550            | 1,550      | 1,580          | 48         | 48             | 160           | 2.2         | 8.0        |                             | 24                    |                       | 3.28        |
| Orange Co. EPD | LW10S        | 1/28/92         | 7.90      | 68.0              | 232             | 8.7                         | 40             | 20         | 1,670            | 1,710      | 1,730          | 10         | 10             | 110           |             | 200.0      |                             | 10                    |                       | 2.30        |
| Orange Co. EPD | LW10S        | 1/28/92         | 7.90      | 68.0              | 232             | 8.7                         | 40             | 20         | 1,670            | 1,710      | 1,730          | 10         | 125            |               |             | 200.0      |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10S        | 2/24/92         | 7.50      | 78.0              | 277             | 8.0                         | 70             | 10         | 1,420            | 1,490      | 1,500          | 43         | 117            |               | 3.9         | 202.0      |                             |                       |                       | 2.30        |
| Orange Co. EPD | LW10S        | 3/24/92         | 7.50      | 78.0              | 277             | 8.0                         | 70             | 10         | 1,420            | 1,490      | 1,500          |            | 43             | 80            | 3.9         | 202.0      |                             | 4                     |                       | 2.30        |
| Orange Co. EPD | LW10S        | 4/29/92         | 7.80      | 50.0              | 220             | 8.3                         | 20             | 20         | 2,040            | 2,060      | 2,080          | 10         | 10             | 160           | 5.8         | 184.0      |                             | 14                    | 54                    | 1.97        |
| Orange Co. EPD | LW10S        | 5/13/92         | 8.30      | 62.0              | 220             | 8.9                         | 60             | 10         | 1,960            | 2,020      | 2,030          | 12         | 12             | 120           | 7.4         | 192.0      |                             | 6                     | 28                    | 1.64        |
| Orange Co. EPD | LW10S        | 6/15/92         | 7.50      | 64.0              | 223             | 5.5                         | 20             | 20         | 1,650            | 1,670      | 1,690          | 38         | 38             | 70            | 10.2        | 183.0      |                             | 16                    | 32                    | 2.30        |
| Orange Co. EPD | LW10S        | 7/2/92          | 8.20      | 62.0              | 206             | 7.6                         | 10             | 20         | 1,460            | 1,460      | 1,490          | 31         | 31             | 70            | 3.4         | 168.0      |                             | 36                    | 98                    | 1.31        |
| Orange Co. EPD | LW10S        | 7/15/92         | 7.60      | 58.0              | 192             | 4.7                         | 10             | 10         | 1,400            | 1,400      | 1,420          | 44         | 44             | 60            | 6.0         | 170.0      |                             | 90                    | 240                   | 1.64        |
| Orange Co. EPD | LW10S        | 8/4/92          | 8.10      | 62.0              | 196             | 4.8                         | 30             | 10         | 2,240            | 2,270      | 2,280          | 7          | 7              | 70            | 2.2         | 164.0      |                             | 20                    |                       | 0.98        |
| Orange Co. EPD | LW10S        | 8/27/92         | 7.70      | 48.0              | 180             | 6.2                         | 40             | 20         | 1,490            | 1,530      | 1,550          | 10         | 10             | 175           | 4.7         | 155.0      |                             | 190                   | 310                   | 1.31        |
| Orange Co. EPD | LW10S        | 9/15/92         | 7.30      | 57.0              | 185             | 4.6                         | 20             | 10         | 1,740            | 1,780      | 1,770          | 14         | 14             | 120           | 9.6         | 169.0      |                             | 260                   | 1,200                 | 0.98        |
| Orange Co. EPD | LW10S        | 10/19/92        | 7.40      | 58.0              | 205             | 7.1                         | 10             | 10         | 1,830            | 1,830      | 1,850          | 15         | 15             | 160           | 4.2         |            |                             | 200                   | 300                   | 1.97        |
| Orange Co. EPD | LW10S        | 11/10/92        | 7.50      | 59.0              | 214             | 7.2                         | 130            | 40         | 1,360            | 1,490      | 1,530          | 12         | 28             | 120           | 2.3         |            |                             | 20                    | 180                   | 2.30        |
| Orange Co. EPD | LW10S        | 12/7/92         | 7.80      | 57.0              | 211             | 10.4                        | 50             | 10         | 970              | 1,020      | 1,030          | 1          | 11             | 100           | 3.7         | 168.0      |                             | 20                    | 460                   | 1.64        |
| Orange Co. EPD | LW10S        | 1/4/93          | 7.90      | 60.0              | 254             | 6.1                         | 50             | 10         | 1,760            | 1,810      | 1,820          | 12         | 39             | 100           | 4.7         | 9.0        |                             | 38                    | 250                   | 2.30        |
| Orange Co. EPD | LW10S        | 1/25/93         | 7.60      | 59.0              | 221             | 6.6                         | 60             | 10         | 1,090            | 1,150      | 1,160          | 13         | 13             | 90            | 3.0         | 8.0        |                             | 54                    | 64                    | 1.97        |
| Orange Co. EPD | LW10S        | 1/27/93         | 7.40      | 58.0              | 220             | 7.2                         | 70             | 30         | 1,200            | 1,270      | 1,300          | 19         | 19             | 100           | 2.3         | 8.0        |                             | 2                     | 88                    | 1.97        |
| Orange Co. EPD | LW10S        | 2/16/93         | 7.50      | 57.0              | 223             | 8.3                         | 50             | 20         | 1,400            | 1,450      | 1,470          | 20         | 20             | 110           | 2.8         | 2.0        |                             | 18                    | 96                    | 1.97        |
| Orange Co. EPD | LW10S        | 3/8/93          | 7.60      | 55.0              | 213             | 8.3                         | 10             | 10         | 1,320            | 1,320      | 1,340          | 8          | 8              | 120           | 4.3         | 2.0        |                             | 1,040                 | 800                   | 2.62        |
| Orange Co. EPD | LW10S        | 3/29/93         | 7.70      | 56.0              | 216             | 9.6                         | 20             | 10         | 1,200            | 1,220      | 1,230          | 12         | 12             | 130           | 4.2         | 5.0        |                             | 64                    | 208                   | 1.97        |
| Orange Co. EPD | LW10S        | 4/5/93          |           |                   |                 |                             | 50             | 20         | 1,340            | 1,390      | 1,410          |            | 102            |               |             |            |                             | 6                     | 800                   |             |
| Orange Co. EPD | LW10S        | 4/14/93         | 7.80      | 56.0              | 222             | 11.1                        | 10             | 10         | 1,580            | 1,580      | 1,600          | 13         | 27             | 140           | 3.9         | 2.0        |                             | 10                    | 38                    | 1.97        |
| Orange Co. EPD | LW10S        | 5/3/93          | 7.50      | 56.0              |                 | 6.7                         | 60             | 20         | 1,450            | 1,510      | 1,530          | 36         | 36             | 140           | 3.0         | 8.0        |                             | 12                    | 6                     | 1.97        |
| Orange Co. EPD | LW10S        | 5/25/93         | 7.40      | 55.0              | 232             | 5.3                         | 40             | 30         | 1,790            | 1,830      | 1,860          | 21         | 21             | 140           | 9.0         | 12.0       |                             | 18                    | 40                    | 1.64        |
| Orange Co. EPD | LW10S        | 6/16/93         | 7.70      | 61.0              | 214             | 5.9                         | 130            | 20         | 1,940            | 2,070      | 2,090          | 24         | 24             |               | 5.1         | 186.0      |                             | 10                    | 42                    | 2.30        |
| Orange Co. EPD | LW10S        | 7/8/93          | 7.80      | 63.0              | 222             | 6.9                         | 20             | 20         | 1,470            | 1,490      | 1,510          | 51         | 51             |               | 7.0         | 178.0      |                             | 52                    | 106                   | 2.30        |
| Orange Co. EPD | LW10S        | 7/28/93         | 8.60      | 58.0              | 199             | 10.1                        | 20             | 10         | 1,360            | 1,380      | 1,390          | 38         | 38             |               | 4.7         | 162.0      |                             | 28                    | 66                    | 1.64        |
| Orange Co. EPD | LW10S        | 8/18/93         | 8.30      | 62.0              | 209             | 8.5                         | 40             | 10         | 1,510            | 1,550      | 1,560          | 23         | 23             |               | 5.6         | 160.0      |                             |                       |                       | 1.64        |
| Orange Co. EPD | LW10S        | 9/8/93          | 7.70      | 63.0              | 189             | 6.0                         | 20             | 10         | 1,380            | 1,400      | 1,410          | 16         | 16             |               | 2.1         | 166.0      |                             | 4                     | 42                    | 1.97        |
| Orange Co. EPD | LW10S        | 12/29/93        | 8.30      | 68.0              | 211             | 10.6                        | 50             | 10         | 1,210            | 1,260      | 1,270          | 6          | 6              |               | 2.4         | 142.0      |                             | 64                    | 430                   | 2.30        |
| Orange Co. EPD | LW10S        | 3/21/94         | 8.60      | 64.0              | 225             | 10.2                        | 70             | 10         | 1,280            | 1,350      | 1,360          | 12         | 12             |               | 8.7         | 15.0       |                             | 32                    | 210                   | 1.97        |
| Orange Co. EPD | LW10S        | 6/20/94         | 6.90      | 44.0              | 158             | 7.3                         | 100            | 10         | 1,100            | 1,200      | 1,210          | 24         | 24             |               | 3.7         | 11.0       |                             | 38                    | 104                   | 1.64        |

Historical Water Quality Data for Lake Lawne

| DataSource                 | Station I.D. | Collection Date | pH (s.u.) | Alkalinity (mg/L) | Cond. (µmho/cm) | Diss. O <sub>2</sub> (mg/L) | Ammonia (µg/L) | NOx (µg/L) | Organic N (µg/L) | TKN (µg/L) | Total N (µg/L) | SRP (µg/L) | Total P (µg/L) | Color (Pt-Co) | BOD5 (mg/L) | TSS (mg/L) | Chyl-a (mg/m <sup>3</sup> ) | F. Coli. (cfu/100 mL) | T. Coli. (cfu/100 mL) | Secchi (ft) |
|----------------------------|--------------|-----------------|-----------|-------------------|-----------------|-----------------------------|----------------|------------|------------------|------------|----------------|------------|----------------|---------------|-------------|------------|-----------------------------|-----------------------|-----------------------|-------------|
| Orange Co. EPD             | LW10S        | 9/21/94         | 6.80      | 45.0              | 159             | 5.3                         | 260            | 120        | 1,240            | 1,500      | 1,620          | 21         | 21             |               |             | 7.0        |                             | 18                    | 56                    | 1.64        |
| Orange Co. EPD             | LW10S        | 12/14/94        | 7.20      | 48.0              | 205             | 6.5                         | 180            | 600        | 950              | 1,130      | 1,730          | 5          | 5              |               | 1.2         | 5.0        |                             | 1,000                 | 800                   | 4.92        |
| Orange Co. EPD             | LW10S        | 3/20/95         | 7.35      | 62.2              | 219             | 7.3                         | 40             | 10         | 1,300            | 1,300      | 1,350          | 25         | 25             |               | 2.9         | 6.0        |                             | 48                    | 460                   | 2.46        |
| Orange Co. EPD             | LW10S        | 9/18/95         | 6.76      |                   | 256             | 4.9                         |                | 20         |                  | 2,340      | 2,360          |            | 20             |               | 3.0         |            |                             | 350                   | 960                   | 1.64        |
| Orange Co. EPD             | LW10S        | 12/21/95        | 6.93      | 48.0              | 219             | 7.4                         |                | 20         |                  | 1,600      | 1,620          |            | 22             |               | 2.3         | 6.0        |                             | 160                   | 240                   | 4.92        |
| Orange Co. EPD             | LW10S        | 3/12/96         | 7.20      | 71.0              | 200             | 8.6                         | 10             | 10         | 1,400            | 1,400      | 1,420          |            | 24             | 12            | 3.5         | 11.0       |                             | 200                   | 590                   | 2.46        |
| Orange Co. EPD             | LW10S        | 6/10/96         | 6.72      | 47.0              | 222             | 6.4                         | 10             | 10         | 1,700            | 1,700      | 1,720          |            | 18             | 80            | 2.2         | 23.0       |                             | 162                   | 600                   | 2.46        |
| Orange Co. EPD             | LW10S        | 9/9/96          | 6.14      | 48.0              | 199             | 5.9                         | 10             | 10         | 1,400            | 1,400      | 1,420          |            | 14             | 70            | 5.1         | 17.0       |                             | 30                    | 54                    | 6.56        |
| Orange Co. EPD             | LW10S        | 12/16/96        | 7.70      | 41.8              | 184             | 8.6                         | 20             | 10         | 1,200            | 1,200      | 1,230          |            | 10             | 90            | 3.1         | 11.0       |                             | 670                   | 520                   | 3.28        |
| Orange Co. EPD             | LW10S        | 2/11/97         | 7.27      | 63.0              | 203             | 6.4                         | 50             | 10         | 1,000            | 1,000      | 1,060          |            | 6              | 60            | 2.6         | 8.0        |                             | 40                    | 36                    | 3.28        |
| Orange Co. EPD             | LW10S        | 5/5/97          | 7.64      | 64.0              | 189             | 6.8                         | 10             | 10         | 1,500            | 1,500      | 1,520          |            | 8              | 80            | 2.9         | 9.0        |                             | 16                    | 50                    | 2.46        |
| Orange Co. EPD             | LW10S        | 9/24/97         | 7.08      | 60.0              | 189             | 4.8                         | 20             | 10         | 1,200            | 1,200      | 1,230          |            | 9              | 45            | 3.0         | 10.0       |                             | 80                    | 174                   | 4.10        |
| Orange Co. EPD             | LW10S        | 3/31/98         | 6.62      | 51.4              | 190             | 7.0                         | 10             | 10         | 1,200            | 1,200      | 1,220          |            | 7              | 100           | 2.5         | 6.5        |                             | 119                   | 131                   | 1.97        |
| Orange Co. EPD             | LW10S        | 6/16/98         | 8.14      | 71.4              | 225             | 6.6                         | 20             | 10         | 1,700            | 1,700      | 1,730          |            | 5              | 80            | 3.5         | 14.0       |                             | 75                    | 265                   | 1.48        |
| Orange Co. EPD             | LW10S        | 9/22/98         | 7.23      | 63.0              | 190             | 4.9                         | 40             | 10         | 1,200            | 1,200      | 1,250          |            | 37             | 45            | 2.0         | 10.5       |                             | 44                    | 90                    | 1.31        |
| Orange Co. EPD             | LW10S        | 12/9/98         | 7.64      | 71.4              | 214             | 6.9                         | 10             | 10         | 1,100            | 1,100      | 1,120          |            | 10             | 55            | 3.1         | 11.0       |                             | 160                   | 1,530                 | 1.64        |
| Orange Co. EPD             | LW10S        | 4/12/99         | 8.38      | 78.0              | 245             | 6.5                         | 18             | 10         | 1,600            | 1,600      | 1,628          |            | 9              | 40            | 4.3         | 13.0       |                             | 12                    | 230                   | 0.98        |
| Orange Co. EPD             | LW10S        | 7/20/99         | 7.62      | 59.0              | 176             | 5.5                         |                |            |                  |            |                |            |                | 35            | 2.7         | 16.0       |                             | 38                    | 50                    | 1.64        |
| Orange Co. EPD             | LW10S        | 10/11/99        | 7.64      | 54.0              | 179             | 9.1                         | 16             | 10         | 1,400            | 1,400      | 1,426          |            | 14             | 100           | 4.2         | 1.0        |                             | 34                    | 42                    | 1.64        |
| Orange Co. EPD             | LW10S        | 3/8/00          | 7.83      | 61.0              | 231             | 8.5                         | 34             | 10         | 970              | 1,000      | 1,014          |            | 9              | 70            | 2.2         | 6.0        |                             | 460                   | 840                   | 2.46        |
| Orange Co. EPD             | LW10S        | 9/21/00         | 8.02      | 76.9              | 216             | 8.5                         | 18             | 10         | 1,400            | 1,400      | 1,428          |            | 5              | 45            | 3.2         | 13.0       |                             | 42                    | 200                   | 1.31        |
| Orange Co. EPD             | LW10S        | 12/17/00        | 7.17      | 81.3              | 207             | 8.8                         | 28             | 10         | 1,200            | 1,200      | 1,238          |            | 9              | 35            | 3.3         | 8.0        |                             | 44                    | 42                    | 1.31        |
| Orange Co. EPD             | LW10S        | 2/20/01         | 7.08      | 83.5              | 247             | 8.5                         | 10             | 10         | 1,100            | 1,100      | 1,120          |            | 5              | 35            | 2.6         | 14.0       |                             | 160                   | 160                   | 1.64        |
| Orange Co. EPD             | LW10S        | 5/29/01         | 7.74      | 73.4              | 210             | 4.7                         | 10             | 10         | 1,600            | 1,600      | 1,620          |            | 5              | 40            | 4.9         | 12.0       |                             | 32                    | 36                    | 1.64        |
| Orange Co. EPD             | LW10S        | 12/18/01        | 6.51      | 79.3              | 107             | 7.2                         | 38             | 10         | 1,400            | 1,400      | 1,448          |            | 5              | 40            | 2.2         | 11.0       | 41.8                        | 64                    | 540                   | 2.46        |
| Orange Co. EPD             | LW10S        | 2/22/02         | 7.69      | 78.0              | 224             | 9.0                         | 25             | 10         | 1,300            | 1,300      | 1,335          |            | 5              | 35            | 4.3         | 9.0        |                             | 64                    | 540                   | 1.31        |
| Orange Co. EPD             | LW10S        | 11/18/04        | 7.13      | 67.0              | 212             | 7.1                         |                | 4          | 1,700            | 1,730      | 1,704          |            | 7              |               |             | 190.0      |                             |                       | 50                    | 1.64        |
| Orange Co. EPD             | LW10S        | 1/26/05         |           | 64.0              |                 |                             | 20             | 16         | 1,300            | 1,300      | 1,336          | 7          | 5              | 120           |             | 8.0        | 22.0                        |                       |                       |             |
| Orange Co. EPD             | LW10S        | 2/1/05          |           |                   |                 |                             |                |            |                  |            |                |            |                |               |             |            |                             | 56                    |                       |             |
| Orange Co. EPD             | LW10S        | 6/22/05         |           | 66.0              |                 |                             | 20             | 17         | 1,320            | 1,320      | 1,357          | 3          | 10             | 90            |             | 8.0        | 36.0                        |                       |                       |             |
| Orange Co. EPD             | LW10S        | 8/18/05         |           | 60.0              |                 |                             | 20             | 6          | 1,440            | 1,440      | 1,466          | 3          | 9              | 115           |             | 9.0        | 39.0                        |                       |                       |             |
| Orange Co. EPD             | LW10S        | 12/7/05         |           | 64.0              |                 |                             | 50             | 30         | 1,330            | 1,380      | 1,410          | 3          | 7              | 100           |             | 9.0        | 29.0                        |                       |                       |             |
| Orange Co. EPD             | LW10S        | 5/4/06          | 8.50      | 77.0              | 240             | 8.9                         | 20             | 4          | 1,670            | 1,670      | 1,694          | 4          | 11             |               |             | 12.0       | 38.5                        | 94                    | 360                   | 1.48        |
| Orange Co. EPD             | LW10S        | 7/26/06         | 8.60      | 71.0              | 188             | 9.5                         | 20             | 3          | 1,200            | 1,200      | 1,223          | 4          | 7              |               |             | 13.0       | 27.1                        | 100                   | 50                    | 1.64        |
| Orange Co. EPD             | LW10S        | 12/4/06         |           |                   |                 | 8.4                         |                |            |                  |            |                |            |                |               |             |            |                             |                       |                       |             |
| Orange Co. EPD             | LW10S        | 1/30/07         | 7.60      | 75.0              | 205             | 8.9                         |                | 2          | 1,000            | 1,000      | 1,002          | 4          | 4              |               | 2.0         | 7.0        |                             | 64                    | 136                   | 2.30        |
| Orange Co. EPD             | LW10S        | 5/31/07         | 7.70      | 90.0              | 244             | 6.3                         | 20             | 2          | 1,310            | 1,310      | 1,332          | 4          | 6              | 26            | 3.0         | 14.0       |                             | 38                    |                       | 1.31        |
| Orange Co. EPD             | LW10S        | 7/30/07         | 7.80      | 80.0              | 218             | 6.7                         | 20             | 5          | 1,140            | 1,160      | 1,165          | 4          | 5              | 30            |             | 12.0       |                             | 620                   |                       | 2.30        |
| Orange Co. EPD             | LW10S        | 10/23/07        | 7.20      | 76.0              | 203             | 6.5                         | 90             | 2          | 930              | 1,020      | 1,022          | 2          | 3              | 38            | 2.0         | 8.0        |                             | 740                   |                       | 2.30        |
| Orange Co. EPD             | LW10S        | 2/6/08          | 7.40      | 78.0              | 218             | 8.6                         | 20             | 3          | 950              | 950        | 973            | 3          | 3              | 31            |             | 4.0        |                             | 14.1                  | 20                    | 6.56        |
| Orange Co. EPD             | LW10S        | 4/23/08         | 8.00      | 76.0              | 215             | 8.0                         | 20             | 3          | 1,080            | 1,080      | 1,103          | 3          | 7              | 57            |             | 6.0        |                             | 18.4                  | 30                    | 2.30        |
| Orange Co. EPD             | LW10S        | 8/7/08          | 7.50      | 63.0              | 180             | 6.6                         | 30             | 3          | 1,150            | 1,150      | 1,183          | 9          | 5              | 82            |             | 6.0        |                             | 32.7                  | 200                   | 2.46        |
| Orange Co. EPD             | LW10S        | 10/23/08        | 7.00      | 63.0              | 196             | 6.1                         | 30             | 21         | 1,550            | 1,550      | 1,601          | 6          | 7              | 119           |             | 1.0        |                             | 24.0                  | 40                    | 2.13        |
| Orange Co. EPD             | LW10S        | 2/10/09         | 7.90      | 72.0              | 220             | 10.0                        | 30             | 3          | 1,420            | 1,420      | 1,453          | 2          | 7              | 61            |             | 1.0        |                             | 14.1                  | 20                    | 2.95        |
| Orange Co. EPD             | LW10S        | 6/30/09         | 6.60      | 61.0              | 193             | 4.9                         | 30             | 9          | 1,660            | 1,660      | 1,699          | 5          | 26             | 111           |             | 5.0        |                             | 19.9                  | 102                   | 2.82        |
| Orange Co. EPD             | LW10S        | 9/8/09          | 7.20      | 64.0              | 188             | 4.8                         | 20             | 2          | 1,310            | 1,310      | 1,332          | 2          | 4              | 37            |             | 4.0        |                             | 10.5                  | 56                    | 2.95        |
| Orange Co. EPD             | LW10S        | 12/3/09         | 7.20      | 76.0              | 213             | 7.2                         | 20             | 37         | 1,660            | 1,660      | 1,717          | 2          | 9              | 60            |             | 2.0        |                             | 29.4                  | 10                    | 2.95        |
| Orange Co. EPD             | LW10S        | 2/8/10          | 7.50      | 70.0              | 207             | 8.3                         |                | 24         | 1,370            | 1,370      | 1,394          | 2          | 9              | 50            |             | 4.0        |                             | 7.4                   | 23                    | 2.95        |
| Orange Co. EPD             | LW10S        | 5/11/10         | 7.40      | 67.0              | 210             | 5.5                         |                | 6          | 1,720            | 1,720      | 1,726          | 2          | 20             | 87            |             | 8.0        |                             | 35.0                  | 46                    | 1.97        |
| Orange Co. EPD             | LW10S        | 7/27/10         | 7.69      | 69.0              | 195             | 5.9                         |                | 6          | 1,470            | 1,480      | 1,476          | 5          | 7              | 67            |             | 8.0        |                             | 18.9                  | 358                   | 2.62        |
| Orange Co. EPD             | LW10S        | 11/23/10        | 7.20      | 73.0              | 192             | 7.2                         |                | 2          | 1,230            | 1,240      | 1,232          | 3          | 10             | 56            |             | 8.0        |                             | 29.4                  | 10                    | 2.13        |
| Minimum Value              |              |                 | 6.14      | 41.8              | 107             | 4.3                         | 10             | 2          | 726              | 777        | 783            | 1          | 3              | 12            | 1.2         | 1.0        | 7.4                         | 2                     | 6                     | 1.0         |
| Maximum Value              |              |                 | 8.60      | 90.0              | 277             | 11.1                        | 260            | 600        | 2,240            | 2,340      | 2,360          | 69         | 125            | 180           | 10.2        | 202.0      | 43.6                        | 1,040                 | 1,530                 | 6.6         |
| Geometric Mean (1990-1999) |              |                 | 7.57      | 60.4              | 215             | 7.2                         | 30             | 13         | 1,372            | 1,429      | 1,457          | 19         | 23             | 89            | 3.7         | 20.4       | - -                         | 37                    | 132                   | 2.0         |
| Geometric Mean (2000-2005) |              |                 | 7.38      | 70.7              | 202             | 7.7                         | 22             | 11         | 1,325            | 1,334      | 1,360          | 4          | 6              | 58            | 3.1         | 12.1       | 32.7                        | 75                    | 167                   | 1.7         |
| Geometric Mean (2006-2011) |              |                 | 7.54      | 71.9              | 206             | 7.1                         | 25             | 5          | 1,299            | 1,308      | 1,328          | 3          | 7              | 55            | 2.3         | 5.4        | 22.3                        | 63                    | 135                   | 2.4         |

## **APPENDIX B**

### **RESULTS OF SURFACE WATER QUALITY MONITORING CONDUCTED IN LAKE LAWNE FROM MARCH 2011-FEBRUARY 2012**

#### **B.1 Vertical Field Profiles**

#### **B.2 Characteristics of Surface Water Samples**



## **B.1 Vertical Field Profiles**

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date    | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |    | ORP<br>(mV) | Secchi<br>(m) |
|------|---------|-------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|----|-------------|---------------|
| 1    | 3/21/11 | 9:24  | 0.25         | 22.77        | 7.19         | 207                 | 132           | 6.9                                     | 80 | 703         | 0.94          |
|      |         | 9:26  | 0.5          | 22.77        | 7.16         | 207                 | 132           | 6.6                                     | 76 | 698         |               |
|      |         | 9:26  | 1.0          | 22.69        | 7.12         | 207                 | 132           | 6.2                                     | 72 | 694         |               |
|      |         | 9:27  | 1.5          | 22.60        | 7.06         | 207                 | 133           | 5.8                                     | 67 | 691         |               |
|      |         | 9:28  | 2.0          | 22.49        | 7.01         | 207                 | 133           | 5.4                                     | 62 | 689         |               |
|      |         | 9:29  | 2.4          | 22.44        | 6.69         | 205                 | 131           | 1.5                                     | 17 | 590         |               |
| 2    | 3/21/11 | 9:42  | 0.25         | 22.30        | 7.06         | 207                 | 132           | 5.8                                     | 67 | 559         | 0.93          |
|      |         | 9:43  | 0.5          | 22.32        | 7.03         | 208                 | 133           | 5.8                                     | 66 | 562         |               |
|      |         | 9:44  | 1.0          | 22.26        | 7.03         | 207                 | 132           | 5.6                                     | 65 | 563         |               |
|      |         | 9:45  | 1.5          | 22.11        | 6.97         | 207                 | 132           | 4.4                                     | 51 | 525         |               |
|      |         | 9:46  | 1.6          | 22.14        | 6.76         | 210                 | 134           | 0.4                                     | 5  | 391         |               |
|      |         |       |              |              |              |                     |               |                                         |    |             |               |
| 3    | 3/21/11 | 9:59  | 0.25         | 22.85        | 7.24         | 208                 | 133           | 7.0                                     | 82 | 463         | 0.95          |
|      |         | 10:00 | 0.5          | 22.85        | 7.22         | 207                 | 133           | 6.8                                     | 79 | 466         |               |
|      |         | 10:01 | 1.0          | 22.83        | 7.21         | 208                 | 133           | 6.8                                     | 79 | 468         |               |
|      |         | 10:02 | 1.5          | 22.78        | 7.20         | 208                 | 133           | 6.8                                     | 79 | 471         |               |
|      |         | 10:02 | 2.0          | 22.64        | 7.13         | 207                 | 132           | 6.2                                     | 72 | 469         |               |
|      |         | 10:03 | 2.5          | 22.41        | 7.05         | 207                 | 133           | 5.6                                     | 65 | 468         |               |
|      |         | 10:04 | 3.0          | 21.97        | 6.93         | 207                 | 132           | 4.3                                     | 49 | 465         |               |
|      |         | 10:05 | 3.3          | 21.23        | 6.81         | 206                 | 132           | 2.8                                     | 32 | 447         |               |
| 4    | 3/21/11 | 10:18 | 0.25         | 23.26        | 7.22         | 208                 | 133           | 7.2                                     | 84 | 477         | 0.98          |
|      |         | 10:18 | 0.5          | 23.24        | 7.20         | 207                 | 132           | 7.0                                     | 82 | 479         |               |
|      |         | 10:19 | 1.0          | 23.20        | 7.21         | 208                 | 133           | 6.8                                     | 80 | 479         |               |
|      |         | 10:20 | 1.5          | 23.08        | 7.16         | 208                 | 133           | 6.7                                     | 78 | 481         |               |
|      |         | 10:21 | 2.0          | 22.82        | 7.02         | 206                 | 132           | 5.4                                     | 64 | 477         |               |
|      |         | 10:23 | 2.3          | 22.74        | 6.93         | 207                 | 133           | 4.7                                     | 54 | 455         |               |
| 1    | 4/26/11 | 8:34  | 0.25         | 26.99        | 7.37         | 193                 | 124           | 6.2                                     | 78 | 624         | 0.47          |
|      |         | 8:34  | 0.5          | 26.94        | 7.34         | 193                 | 124           | 5.8                                     | 73 | 623         |               |
|      |         | 8:35  | 1.0          | 26.90        | 7.33         | 193                 | 123           | 5.8                                     | 73 | 621         |               |
|      |         | 8:36  | 1.5          | 26.82        | 7.32         | 193                 | 123           | 5.7                                     | 72 | 621         |               |
|      |         | 8:37  | 1.8          | 26.73        | 7.19         | 192                 | 123           | 3.6                                     | 45 | 607         |               |
| 2    | 4/26/11 | 8:49  | 0.25         | 26.07        | 7.22         | 197                 | 126           | 5.5                                     | 67 | 590         | 0.55          |
|      |         | 8:50  | 0.5          | 26.04        | 7.17         | 197                 | 126           | 5.2                                     | 65 | 589         |               |
|      |         | 8:51  | 1.0          | 25.92        | 7.10         | 199                 | 127           | 5.0                                     | 61 | 587         |               |
|      |         | 8:52  | 1.5          | 25.68        | 6.82         | 213                 | 136           | 2.0                                     | 24 | 507         |               |
|      |         | 8:53  | 1.6          | 25.67        | 6.84         | 212                 | 136           | 0.9                                     | 11 | 477         |               |
| 3    | 4/26/11 | 9:06  | 0.25         | 26.59        | 7.30         | 197                 | 126           | 6.3                                     | 79 | 496         | 0.52          |
|      |         | 9:07  | 0.5          | 26.59        | 7.30         | 197                 | 126           | 5.9                                     | 74 | 496         |               |
|      |         | 9:08  | 1.0          | 26.58        | 7.27         | 196                 | 125           | 6.0                                     | 74 | 497         |               |
|      |         | 9:09  | 1.5          | 26.55        | 7.23         | 196                 | 125           | 5.7                                     | 71 | 496         |               |
|      |         | 9:10  | 2.0          | 26.54        | 7.22         | 196                 | 126           | 5.0                                     | 62 | 497         |               |
| 4    | 4/26/11 | 9:22  | 0.25         | 26.69        | 7.37         | 195                 | 125           | 6.4                                     | 80 | 498         | 0.69          |
|      |         | 9:23  | 0.5          | 26.68        | 7.35         | 195                 | 125           | 6.3                                     | 79 | 497         |               |
|      |         | 9:23  | 1.0          | 26.61        | 7.32         | 194                 | 124           | 5.9                                     | 74 | 498         |               |
|      |         | 9:24  | 1.5          | 26.51        | 7.22         | 195                 | 125           | 5.4                                     | 67 | 496         |               |
|      |         | 9:25  | 2.0          | 26.47        | 7.14         | 195                 | 125           | 5.1                                     | 64 | 494         |               |
|      |         | 9:26  | 2.5          | 26.34        | 6.95         | 196                 | 125           | 2.8                                     | 34 | 488         |               |
|      |         | 9:27  | 3.0          | 26.27        | 6.80         | 200                 | 128           | 0.9                                     | 11 | 359         |               |

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date    | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |    | ORP<br>(mV) | Secchi<br>(m) |
|------|---------|-------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|----|-------------|---------------|
| 1    | 5/25/11 | 9:27  | 0.25         | 28.72        | 7.44         | 197                 | 126           | 6.2                                     | 80 | 496         | 0.51          |
|      |         | 9:28  | 0.5          | 28.76        | 7.42         | 197                 | 126           | 6.2                                     | 81 | 495         |               |
|      |         | 9:29  | 1.0          | 28.75        | 7.42         | 197                 | 126           | 5.9                                     | 77 | 496         |               |
|      |         | 9:29  | 1.5          | 28.74        | 7.40         | 198                 | 126           | 5.9                                     | 76 | 496         |               |
|      |         | 9:30  | 2.0          | 28.76        | 7.40         | 198                 | 127           | 5.9                                     | 76 | 497         |               |
|      |         | 9:32  | 2.1          | 28.71        | 7.03         | 247                 | 158           | 0.5                                     | 6  | 188         |               |
| 2    | 5/25/11 | 9:47  | 0.25         | 28.26        | 7.42         | 201                 | 129           | 6.5                                     | 83 | 469         | 0.54          |
|      |         | 9:47  | 0.5          | 28.23        | 7.42         | 200                 | 128           | 6.2                                     | 79 | 469         |               |
|      |         | 9:48  | 1.0          | 27.89        | 7.28         | 200                 | 128           | 5.2                                     | 66 | 466         |               |
|      |         | 9:50  | 1.4          | 27.58        | 7.11         | 200                 | 128           | 3.0                                     | 38 | 158         |               |
| 3    | 5/25/11 | 10:02 | 0.25         | 28.54        | 7.58         | 200                 | 128           | 6.8                                     | 88 | 454         | 0.62          |
|      |         | 10:03 | 0.5          | 28.56        | 7.60         | 200                 | 128           | 6.6                                     | 86 | 458         |               |
|      |         | 10:04 | 1.0          | 28.53        | 7.60         | 200                 | 128           | 6.6                                     | 85 | 461         |               |
|      |         | 10:04 | 1.5          | 28.45        | 7.55         | 199                 | 127           | 6.4                                     | 82 | 460         |               |
|      |         | 10:05 | 2.0          | 28.37        | 7.45         | 199                 | 127           | 5.8                                     | 74 | 458         |               |
|      |         | 10:06 | 2.1          | 28.37        | 7.41         | 198                 | 126           | 5.6                                     | 72 | 459         |               |
| 4    | 5/25/11 | 10:14 | 0.25         | 28.55        | 7.60         | 198                 | 127           | 7.0                                     | 90 | 478         | 0.64          |
|      |         | 10:15 | 0.5          | 28.53        | 7.59         | 197                 | 126           | 6.8                                     | 88 | 479         |               |
|      |         | 10:16 | 1.0          | 28.48        | 7.57         | 197                 | 126           | 6.5                                     | 84 | 481         |               |
|      |         | 10:17 | 1.5          | 28.39        | 7.51         | 196                 | 126           | 6.3                                     | 80 | 480         |               |
|      |         | 10:17 | 2.0          | 28.35        | 7.43         | 196                 | 126           | 5.7                                     | 74 | 478         |               |
|      |         | 10:18 | 2.5          | 27.83        | 7.10         | 196                 | 125           | 2.8                                     | 36 | 465         |               |
|      |         | 10:22 | 3.0          | 27.39        | 6.97         | 212                 | 136           | 0.2                                     | 3  | 69          |               |
| 1    | 6/22/11 | 9:44  | 0.25         | 30.86        | 7.95         | 197                 | 126           | 6.9                                     | 93 | 634         | 0.63          |
|      |         | 9:45  | 0.5          | 30.87        | 7.93         | 198                 | 127           | 6.8                                     | 91 | 617         |               |
|      |         | 9:46  | 1.0          | 30.82        | 7.82         | 198                 | 127           | 6.4                                     | 86 | 609         |               |
|      |         | 9:47  | 1.5          | 30.76        | 7.58         | 198                 | 127           | 5.4                                     | 72 | 598         |               |
|      |         | 9:48  | 1.8          | 30.75        | 7.05         | 195                 | 124           | 0.7                                     | 11 | 389         |               |
| 2    | 6/22/11 | 10:09 | 0.25         | 30.70        | 7.99         | 196                 | 125           | 7.1                                     | 95 | 474         | 0.58          |
|      |         | 10:10 | 0.5          | 30.62        | 7.95         | 196                 | 126           | 6.9                                     | 92 | 473         |               |
|      |         | 10:11 | 1.0          | 30.39        | 7.67         | 197                 | 126           | 6.0                                     | 80 | 465         |               |
|      |         | 10:12 | 1.5          | 30.16        | 7.37         | 198                 | 127           | 4.5                                     | 60 | 418         |               |
| 3    | 6/22/11 | 10:26 | 0.25         | 30.60        | 7.78         | 196                 | 125           | 6.7                                     | 89 | 482         | 0.52          |
|      |         | 10:27 | 0.5          | 30.57        | 7.76         | 197                 | 126           | 6.7                                     | 89 | 484         |               |
|      |         | 10:28 | 1.0          | 30.50        | 7.71         | 197                 | 126           | 6.3                                     | 84 | 460         |               |
|      |         | 10:29 | 1.5          | 30.32        | 7.57         | 197                 | 126           | 5.6                                     | 75 | 458         |               |
|      |         | 10:29 | 2.0          | 30.22        | 7.40         | 197                 | 126           | 4.5                                     | 60 | 453         |               |
|      |         | 10:30 | 2.2          | 30.11        | 7.25         | 197                 | 126           | 3.4                                     | 45 | 445         |               |
| 4    | 6/22/11 | 10:44 | 0.25         | 30.58        | 7.85         | 195                 | 125           | 6.9                                     | 92 | 462         | 0.53          |
|      |         | 10:44 | 0.5          | 30.47        | 7.84         | 196                 | 126           | 6.9                                     | 92 | 463         |               |
|      |         | 10:45 | 1.0          | 30.25        | 7.81         | 196                 | 126           | 6.5                                     | 87 | 464         |               |
|      |         | 10:46 | 1.5          | 30.09        | 7.60         | 197                 | 126           | 5.6                                     | 74 | 457         |               |
|      |         | 10:46 | 2.0          | 29.93        | 7.21         | 197                 | 126           | 2.2                                     | 28 | 444         |               |
|      |         | 10:47 | 2.2          | 29.75        | 7.00         | 196                 | 125           | 0.9                                     | 12 | 375         |               |

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date    | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |     | ORP<br>(mV) | Secchi<br>(m) |
|------|---------|-------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|-----|-------------|---------------|
| 1    | 7/21/11 | 9:09  | 0.25         | 30.68        | 8.20         | 157                 | 101           | 8.9                                     | 119 | 344         | 0.45          |
|      |         | 9:10  | 0.5          | 30.70        | 8.26         | 157                 | 100           | 8.7                                     | 116 | 343         |               |
|      |         | 9:10  | 1.5          | 30.58        | 7.99         | 158                 | 101           | 8.1                                     | 108 | 332         |               |
|      |         | 9:11  | 2.0          | 29.88        | 7.07         | 159                 | 101           | 3.4                                     | 44  | 305         |               |
|      |         | 9:12  | 2.1          | 29.52        | 6.87         | 160                 | 102           | 1.9                                     | 25  | 272         |               |
| 2    | 7/21/11 | 9:26  | 0.25         | 30.76        | 7.43         | 166                 | 106           | 7.5                                     | 100 | 303         | 0.39          |
|      |         | 9:27  | 0.5          | 30.55        | 7.41         | 162                 | 104           | 6.9                                     | 92  | 303         |               |
|      |         | 9:28  | 1.0          | 30.30        | 7.16         | 162                 | 103           | 5.6                                     | 74  | 294         |               |
|      |         | 9:30  | 1.5          | 29.87        | 6.75         | 192                 | 123           | 0.4                                     | 6   | 163         |               |
| 3    | 7/21/11 | 9:46  | 0.25         | 30.73        | 8.04         | 157                 | 101           | 8.2                                     | 110 | 384         | 0.41          |
|      |         | 9:47  | 0.5          | 30.69        | 8.03         | 157                 | 100           | 8.0                                     | 107 | 384         |               |
|      |         | 9:48  | 1.0          | 30.40        | 7.65         | 159                 | 102           | 7.0                                     | 93  | 371         |               |
|      |         | 9:49  | 1.5          | 30.10        | 7.34         | 160                 | 102           | 5.0                                     | 67  | 362         |               |
|      |         | 9:49  | 2.0          | 29.71        | 7.08         | 159                 | 102           | 3.0                                     | 39  | 356         |               |
|      |         | 9:50  | 2.5          | 29.53        | 6.88         | 160                 | 102           | 2.0                                     | 26  | 350         |               |
|      |         | 9:50  | 3.0          | 29.22        | 6.78         | 158                 | 101           | 0.8                                     | 11  | 347         |               |
|      |         | 9:51  | 3.3          | 29.10        | 6.70         | 158                 | 101           | 0.6                                     | 8   | 337         |               |
| 4    | 7/21/11 | 10:07 | 0.25         | 30.51        | 7.94         | 157                 | 100           | 8.1                                     | 108 | 393         | 0.35          |
|      |         | 10:08 | 0.5          | 30.36        | 7.83         | 158                 | 101           | 7.8                                     | 104 | 389         |               |
|      |         | 10:09 | 1.0          | 29.83        | 7.48         | 159                 | 102           | 6.5                                     | 85  | 378         |               |
|      |         | 10:10 | 1.5          | 29.70        | 7.33         | 159                 | 102           | 5.9                                     | 78  | 374         |               |
|      |         | 10:10 | 2.0          | 29.60        | 7.19         | 159                 | 102           | 5.0                                     | 65  | 371         |               |
|      |         | 10:11 | 2.4          | 29.51        | 6.96         | 159                 | 102           | 3.5                                     | 45  | 329         |               |
| 1    | 8/26/11 | 9:06  | 0.25         | 29.14        | 7.11         | 163                 | 104           | 5.0                                     | 65  | 398         | 0.52          |
|      |         | 9:07  | 0.5          | 29.15        | 7.09         | 163                 | 104           | 4.9                                     | 64  | 397         |               |
|      |         | 9:08  | 1.0          | 29.14        | 7.10         | 162                 | 104           | 4.9                                     | 64  | 398         |               |
|      |         | 9:08  | 1.5          | 29.15        | 7.12         | 163                 | 104           | 5.0                                     | 66  | 399         |               |
|      |         | 9:09  | 2.0          | 29.14        | 7.13         | 162                 | 104           | 5.0                                     | 66  | 399         |               |
|      |         | 9:10  | 2.5          | 29.15        | 7.12         | 164                 | 105           | 5.0                                     | 65  | 398         |               |
|      |         | 9:11  | 2.7          | 29.18        | 6.69         | 195                 | 125           | 0.4                                     | 5   | 179         |               |
| 2    | 8/26/11 | 9:23  | 0.25         | 28.72        | 7.08         | 165                 | 105           | 4.6                                     | 59  | 351         | 0.53          |
|      |         | 9:24  | 0.5          | 28.73        | 7.00         | 165                 | 106           | 4.6                                     | 59  | 348         |               |
|      |         | 9:24  | 1.0          | 28.71        | 6.96         | 164                 | 105           | 4.2                                     | 55  | 349         |               |
|      |         | 9:25  | 1.5          | 28.26        | 6.67         | 194                 | 124           | 0.2                                     | 3   | 183         |               |
| 3    | 8/26/11 | 9:57  | 0.25         | 29.55        | 7.11         | 163                 | 105           | 5.0                                     | 65  | 345         | 0.52          |
|      |         | 9:58  | 0.5          | 29.54        | 7.08         | 163                 | 104           | 4.8                                     | 63  | 346         |               |
|      |         | 9:58  | 1.0          | 29.47        | 7.05         | 163                 | 105           | 4.6                                     | 60  | 345         |               |
|      |         | 9:59  | 1.5          | 29.47        | 7.03         | 163                 | 104           | 4.4                                     | 57  | 347         |               |
|      |         | 10:00 | 2.0          | 29.48        | 6.99         | 163                 | 105           | 1.5                                     | 20  | 275         |               |
| 4    | 8/26/11 | 9:47  | 0.25         | 29.51        | 7.14         | 163                 | 105           | 4.9                                     | 64  | 352         | 0.51          |
|      |         | 9:48  | 0.5          | 29.51        | 7.08         | 164                 | 105           | 4.8                                     | 63  | 351         |               |
|      |         | 9:48  | 1.0          | 29.49        | 7.05         | 164                 | 105           | 4.7                                     | 61  | 351         |               |
|      |         | 9:49  | 1.5          | 29.48        | 7.03         | 164                 | 105           | 4.5                                     | 60  | 352         |               |
|      |         | 9:50  | 2.0          | 29.48        | 7.02         | 164                 | 105           | 4.5                                     | 59  | 352         |               |
|      |         | 9:51  | 2.4          | 29.48        | 6.99         | 165                 | 105           | 3.6                                     | 48  | 281         |               |

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date     | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l)    (% Sat.) |    | ORP<br>(mV) | Secchi<br>(m) |
|------|----------|-------|--------------|--------------|--------------|---------------------|---------------|--------------------------------------------|----|-------------|---------------|
| 1    | 10/24/11 | 9:01  | 0.25         | 20.98        | 6.97         | 171                 | 109           | 7.7                                        | 87 | 383         | 0.48          |
|      |          | 9:01  | 0.5          | 20.97        | 7.04         | 171                 | 109           | 7.2                                        | 81 | 385         |               |
|      |          | 9:02  | 1.0          | 20.98        | 7.09         | 170                 | 109           | 7.1                                        | 79 | 387         |               |
|      |          | 9:02  | 1.5          | 20.96        | 7.10         | 171                 | 109           | 6.8                                        | 76 | 388         |               |
|      |          | 9:04  | 1.9          | 20.96        | 7.06         | 172                 | 110           | 6.2                                        | 70 | 230         |               |
|      |          |       |              |              |              |                     |               |                                            |    |             |               |
| 2    | 10/24/11 | 9:14  | 0.25         | 21.41        | 7.06         | 181                 | 116           | 7.3                                        | 82 | 309         | 0.46          |
|      |          | 9:15  | 0.5          | 21.40        | 7.05         | 181                 | 116           | 7.0                                        | 79 | 313         |               |
|      |          | 9:16  | 1.0          | 21.40        | 7.05         | 181                 | 116           | 6.9                                        | 78 | 316         |               |
|      |          | 9:16  | 1.5          | 21.34        | 7.00         | 183                 | 117           | 6.6                                        | 74 | 318         |               |
|      |          | 9:17  | 1.7          | 20.75        | 6.58         | 215                 | 138           | 3.4                                        | 38 | 167         |               |
|      |          |       |              |              |              |                     |               |                                            |    |             |               |
| 3    | 10/24/11 | 9:35  | 0.25         | 22.01        | 7.35         | 172                 | 110           | 7.6                                        | 87 | 338         | 0.48          |
|      |          | 9:35  | 0.5          | 22.01        | 7.37         | 172                 | 110           | 7.5                                        | 86 | 342         |               |
|      |          | 9:36  | 1.0          | 22.00        | 7.37         | 172                 | 110           | 7.4                                        | 85 | 344         |               |
|      |          | 9:36  | 1.5          | 21.93        | 7.20         | 174                 | 111           | 6.4                                        | 73 | 340         |               |
|      |          | 9:37  | 2.0          | 21.74        | 7.06         | 175                 | 112           | 5.6                                        | 64 | 336         |               |
|      |          | 9:37  | 2.5          | 21.42        | 7.03         | 175                 | 112           | 5.3                                        | 60 | 337         |               |
|      |          | 9:38  | 3.0          | 21.37        | 7.03         | 174                 | 111           | 5.0                                        | 57 | 338         |               |
|      |          | 9:39  | 3.5          | 21.33        | 7.01         | 175                 | 112           | 4.8                                        | 54 | 339         |               |
|      |          | 9:39  | 4.0          | 21.30        | 6.97         | 176                 | 113           | 4.5                                        | 51 | 337         |               |
|      |          | 9:39  | 4.5          | 21.29        | 6.95         | 177                 | 113           | 4.4                                        | 49 | 337         |               |
|      |          | 9:40  | 5.0          | 21.30        | 6.93         | 177                 | 113           | 4.2                                        | 47 | 336         |               |
| 9:41 | 5.5      | 21.29 | 6.93         | 177          | 113          | 4.1                 | 46            | 336                                        |    |             |               |
|      |          |       |              |              |              |                     |               |                                            |    |             |               |
| 4    | 10/24/11 | 9:53  | 0.25         | 21.99        | 7.38         | 172                 | 110           | 7.6                                        | 87 | 370         | 0.48          |
|      |          | 9:53  | 0.5          | 21.99        | 7.37         | 172                 | 110           | 7.5                                        | 85 | 370         |               |
|      |          | 9:54  | 1.0          | 21.98        | 7.37         | 172                 | 110           | 7.2                                        | 83 | 371         |               |
|      |          | 9:54  | 1.5          | 21.93        | 7.31         | 172                 | 110           | 6.9                                        | 78 | 370         |               |
|      |          | 9:55  | 2.0          | 21.77        | 7.16         | 173                 | 111           | 5.6                                        | 64 | 364         |               |
|      |          | 9:56  | 2.4          | 21.74        | 7.04         | 173                 | 111           | 4.7                                        | 53 | 357         |               |
|      |          |       |              |              |              |                     |               |                                            |    |             |               |



# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date     | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |    | ORP<br>(mV) | Secchi<br>(m) |
|------|----------|-------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|----|-------------|---------------|
| 1    | 11/22/11 | 9:24  | 0.25         | 23.03        | 7.77         | 174                 | 112           | 7.9                                     | 92 | 266         | 0.54          |
|      |          | 9:25  | 0.5          | 22.71        | 7.69         | 174                 | 111           | 7.5                                     | 87 | 266         |               |
|      |          | 9:25  | 1.0          | 22.44        | 7.59         | 175                 | 112           | 6.9                                     | 80 | 266         |               |
|      |          | 9:26  | 1.5          | 22.22        | 7.45         | 175                 | 112           | 6.2                                     | 71 | 262         |               |
|      |          | 9:27  | 1.9          | 22.21        | 7.33         | 175                 | 112           | 4.8                                     | 55 | 111         |               |
| 2    | 11/22/11 | 9:41  | 0.25         | 23.37        | 7.91         | 174                 | 112           | 8.1                                     | 95 | 260         | 0.66          |
|      |          | 9:41  | 0.5          | 22.50        | 7.72         | 174                 | 112           | 7.5                                     | 86 | 252         |               |
|      |          | 9:42  | 1.0          | 22.04        | 7.50         | 175                 | 112           | 6.5                                     | 75 | 246         |               |
|      |          | 9:43  | 1.5          | 21.73        | 7.15         | 180                 | 115           | 1.3                                     | 14 | 88          |               |
| 3    | 11/22/11 | 9:59  | 0.25         | 23.29        | 7.91         | 173                 | 111           | 8.2                                     | 96 | 258         | 0.53          |
|      |          | 9:59  | 0.5          | 23.27        | 7.89         | 174                 | 112           | 8.1                                     | 95 | 259         |               |
|      |          | 10:00 | 1.0          | 22.76        | 7.70         | 175                 | 112           | 7.4                                     | 86 | 251         |               |
|      |          | 10:00 | 1.5          | 22.31        | 7.46         | 175                 | 112           | 6.1                                     | 70 | 240         |               |
|      |          | 10:01 | 2.0          | 21.97        | 7.36         | 176                 | 113           | 5.3                                     | 60 | 238         |               |
|      |          | 10:02 | 2.5          | 21.76        | 7.28         | 177                 | 113           | 4.5                                     | 51 | 235         |               |
|      |          | 10:02 | 3.0          | 21.52        | 7.20         | 176                 | 113           | 3.3                                     | 38 | 233         |               |
|      |          | 10:03 | 3.5          | 21.19        | 7.15         | 175                 | 112           | 2.8                                     | 31 | 232         |               |
|      |          | 10:03 | 4.0          | 20.77        | 7.08         | 176                 | 112           | 1.8                                     | 20 | 230         |               |
|      |          | 10:04 | 4.5          | 20.50        | 7.05         | 176                 | 113           | 1.3                                     | 15 | 228         |               |
|      |          | 10:04 | 5.0          | 20.33        | 7.02         | 176                 | 113           | 0.8                                     | 9  | 213         |               |
|      |          | 10:05 | 5.5          | 20.30        | 7.03         | 179                 | 114           | 0.7                                     | 7  | 89          |               |
| 4    | 11/22/11 | 10:18 | 0.25         | 23.35        | 7.92         | 174                 | 111           | 8.2                                     | 96 | 241         | 0.59          |
|      |          | 10:18 | 0.5          | 23.37        | 7.91         | 174                 | 112           | 8.1                                     | 95 | 243         |               |
|      |          | 10:19 | 1.0          | 22.88        | 7.81         | 175                 | 112           | 7.7                                     | 90 | 238         |               |
|      |          | 10:19 | 1.5          | 22.47        | 7.53         | 175                 | 112           | 6.4                                     | 74 | 228         |               |
|      |          | 10:20 | 2.0          | 22.04        | 7.28         | 176                 | 113           | 4.4                                     | 50 | 216         |               |
|      |          | 10:20 | 2.5          | 21.68        | 7.17         | 176                 | 113           | 3.1                                     | 36 | 214         |               |
|      |          | 10:21 | 3.0          | 21.68        | 7.16         | 176                 | 113           | 2.9                                     | 33 | 215         |               |
|      |          | 10:22 | 3.5          | 21.69        | 7.12         | 179                 | 115           | 1.5                                     | 17 | 72          |               |

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date     | Time | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |    | ORP<br>(mV) | Secchi<br>(m) |
|------|----------|------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|----|-------------|---------------|
| 1    | 12/22/11 | 8:13 | 0.25         | 19.62        | 7.69         | 181                 | 116           | 8.5                                     | 93 | 387         | 0.52          |
|      |          | 8:14 | 0.5          | 19.66        | 7.68         | 180                 | 115           | 7.3                                     | 80 | 388         |               |
|      |          | 8:15 | 1.0          | 19.67        | 7.65         | 180                 | 115           | 7.0                                     | 76 | 391         |               |
|      |          | 8:16 | 1.5          | 19.67        | 7.64         | 180                 | 115           | 6.8                                     | 75 | 394         |               |
|      |          | 8:17 | 2.0          | 19.66        | 7.61         | 180                 | 115           | 6.6                                     | 72 | 391         |               |
|      |          | 8:18 | 2.5          | 19.66        | 7.07         | 179                 | 114           | 1.2                                     | 13 | 163         |               |
|      |          | 8:19 | 2.8          | 19.73        | 7.08         | 176                 | 113           | 1.1                                     | 12 | 147         |               |
| 2    | 12/22/11 | 8:30 | 0.25         | 19.59        | 7.53         | 183                 | 117           | 7.6                                     | 83 | 300         | 0.45          |
|      |          | 8:30 | 0.5          | 19.59        | 7.52         | 183                 | 117           | 6.7                                     | 73 | 304         |               |
|      |          | 8:31 | 1.0          | 19.58        | 7.49         | 183                 | 117           | 6.2                                     | 67 | 309         |               |
|      |          | 8:33 | 1.4          | 19.56        | 7.34         | 182                 | 116           | 3.9                                     | 43 | 246         |               |
| 3    | 12/22/11 | 8:48 | 0.25         | 19.43        | 7.49         | 181                 | 116           | 7.6                                     | 82 | 333         | 0.46          |
|      |          | 8:49 | 0.5          | 19.43        | 7.47         | 181                 | 116           | 6.8                                     | 74 | 334         |               |
|      |          | 8:49 | 1.0          | 19.43        | 7.46         | 182                 | 116           | 6.3                                     | 69 | 336         |               |
|      |          | 8:50 | 1.5          | 19.42        | 7.46         | 182                 | 116           | 6.0                                     | 66 | 338         |               |
|      |          | 8:51 | 2.0          | 19.40        | 7.44         | 182                 | 116           | 5.8                                     | 63 | 338         |               |
|      |          | 8:52 | 2.5          | 19.38        | 7.45         | 181                 | 116           | 5.7                                     | 62 | 340         |               |
|      |          | 8:53 | 3.0          | 19.37        | 7.47         | 182                 | 116           | 5.8                                     | 63 | 343         |               |
|      |          | 8:54 | 3.5          | 19.36        | 7.46         | 182                 | 116           | 5.7                                     | 62 | 344         |               |
|      |          | 8:55 | 4.0          | 19.36        | 7.43         | 182                 | 116           | 5.3                                     | 58 | 343         |               |
|      |          | 8:56 | 4.5          | 19.36        | 7.40         | 182                 | 116           | 5.3                                     | 57 | 342         |               |
|      |          | 8:57 | 5.0          | 19.32        | 7.37         | 183                 | 117           | 5.0                                     | 54 | 340         |               |
|      |          | 8:59 | 5.5          | 19.17        | 7.19         | 186                 | 119           | 2.5                                     | 27 | 225         |               |
| 4    | 12/22/11 | 9:10 | 0.25         | 19.40        | 7.51         | 180                 | 115           | 7.3                                     | 80 | 326         | 0.42          |
|      |          | 9:11 | 0.5          | 19.33        | 7.46         | 181                 | 116           | 6.6                                     | 72 | 327         |               |
|      |          | 9:12 | 1.0          | 19.21        | 7.42         | 181                 | 116           | 6.1                                     | 66 | 326         |               |
|      |          | 9:12 | 1.5          | 19.17        | 7.40         | 181                 | 116           | 5.5                                     | 59 | 328         |               |
|      |          | 9:13 | 2.0          | 19.14        | 7.39         | 181                 | 116           | 5.3                                     | 58 | 329         |               |
|      |          | 9:15 | 2.5          | 19.13        | 7.40         | 182                 | 116           | 5.3                                     | 57 | 332         |               |
|      |          | 9:17 | 3.0          | 19.08        | 7.27         | 182                 | 116           | 4.5                                     | 49 | 198         |               |

## Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date    | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l)    (% Sat.) | ORP<br>(mV) | Secchi<br>(m) |
|------|---------|-------|--------------|--------------|--------------|---------------------|---------------|--------------------------------------------|-------------|---------------|
| 1    | 1/17/12 | 9:33  | 0.25         | 15.14        | 7.57         | 187                 | 120           | 8.4     83                                 | 440         | 0.74          |
|      |         | 9:34  | 0.5          | 15.09        | 7.53         | 188                 | 120           | 8.1     80                                 | 438         |               |
|      |         | 9:35  | 1.0          | 14.99        | 7.50         | 188                 | 120           | 7.7     77                                 | 435         |               |
|      |         | 9:36  | 1.5          | 14.89        | 7.45         | 188                 | 120           | 7.3     72                                 | 430         |               |
|      |         | 9:38  | 1.7          | 14.95        | 7.14         | 183                 | 117           | 3.5     34                                 | 145         |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |
| 2    | 1/17/12 | 9:49  | 0.25         | 14.82        | 7.57         | 188                 | 120           | 7.9     78                                 | 362         | 0.73          |
|      |         | 9:50  | 0.5          | 14.71        | 7.53         | 189                 | 121           | 7.7     76                                 | 362         |               |
|      |         | 9:52  | 1.0          | 14.58        | 7.47         | 189                 | 121           | 7.3     72                                 | 361         |               |
|      |         | 9:53  | 1.3          | 14.57        | 7.43         | 189                 | 121           | 7.0     69                                 | 312         |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |
| 3    | 1/17/12 | 10:09 | 0.25         | 15.44        | 7.60         | 187                 | 120           | 8.4     84                                 | 368         | 0.89          |
|      |         | 10:10 | 0.5          | 15.39        | 7.56         | 188                 | 120           | 8.3     83                                 | 368         |               |
|      |         | 10:10 | 1.0          | 15.22        | 7.54         | 188                 | 120           | 8.1     81                                 | 369         |               |
|      |         | 10:11 | 1.5          | 15.20        | 7.53         | 188                 | 120           | 7.9     79                                 | 369         |               |
|      |         | 10:12 | 2.0          | 15.15        | 7.52         | 188                 | 120           | 7.9     79                                 | 370         |               |
|      |         | 10:13 | 2.5          | 15.15        | 7.51         | 188                 | 120           | 7.8     77                                 | 370         |               |
|      |         | 10:14 | 3.0          | 15.10        | 7.49         | 188                 | 120           | 7.7     77                                 | 369         |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |
| 4    | 1/17/12 | 10:18 | 3.1          | 15.10        | 7.44         | 188                 | 120           | 4.2     42                                 | 276         | 0.62          |
|      |         | 10:31 | 0.25         | 15.78        | 7.59         | 188                 | 120           | 8.5     86                                 | 355         |               |
|      |         | 10:32 | 0.5          | 15.74        | 7.56         | 188                 | 121           | 8.2     82                                 | 355         |               |
|      |         | 10:33 | 1.0          | 15.39        | 7.50         | 188                 | 120           | 7.8     78                                 | 355         |               |
|      |         | 10:34 | 1.5          | 15.34        | 7.52         | 188                 | 120           | 8.0     79                                 | 360         |               |
|      |         | 10:35 | 2.0          | 15.31        | 7.48         | 188                 | 120           | 7.6     76                                 | 360         |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |
|      |         |       |              |              |              |                     |               |                                            |             |               |

# Vertical Field Profiles Collected in Lake Lawne from March 2011 - February 2012

| Site | Date    | Time  | Depth<br>(m) | Temp<br>(°C) | pH<br>(s.u.) | SpCond<br>(µmho/cm) | TDS<br>(mg/l) | Diss. O <sub>2</sub><br>(mg/l) (% Sat.) |     | ORP<br>(mV) | Secchi<br>(m) |
|------|---------|-------|--------------|--------------|--------------|---------------------|---------------|-----------------------------------------|-----|-------------|---------------|
| 1    | 2/20/12 | 10:51 | 0.25         | 20.20        | 7.67         | 195                 | 125           | 10.6                                    | 117 | 335         | 0.81          |
|      |         | 10:52 | 0.5          | 20.14        | 7.65         | 195                 | 125           | 10.5                                    | 116 | 335         |               |
|      |         | 10:53 | 1.0          | 20.11        | 7.63         | 196                 | 125           | 10.2                                    | 113 | 336         |               |
|      |         | 10:54 | 1.5          | 20.08        | 7.63         | 195                 | 125           | 9.8                                     | 107 | 337         |               |
|      |         | 10:55 | 2.0          | 19.97        | 7.60         | 195                 | 125           | 9.2                                     | 102 | 336         |               |
|      |         | 10:57 | 2.3          | 20.03        | 6.92         | 208                 | 133           | 3.2                                     | 35  | 64          |               |
| 2    | 2/20/12 | 11:09 | 0.25         | 20.18        | 7.68         | 197                 | 126           | 7.3                                     | 81  | 271         | 0.80          |
|      |         | 11:10 | 0.5          | 19.85        | 7.66         | 197                 | 126           | 7.1                                     | 78  | 276         |               |
|      |         | 11:11 | 1.0          | 19.73        | 7.64         | 196                 | 126           | 7.2                                     | 78  | 281         |               |
|      |         | 11:13 | 1.3          | 19.75        | 7.13         | 199                 | 127           | 2.9                                     | 32  | 63          |               |
| 3    | 2/20/12 | 11:26 | 0.25         | 19.77        | 7.63         | 196                 | 126           | 7.1                                     | 78  | 260         | 0.84          |
|      |         | 11:27 | 0.5          | 19.77        | 7.57         | 196                 | 126           | 6.9                                     | 76  | 265         |               |
|      |         | 11:28 | 1.0          | 19.75        | 7.56         | 196                 | 126           | 7.0                                     | 77  | 269         |               |
|      |         | 11:29 | 1.5          | 19.72        | 7.56         | 196                 | 125           | 6.9                                     | 75  | 272         |               |
|      |         | 11:30 | 2.0          | 19.64        | 7.54         | 196                 | 125           | 6.8                                     | 75  | 274         |               |
|      |         | 11:31 | 2.5          | 19.56        | 7.53         | 196                 | 126           | 6.8                                     | 74  | 277         |               |
|      |         | 11:32 | 3.0          | 19.49        | 7.49         | 196                 | 125           | 6.5                                     | 71  | 275         |               |
|      |         | 11:34 | 3.5          | 19.25        | 7.40         | 196                 | 125           | 5.9                                     | 64  | 266         |               |
| 4    | 2/20/12 | 11:46 | 0.25         | 19.86        | 7.60         | 196                 | 126           | 7.2                                     | 79  | 283         | 0.83          |
|      |         | 11:47 | 0.5          | 19.75        | 7.57         | 197                 | 126           | 7.0                                     | 77  | 285         |               |
|      |         | 11:48 | 1.0          | 19.67        | 7.56         | 197                 | 126           | 7.1                                     | 77  | 288         |               |
|      |         | 11:49 | 1.5          | 19.64        | 7.56         | 196                 | 126           | 7.0                                     | 77  | 292         |               |
|      |         | 11:50 | 2.0          | 19.49        | 7.54         | 196                 | 125           | 6.9                                     | 75  | 293         |               |
|      |         | 11:51 | 2.5          | 19.05        | 7.37         | 197                 | 126           | 5.8                                     | 62  | 283         |               |
|      |         | 11:52 | 3.0          | 18.63        | 7.21         | 198                 | 126           | 4.4                                     | 47  | 272         |               |
|      |         | 11:53 | 3.3          | 18.60        | 7.13         | 200                 | 128           | 2.2                                     | 24  | 107         |               |

## **B.2 Characteristics of Surface Water Samples**



# Characteristics of Surface Water Samples Collected in Lake Lawne from March 2011 - February 2012

| Site | Depth           | Date Collected | pH (s.u.) | Alkalinity (mg/l) | NH3 (µg/l) | NOX (µg/l) | Diss. Org. N (µg/l) | Part. N (µg/l) | Total N (µg/l) | SRP (µg/l) | Diss. Org. P (µg/l) | Part. P (µg/l) | Total P (µg/l) | Turbidity (NTU) | Color (Pt-Co) | Chyl- a (mg/m³) |
|------|-----------------|----------------|-----------|-------------------|------------|------------|---------------------|----------------|----------------|------------|---------------------|----------------|----------------|-----------------|---------------|-----------------|
| 1    | Surface         | 3/21/11        | 6.84      | 68.0              | 10         | 5          | 200                 | 250            | 465            | 1          | 4                   | 29             | 34             | 3.0             | 47            | 6.1             |
| 1    | Surface         | 4/26/11        | 7.15      | 70.2              | 79         | 5          | 299                 | 918            | 1,301          | 1          | 6                   | 60             | 67             | 8.3             | 66            | 23.2            |
| 1    | Surface         | 5/25/11        | 7.04      | 68.2              | 125        | 1          | 122                 | 431            | 679            | 2          | 6                   | 47             | 55             | 5.8             | 54            | 11.7            |
| 1    | Surface         | 6/22/11        | 7.19      | 66.6              | 21         | 29         | 121                 | 1,068          | 1,239          | 1          | 3                   | 82             | 86             | 8.3             | 52            | 74.6            |
| 1    | Surface         | 7/21/11        | 7.14      | 64.8              | 229        | 5          | 279                 | 486            | 999            | 1          | 4                   | 56             | 61             | 6.6             | 58            | 44.5            |
| 1    | Surface         | 8/26/11        | 6.49      | 58.2              | 128        | 5          | 752                 | 279            | 1,164          | 1          | 10                  | 58             | 69             | 7.0             | 76            | 20.7            |
| 1    | Surface         | 9/30/11        | 7.17      | 65.6              | 28         | 5          | 546                 | 455            | 1,034          | 1          | 16                  | 44             | 61             | 4.7             | 62            | 26.8            |
| 1    | Surface         | 10/24/11       | 7.06      | 65.8              | 12         | 5          | 422                 | 290            | 729            | 1          | 7                   | 32             | 40             | 4.5             | 91            | 21.1            |
| 1    | Surface         | 11/22/11       | 7.25      | 67.4              | 6          | 6          | 150                 | 341            | 503            | 1          | 4                   | 12             | 17             | 4.8             | 88            | 41.2            |
| 1    | Surface         | 12/22/11       | 7.07      | 67.6              | 21         | 5          | 488                 | 198            | 712            | 3          | 5                   | 18             | 26             | 4.7             | 74            | 18.8            |
| 1    | Surface         | 1/17/12        | 7.31      | 68.6              | 14         | 31         | 512                 | 179            | 736            | 1          | 2                   | 28             | 31             | 3.1             | 63            | 19.7            |
| 1    | Surface         | 2/20/12        | 7.05      | 65.6              | 10         | 3          | 497                 | 164            | 674            | 1          | 14                  | 36             | 51             | 4.4             | 59            | 13.7            |
|      |                 |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                 |
|      | Minimum Value:  |                | 6.49      | 58.2              | 6          | 1          | 121                 | 164            | 465            | 1          | 2                   | 12             | 17             | 3.0             | 47            | 6.1             |
|      | Maximum Value:  |                | 7.31      | 70.2              | 229        | 31         | 752                 | 1,068          | 1,301          | 3          | 16                  | 82             | 86             | 8.3             | 91            | 74.6            |
|      | Median Value:   |                | 7.11      | 67.0              | 21         | 5          | 361                 | 316            | 733            | 1          | 6                   | 40             | 53             | 4.8             | 63            | 20.9            |
|      | Geometric Mean: |                | 7.06      | 66.3              | 29         | 6          | 310                 | 353            | 810            | 1          | 6                   | 37             | 45             | 5.2             | 65            | 22.1            |
|      |                 |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                 |
| 1    | Bottom          | 3/21/11        | 6.80      | 70.2              | 3          | 3          | 309                 | 352            | 667            | 2          | 3                   | 34             | 39             | 3.1             | 46            | 19.8            |
| 1    | Bottom          | 4/26/11        | 7.33      | 63.8              | 76         | 5          | 531                 | 722            | 1,334          | 2          | 6                   | 59             | 67             | 8.6             | 66            | 39.7            |
| 1    | Bottom          | 5/25/11        | 7.18      | 66.4              | 125        | 3          | 483                 | 560            | 1,171          | 3          | 8                   | 57             | 68             | 5.2             | 51            | 19.0            |
| 1    | Bottom          | 6/22/11        | 7.10      | 71.0              | 20         | 17         | 380                 | 701            | 1,118          | 1          | 7                   | 72             | 80             | 7.1             | 50            | 55.7            |
| 1    | Bottom          | 7/21/11        | 6.78      | 60.2              | 105        | 3          | 378                 | 719            | 1,205          | 2          | 6                   | 69             | 77             | 8.3             | 57            | 32.8            |
| 1    | Bottom          | 8/26/11        | 6.61      | 62.2              | 115        | 3          | 612                 | 474            | 1,204          | 2          | 2                   | 56             | 60             | 27.5            | 76            | 39.7            |
| 1    | Bottom          | 9/30/11        | 7.14      | 60.6              | 32         | 1          | 658                 | 450            | 1,141          | 1          | 17                  | 53             | 71             | 6.8             | 62            | 50.8            |
| 1    | Bottom          | 10/24/11       | 6.98      | 64.8              | 15         | 4          | 431                 | 309            | 759            | 1          | 3                   | 38             | 42             | 4.8             | 89            | 16.0            |
| 1    | Bottom          | 11/22/11       | 7.14      | 62.2              | 24         | 4          | 460                 | 291            | 779            | 1          | 1                   | 31             | 33             | 4.7             | 88            | 37.7            |
| 1    | Bottom          | 12/22/11       | 7.11      | 62.4              | 6          | 3          | 429                 | 276            | 714            | 1          | 3                   | 41             | 45             | 5.4             | 72            | 27.0            |
| 1    | Bottom          | 1/17/12        | 7.13      | 68.2              | 23         | 31         | 505                 | 199            | 758            | 1          | 4                   | 29             | 34             | 3.1             | 63            | 15.8            |
| 1    | Bottom          | 2/20/12        | 7.11      | 64.2              | 15         | 3          | 498                 | 229            | 745            | 2          | 14                  | 31             | 47             | 4.1             | 59            | 8.2             |
|      |                 |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                 |
|      | Minimum Value:  |                | 6.61      | 60.2              | 3          | 1          | 309                 | 199            | 667            | 1          | 1                   | 29             | 33             | 3.1             | 46            | 8.2             |
|      | Maximum Value:  |                | 7.33      | 71.0              | 125        | 31         | 658                 | 722            | 1,334          | 3          | 17                  | 72             | 80             | 27.5            | 89            | 55.7            |
|      | Median Value:   |                | 7.11      | 64.0              | 24         | 3          | 472                 | 401            | 949            | 2          | 5                   | 47             | 54             | 5.3             | 63            | 29.9            |
|      | Geometric Mean: |                | 7.03      | 64.6              | 27         | 4          | 463                 | 401            | 937            | 1          | 5                   | 45             | 53             | 6.0             | 64            | 26.4            |
|      |                 |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                 |

Characteristics of Surface Water Samples Collected in Lake Lawne from March 2011 - February 2012

| Site            | Depth   | Date Collected | pH (s.u.) | Alkalinity (mg/l) | NH3 (µg/l) | NOX (µg/l) | Diss. Org. N (µg/l) | Part. N (µg/l) | Total N (µg/l) | SRP (µg/l) | Diss. Org. P (µg/l) | Part. P (µg/l) | Total P (µg/l) | Turbidity (NTU) | Color (Pt-Co) | Chyl- a (mg/m <sup>3</sup> ) |
|-----------------|---------|----------------|-----------|-------------------|------------|------------|---------------------|----------------|----------------|------------|---------------------|----------------|----------------|-----------------|---------------|------------------------------|
| 2               | Surface | 3/21/11        | 6.84      | 69.8              | 78         | 3          | 311                 | 208            | 600            | 2          | 4                   | 42             | 48             | 3.8             | 47            | 11.5                         |
| 2               | Surface | 4/26/11        | 6.74      | 63.2              | 309        | 3          | 218                 | 441            | 971            | 2          | 5                   | 88             | 95             | 13.5            | 76            | 82.5                         |
| 2               | Surface | 5/25/11        | 7.16      | 69.4              | 125        | 3          | 869                 | 197            | 1,194          | 4          | 7                   | 42             | 53             | 4.1             | 53            | 14.6                         |
| 2               | Surface | 6/22/11        | 7.30      | 66.2              | 100        | 8          | 591                 | 683            | 1,382          | 1          | 1                   | 73             | 75             | 7.9             | 50            | 41.8                         |
| 2               | Surface | 7/21/11        | 6.88      | 55.2              | 105        | 3          | 197                 | 996            | 1,301          | 3          | 3                   | 69             | 75             | 7.2             | 77            | 45.7                         |
| 2               | Surface | 8/26/11        | 6.69      | 63.4              | 52         | 1          | 639                 | 506            | 1,198          | 2          | 1                   | 53             | 56             | 8.3             | 91            | 10.5                         |
| 2               | Surface | 9/30/11        | 6.96      | 59.6              | 10         | 3          | 628                 | 311            | 952            | 1          | 17                  | 43             | 61             | 4.2             | 65            | 28.9                         |
| 2               | Surface | 10/24/11       | 6.92      | 61.2              | 17         | 13         | 504                 | 247            | 781            | 1          | 3                   | 40             | 44             | 4.9             | 135           | 24.8                         |
| 2               | Surface | 11/22/11       | 7.18      | 66.4              | 9          | 3          | 339                 | 459            | 810            | 1          | 1                   | 33             | 35             | 3.8             | 88            | 28.7                         |
| 2               | Surface | 12/22/11       | 6.87      | 67.6              | 25         | 3          | 710                 | 135            | 873            | 5          | 1                   | 74             | 80             | 19.2            | 78            | 27.7                         |
| 2               | Surface | 1/17/12        | 7.11      | 67.4              | 17         | 29         | 688                 | 166            | 900            | 1          | 3                   | 27             | 31             | 3.4             | 65            | 28.9                         |
| 2               | Surface | 2/20/12        | 7.16      | 65.8              | 3          | 3          | 480                 | 253            | 739            | 2          | 16                  | 37             | 55             | 3.8             | 60            | 9.6                          |
|                 |         |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
| Minimum Value:  |         |                | 6.69      | 55.2              | 3          | 1          | 197                 | 135            | 600            | 1          | 1                   | 27             | 31             | 3.4             | 47            | 9.6                          |
| Maximum Value:  |         |                | 7.30      | 69.8              | 309        | 29         | 869                 | 996            | 1,382          | 5          | 17                  | 88             | 95             | 19.2            | 135           | 82.5                         |
| Median Value:   |         |                | 6.94      | 66.0              | 39         | 3          | 548                 | 282            | 926            | 2          | 3                   | 43             | 56             | 4.6             | 71            | 28.2                         |
| Geometric Mean: |         |                | 6.98      | 64.5              | 35         | 4          | 468                 | 322            | 948            | 2          | 3                   | 49             | 56             | 5.9             | 71            | 24.4                         |
|                 |         |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
| 2               | Bottom  | 3/21/11        | 6.83      | 68.8              | 82         | 3          | 584                 | 280            | 949            | 2          | 2                   | 53             | 57             | 5.6             | 46            | 15.5                         |
| 2               | Bottom  | 4/26/11        | 6.84      | 63.4              | 96         | 3          | 570                 | 463            | 1,132          | 2          | 9                   | 69             | 80             | 9.5             | 82            | 37.3                         |
| 2               | Bottom  | 5/25/11        | 7.13      | 68.4              | 124        | 3          | 559                 | 129            | 815            | 4          | 10                  | 57             | 71             | 11.1            | 54            | 20.7                         |
| 2               | Bottom  | 6/22/11        | 7.06      | 69.0              | 93         | 2          | 558                 | 724            | 1,377          | 1          | 12                  | 84             | 97             | 7.7             | 50            | 18.0                         |
| 2               | Bottom  | 7/21/11        | 6.99      | 57.4              | 76         | 2          | 427                 | 501            | 1,006          | 3          | 2                   | 66             | 71             | 7.6             | 65            | 41.6                         |
| 2               | Bottom  | 8/26/11        | 6.71      | 57.6              | 27         | 3          | 743                 | 352            | 1,125          | 3          | 3                   | 51             | 57             | 4.9             | 94            | 28.3                         |
| 2               | Bottom  | 9/30/11        | 7.08      | 66.2              | 17         | 3          | 534                 | 218            | 772            | 1          | 16                  | 44             | 61             | 4.2             | 64            | 31.1                         |
| 2               | Bottom  | 10/24/11       | 6.81      | 55.8              | 16         | 45         | 516                 | 285            | 862            | 1          | 1                   | 41             | 43             | 4.3             | 185           | 32.2                         |
| 2               | Bottom  | 11/22/11       | 7.25      | 60.6              | 9          | 14         | 594                 | 970            | 1,587          | 6          | 2                   | 38             | 46             | 3.8             | 89            | 51.8                         |
| 2               | Bottom  | 12/22/11       | 7.03      | 59.8              | 22         | 3          | 798                 | 182            | 1,005          | 2          | 1                   | 80             | 83             | 12.7            | 74            | 25.0                         |
| 2               | Bottom  | 1/17/12        | 7.19      | 65.6              | 11         | 29         | 609                 | 170            | 819            | 1          | 5                   | 26             | 32             | 3.7             | 65            | 22.9                         |
| 2               | Bottom  | 2/20/12        | 7.24      | 66.0              | 11         | 3          | 503                 | 159            | 676            | 2          | 14                  | 30             | 46             | 4.1             | 62            | 24.4                         |
|                 |         |                |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
| Minimum Value:  |         |                | 6.71      | 55.8              | 9          | 2          | 427                 | 129            | 676            | 1          | 1                   | 26             | 32             | 3.7             | 46            | 15.5                         |
| Maximum Value:  |         |                | 7.25      | 69.0              | 124        | 45         | 798                 | 970            | 1,587          | 6          | 16                  | 84             | 97             | 12.7            | 185           | 51.8                         |
| Median Value:   |         |                | 7.05      | 64.5              | 25         | 3          | 565                 | 283            | 977            | 2          | 4                   | 52             | 59             | 5.3             | 65            | 26.7                         |
| Geometric Mean: |         |                | 7.01      | 63.0              | 32         | 5          | 575                 | 304            | 982            | 2          | 4                   | 50             | 59             | 6.0             | 72            | 27.5                         |

Characteristics of Surface Water Samples Collected in Lake Lawne from March 2011 - February 2012

| Site | Depth   | Date Collected  | pH (s.u.) | Alkalinity (mg/l) | NH3 (µg/l) | NOX (µg/l) | Diss. Org. N (µg/l) | Part. N (µg/l) | Total N (µg/l) | SRP (µg/l) | Diss. Org. P (µg/l) | Part. P (µg/l) | Total P (µg/l) | Turbidity (NTU) | Color (Pt-Co) | Chyl- a (mg/m <sup>3</sup> ) |
|------|---------|-----------------|-----------|-------------------|------------|------------|---------------------|----------------|----------------|------------|---------------------|----------------|----------------|-----------------|---------------|------------------------------|
| 3    | Surface | 3/21/11         | 7.02      | 69.4              | 69         | 3          | 436                 | 82             | 590            | 1          | 3                   | 23             | 27             | 2.6             | 46            | 8.6                          |
| 3    | Surface | 4/26/11         | 6.95      | 64.0              | 27         | 3          | 568                 | 110            | 708            | 3          | 1                   | 63             | 67             | 7.4             | 67            | 56.1                         |
| 3    | Surface | 5/25/11         | 7.35      | 67.0              | 103        | 3          | 622                 | 151            | 879            | 2          | 7                   | 45             | 54             | 4.2             | 54            | 19.2                         |
| 3    | Surface | 6/22/11         | 7.11      | 68.8              | 98         | 2          | 712                 | 429            | 1,241          | 1          | 12                  | 69             | 82             | 6.5             | 38            | 49.0                         |
| 3    | Surface | 7/21/11         | 7.22      | 61.8              | 101        | 3          | 404                 | 408            | 916            | 3          | 3                   | 57             | 63             | 7.4             | 57            | 42.2                         |
| 3    | Surface | 8/26/11         | 6.96      | 70.8              | 30         | 3          | 622                 | 356            | 1,011          | 1          | 1                   | 48             | 50             | 8.9             | 75            | 42.0                         |
| 3    | Surface | 9/30/11         | 6.94      | 59.8              | 21         | 3          | 478                 | 511            | 1,013          | 1          | 17                  | 42             | 60             | 4.0             | 64            | 26.4                         |
| 3    | Surface | 10/24/11        | 7.01      | 60.2              | 25         | 6          | 417                 | 429            | 877            | 2          | 11                  | 37             | 50             | 4.0             | 101           | 35.6                         |
| 3    | Surface | 11/22/11        | 7.08      | 63.4              | 13         | 3          | 626                 | 467            | 1,109          | 2          | 12                  | 43             | 57             | 4.1             | 91            | 41.4                         |
| 3    | Surface | 12/22/11        | 6.91      | 68.4              | 18         | 11         | 421                 | 258            | 708            | 2          | 13                  | 38             | 53             | 4.1             | 72            | 22.5                         |
| 3    | Surface | 1/17/12         | 7.26      | 68.4              | 17         | 12         | 414                 | 317            | 760            | 1          | 6                   | 25             | 32             | 2.9             | 65            | 29.9                         |
| 3    | Surface | 2/20/12         | 7.21      | 64.8              | 10         | 3          | 458                 | 333            | 804            | 2          | 5                   | 34             | 41             | 2.8             | 62            | 20.1                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
|      |         | Minimum Value:  | 6.91      | 59.8              | 10         | 2          | 404                 | 82             | 590            | 1          | 1                   | 23             | 27             | 2.6             | 38            | 8.6                          |
|      |         | Maximum Value:  | 7.35      | 70.8              | 103        | 12         | 712                 | 511            | 1,241          | 3          | 17                  | 69             | 82             | 8.9             | 101           | 56.1                         |
|      |         | Median Value:   | 7.05      | 65.9              | 26         | 3          | 468                 | 345            | 878            | 2          | 7                   | 43             | 54             | 4.1             | 65            | 32.8                         |
|      |         | Geometric Mean: | 7.08      | 65.5              | 32         | 4          | 505                 | 280            | 867            | 2          | 5                   | 42             | 51             | 4.5             | 64            | 29.4                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
| 3    | Bottom  | 3/21/11         | 7.07      | 69.4              | 80         | 3          | 400                 | 396            | 879            | 2          | 6                   | 30             | 38             | 3.3             | 46            | 15.3                         |
| 3    | Bottom  | 4/26/11         | 7.14      | 67.4              | 23         | 1          | 574                 | 539            | 1,137          | 4          | 12                  | 57             | 73             | 9.0             | 67            | 36.5                         |
| 3    | Bottom  | 5/25/11         | 7.21      | 70.4              | 136        | 3          | 411                 | 698            | 1,248          | 7          | 7                   | 44             | 58             | 4.4             | 54            | 16.2                         |
| 3    | Bottom  | 6/22/11         | 7.56      | 68.2              | 96         | 3          | 561                 | 718            | 1,378          | 6          | 6                   | 78             | 90             | 8.5             | 38            | 55.7                         |
| 3    | Bottom  | 7/21/11         | 6.77      | 59.0              | 109        | 1          | 459                 | 534            | 1,103          | 3          | 4                   | 64             | 71             | 6.6             | 60            | 62.9                         |
| 3    | Bottom  | 8/26/11         | 6.89      | 59.2              | 348        | 3          | 390                 | 704            | 1,445          | 2          | 2                   | 54             | 58             | 5.2             | 76            | 48.1                         |
| 3    | Bottom  | 9/30/11         | 6.68      | 65.4              | 29         | 1          | 180                 | 1,076          | 1,286          | 9          | 18                  | 94             | 121            | 7.7             | 74            | 27.2                         |
| 3    | Bottom  | 10/24/11        | 6.87      | 60.4              | 275        | 10         | 475                 | 279            | 1,039          | 2          | 3                   | 50             | 55             | 4.4             | 113           | 37.9                         |
| 3    | Bottom  | 11/22/11        | 6.87      | 64.0              | 37         | 7          | 663                 | 409            | 1,116          | 3          | 3                   | 55             | 61             | 7.4             | 94            | 42.0                         |
| 3    | Bottom  | 12/22/11        | 6.51      | 60.6              | 23         | 5          | 395                 | 646            | 1,069          | 4          | 2                   | 32             | 38             | 9.2             | 75            | 9.0                          |
| 3    | Bottom  | 1/17/12         | 7.16      | 66.4              | 23         | 24         | 220                 | 411            | 678            | 1          | 13                  | 20             | 34             | 2.6             | 66            | 19.9                         |
| 3    | Bottom  | 2/20/12         | 7.19      | 66.0              | 20         | 6          | 457                 | 310            | 793            | 3          | 8                   | 30             | 41             | 2.8             | 60            | 12.9                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
|      |         | Minimum Value:  | 6.51      | 59.0              | 20         | 1          | 180                 | 279            | 678            | 1          | 2                   | 20             | 34             | 2.6             | 38            | 9.0                          |
|      |         | Maximum Value:  | 7.56      | 70.4              | 348        | 24         | 663                 | 1,076          | 1,445          | 9          | 18                  | 94             | 121            | 9.2             | 113           | 62.9                         |
|      |         | Median Value:   | 6.98      | 65.7              | 59         | 3          | 434                 | 537            | 1,110          | 3          | 6                   | 52             | 58             | 5.9             | 67            | 31.9                         |
|      |         | Geometric Mean: | 6.99      | 64.6              | 61         | 4          | 408                 | 522            | 1,074          | 3          | 6                   | 46             | 57             | 5.4             | 66            | 27.0                         |

Characteristics of Surface Water Samples Collected in Lake Lawne from March 2011 - February 2012

| Site | Depth   | Date Collected  | pH (s.u.) | Alkalinity (mg/l) | NH3 (µg/l) | NOX (µg/l) | Diss. Org. N (µg/l) | Part. N (µg/l) | Total N (µg/l) | SRP (µg/l) | Diss. Org. P (µg/l) | Part. P (µg/l) | Total P (µg/l) | Turbidity (NTU) | Color (Pt-Co) | Chyl- a (mg/m <sup>3</sup> ) |
|------|---------|-----------------|-----------|-------------------|------------|------------|---------------------|----------------|----------------|------------|---------------------|----------------|----------------|-----------------|---------------|------------------------------|
| 4    | Surface | 3/21/11         | 7.09      | 68.0              | 84         | 3          | 140                 | 496            | 723            | 1          | 4                   | 29             | 34             | 3.0             | 47            | 7.7                          |
| 4    | Surface | 4/26/11         | 7.20      | 67.6              | 14         | 5          | 158                 | 467            | 644            | 1          | 7                   | 64             | 72             | 8.1             | 69            | 45.5                         |
| 4    | Surface | 5/25/11         | 7.00      | 72.6              | 66         | 3          | 103                 | 447            | 619            | 4          | 6                   | 53             | 63             | 4.1             | 53            | 24.9                         |
| 4    | Surface | 6/22/11         | 7.27      | 66.2              | 98         | 3          | 108                 | 763            | 972            | 6          | 6                   | 77             | 89             | 6.5             | 53            | 61.7                         |
| 4    | Surface | 7/21/11         | 6.95      | 59.8              | 62         | 3          | 132                 | 531            | 728            | 4          | 5                   | 62             | 71             | 7.1             | 59            | 50.4                         |
| 4    | Surface | 8/26/11         | 6.82      | 60.0              | 28         | 3          | 686                 | 561            | 1,278          | 1          | 2                   | 48             | 51             | 5.1             | 78            | 22.3                         |
| 4    | Surface | 9/30/11         | 7.06      | 61.2              | 26         | 1          | 526                 | 605            | 1,158          | 1          | 17                  | 44             | 62             | 3.9             | 65            | 21.1                         |
| 4    | Surface | 10/24/11        | 6.99      | 59.6              | 18         | 6          | 373                 | 679            | 1,076          | 1          | 4                   | 50             | 55             | 4.2             | 101           | 34.2                         |
| 4    | Surface | 11/22/11        | 7.28      | 61.0              | 10         | 3          | 789                 | 270            | 1,072          | 1          | 1                   | 22             | 24             | 4.2             | 92            | 53.3                         |
| 4    | Surface | 12/22/11        | 6.87      | 62.2              | 13         | 2          | 592                 | 361            | 968            | 2          | 2                   | 15             | 19             | 4.4             | 74            | 24.4                         |
| 4    | Surface | 1/17/12         | 7.27      | 67.4              | 14         | 7          | 426                 | 299            | 746            | 1          | 10                  | 19             | 30             | 3.5             | 68            | 35.6                         |
| 4    | Surface | 2/20/12         | 7.24      | 64.8              | 14         | 1          | 510                 | 161            | 686            | 3          | 14                  | 20             | 37             | 2.7             | 63            | 17.8                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
|      |         | Minimum Value:  | 6.82      | 59.6              | 10         | 1          | 103                 | 161            | 619            | 1          | 1                   | 15             | 19             | 2.7             | 47            | 7.7                          |
|      |         | Maximum Value:  | 7.28      | 72.6              | 98         | 7          | 789                 | 763            | 1,278          | 6          | 17                  | 77             | 89             | 8.1             | 101           | 61.7                         |
|      |         | Median Value:   | 7.08      | 63.5              | 22         | 3          | 400                 | 482            | 857            | 1          | 6                   | 46             | 53             | 4.2             | 67            | 29.6                         |
|      |         | Geometric Mean: | 7.08      | 64.1              | 27         | 3          | 296                 | 435            | 864            | 2          | 5                   | 37             | 46             | 4.5             | 67            | 29.0                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
| 4    | Bottom  | 3/21/11         | 7.29      | 68.4              | 117        | 3          | 207                 | 334            | 661            | 1          | 5                   | 29             | 35             | 3.6             | 48            | 11.9                         |
| 4    | Bottom  | 4/26/11         | 6.91      | 69.0              | 23         | 1          | 247                 | 448            | 719            | 2          | 6                   | 74             | 82             | 7.2             | 68            | 35.9                         |
| 4    | Bottom  | 5/25/11         | 6.85      | 69.6              | 117        | 3          | 106                 | 575            | 801            | 7          | 2                   | 69             | 78             | 7.5             | 54            | 24.7                         |
| 4    | Bottom  | 6/22/11         | 6.99      | 64.6              | 107        | 3          | 215                 | 420            | 745            | 1          | 1                   | 74             | 76             | 5.0             | 51            | 16.4                         |
| 4    | Bottom  | 7/21/11         | 6.82      | 62.4              | 107        | 3          | 257                 | 561            | 928            | 4          | 4                   | 96             | 104            | 14.3            | 59            | 62.5                         |
| 4    | Bottom  | 8/26/11         | 6.85      | 61.4              | 32         | 3          | 499                 | 517            | 1,051          | 3          | 3                   | 46             | 52             | 4.9             | 78            | 37.1                         |
| 4    | Bottom  | 9/30/11         | 6.80      | 64.2              | 37         | 2          | 359                 | 895            | 1,293          | 1          | 2                   | 85             | 88             | 9.3             | 65            | 34.8                         |
| 4    | Bottom  | 10/24/11        | 6.60      | 54.2              | 107        | 8          | 795                 | 380            | 1,290          | 1          | 4                   | 47             | 52             | 5.9             | 101           | 24.8                         |
| 4    | Bottom  | 11/22/11        | 7.34      | 62.6              | 27         | 9          | 722                 | 310            | 1,068          | 2          | 2                   | 37             | 41             | 5.8             | 91            | 51.2                         |
| 4    | Bottom  | 12/22/11        | 6.81      | 59.6              | 19         | 8          | 447                 | 241            | 715            | 1          | 2                   | 46             | 49             | 4.5             | 75            | 17.6                         |
| 4    | Bottom  | 1/17/12         | 7.15      | 64.2              | 23         | 13         | 418                 | 246            | 700            | 1          | 7                   | 25             | 33             | 3.2             | 68            | 10.7                         |
| 4    | Bottom  | 2/20/12         | 7.19      | 65.2              | 20         | 6          | 465                 | 388            | 879            | 4          | 15                  | 28             | 47             | 4.7             | 63            | 13.7                         |
|      |         |                 |           |                   |            |            |                     |                |                |            |                     |                |                |                 |               |                              |
|      |         | Minimum Value:  | 6.60      | 54.2              | 19         | 1          | 106                 | 241            | 661            | 1          | 1                   | 25             | 33             | 3.2             | 48            | 10.7                         |
|      |         | Maximum Value:  | 7.34      | 69.6              | 117        | 13         | 795                 | 895            | 1,293          | 7          | 15                  | 96             | 104            | 14.3            | 101           | 62.5                         |
|      |         | Median Value:   | 6.88      | 64.2              | 35         | 3          | 389                 | 404            | 840            | 2          | 4                   | 47             | 52             | 5.4             | 67            | 24.8                         |
|      |         | Geometric Mean: | 6.96      | 63.6              | 47         | 4          | 343                 | 414            | 880            | 2          | 3                   | 50             | 58             | 5.8             | 67            | 24.5                         |

## **APPENDIX C**

### **WATERSHED HYDROLOGIC MODEL FOR LAKE LAWNE**



Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin              | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.959      | 59.1      | 43.5                | 0.482          | 1.93                            | 0.80                           | 0.39                  | 0.00                   | 0.39                        | 0.20                     | 0.31                          | 0.00                        | 0.31                             | 0.10                         | 0.28                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 1.626      | 47.4      | 85.3                | 0.471          | 3.19                            | 0.80                           | 0.64                  | 0.00                   | 0.64                        | 0.20                     | 0.51                          | 0.00                        | 0.51                             | 0.10                         | 0.46                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.000      | 0.0       | 49.0                | 0.134          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 1.356      | 0.0       | 39.0                | 0.127          | 0.72                            | 0.00                           | 0.72                  | 0.00                   | 0.72                        | 0.20                     | 0.57                          | 0.00                        | 0.57                             | 0.10                         | 0.52                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.001      | 0.0       | 74.0                | 0.185          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 2.826      | 0.0       | 77.0                | 0.199          | 2.35                            | 0.00                           | 2.35                  | 0.00                   | 2.35                        | 0.20                     | 1.88                          | 0.00                        | 1.88                             | 0.10                         | 1.69                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | C/D                   | 2.045      | 0.0       | 77.0                | 0.199          | 1.70                            | 0.00                           | 1.70                  | 0.00                   | 1.70                        | 0.20                     | 1.36                          | 0.00                        | 1.36                             | 0.10                         | 1.22                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | MDR            | A/D                   | 0.996      | 20.0      | 57.4                | 0.183          | 0.76                            | 0.00                           | 0.76                  | 0.00                   | 0.76                        | 0.20                     | 0.61                          | 0.00                        | 0.61                             | 0.10                         | 0.55                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | MDR            | B/D                   | 0.238      | 20.0      | 72.6                | 0.217          | 0.21                            | 0.00                           | 0.21                  | 0.00                   | 0.21                        | 0.20                     | 0.17                          | 0.00                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | MDR            | C/D                   | 3.088      | 20.0      | 81.5                | 0.262          | 3.38                            | 0.00                           | 3.38                  | 0.00                   | 3.38                        | 0.20                     | 2.70                          | 0.00                        | 2.70                             | 0.10                         | 2.43                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | C/D                   | 1.339      | 0.0       | 84.0                | 0.249          | 1.39                            | 0.00                           | 1.39                  | 0.00                   | 1.39                        | 0.20                     | 1.11                          | 0.00                        | 1.11                             | 0.10                         | 1.00                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.493      | 0.0       | 49.9                | 0.134          | 0.28                            | 0.00                           | 0.28                  | 0.00                   | 0.28                        | 0.20                     | 0.22                          | 0.00                        | 0.22                             | 0.10                         | 0.20                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 7.974      | 0.0       | 95.0                | 0.464          | 15.44                           | 0.00                           | 15.44                 | 0.00                   | 15.44                       | 0.20                     | 12.35                         | 0.00                        | 12.35                            | 0.10                         | 11.12                       |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | None                      | None           | Wetland | None       | Pond       | Canal           | WATER          | W                     | 0.146      | 100.0     | 98.0                | 0.809          | 0.49                            | 0.00                           | 0.49                  | 0.00                   | 0.49                        | 0.20                     | 0.39                          | 0.00                        | 0.39                             | 0.10                         | 0.35                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 1.755      | 58.2      | 43.5                | 0.475          | 3.47                            | 0.20                           | 2.78                  | 0.00                   | 2.78                        | 0.20                     | 2.22                          | 0.00                        | 2.22                             | 0.10                         | 2.00                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 8.736      | 64.6      | 79.1                | 0.560          | 20.40                           | 0.20                           | 16.32                 | 0.00                   | 16.32                       | 0.20                     | 13.06                         | 0.00                        | 13.06                            | 0.10                         | 11.75                       |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.001      | 0.0       | 98.0                | 0.627          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Auto Transport Wetland | 01       | 01-01        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 0.828      | 100.0     | 98.0                | 0.809          | 2.79                            | 0.20                           | 2.23                  | 0.00                   | 2.23                        | 0.20                     | 1.79                          | 0.00                        | 1.79                             | 0.10                         | 1.61                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | INSTITUTIONAL  | A/D                   | 0.118      | 0.0       | 39.0                | 0.127          | 0.06                            | 0.80                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | OPEN           | A/D                   | 0.483      | 0.0       | 84.0                | 0.249          | 0.50                            | 0.80                           | 0.10                  | 0.00                   | 0.10                        | 0.00                     | 0.10                          | 0.00                        | 0.10                             | 0.10                         | 0.09                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | OPEN           | B/D                   | 0.441      | 0.0       | 84.0                | 0.249          | 0.46                            | 0.80                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.002      | 0.0       | 61.0                | 0.149          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.008      | 0.0       | 74.0                | 0.185          | 0.01                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | FOREST         | B/D                   | 0.156      | 0.0       | 77.0                | 0.199          | 0.13                            | 0.80                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.02                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | HDR            | A/D                   | 1.138      | 41.2      | 71.5                | 0.371          | 1.76                            | 0.80                           | 0.35                  | 0.00                   | 0.35                        | 0.00                     | 0.35                          | 0.00                        | 0.35                             | 0.10                         | 0.32                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | HDR            | B/D                   | 0.127      | 90.0      | 98.0                | 0.788          | 0.42                            | 0.80                           | 0.08                  | 0.00                   | 0.08                        | 0.00                     | 0.08                          | 0.00                        | 0.08                             | 0.10                         | 0.08                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | HDR            | C/D                   | 2.213      | 40.0      | 82.9                | 0.407          | 3.76                            | 0.80                           | 0.75                  | 0.00                   | 0.75                        | 0.00                     | 0.75                          | 0.00                        | 0.75                             | 0.10                         | 0.68                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 3.045      | 67.5      | 52.6                | 0.552          | 7.01                            | 0.80                           | 1.40                  | 0.00                   | 1.40                        | 0.00                     | 1.40                          | 0.00                        | 1.40                             | 0.10                         | 1.26                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 1.832      | 27.8      | 46.8                | 0.234          | 1.79                            | 0.80                           | 0.36                  | 0.00                   | 0.36                        | 0.00                     | 0.36                          | 0.00                        | 0.36                             | 0.10                         | 0.32                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.642      | 0.0       | 78.4                | 0.207          | 1.42                            | 0.80                           | 0.28                  | 0.00                   | 0.28                        | 0.00                     | 0.28                          | 0.00                        | 0.28                             | 0.10                         | 0.26                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | B/D                   | 0.008      | 0.0       | 61.0                | 0.149          | 0.01                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 4.493      | 20.0      | 81.5                | 0.262          | 4.91                            | 0.80                           | 0.98                  | 0.00                   | 0.98                        | 0.00                     | 0.98                          | 0.00                        | 0.98                             | 0.10                         | 0.88                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.651      | 0.0       | 84.0                | 0.249          | 0.68                            | 0.80                           | 0.14                  | 0.00                   | 0.14                        | 0.00                     | 0.14                          | 0.00                        | 0.14                             | 0.10                         | 0.12                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | B/D                   | 1.110      | 0.0       | 84.0                | 0.249          | 1.15                            | 0.80                           | 0.23                  | 0.00                   | 0.23                        | 0.00                     | 0.23                          | 0.00                        | 0.23                             | 0.10                         | 0.21                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 0.578      | 0.0       | 84.0                | 0.249          | 0.60                            | 0.80                           | 0.12                  | 0.00                   | 0.12                        | 0.00                     | 0.12                          | 0.00                        | 0.12                             | 0.10                         | 0.11                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 3.082      | 60.6      | 57.8                | 0.501          | 6.44                            | 0.80                           | 1.29                  | 0.00                   | 1.29                        | 0.00                     | 1.29                          | 0.00                        | 1.29                             | 0.10                         | 1.16                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | B/D                   | 0.689      | 67.2      | 78.5                | 0.577          | 1.66                            | 0.80                           | 0.33                  | 0.00                   | 0.33                        | 0.00                     | 0.33                          | 0.00                        | 0.33                             | 0.10                         | 0.30                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 1.477      | 63.1      | 82.6                | 0.561          | 3.46                            | 0.80                           | 0.69                  | 0.00                   | 0.69                        | 0.00                     | 0.69                          | 0.00                        | 0.69                             | 0.10                         | 0.62                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Canal           | WETLAND        | A/D                   | 0.003      | 0.0       | 95.0                | 0.464          | 0.01                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | None           | None    | None       | None       | Direct          | TRANSPORTATION | C/D                   | 0.000      | 90.0      | 98.0                | 0.788          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.00                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A/D                   | 4.718      | 67.3      | 47.4                | 0.549          | 10.79                           | 0.80                           | 2.16                  | 0.25                   | 1.62                        | 0.00                     | 1.62                          | 0.00                        | 1.62                             | 0.10                         | 1.46                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | Canal      | Canal           | WATER          | W                     | 7.131      | 100.0     | 98.0                | 0.809          | 24.06                           | 0.00                           | 24.06                 | 0.00                   | 24.06                       | 0.00                     | 24.06                         | 0.00                        | 24.06                            | 0.10                         | 21.66                       |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | A                     | 0.211      | 0.0       | 39.0                | 0.127          | 0.11                            | 0.00                           | 0.11                  | 0.00                   | 0.11                        | 0.00                     | 0.11                          | 0.00                        | 0.11                             | 0.10                         | 0.10                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | A/D                   | 40.940     | 65.7      | 50.5                | 0.537          | 91.72                           | 0.00                           | 91.72                 | 0.00                   | 91.72                       | 0.00                     | 91.72                         | 0.00                        | 91.72                            | 0.10                         | 82.55                       |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.065      | 0.0       | 61.0                | 0.149          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A/D                   | 8.703      | 0.0       | 77.0                | 0.199          | 7.24                            | 0.00                           | 7.24                  | 0.00                   | 7.24                        | 0.00                     | 7.24                          | 0.00                        | 7.24                             | 0.10                         | 6.51                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | FOREST         | B/D                   | 0.543      | 0.0       | 77.0                | 0.199          | 0.45                            | 0.00                           | 0.45                  | 0.00                   | 0.45                        | 0.00                     | 0.45                          | 0.00                        | 0.45                             | 0.10                         | 0.41                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | GOLF COURSE    | A/D                   | 1.813      | 0.0       | 39.0                | 0.127          | 0.96                            | 0.00                           | 0.96                  | 0.00                   | 0.96                        | 0.00                     | 0.96                          | 0.00                        | 0.96                             | 0.10                         | 0.86                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | HDR            | A/D                   | 0.006      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | INDUSTRIAL     | A                     | 1.518      | 50.6      | 49.7                | 0.417          | 2.64                            | 0.00                           | 2.64                  | 0.00                   | 2.64                        | 0.00                     | 2.64                          | 0.00                        | 2.64                             | 0.10                         | 2.38                        |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 52.321     | 66.6      | 53.9                | 0.546          | 119.12                          | 0.00                           | 119.12                | 0.00                   | 119.12                      | 0.00                     | 119.12                        | 0.00                        | 119.12                           | 0.10                         | 107.21                      |
| Canal 1 | Canal 1                | 01       | 01-02        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 3.307      | 69.8      | 54.5                | 0.571          | 7.87                            | 0.00                           | 7.87                  | 0.00                   | 7.87                        | 0.00                     | 7.87                          | 0.00                        | 7.87                             | 0.10                         | 7.09                        |
| Canal 1 | Canal 1                | 01       | 01-          |                           |                |         |            |            |                 |                |                       |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                       | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|---------------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | HDR            | B/D                   | 1.988      | 24.3      | 73.1                | 0.250          | 2.08                            | 0.20                           | 1.66                  | 0.00                   | 1.66                        | 0.00                     | 1.66                          | 0.00                        | 1.66                             | 0.10                         | 1.49                        |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | INDUSTRIAL     | A                     | 0.018      | 85.0      | 98.0                | 0.777          | 0.06                            | 0.20                           | 0.05                  | 0.00                   | 0.05                        | 0.00                     | 0.05                          | 0.00                        | 0.05                             | 0.10                         | 0.04                        |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 21.534     | 71.3      | 59.4                | 0.586          | 52.59                           | 0.20                           | 42.07                 | 0.00                   | 42.07                       | 0.00                     | 42.07                         | 0.00                        | 42.07                            | 0.10                         | 37.87                       |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 1.769      | 52.8      | 46.3                | 0.433          | 3.19                            | 0.20                           | 2.55                  | 0.00                   | 2.55                        | 0.00                     | 2.55                          | 0.00                        | 2.55                             | 0.10                         | 2.30                        |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 10.143     | 0.0       | 84.0                | 0.249          | 10.52                           | 0.20                           | 8.42                  | 0.00                   | 8.42                        | 0.00                     | 8.42                          | 0.00                        | 8.42                             | 0.10                         | 7.58                        |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | None       | Canal           | OPEN           | B/D                   | 0.413      | 0.0       | 84.0                | 0.249          | 0.43                            | 0.20                           | 0.34                  | 0.00                   | 0.34                        | 0.00                     | 0.34                          | 0.00                        | 0.34                             | 0.10                         | 0.31                        |
| Canal 1 | Canal 1                         | 01       | 01-02        | Wet Pond                  | None           | None    | None       | Wet Pond   | Canal           | WATER          | W                     | 4.200      | 100.0     | 98.0                | 0.809          | 14.17                           | 0.20                           | 11.34                 | 0.00                   | 11.34                       | 0.00                     | 11.34                         | 0.00                        | 11.34                            | 0.10                         | 10.20                       |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | None    | Pond       | None       | Canal           | GOLF COURSE    | A                     | 1.960      | 0.0       | 39.0                | 0.127          | 1.04                            | 0.00                           | 1.04                  | 0.00                   | 1.04                        | 0.00                     | 1.04                          | 0.20                        | 0.83                             | 0.10                         | 0.75                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | None    | Pond       | None       | Canal           | GOLF COURSE    | A/D                   | 0.371      | 0.0       | 39.0                | 0.127          | 0.20                            | 0.00                           | 0.20                  | 0.00                   | 0.20                        | 0.00                     | 0.20                          | 0.20                        | 0.16                             | 0.10                         | 0.14                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | None       | None       | Canal           | GOLF COURSE    | A                     | 2.153      | 0.0       | 39.0                | 0.127          | 1.14                            | 0.00                           | 1.14                  | 0.00                   | 1.14                        | 0.20                     | 0.91                          | 0.00                        | 0.91                             | 0.10                         | 0.82                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | None       | None       | Canal           | GOLF COURSE    | A/D                   | 3.462      | 0.0       | 39.0                | 0.127          | 1.83                            | 0.00                           | 1.83                  | 0.00                   | 1.83                        | 0.20                     | 1.46                          | 0.00                        | 1.46                             | 0.10                         | 1.32                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | None       | None       | Canal           | HDR            | A/D                   | 0.051      | 3.6       | 41.7                | 0.128          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.20                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 27.833     | 0.0       | 95.0                | 0.464          | 53.90                           | 0.00                           | 53.90                 | 0.00                   | 53.90                       | 0.20                     | 43.12                         | 0.00                        | 43.12                            | 0.10                         | 38.81                       |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | Pond       | GC Pond    | Canal           | WATER          | W                     | 1.617      | 100.0     | 98.0                | 0.809          | 5.46                            | 0.00                           | 5.46                  | 0.00                   | 5.46                        | 0.20                     | 4.36                          | 0.20                        | 3.49                             | 0.10                         | 3.14                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | Pond       | None       | Canal           | GOLF COURSE    | A                     | 3.773      | 0.0       | 39.0                | 0.127          | 1.99                            | 0.00                           | 1.99                  | 0.00                   | 1.99                        | 0.20                     | 1.59                          | 0.20                        | 1.28                             | 0.10                         | 1.15                        |
| Canal 1 | Country Club of Orlando Wetland | 01       | 01-03        | None                      | None           | Wetland | Pond       | None       | Canal           | GOLF COURSE    | A/D                   | 2.641      | 0.0       | 39.0                | 0.127          | 1.40                            | 0.00                           | 1.40                  | 0.00                   | 1.40                        | 0.20                     | 1.12                          | 0.20                        | 0.89                             | 0.10                         | 0.80                        |
| Canal 1 | Courtesy Chevrolet Borrow Pit   | 01       | 01-04        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.025      | 0.0       | 82.2                | 0.234          | 0.02                            | 0.00                           | 0.02                  | 0.00                   | 0.02                        | 0.20                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.020      | 0.0       | 61.0                | 0.149          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.201      | 0.0       | 74.0                | 0.185          | 0.16                            | 0.00                           | 0.16                  | 0.00                   | 0.16                        | 0.20                     | 0.12                          | 0.00                        | 0.12                             | 0.10                         | 0.11                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | B/D                   | 0.001      | 0.0       | 77.0                | 0.199          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | C/D                   | 4.434      | 0.0       | 77.0                | 0.199          | 3.69                            | 0.00                           | 3.69                  | 0.00                   | 3.69                        | 0.20                     | 2.95                          | 0.00                        | 2.95                             | 0.10                         | 2.66                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | C/D                   | 0.435      | 0.0       | 84.0                | 0.249          | 0.45                            | 0.00                           | 0.45                  | 0.00                   | 0.45                        | 0.20                     | 0.36                          | 0.00                        | 0.36                             | 0.10                         | 0.33                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.081      | 0.0       | 49.0                | 0.134          | 0.05                            | 0.00                           | 0.05                  | 0.00                   | 0.05                        | 0.20                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.03                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.036      | 0.0       | 82.8                | 0.239          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.20                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 3.945      | 0.0       | 95.0                | 0.464          | 7.64                            | 0.00                           | 7.64                  | 0.00                   | 7.64                        | 0.20                     | 6.11                          | 0.00                        | 6.11                             | 0.10                         | 5.50                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | C/D                   | 2.965      | 0.0       | 95.0                | 0.464          | 5.74                            | 0.00                           | 5.74                  | 0.00                   | 5.74                        | 0.20                     | 4.59                          | 0.00                        | 4.59                             | 0.10                         | 4.13                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 0.492      | 0.0       | 77.0                | 0.199          | 0.41                            | 0.00                           | 0.41                  | 0.00                   | 0.41                        | 0.20                     | 0.33                          | 0.20                        | 0.26                             | 0.10                         | 0.24                        |
| Canal 1 | Dollar Tree Wetland             | 01       | 01-05        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | A/D                   | 0.134      | 0.0       | 95.0                | 0.464          | 0.26                            | 0.00                           | 0.26                  | 0.00                   | 0.26                        | 0.20                     | 0.21                          | 0.20                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | Elmo Dr. Wetland                | 01       | 01-06        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | A/D                   | 0.536      | 0.0       | 77.0                | 0.199          | 0.45                            | 0.00                           | 0.45                  | 0.00                   | 0.45                        | 0.20                     | 0.36                          | 0.20                        | 0.29                             | 0.10                         | 0.26                        |
| Canal 1 | Elmo Dr. Wetland                | 01       | 01-06        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 1.979      | 0.0       | 77.0                | 0.199          | 1.65                            | 0.00                           | 1.65                  | 0.00                   | 1.65                        | 0.20                     | 1.32                          | 0.20                        | 1.05                             | 0.10                         | 0.95                        |
| Canal 1 | Elmo Dr. Wetland                | 01       | 01-06        | None                      | None           | Wetland | Pond       | None       | Canal           | MDR            | C/D                   | 0.286      | 0.0       | 84.8                | 0.256          | 0.30                            | 0.00                           | 0.30                  | 0.00                   | 0.30                        | 0.20                     | 0.24                          | 0.20                        | 0.20                             | 0.10                         | 0.18                        |
| Canal 1 | Elmo Dr. Wetland                | 01       | 01-06        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | A/D                   | 0.387      | 0.0       | 95.0                | 0.464          | 0.75                            | 0.00                           | 0.75                  | 0.00                   | 0.75                        | 0.20                     | 0.60                          | 0.20                        | 0.48                             | 0.10                         | 0.43                        |
| Canal 1 | Elmo Dr. Wetland                | 01       | 01-06        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | C/D                   | 0.107      | 0.0       | 95.0                | 0.464          | 0.21                            | 0.00                           | 0.21                  | 0.00                   | 0.21                        | 0.20                     | 0.17                          | 0.20                        | 0.13                             | 0.10                         | 0.12                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | GOLF COURSE    | A                     | 2.780      | 0.0       | 39.0                | 0.127          | 1.47                            | 0.00                           | 1.47                  | 0.00                   | 1.47                        | 0.00                     | 1.47                          | 0.20                        | 1.18                             | 0.10                         | 1.06                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | GOLF COURSE    | A/D                   | 1.554      | 0.0       | 39.0                | 0.127          | 0.82                            | 0.00                           | 0.82                  | 0.00                   | 0.82                        | 0.00                     | 0.82                          | 0.20                        | 0.66                             | 0.10                         | 0.59                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | A                     | 2.895      | 19.2      | 56.5                | 0.175          | 2.11                            | 0.00                           | 2.11                  | 0.00                   | 2.11                        | 0.00                     | 2.11                          | 0.20                        | 1.69                             | 0.10                         | 1.52                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | A/D                   | 2.581      | 20.0      | 57.4                | 0.183          | 1.97                            | 0.00                           | 1.97                  | 0.00                   | 1.97                        | 0.00                     | 1.97                          | 0.20                        | 1.57                             | 0.10                         | 1.42                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | B/D                   | 2.331      | 20.0      | 72.6                | 0.217          | 2.11                            | 0.00                           | 2.11                  | 0.00                   | 2.11                        | 0.00                     | 2.11                          | 0.20                        | 1.69                             | 0.10                         | 1.52                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | C/D                   | 4.414      | 20.0      | 81.5                | 0.262          | 4.83                            | 0.00                           | 4.83                  | 0.00                   | 4.83                        | 0.00                     | 4.83                          | 0.20                        | 3.86                             | 0.10                         | 3.48                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A                     | 3.648      | 0.0       | 49.0                | 0.134          | 2.03                            | 0.00                           | 2.03                  | 0.00                   | 2.03                        | 0.00                     | 2.03                          | 0.20                        | 1.63                             | 0.10                         | 1.46                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A/D                   | 1.225      | 0.0       | 84.0                | 0.249          | 1.27                            | 0.00                           | 1.27                  | 0.00                   | 1.27                        | 0.00                     | 1.27                          | 0.20                        | 1.02                             | 0.10                         | 0.92                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | B/D                   | 0.069      | 0.0       | 84.0                | 0.249          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.00                     | 0.07                          | 0.20                        | 0.06                             | 0.10                         | 0.05                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 0.233      | 0.0       | 84.0                | 0.249          | 0.24                            | 0.00                           | 0.24                  | 0.00                   | 0.24                        | 0.00                     | 0.24                          | 0.20                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | Forrest Club Dr. Pond           | 01       | 01-07        | None                      | None           | None    | Pond       | Pond       | Canal           | WATER          | W                     | 1.465      | 100.0     | 98.0                | 0.809          | 4.94                            | 0.00                           | 4.94                  | 0.00                   | 4.94                        | 0.00                     | 4.94                          | 0.20                        | 3.96                             | 0.10                         | 3.56                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 1.903      | 68.7      | 77.0                | 0.585          | 4.64                            | 0.80                           | 0.93                  | 0.00                   | 0.93                        | 0.20                     | 0.74                          | 0.00                        | 0.74                             | 0.10                         | 0.67                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.001      | 0.0       | 79.0                | 0.210          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.399      | 0.0       | 39.0                | 0.127          | 0.21                            | 0.00                           | 0.21                  | 0.00                   | 0.21                        | 0.20                     | 0.17                          | 0.00                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 2.444      | 22.5      | 85.4                | 0.311          | 3.16                            | 0.00                           | 3.16                  | 0.00                   | 3.16                        | 0.20                     | 2.53                          | 0.00                        | 2.53                             | 0.10                         | 2.28                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 0.539      | 0.0       | 95.0                | 0.464          | 1.04                            | 0.00                           | 1.04                  | 0.00                   | 1.04                        | 0.20                     | 0.84                          | 0.00                        | 0.84                             | 0.10                         | 0.75                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | C/D                   | 0.111      | 0.0       | 95.0                | 0.464          | 0.21                            | 0.00                           | 0.21                  | 0.00                   | 0.21                        | 0.20                     | 0.17                          | 0.00                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.174      | 19.4      | 39.7                | 0.162          | 0.12                            | 0.20                           | 0.09                  | 0.00                   | 0.09                        | 0.20                     | 0.08                          | 0.00                        | 0.08                             | 0.10                         | 0.07                        |
| Canal 1 | Goodyear Wetland                | 01       | 01-08        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 2.998      | 81.2      | 79.5                | 0.677          | 8.47                            | 0.20                           | 6.77                  | 0.00                   | 6.77                        | 0.20                     | 5.42                          | 0.00                        | 5.42                             | 0.10                         | 4.88</                      |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                     | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|-------------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 1.504      | 69.2      | 59.2                | 0.569          | 3.57                            | 0.80                           | 0.71                  | 0.25                   | 0.54                        | 0.00                     | 0.54                          | 0.00                        | 0.54                             | 0.10                         | 0.48                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | A                     | 0.329      | 0.0       | 49.0                | 0.134          | 0.18                            | 0.80                           | 0.04                  | 0.25                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.02                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.075      | 0.0       | 84.0                | 0.249          | 0.08                            | 0.80                           | 0.02                  | 0.25                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A                     | 0.172      | 38.8      | 48.3                | 0.322          | 0.23                            | 0.00                           | 0.23                  | 0.25                   | 0.17                        | 0.00                     | 0.17                          | 0.00                        | 0.17                             | 0.10                         | 0.16                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A/D                   | 27.159     | 36.6      | 71.5                | 0.337          | 38.12                           | 0.00                           | 38.12                 | 0.25                   | 28.59                       | 0.00                     | 28.59                         | 0.00                        | 28.59                            | 0.10                         | 25.73                       |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.422      | 59.5      | 72.1                | 0.509          | 0.89                            | 0.00                           | 0.89                  | 0.25                   | 0.67                        | 0.00                     | 0.67                          | 0.00                        | 0.67                             | 0.10                         | 0.60                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.127      | 2.8       | 74.0                | 0.185          | 0.10                            | 0.00                           | 0.10                  | 0.25                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.07                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | FOREST         | A                     | 0.171      | 0.0       | 30.0                | 0.123          | 0.09                            | 0.00                           | 0.09                  | 0.25                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | FOREST         | A/D                   | 1.158      | 0.0       | 77.0                | 0.199          | 0.96                            | 0.00                           | 0.96                  | 0.25                   | 0.72                        | 0.00                     | 0.72                          | 0.00                        | 0.72                             | 0.10                         | 0.65                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | FOREST         | B/D                   | 0.368      | 0.0       | 77.0                | 0.199          | 0.31                            | 0.00                           | 0.31                  | 0.25                   | 0.23                        | 0.00                     | 0.23                          | 0.00                        | 0.23                             | 0.10                         | 0.21                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | FOREST         | C/D                   | 0.968      | 0.0       | 77.0                | 0.199          | 0.80                            | 0.00                           | 0.80                  | 0.25                   | 0.60                        | 0.00                     | 0.60                          | 0.00                        | 0.60                             | 0.10                         | 0.54                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 3.879      | 63.5      | 65.0                | 0.529          | 8.56                            | 0.00                           | 8.56                  | 0.25                   | 6.42                        | 0.00                     | 6.42                          | 0.00                        | 6.42                             | 0.10                         | 5.78                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 8.590      | 0.0       | 84.0                | 0.249          | 8.91                            | 0.00                           | 8.91                  | 0.25                   | 6.68                        | 0.00                     | 6.68                          | 0.00                        | 6.68                             | 0.10                         | 6.02                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | B/D                   | 0.596      | 0.0       | 84.0                | 0.249          | 0.62                            | 0.00                           | 0.62                  | 0.25                   | 0.46                        | 0.00                     | 0.46                          | 0.00                        | 0.46                             | 0.10                         | 0.42                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A                     | 7.278      | 0.0       | 70.7                | 0.173          | 5.25                            | 0.00                           | 5.25                  | 0.25                   | 3.94                        | 0.00                     | 3.94                          | 0.00                        | 3.94                             | 0.10                         | 3.54                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 44.095     | 0.0       | 68.4                | 0.166          | 30.51                           | 0.00                           | 30.51                 | 0.25                   | 22.89                       | 0.00                     | 22.89                         | 0.00                        | 22.89                            | 0.10                         | 20.60                       |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | B/D                   | 2.913      | 0.0       | 78.4                | 0.207          | 2.52                            | 0.00                           | 2.52                  | 0.25                   | 1.89                        | 0.00                     | 1.89                          | 0.00                        | 1.89                             | 0.10                         | 1.70                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 8.310      | 0.0       | 90.2                | 0.333          | 11.52                           | 0.00                           | 11.52                 | 0.25                   | 8.64                        | 0.00                     | 8.64                          | 0.00                        | 8.64                             | 0.10                         | 7.78                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | WETLAND        | A/D                   | 0.746      | 0.0       | 95.0                | 0.464          | 1.45                            | 0.00                           | 1.45                  | 0.25                   | 1.08                        | 0.00                     | 1.08                          | 0.00                        | 1.08                             | 0.10                         | 0.98                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | WETLAND        | B/D                   | 0.407      | 0.0       | 95.0                | 0.464          | 0.79                            | 0.00                           | 0.79                  | 0.25                   | 0.59                        | 0.00                     | 0.59                          | 0.00                        | 0.59                             | 0.10                         | 0.53                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | None                      | Swale          | None    | None       | None       | Canal           | WETLAND        | C/D                   | 0.004      | 0.0       | 95.0                | 0.464          | 0.01                            | 0.00                           | 0.01                  | 0.25                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | INSTITUTIONAL  | A                     | 0.018      | 41.2      | 41.2                | 0.338          | 0.03                            | 0.20                           | 0.02                  | 0.25                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | INSTITUTIONAL  | A/D                   | 0.032      | 50.5      | 42.2                | 0.413          | 0.06                            | 0.20                           | 0.04                  | 0.25                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | OPEN           | A                     | 0.197      | 0.0       | 49.0                | 0.134          | 0.11                            | 0.20                           | 0.09                  | 0.25                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | OPEN           | A/D                   | 1.396      | 0.0       | 84.0                | 0.249          | 1.45                            | 0.20                           | 1.16                  | 0.25                   | 0.87                        | 0.00                     | 0.87                          | 0.00                        | 0.87                             | 0.10                         | 0.78                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A                     | 0.664      | 61.5      | 56.5                | 0.507          | 1.40                            | 0.20                           | 1.12                  | 0.25                   | 0.84                        | 0.00                     | 0.84                          | 0.00                        | 0.84                             | 0.10                         | 0.76                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A/D                   | 15.413     | 70.3      | 71.8                | 0.588          | 37.81                           | 0.20                           | 30.25                 | 0.25                   | 22.69                       | 0.00                     | 22.69                         | 0.00                        | 22.69                            | 0.10                         | 20.42                       |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | B/D                   | 1.167      | 55.0      | 69.9                | 0.471          | 2.29                            | 0.20                           | 1.83                  | 0.25                   | 1.38                        | 0.00                     | 1.38                          | 0.00                        | 1.38                             | 0.10                         | 1.24                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.171      | 69.0      | 79.9                | 0.593          | 0.42                            | 0.20                           | 0.34                  | 0.25                   | 0.25                        | 0.00                     | 0.25                          | 0.00                        | 0.25                             | 0.10                         | 0.23                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | A                     | 2.076      | 94.2      | 90.3                | 0.777          | 6.73                            | 0.20                           | 5.38                  | 0.25                   | 4.04                        | 0.00                     | 4.04                          | 0.00                        | 4.04                             | 0.10                         | 3.63                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 15.609     | 87.3      | 64.1                | 0.712          | 46.34                           | 0.20                           | 37.07                 | 0.25                   | 27.80                       | 0.00                     | 27.80                         | 0.00                        | 27.80                            | 0.10                         | 25.02                       |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | A                     | 0.421      | 0.0       | 49.0                | 0.134          | 0.23                            | 0.20                           | 0.19                  | 0.25                   | 0.14                        | 0.00                     | 0.14                          | 0.00                        | 0.14                             | 0.10                         | 0.13                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 1.746      | 0.0       | 84.0                | 0.249          | 1.81                            | 0.20                           | 1.45                  | 0.25                   | 1.09                        | 0.00                     | 1.09                          | 0.00                        | 1.09                             | 0.10                         | 0.98                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | B/D                   | 0.220      | 0.0       | 84.0                | 0.249          | 0.23                            | 0.20                           | 0.18                  | 0.25                   | 0.14                        | 0.00                     | 0.14                          | 0.00                        | 0.14                             | 0.10                         | 0.12                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 2.250      | 78.6      | 69.0                | 0.648          | 6.08                            | 0.20                           | 4.86                  | 0.25                   | 3.65                        | 0.00                     | 3.65                          | 0.00                        | 3.65                             | 0.10                         | 3.28                        |
| Canal 1 | John Young Parkway Swale 01   | 01       | 01-11        | Wet Pond                  | Swale          | None    | None       | Wet Pond   | Canal           | WATER          | W                     | 1.929      | 100.0     | 98.0                | 0.809          | 6.51                            | 0.20                           | 5.21                  | 0.25                   | 3.91                        | 0.00                     | 3.91                          | 0.00                        | 3.91                             | 0.10                         | 3.52                        |
| Canal 1 | John Young Parkway Swale 02   | 01       | 01-12        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A                     | 1.739      | 0.0       | 66.3                | 0.160          | 1.16                            | 0.00                           | 1.16                  | 0.25                   | 0.87                        | 0.00                     | 0.87                          | 0.00                        | 0.87                             | 0.10                         | 0.79                        |
| Canal 1 | John Young Parkway Swale 02   | 01       | 01-12        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 10.018     | 0.0       | 63.5                | 0.154          | 6.44                            | 0.00                           | 6.44                  | 0.25                   | 4.83                        | 0.00                     | 4.83                          | 0.00                        | 4.83                             | 0.10                         | 4.35                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | OPEN           | A/D                   | 0.408      | 0.0       | 84.0                | 0.249          | 0.42                            | 0.80                           | 0.08                  | 0.00                   | 0.08                        | 0.00                     | 0.08                          | 0.00                        | 0.08                             | 0.10                         | 0.08                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | FOREST         | A/D                   | 0.142      | 0.0       | 77.0                | 0.199          | 0.12                            | 0.80                           | 0.02                  | 0.00                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | A/D                   | 6.552      | 20.0      | 57.4                | 0.183          | 4.99                            | 0.80                           | 1.00                  | 0.00                   | 1.00                        | 0.00                     | 1.00                          | 0.00                        | 1.00                             | 0.10                         | 0.90                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | B/D                   | 6.441      | 20.0      | 72.6                | 0.217          | 5.82                            | 0.80                           | 1.16                  | 0.00                   | 1.16                        | 0.00                     | 1.16                          | 0.00                        | 1.16                             | 0.10                         | 1.05                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 5.252      | 20.0      | 81.5                | 0.262          | 5.74                            | 0.80                           | 1.15                  | 0.00                   | 1.15                        | 0.00                     | 1.15                          | 0.00                        | 1.15                             | 0.10                         | 1.03                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 1.641      | 0.0       | 84.0                | 0.249          | 1.70                            | 0.80                           | 0.34                  | 0.00                   | 0.34                        | 0.00                     | 0.34                          | 0.00                        | 0.34                             | 0.10                         | 0.31                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.040      | 0.0       | 49.0                | 0.134          | 0.02                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | Dry Pond                  | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 0.774      | 0.0       | 77.0                | 0.199          | 0.64                            | 0.80                           | 0.13                  | 0.00                   | 0.13                        | 0.20                     | 0.10                          | 0.20                        | 0.08                             | 0.10                         | 0.07                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 1.122      | 0.0       | 84.0                | 0.249          | 1.16                            | 0.00                           | 1.16                  | 0.00                   | 1.16                        | 0.20                     | 0.93                          | 0.00                        | 0.93                             | 0.10                         | 0.84                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.002      | 0.0       | 49.0                | 0.134          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 01 | 01       | 01-13        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 38.005     | 0.0       | 95.0                | 0.464          | 73.59                           | 0.00                           | 73.59                 | 0.00                   | 73.59                       | 0.20                     | 58.87                         | 0.00                        | 58.87                            | 0.10                         | 52.99                       |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Dry Pond                  | None           | Wetland | None       | Dry Pond   | Canal           | OPEN           | C/D                   | 0.211      | 0.0       | 84.0                | 0.249          | 0.22                            | 0.80                           | 0.04                  | 0.00                   | 0.04                        | 0.20                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | HDR            | C/D                   | 0.001      | 90.0      | 98.0                | 0.788          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Dry Pond                  | None</         |         |            |            |                 |                |                       |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |



Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                     | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|-------------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | B/D                   | 3.065      | 0.0       | 77.0                | 0.199          | 2.55                            | 0.00                           | 2.55                  | 0.00                   | 2.55                        | 0.20                     | 2.04                          | 0.20                        | 1.63                             | 0.10                         | 1.47                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 0.923      | 0.0       | 77.0                | 0.199          | 0.77                            | 0.00                           | 0.77                  | 0.00                   | 0.77                        | 0.20                     | 0.61                          | 0.20                        | 0.49                             | 0.10                         | 0.44                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | HDR            | A/D                   | 0.409      | 0.0       | 39.0                | 0.127          | 0.22                            | 0.00                           | 0.22                  | 0.00                   | 0.22                        | 0.20                     | 0.17                          | 0.20                        | 0.14                             | 0.10                         | 0.12                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | HDR            | C/D                   | 0.068      | 0.0       | 86.1                | 0.273          | 0.08                            | 0.00                           | 0.08                  | 0.00                   | 0.08                        | 0.20                     | 0.06                          | 0.20                        | 0.05                             | 0.10                         | 0.04                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | INSTITUTIONAL  | B/D                   | 0.866      | 0.0       | 61.0                | 0.149          | 0.54                            | 0.00                           | 0.54                  | 0.00                   | 0.54                        | 0.20                     | 0.43                          | 0.20                        | 0.34                             | 0.10                         | 0.31                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.461      | 0.0       | 74.9                | 0.188          | 1.15                            | 0.00                           | 1.15                  | 0.00                   | 1.15                        | 0.20                     | 0.92                          | 0.20                        | 0.73                             | 0.10                         | 0.66                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | OPEN           | B/D                   | 0.344      | 0.0       | 84.0                | 0.249          | 0.36                            | 0.00                           | 0.36                  | 0.00                   | 0.36                        | 0.20                     | 0.29                          | 0.20                        | 0.23                             | 0.10                         | 0.21                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | OPEN           | C/D                   | 0.395      | 0.0       | 84.0                | 0.249          | 0.41                            | 0.00                           | 0.41                  | 0.00                   | 0.41                        | 0.20                     | 0.33                          | 0.20                        | 0.26                             | 0.10                         | 0.24                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | B/D                   | 0.672      | 0.0       | 95.0                | 0.464          | 1.30                            | 0.00                           | 1.30                  | 0.00                   | 1.30                        | 0.20                     | 1.04                          | 0.20                        | 0.83                             | 0.10                         | 0.75                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | None           | Wetland | Pond       | Pond       | Canal           | WATER          | W                     | 0.612      | 100.0     | 98.0                | 0.809          | 2.07                            | 0.00                           | 2.07                  | 0.00                   | 2.07                        | 0.20                     | 1.65                          | 0.20                        | 1.32                             | 0.10                         | 1.19                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | None                      | Swale          | Wetland | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 2.961      | 26.6      | 83.9                | 0.325          | 4.01                            | 0.00                           | 4.01                  | 0.25                   | 3.01                        | 0.20                     | 2.41                          | 0.00                        | 2.41                             | 0.10                         | 2.17                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.563      | 30.9      | 84.7                | 0.359          | 2.34                            | 0.20                           | 1.87                  | 0.00                   | 1.87                        | 0.20                     | 1.50                          | 0.00                        | 1.50                             | 0.10                         | 1.35                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | B/D                   | 0.097      | 0.0       | 84.0                | 0.249          | 0.10                            | 0.20                           | 0.00                  | 0.08                   | 0.20                        | 0.06                     | 0.00                          | 0.06                        | 0.10                             | 0.06                         |                             |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | C/D                   | 0.561      | 0.0       | 84.0                | 0.249          | 0.58                            | 0.20                           | 0.47                  | 0.00                   | 0.47                        | 0.20                     | 0.37                          | 0.00                        | 0.37                             | 0.10                         | 0.34                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 0.138      | 100.0     | 98.0                | 0.809          | 0.47                            | 0.20                           | 0.37                  | 0.00                   | 0.37                        | 0.20                     | 0.30                          | 0.00                        | 0.30                             | 0.10                         | 0.27                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-14        | Wet Pond                  | Swale          | Wetland | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 0.001      | 0.0       | 98.0                | 0.627          | 0.00                            | 0.20                           | 0.00                  | 0.25                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 02 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | Dry Pond   | Canal           | COMMERCIAL     | A/D                   | 0.138      | 0.0       | 39.0                | 0.127          | 0.07                            | 0.80                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | Dry Pond   | Canal           | COMMERCIAL     | B/D                   | 0.073      | 0.0       | 61.0                | 0.149          | 0.05                            | 0.80                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 14.300     | 53.0      | 45.7                | 0.434          | 25.89                           | 0.80                           | 5.18                  | 0.00                   | 5.18                        | 0.20                     | 4.14                          | 0.00                        | 4.14                             | 0.10                         | 3.73                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 8.314      | 72.1      | 68.1                | 0.598          | 20.71                           | 0.80                           | 4.14                  | 0.00                   | 4.14                        | 0.20                     | 3.31                          | 0.00                        | 3.31                             | 0.10                         | 2.98                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 0.180      | 0.0       | 77.0                | 0.199          | 0.15                            | 0.80                           | 0.03                  | 0.00                   | 0.03                        | 0.20                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 1.401      | 57.7      | 47.9                | 0.472          | 2.76                            | 0.80                           | 0.55                  | 0.00                   | 0.55                        | 0.20                     | 0.44                          | 0.00                        | 0.44                             | 0.10                         | 0.40                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Dry Pond                  | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.006      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.80                           | 0.00                  | 0.25                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A                     | 0.599      | 0.0       | 30.0                | 0.123          | 0.31                            | 0.00                           | 0.31                  | 0.00                   | 0.31                        | 0.00                     | 0.31                          | 0.00                        | 0.31                             | 0.10                         | 0.28                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A/D                   | 1.710      | 0.0       | 77.0                | 0.199          | 1.42                            | 0.00                           | 1.42                  | 0.00                   | 1.42                        | 0.00                     | 1.42                          | 0.00                        | 1.42                             | 0.10                         | 1.28                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | A                     | 0.479      | 0.0       | 76.1                | 0.195          | 0.39                            | 0.00                           | 0.39                  | 0.00                   | 0.39                        | 0.00                     | 0.39                          | 0.00                        | 0.39                             | 0.10                         | 0.35                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 1.661      | 0.0       | 92.4                | 0.394          | 2.73                            | 0.00                           | 2.73                  | 0.00                   | 2.73                        | 0.00                     | 2.73                          | 0.00                        | 2.73                             | 0.10                         | 2.46                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.231      | 0.9       | 39.1                | 0.127          | 0.12                            | 0.00                           | 0.12                  | 0.00                   | 0.12                        | 0.20                     | 0.10                          | 0.00                        | 0.10                             | 0.10                         | 0.09                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.059      | 86.3      | 86.9                | 0.725          | 0.18                            | 0.00                           | 0.18                  | 0.00                   | 0.18                        | 0.20                     | 0.14                          | 0.00                        | 0.14                             | 0.10                         | 0.13                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A                     | 0.605      | 0.0       | 30.0                | 0.123          | 0.31                            | 0.00                           | 0.31                  | 0.00                   | 0.31                        | 0.20                     | 0.25                          | 0.00                        | 0.25                             | 0.10                         | 0.22                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 5.045      | 0.0       | 77.0                | 0.199          | 4.20                            | 0.00                           | 4.20                  | 0.00                   | 4.20                        | 0.20                     | 3.36                          | 0.00                        | 3.36                             | 0.10                         | 3.02                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | LDR            | A/D                   | 0.147      | 0.0       | 39.0                | 0.127          | 0.08                            | 0.00                           | 0.08                  | 0.00                   | 0.08                        | 0.20                     | 0.06                          | 0.00                        | 0.06                             | 0.10                         | 0.06                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A                     | 0.083      | 0.0       | 49.0                | 0.134          | 0.05                            | 0.00                           | 0.05                  | 0.00                   | 0.05                        | 0.20                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.03                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 3.712      | 0.0       | 65.9                | 0.159          | 2.47                            | 0.00                           | 2.47                  | 0.00                   | 2.47                        | 0.20                     | 1.97                          | 0.00                        | 1.97                             | 0.10                         | 1.78                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A                     | 1.509      | 0.0       | 95.0                | 0.464          | 2.92                            | 0.00                           | 2.92                  | 0.00                   | 2.92                        | 0.20                     | 2.34                          | 0.00                        | 2.34                             | 0.10                         | 2.10                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 58.709     | 0.0       | 95.0                | 0.464          | 113.68                          | 0.00                           | 113.68                | 0.00                   | 113.68                      | 0.20                     | 90.95                         | 0.00                        | 90.95                            | 0.10                         | 81.85                       |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.484      | 20.2      | 50.5                | 0.176          | 0.36                            | 0.00                           | 0.36                  | 0.25                   | 0.27                        | 0.00                     | 0.27                          | 0.00                        | 0.27                             | 0.10                         | 0.24                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.001      | 0.0       | 84.0                | 0.249          | 0.00                            | 0.00                           | 0.00                  | 0.25                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A                     | 0.009      | 0.0       | 98.0                | 0.627          | 0.02                            | 0.00                           | 0.02                  | 0.25                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 5.569      | 0.0       | 74.8                | 0.188          | 4.36                            | 0.00                           | 4.36                  | 0.25                   | 3.27                        | 0.00                     | 3.27                          | 0.00                        | 3.27                             | 0.10                         | 2.94                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.865      | 2.5       | 43.5                | 0.129          | 0.47                            | 0.00                           | 0.47                  | 0.25                   | 0.35                        | 0.20                     | 0.28                          | 0.00                        | 0.28                             | 0.10                         | 0.25                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.222      | 40.0      | 66.2                | 0.351          | 0.32                            | 0.00                           | 0.32                  | 0.25                   | 0.24                        | 0.20                     | 0.19                          | 0.00                        | 0.19                             | 0.10                         | 0.18                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 1.413      | 0.0       | 78.8                | 0.209          | 1.23                            | 0.00                           | 1.23                  | 0.25                   | 0.92                        | 0.20                     | 0.74                          | 0.00                        | 0.74                             | 0.10                         | 0.67                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | None                      | Swale          | Wetland | None       | None       | Canal           | TRANSPORTATION | B/D                   | 0.014      | 0.0       | 87.3                | 0.289          | 0.02                            | 0.00                           | 0.02                  | 0.25                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 9.302      | 76.9      | 49.4                | 0.626          | 24.28                           | 0.20                           | 19.42                 | 0.00                   | 19.42                       | 0.20                     | 15.54                         | 0.00                        | 15.54                            | 0.10                         | 13.98                       |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.412      | 71.6      | 66.0                | 0.592          | 1.02                            | 0.20                           | 0.81                  | 0.00                   | 0.81                        | 0.20                     | 0.65                          | 0.00                        | 0.65                             | 0.10                         | 0.59                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.646      | 0.0       | 84.0                | 0.249          | 0.67                            | 0.20                           | 0.54                  | 0.00                   | 0.54                        | 0.20                     | 0.43                          | 0.00                        | 0.43                             | 0.10                         | 0.39                        |
| Canal 1 | John Young Parkway Wetland 03 | 01       | 01-15        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 0.695      | 100.0     | 98.0                | 0.809          | 2.35                            | 0.20                           | 1.88                  | 0.00                   | 1.88                        | 0.20                     | 1.50                          | 0.00                        | 1.50                             | 0.10                         | 1.35                        |
| Canal 1 | John Young Parkway Wetland 04 | 01       | 01-16        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.003      | 0.0       | 49.0                | 0.134          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | John Young Parkway Wetland 04 | 01       | 01-16        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A                     | 0.574      | 0.0       | 30.0                | 0.123          | 0.30                            | 0.00                           | 0.30                  | 0.00                   | 0.30                        | 0.20                     | 0.24                          | 0.00                        | 0.24                             | 0.10                         | 0.21                        |
| Canal 1 | John Young Parkway Wetland 04 | 01       | 01-16        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 5.804      | 0.0       | 77.0                | 0.199          | 4.83                            | 0.00                           | 4.83                  | 0.00                   | 4.83                        | 0.20                     | 3.86                          | 0.00                        | 3.86                             | 0.10                         | 3.48                        |
| Canal 1 | John Young Parkway Wetland 04 | 01       | 01-16        | None                      |                |         |            |            |                 |                |                       |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                   | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|-----------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | B/D                   | 0.030      | 0.0       | 61.0                | 0.149          | 0.02                            | 0.00                           | 0.02                  | 0.00                   | 0.02                        | 0.20                     | 0.01                          | 0.20                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 25.784     | 59.1      | 82.7                | 0.535          | 57.48                           | 0.00                           | 57.48                 | 0.00                   | 57.48                       | 0.20                     | 45.99                         | 0.20                        | 36.79                            | 0.10                         | 33.11                       |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | A/D                   | 0.008      | 0.0       | 77.0                | 0.199          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.20                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | B/D                   | 0.123      | 0.0       | 77.0                | 0.199          | 0.10                            | 0.00                           | 0.10                  | 0.00                   | 0.10                        | 0.20                     | 0.08                          | 0.20                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 0.361      | 0.0       | 77.0                | 0.199          | 0.30                            | 0.00                           | 0.30                  | 0.00                   | 0.30                        | 0.20                     | 0.24                          | 0.20                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | HDR            | C/D                   | 0.083      | 0.0       | 85.3                | 0.261          | 0.09                            | 0.00                           | 0.09                  | 0.00                   | 0.09                        | 0.20                     | 0.07                          | 0.20                        | 0.06                             | 0.10                         | 0.05                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | MDR            | C/D                   | 1.500      | 0.0       | 84.8                | 0.256          | 1.60                            | 0.00                           | 1.60                  | 0.00                   | 1.60                        | 0.20                     | 1.28                          | 0.20                        | 1.02                             | 0.10                         | 0.92                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | OPEN           | C/D                   | 0.996      | 0.0       | 84.0                | 0.249          | 1.03                            | 0.00                           | 1.03                  | 0.00                   | 1.03                        | 0.20                     | 0.83                          | 0.20                        | 0.66                             | 0.10                         | 0.60                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | TRANSPORTATION | C/D                   | 0.294      | 0.0       | 83.9                | 0.248          | 0.30                            | 0.00                           | 0.30                  | 0.00                   | 0.30                        | 0.20                     | 0.24                          | 0.20                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | A/D                   | 0.422      | 0.0       | 95.0                | 0.464          | 0.82                            | 0.00                           | 0.82                  | 0.00                   | 0.82                        | 0.20                     | 0.65                          | 0.20                        | 0.52                             | 0.10                         | 0.47                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | C/D                   | 0.109      | 0.0       | 95.0                | 0.464          | 0.21                            | 0.00                           | 0.21                  | 0.00                   | 0.21                        | 0.20                     | 0.17                          | 0.20                        | 0.14                             | 0.10                         | 0.12                        |
| Canal 1 | Kensington Dr. Borrow Pit   | 01       | 01-19        | None                      | None           | Wetland | Pond       | Pond       | Canal           | WATER          | W                     | 3.231      | 100.0     | 98.0                | 0.809          | 10.90                           | 0.00                           | 10.90                 | 0.00                   | 10.90                       | 0.20                     | 8.72                          | 0.20                        | 6.98                             | 0.10                         | 6.28                        |
| Canal 1 | Kensington Dr. Wetland      | 01       | 01-20        | None                      | None           | Wetland | Pond       | None       | Canal           | MDR            | C/D                   | 0.439      | 0.0       | 84.8                | 0.256          | 0.47                            | 0.00                           | 0.47                  | 0.00                   | 0.47                        | 0.20                     | 0.37                          | 0.20                        | 0.30                             | 0.10                         | 0.27                        |
| Canal 1 | Kensington Dr. Wetland      | 01       | 01-20        | None                      | None           | Wetland | Pond       | None       | Canal           | OPEN           | C/D                   | 0.257      | 0.0       | 84.0                | 0.249          | 0.27                            | 0.00                           | 0.27                  | 0.00                   | 0.27                        | 0.20                     | 0.21                          | 0.20                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | Kensington Dr. Wetland      | 01       | 01-20        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | A/D                   | 1.242      | 0.0       | 95.0                | 0.464          | 2.41                            | 0.00                           | 2.41                  | 0.00                   | 2.41                        | 0.20                     | 1.92                          | 0.20                        | 1.54                             | 0.10                         | 1.39                        |
| Canal 1 | Kensington Dr. Wetland      | 01       | 01-20        | None                      | None           | Wetland | Pond       | None       | Canal           | WETLAND        | C/D                   | 0.648      | 0.0       | 95.0                | 0.464          | 1.25                            | 0.00                           | 1.25                  | 0.00                   | 1.25                        | 0.20                     | 1.00                          | 0.20                        | 0.80                             | 0.10                         | 0.72                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 1.752      | 0.0       | 77.0                | 0.199          | 1.46                            | 0.00                           | 1.46                  | 0.00                   | 1.46                        | 0.20                     | 1.17                          | 0.00                        | 1.17                             | 0.10                         | 1.05                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.121      | 0.0       | 49.0                | 0.134          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.20                     | 0.05                          | 0.00                        | 0.05                             | 0.10                         | 0.05                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 2.028      | 0.0       | 95.0                | 0.464          | 3.93                            | 0.00                           | 3.93                  | 0.00                   | 3.93                        | 0.20                     | 3.14                          | 0.00                        | 3.14                             | 0.10                         | 2.83                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.003      | 95.0      | 98.0                | 0.799          | 0.01                            | 0.20                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 1.260      | 0.0       | 84.0                | 0.249          | 1.31                            | 0.20                           | 1.05                  | 0.00                   | 1.05                        | 0.20                     | 0.84                          | 0.00                        | 0.84                             | 0.10                         | 0.75                        |
| Canal 1 | Lynx Wetland                | 01       | 01-21        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 0.530      | 100.0     | 98.0                | 0.809          | 1.79                            | 0.20                           | 1.43                  | 0.00                   | 1.43                        | 0.20                     | 1.14                          | 0.00                        | 1.14                             | 0.10                         | 1.03                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | Dry Pond   | Canal           | OPEN           | A/D                   | 0.006      | 0.0       | 84.0                | 0.249          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.90                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | Dry Pond   | Canal           | OPEN           | B/D                   | 0.270      | 0.0       | 84.0                | 0.249          | 0.28                            | 0.00                           | 0.28                  | 0.00                   | 0.28                        | 0.00                     | 0.28                          | 0.90                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | None       | Canal           | FOREST         | A/D                   | 0.008      | 0.0       | 77.0                | 0.199          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.90                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | None       | Canal           | OPEN           | A/D                   | 1.806      | 0.0       | 84.0                | 0.249          | 1.87                            | 0.00                           | 1.87                  | 0.00                   | 1.87                        | 0.00                     | 1.87                          | 0.90                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | None       | Canal           | OPEN           | B/D                   | 0.945      | 0.0       | 84.0                | 0.249          | 0.98                            | 0.00                           | 0.98                  | 0.00                   | 0.98                        | 0.00                     | 0.98                          | 0.90                        | 0.10                             | 0.10                         | 0.09                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | None       | Canal           | TRANSPORTATION | A/D                   | 0.003      | 0.0       | 49.0                | 0.134          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.90                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | Mercy Dr. Depression        | 01       | 01-22        | None                      | None           | None    | Depression | None       | Canal           | TRANSPORTATION | B/D                   | 0.008      | 0.0       | 69.0                | 0.168          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.90                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | New Hampshire St Borrow Pit | 01       | 01-23        | None                      | None           | None    | Pond       | None       | Canal           | FOREST         | A/D                   | 2.334      | 0.0       | 77.0                | 0.199          | 1.94                            | 0.00                           | 1.94                  | 0.00                   | 1.94                        | 0.00                     | 1.94                          | 0.20                        | 1.55                             | 0.10                         | 1.40                        |
| Canal 1 | New Hampshire St Borrow Pit | 01       | 01-23        | None                      | None           | None    | Pond       | None       | Canal           | LDR            | A/D                   | 0.150      | 0.0       | 46.8                | 0.132          | 0.08                            | 0.00                           | 0.08                  | 0.00                   | 0.08                        | 0.00                     | 0.08                          | 0.20                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 1 | New Hampshire St Borrow Pit | 01       | 01-23        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A/D                   | 0.305      | 0.0       | 84.0                | 0.249          | 0.32                            | 0.00                           | 0.32                  | 0.00                   | 0.32                        | 0.00                     | 0.32                          | 0.20                        | 0.25                             | 0.10                         | 0.23                        |
| Canal 1 | New Hampshire St Borrow Pit | 01       | 01-23        | None                      | None           | None    | Pond       | None       | Canal           | WETLAND        | A/D                   | 0.064      | 0.0       | 95.0                | 0.464          | 0.12                            | 0.00                           | 0.12                  | 0.00                   | 0.12                        | 0.00                     | 0.12                          | 0.20                        | 0.10                             | 0.10                         | 0.09                        |
| Canal 1 | New Hampshire St Borrow Pit | 01       | 01-23        | None                      | None           | None    | Pond       | Pond       | Canal           | WATER          | W                     | 3.471      | 100.0     | 98.0                | 0.809          | 11.71                           | 0.00                           | 11.71                 | 0.00                   | 11.71                       | 0.00                     | 11.71                         | 0.20                        | 9.37                             | 0.10                         | 8.43                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.269      | 0.0       | 84.0                | 0.249          | 0.28                            | 0.80                           | 0.06                  | 0.00                   | 0.06                        | 0.20                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | Dry Pond                  | Swale          | Wetland | None       | Dry Pond   | Canal           | WATER          | W                     | 0.234      | 100.0     | 98.0                | 0.809          | 0.79                            | 0.80                           | 0.16                  | 0.25                   | 0.12                        | 0.20                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.09                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | Dry Pond                  | Swale          | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 1.079      | 43.2      | 66.5                | 0.376          | 1.69                            | 0.80                           | 0.34                  | 0.25                   | 0.25                        | 0.20                     | 0.20                          | 0.00                        | 0.20                             | 0.10                         | 0.18                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | Dry Pond                  | Swale          | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 3.592      | 0.0       | 84.0                | 0.249          | 3.73                            | 0.80                           | 0.75                  | 0.25                   | 0.56                        | 0.20                     | 0.45                          | 0.00                        | 0.45                             | 0.10                         | 0.40                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A/D                   | 0.006      | 0.0       | 77.0                | 0.199          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.10                             | 0.00                         |                             |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 3.289      | 0.0       | 91.4                | 0.367          | 5.03                            | 0.00                           | 5.03                  | 0.00                   | 5.03                        | 0.20                     | 4.02                          | 0.00                        | 4.02                             | 0.10                         | 3.62                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 3.180      | 0.0       | 77.0                | 0.199          | 2.65                            | 0.00                           | 2.65                  | 0.00                   | 2.65                        | 0.20                     | 2.12                          | 0.00                        | 2.12                             | 0.10                         | 1.90                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | None           | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 0.128      | 0.0       | 98.0                | 0.627          | 0.33                            | 0.00                           | 0.33                  | 0.00                   | 0.33                        | 0.20                     | 0.27                          | 0.00                        | 0.27                             | 0.10                         | 0.24                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 4.275      | 0.0       | 84.0                | 0.249          | 4.44                            | 0.00                           | 4.44                  | 0.00                   | 4.44                        | 0.20                     | 3.55                          | 0.00                        | 3.55                             | 0.10                         | 3.19                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.401      | 0.0       | 78.5                | 0.208          | 0.35                            | 0.00                           | 0.35                  | 0.25                   | 0.26                        | 0.20                     | 0.21                          | 0.00                        | 0.21                             | 0.10                         | 0.19                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | Swale          | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 3.023      | 0.0       | 77.0                | 0.199          | 2.51                            | 0.00                           | 2.51                  | 0.25                   | 1.89                        | 0.20                     | 1.51                          | 0.00                        | 1.51                             | 0.10                         | 1.36                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | Swale          | Wetland | None       | None       | Canal           | FOREST         | B/D                   | 0.045      | 0.0       | 77.0                | 0.199          | 0.04                            | 0.00                           | 0.04                  | 0.25                   | 0.03                        | 0.20                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | Swale          | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 0.256      | 0.0       | 98.0                | 0.627          | 0.67                            | 0.00                           | 0.67                  | 0.25                   | 0.50                        | 0.20                     | 0.40                          | 0.00                        | 0.40                             | 0.10                         | 0.36                        |
| Canal 1 | New Hampshire St Wetland 01 | 01       | 01-24        | None                      | Swale          | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.398      | 0.0       | 84.0                | 0.249          | 0.41                            | 0.00                           | 0.41                  | 0.25                   | 0.31                        | 0.20                     | 0.25                          | 0.00                        | 0.25                             | 0.10                         | 0.22                        |
| Canal 1 | New Hampshire St Wetland 02 | 01       | 01-25        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 0.311      | 0.0       | 77.0                | 0.199          | 0.26                            | 0.80                           | 0.05                  | 0.00                   | 0.05                        | 0.20                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 1 | New Hampshire St Wetland 02 | 01       | 01-25        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | FOREST         | B/D                   | 0.212      | 0.0       | 77.0                | 0.199          | 0.18                            | 0.80                           | 0.04                  | 0.00                   | 0.04                        | 0.20                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 1 | New Hampshire St Wetland 02 | 01       | 01-25        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.096      | 0.0       | 98.0                | 0.627          | 0.25                            | 0.00                           | 0.25                  | 0.00                   | 0.25                        | 0.20                     | 0.20                          | 0.00                        | 0.20                             | 0.10                         | 0.18                        |
| Canal 1 | New Hampshire St Wetland 02 | 01       | 01-25        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 3.636      | 0.0       | 77.0                | 0.199          | 3.02                            | 0.00                           | 3.02                  | 0.00                   | 3.02                        | 0.20                     | 2.42                          | 0.00                        |                                  |                              |                             |



Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                   | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|-----------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 0.917      | 0.0       | 77.0                | 0.199          | 0.76                            | 0.00                           | 0.76                  | 0.00                   | 0.76                        | 0.20                     | 0.61                          | 0.00                        | 0.61                             | 0.10                         | 0.55                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 0.901      | 0.0       | 39.0                | 0.127          | 0.48                            | 0.00                           | 0.48                  | 0.00                   | 0.48                        | 0.20                     | 0.38                          | 0.00                        | 0.38                             | 0.10                         | 0.34                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | B/D                   | 0.005      | 0.0       | 61.0                | 0.149          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 1.427      | 19.0      | 41.4                | 0.160          | 0.95                            | 0.00                           | 0.95                  | 0.00                   | 0.95                        | 0.20                     | 0.76                          | 0.00                        | 0.76                             | 0.10                         | 0.69                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 3.632      | 0.0       | 84.0                | 0.249          | 3.77                            | 0.00                           | 3.77                  | 0.00                   | 3.77                        | 0.20                     | 3.01                          | 0.00                        | 3.01                             | 0.10                         | 2.71                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | B/D                   | 0.343      | 0.0       | 84.0                | 0.249          | 0.36                            | 0.00                           | 0.36                  | 0.00                   | 0.36                        | 0.20                     | 0.29                          | 0.00                        | 0.29                             | 0.10                         | 0.26                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 1.930      | 0.0       | 95.0                | 0.464          | 3.74                            | 0.00                           | 3.74                  | 0.00                   | 3.74                        | 0.20                     | 2.99                          | 0.00                        | 2.99                             | 0.10                         | 2.69                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | B/D                   | 0.777      | 0.0       | 95.0                | 0.464          | 1.50                            | 0.00                           | 1.50                  | 0.00                   | 1.50                        | 0.20                     | 1.20                          | 0.00                        | 1.20                             | 0.10                         | 1.08                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.245      | 2.8       | 91.6                | 0.370          | 0.38                            | 0.00                           | 0.38                  | 0.25                   | 0.28                        | 0.20                     | 0.23                          | 0.00                        | 0.23                             | 0.10                         | 0.20                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 0.116      | 0.0       | 98.0                | 0.627          | 0.30                            | 0.00                           | 0.30                  | 0.25                   | 0.23                        | 0.20                     | 0.18                          | 0.00                        | 0.18                             | 0.10                         | 0.16                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | Swale          | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 0.167      | 29.1      | 98.0                | 0.657          | 0.46                            | 0.00                           | 0.46                  | 0.25                   | 0.34                        | 0.20                     | 0.27                          | 0.00                        | 0.27                             | 0.10                         | 0.25                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | Swale          | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.772      | 0.0       | 84.0                | 0.249          | 0.80                            | 0.00                           | 0.80                  | 0.25                   | 0.60                        | 0.20                     | 0.48                          | 0.00                        | 0.48                             | 0.10                         | 0.43                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | None                      | Swale          | Wetland | None       | None       | Canal           | OPEN           | B/D                   | 0.120      | 0.0       | 84.0                | 0.249          | 0.12                            | 0.00                           | 0.12                  | 0.25                   | 0.09                        | 0.20                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.07                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 0.000      | 0.0       | 77.0                | 0.199          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 1.078      | 57.6      | 47.9                | 0.472          | 2.12                            | 0.20                           | 1.70                  | 0.00                   | 1.70                        | 0.20                     | 1.36                          | 0.00                        | 1.36                             | 0.10                         | 1.22                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.465      | 0.0       | 84.0                | 0.249          | 0.48                            | 0.20                           | 0.39                  | 0.00                   | 0.39                        | 0.20                     | 0.31                          | 0.00                        | 0.31                             | 0.10                         | 0.28                        |
| Canal 1 | New Hampshire St Wetland 03 | 01       | 01-26        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 0.210      | 100.0     | 98.0                | 0.809          | 0.71                            | 0.20                           | 0.57                  | 0.00                   | 0.57                        | 0.20                     | 0.45                          | 0.00                        | 0.45                             | 0.10                         | 0.41                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Dry Pond                  | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 1.562      | 65.1      | 44.8                | 0.530          | 3.45                            | 0.80                           | 0.69                  | 0.00                   | 0.69                        | 0.20                     | 0.55                          | 0.00                        | 0.55                             | 0.10                         | 0.50                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 4.656      | 49.9      | 52.5                | 0.413          | 8.02                            | 0.00                           | 8.02                  | 0.00                   | 8.02                        | 0.20                     | 6.42                          | 0.00                        | 6.42                             | 0.10                         | 5.78                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | FOREST         | A/D                   | 0.124      | 0.0       | 77.0                | 0.199          | 0.10                            | 0.00                           | 0.10                  | 0.00                   | 0.10                        | 0.20                     | 0.08                          | 0.00                        | 0.08                             | 0.10                         | 0.07                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 15.418     | 47.2      | 71.8                | 0.417          | 26.79                           | 0.00                           | 26.79                 | 0.00                   | 26.79                       | 0.20                     | 21.43                         | 0.00                        | 21.43                            | 0.10                         | 19.29                       |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 2.753      | 0.0       | 84.0                | 0.249          | 2.86                            | 0.00                           | 2.86                  | 0.00                   | 2.86                        | 0.20                     | 2.29                          | 0.00                        | 2.29                             | 0.10                         | 2.06                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.004      | 0.0       | 98.0                | 0.627          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | A/D                   | 52.822     | 0.0       | 95.0                | 0.464          | 102.28                          | 0.00                           | 102.28                | 0.00                   | 102.28                      | 0.20                     | 81.83                         | 0.00                        | 81.83                            | 0.10                         | 73.64                       |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | B/D                   | 1.156      | 0.0       | 95.0                | 0.464          | 2.24                            | 0.00                           | 2.24                  | 0.00                   | 2.24                        | 0.20                     | 1.79                          | 0.00                        | 1.79                             | 0.10                         | 1.61                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | None                      | None           | Wetland | None       | Pond       | Canal           | WATER          | W                     | 0.252      | 100.0     | 98.0                | 0.809          | 0.85                            | 0.00                           | 0.85                  | 0.00                   | 0.85                        | 0.20                     | 0.68                          | 0.00                        | 0.68                             | 0.10                         | 0.61                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | Dry Pond   | Canal           | WATER          | A/D                   | 0.451      | 0.0       | 98.0                | 0.627          | 1.18                            | 0.20                           | 0.94                  | 0.00                   | 0.94                        | 0.20                     | 0.75                          | 0.00                        | 0.75                             | 0.10                         | 0.68                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A                     | 4.312      | 91.3      | 71.5                | 0.744          | 13.38                           | 0.20                           | 10.71                 | 0.00                   | 10.71                       | 0.20                     | 8.57                          | 0.00                        | 8.57                             | 0.10                         | 7.71                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 21.918     | 70.9      | 51.1                | 0.579          | 52.89                           | 0.20                           | 42.31                 | 0.00                   | 42.31                       | 0.20                     | 33.85                         | 0.00                        | 33.85                            | 0.10                         | 30.47                       |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 3.450      | 78.4      | 68.1                | 0.645          | 9.28                            | 0.20                           | 7.43                  | 0.00                   | 7.43                        | 0.20                     | 5.94                          | 0.00                        | 5.94                             | 0.10                         | 5.35                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | INDUSTRIAL     | A/D                   | 3.244      | 60.5      | 54.9                | 0.498          | 6.73                            | 0.20                           | 5.39                  | 0.00                   | 5.39                        | 0.20                     | 4.31                          | 0.00                        | 4.31                             | 0.10                         | 3.88                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 1.140      | 0.0       | 84.0                | 0.249          | 1.18                            | 0.20                           | 0.95                  | 0.00                   | 0.95                        | 0.20                     | 0.76                          | 0.00                        | 0.76                             | 0.10                         | 0.68                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | TRANSPORTATION | A/D                   | 0.245      | 0.0       | 90.1                | 0.331          | 0.34                            | 0.20                           | 0.27                  | 0.00                   | 0.27                        | 0.20                     | 0.22                          | 0.00                        | 0.22                             | 0.10                         | 0.19                        |
| Canal 1 | Princeton St. Wetland       | 01       | 01-27        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 1.177      | 100.0     | 98.0                | 0.809          | 3.97                            | 0.20                           | 3.18                  | 0.00                   | 3.18                        | 0.20                     | 2.54                          | 0.00                        | 2.54                             | 0.10                         | 2.29                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 0.643      | 18.9      | 44.9                | 0.161          | 0.43                            | 0.00                           | 0.43                  | 0.00                   | 0.43                        | 0.20                     | 0.35                          | 0.20                        | 0.28                             | 0.10                         | 0.25                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | B/D                   | 0.838      | 0.0       | 61.0                | 0.149          | 0.52                            | 0.00                           | 0.52                  | 0.00                   | 0.52                        | 0.20                     | 0.42                          | 0.20                        | 0.33                             | 0.10                         | 0.30                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 1.430      | 5.4       | 74.3                | 0.186          | 1.11                            | 0.00                           | 1.11                  | 0.00                   | 1.11                        | 0.20                     | 0.89                          | 0.20                        | 0.71                             | 0.10                         | 0.64                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | A/D                   | 0.349      | 0.0       | 77.0                | 0.199          | 0.29                            | 0.00                           | 0.29                  | 0.00                   | 0.29                        | 0.20                     | 0.23                          | 0.20                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | B/D                   | 0.323      | 0.0       | 77.0                | 0.199          | 0.27                            | 0.00                           | 0.27                  | 0.00                   | 0.27                        | 0.20                     | 0.22                          | 0.20                        | 0.17                             | 0.10                         | 0.15                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 7.222      | 0.0       | 77.0                | 0.199          | 6.01                            | 0.00                           | 6.01                  | 0.00                   | 6.01                        | 0.20                     | 4.81                          | 0.20                        | 3.84                             | 0.10                         | 3.46                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | MDR            | A/D                   | 5.134      | 20.0      | 57.4                | 0.183          | 3.91                            | 0.00                           | 3.91                  | 0.00                   | 3.91                        | 0.20                     | 3.13                          | 0.20                        | 2.50                             | 0.10                         | 2.25                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | MDR            | C/D                   | 3.203      | 0.0       | 84.8                | 0.256          | 3.41                            | 0.00                           | 3.41                  | 0.00                   | 3.41                        | 0.20                     | 2.73                          | 0.20                        | 2.18                             | 0.10                         | 1.97                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | OPEN           | C/D                   | 0.157      | 0.0       | 84.0                | 0.249          | 0.16                            | 0.00                           | 0.16                  | 0.00                   | 0.16                        | 0.20                     | 0.13                          | 0.20                        | 0.10                             | 0.10                         | 0.09                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | None           | Wetland | Pond       | None       | Canal           | TRANSPORTATION | A/D                   | 0.026      | 0.0       | 83.9                | 0.248          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.20                     | 0.02                          | 0.20                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.001      | 95.0      | 98.0                | 0.799          | 0.00                            | 0.00                           | 0.00                  | 0.25                   | 0.00                        | 0.20                     | 0.00                          | 0.00                        | 0.10                             | 0.00                         |                             |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 0.633      | 26.4      | 76.2                | 0.277          | 0.73                            | 0.00                           | 0.73                  | 0.25                   | 0.55                        | 0.20                     | 0.44                          | 0.20                        | 0.35                             | 0.10                         | 0.32                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | Pond       | None       | Canal           | FOREST         | C/D                   | 0.143      | 0.0       | 77.0                | 0.199          | 0.12                            | 0.00                           | 0.12                  | 0.25                   | 0.09                        | 0.20                     | 0.07                          | 0.20                        | 0.06                             | 0.10                         | 0.05                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | Pond       | None       | Canal           | HDR            | C/D                   | 0.100      | 28.5      | 79.3                | 0.307          | 0.13                            | 0.00                           | 0.13                  | 0.25                   | 0.10                        | 0.20                     | 0.08                          | 0.20                        | 0.06                             | 0.10                         | 0.06                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | Pond       | None       | Canal           | MDR            | C/D                   | 14.630     | 8.5       | 83.5                | 0.245          | 14.95                           | 0.00                           | 14.95                 | 0.25                   | 11.21                       | 0.20                     | 8.97                          | 0.20                        | 7.17                             | 0.10                         | 6.46                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | None                      | Swale          | Wetland | Pond       | None       | Canal           | OPEN           | C/D                   | 0.178      | 0.0       | 84.0                | 0.249          | 0.18                            | 0.00                           | 0.18                  | 0.25                   | 0.14                        | 0.20                     | 0.11                          | 0.20                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | Wet Pond                  | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 0.113      | 95.0      | 98.0                | 0.799          | 0.38                            | 0.20                           | 0.30                  | 0.00                   | 0.30                        | 0.20                     | 0.24                          | 0.20                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 1 | S. WD Judge Dr.             | 01       | 01-28        | Wet Pond                  | None           | Wetland | Pond       | None       | Canal           | COMMERCIAL     | B/D                   | 2.962      | 86.1      | 73.1                | 0.70           |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                     | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|-------------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 4.075      | 36.7      | 87.9                | 0.428          | 7.27                            | 0.80                           | 1.45                  | 0.00                   | 1.45                        | 0.00                     | 1.45                          | 0.00                        | 1.45                             | 0.10                         | 1.31                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | B/D                   | 0.598      | 20.0      | 72.6                | 0.217          | 0.54                            | 0.80                           | 0.11                  | 0.00                   | 0.11                        | 0.00                     | 0.11                          | 0.00                        | 0.11                             | 0.10                         | 0.10                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 2.147      | 20.0      | 81.5                | 0.262          | 2.35                            | 0.80                           | 0.47                  | 0.00                   | 0.47                        | 0.00                     | 0.47                          | 0.00                        | 0.47                             | 0.10                         | 0.42                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | B/D                   | 0.312      | 0.0       | 84.0                | 0.249          | 0.32                            | 0.80                           | 0.06                  | 0.00                   | 0.06                        | 0.00                     | 0.06                          | 0.00                        | 0.06                             | 0.10                         | 0.06                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 1.048      | 0.0       | 84.0                | 0.249          | 1.09                            | 0.80                           | 0.22                  | 0.00                   | 0.22                        | 0.00                     | 0.22                          | 0.00                        | 0.22                             | 0.10                         | 0.20                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | B/D                   | 1.269      | 31.0      | 83.8                | 0.353          | 1.87                            | 0.80                           | 0.37                  | 0.00                   | 0.37                        | 0.00                     | 0.37                          | 0.00                        | 0.37                             | 0.10                         | 0.34                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 3.028      | 60.9      | 82.4                | 0.545          | 6.88                            | 0.80                           | 1.38                  | 0.00                   | 1.38                        | 0.00                     | 1.38                          | 0.00                        | 1.38                             | 0.10                         | 1.24                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | Canal      | Canal           | WATER          | W                     | 0.380      | 100.0     | 98.0                | 0.809          | 1.28                            | 0.00                           | 1.28                  | 0.00                   | 1.28                        | 0.00                     | 1.28                          | 0.00                        | 1.28                             | 0.10                         | 1.15                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 1.273      | 19.7      | 77.7                | 0.236          | 1.25                            | 0.00                           | 1.25                  | 0.00                   | 1.25                        | 0.00                     | 1.25                          | 0.00                        | 1.25                             | 0.10                         | 1.13                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | B/D                   | 0.213      | 0.0       | 77.0                | 0.199          | 0.18                            | 0.00                           | 0.18                  | 0.00                   | 0.18                        | 0.00                     | 0.18                          | 0.00                        | 0.18                             | 0.10                         | 0.16                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 1.186      | 0.0       | 77.0                | 0.199          | 0.99                            | 0.00                           | 0.99                  | 0.00                   | 0.99                        | 0.00                     | 0.99                          | 0.00                        | 0.99                             | 0.10                         | 0.89                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | HDR            | B/D                   | 3.782      | 17.0      | 79.1                | 0.225          | 3.54                            | 0.00                           | 3.54                  | 0.00                   | 3.54                        | 0.00                     | 3.54                          | 0.00                        | 3.54                             | 0.10                         | 3.19                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | HDR            | C/D                   | 19.796     | 32.4      | 86.0                | 0.382          | 31.50                           | 0.00                           | 31.50                 | 0.00                   | 31.50                       | 0.00                     | 31.50                         | 0.00                        | 31.50                            | 0.10                         | 28.35                       |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | B/D                   | 0.001      | 0.0       | 61.0                | 0.149          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | A/D                   | 0.002      | 20.0      | 57.4                | 0.183          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.10                             | 0.00                         |                             |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | B/D                   | 1.313      | 20.0      | 72.6                | 0.217          | 1.19                            | 0.00                           | 1.19                  | 0.00                   | 1.19                        | 0.00                     | 1.19                          | 0.00                        | 1.19                             | 0.10                         | 1.07                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 10.073     | 14.8      | 82.5                | 0.236          | 9.93                            | 0.00                           | 9.93                  | 0.00                   | 9.93                        | 0.00                     | 9.93                          | 0.00                        | 9.93                             | 0.10                         | 8.94                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.039      | 0.0       | 84.0                | 0.249          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | B/D                   | 0.129      | 0.0       | 84.0                | 0.249          | 0.13                            | 0.00                           | 0.13                  | 0.00                   | 0.13                        | 0.00                     | 0.13                          | 0.00                        | 0.13                             | 0.10                         | 0.12                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 4.228      | 0.0       | 84.0                | 0.249          | 4.39                            | 0.00                           | 4.39                  | 0.00                   | 4.39                        | 0.00                     | 4.39                          | 0.00                        | 4.39                             | 0.10                         | 3.95                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | B/D                   | 0.208      | 0.0       | 78.5                | 0.208          | 0.18                            | 0.00                           | 0.18                  | 0.00                   | 0.18                        | 0.00                     | 0.18                          | 0.00                        | 0.18                             | 0.10                         | 0.16                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.058      | 18.5      | 85.6                | 0.288          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 2 | Canal 2                       | 02       | 02-01        | None                      | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 0.514      | 6.5       | 81.5                | 0.228          | 0.49                            | 0.00                           | 0.49                  | 0.25                   | 0.37                        | 0.00                     | 0.37                          | 0.00                        | 0.37                             | 0.10                         | 0.33                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | Dry Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 11.341     | 61.3      | 80.6                | 0.541          | 25.58                           | 0.80                           | 5.12                  | 0.00                   | 5.12                        | 0.00                     | 5.12                          | 0.20                        | 4.09                             | 0.10                         | 3.68                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.027      | 95.0      | 98.0                | 0.799          | 0.09                            | 0.00                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.001      | 95.0      | 98.0                | 0.799          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.10                             | 0.00                         |                             |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A                     | 0.443      | 66.7      | 59.9                | 0.550          | 1.02                            | 0.00                           | 1.02                  | 0.00                   | 1.02                        | 0.00                     | 1.02                          | 0.20                        | 0.81                             | 0.10                         | 0.73                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 4.386      | 77.0      | 69.9                | 0.636          | 11.64                           | 0.00                           | 11.64                 | 0.00                   | 11.64                       | 0.00                     | 11.64                         | 0.20                        | 9.31                             | 0.10                         | 8.38                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 57.268     | 78.3      | 89.6                | 0.685          | 163.54                          | 0.00                           | 163.54                | 0.00                   | 163.54                      | 0.00                     | 163.54                        | 0.20                        | 130.83                           | 0.10                         | 117.75                      |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | FOREST         | A/D                   | 0.450      | 0.0       | 77.0                | 0.199          | 0.37                            | 0.00                           | 0.37                  | 0.00                   | 0.37                        | 0.00                     | 0.37                          | 0.20                        | 0.30                             | 0.10                         | 0.27                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | FOREST         | B/D                   | 0.536      | 0.0       | 77.0                | 0.199          | 0.45                            | 0.00                           | 0.45                  | 0.00                   | 0.45                        | 0.00                     | 0.45                          | 0.20                        | 0.36                             | 0.10                         | 0.32                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | FOREST         | C/D                   | 1.226      | 0.0       | 77.0                | 0.199          | 1.02                            | 0.00                           | 1.02                  | 0.00                   | 1.02                        | 0.00                     | 1.02                          | 0.20                        | 0.82                             | 0.10                         | 0.73                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | A/D                   | 0.002      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.20                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | C/D                   | 0.094      | 0.0       | 74.0                | 0.185          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.00                     | 0.07                          | 0.20                        | 0.06                             | 0.10                         | 0.05                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | INDUSTRIAL     | C/D                   | 2.121      | 79.0      | 84.0                | 0.671          | 5.93                            | 0.00                           | 5.93                  | 0.00                   | 5.93                        | 0.00                     | 5.93                          | 0.20                        | 4.74                             | 0.10                         | 4.27                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | A/D                   | 1.451      | 20.0      | 57.4                | 0.183          | 1.11                            | 0.00                           | 1.11                  | 0.00                   | 1.11                        | 0.00                     | 1.11                          | 0.20                        | 0.88                             | 0.10                         | 0.80                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | C/D                   | 1.315      | 20.0      | 81.5                | 0.262          | 1.44                            | 0.00                           | 1.44                  | 0.00                   | 1.44                        | 0.00                     | 1.44                          | 0.20                        | 1.15                             | 0.10                         | 1.04                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | C/D                   | 23.652     | 76.9      | 82.5                | 0.654          | 64.47                           | 0.00                           | 64.47                 | 0.00                   | 64.47                       | 0.00                     | 64.47                         | 0.20                        | 51.58                            | 0.10                         | 46.42                       |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | WETLAND        | A/D                   | 2.649      | 0.0       | 95.0                | 0.464          | 5.13                            | 0.00                           | 5.13                  | 0.00                   | 5.13                        | 0.00                     | 5.13                          | 0.20                        | 4.10                             | 0.10                         | 3.69                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | WETLAND        | B/D                   | 0.005      | 0.0       | 95.0                | 0.464          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.20                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | None       | Canal           | WETLAND        | C/D                   | 0.806      | 0.0       | 95.0                | 0.464          | 1.56                            | 0.00                           | 1.56                  | 0.00                   | 1.56                        | 0.00                     | 1.56                          | 0.20                        | 1.25                             | 0.10                         | 1.12                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | None           | None    | Pond       | Pond       | Canal           | WATER          | W                     | 4.271      | 100.0     | 98.0                | 0.809          | 14.41                           | 0.00                           | 14.41                 | 0.00                   | 14.41                       | 0.00                     | 14.41                         | 0.20                        | 11.53                            | 0.10                         | 10.38                       |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | COMMERCIAL     | A                     | 0.813      | 49.4      | 58.0                | 0.414          | 1.40                            | 0.00                           | 1.40                  | 0.25                   | 1.05                        | 0.00                     | 1.05                          | 0.20                        | 0.84                             | 0.10                         | 0.76                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 1.634      | 84.5      | 97.1                | 0.767          | 5.22                            | 0.00                           | 5.22                  | 0.25                   | 3.92                        | 0.00                     | 3.92                          | 0.20                        | 3.13                             | 0.10                         | 2.82                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | HDR            | A                     | 0.011      | 34.8      | 40.7                | 0.286          | 0.01                            | 0.00                           | 0.01                  | 0.25                   | 0.01                        | 0.00                     | 0.01                          | 0.20                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | HDR            | C/D                   | 0.431      | 29.8      | 79.8                | 0.319          | 0.57                            | 0.00                           | 0.57                  | 0.25                   | 0.43                        | 0.00                     | 0.43                          | 0.20                        | 0.34                             | 0.10                         | 0.31                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | MDR            | A                     | 0.787      | 5.7       | 64.3                | 0.156          | 0.51                            | 0.00                           | 0.51                  | 0.25                   | 0.38                        | 0.00                     | 0.38                          | 0.20                        | 0.31                             | 0.10                         | 0.28                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | MDR            | C/D                   | 13.710     | 0.5       | 84.7                | 0.255          | 14.56                           | 0.00                           | 14.56                 | 0.25                   | 10.92                       | 0.00                     | 10.92                         | 0.20                        | 8.73                             | 0.10                         | 7.86                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | None                      | Swale          | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 0.024      | 0.0       | 84.0                | 0.249          | 0.03                            | 0.00                           | 0.03                  | 0.25                   | 0.02                        | 0.00                     | 0.02                          | 0.20                        | 0.02                             | 0.10                         | 0.01                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A                     | 0.093      | 70.4      | 63.7                | 0.581          | 0.23                            | 0.20                           | 0.18                  | 0.00                   | 0.18                        | 0.00                     | 0.18                          | 0.20                        | 0.14                             | 0.10                         | 0.13                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 2.211      | 35.3      | 42.1                | 0.291          | 2.69                            | 0.20                           | 2.15                  | 0.00                   | 2.15                        | 0.00                     | 2.15                          | 0.20                        | 1.72                             | 0.10                         | 1.55                        |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 11.077     | 68.9      | 79.3                | 0.591          | 27.29                           | 0.20                           | 21.83                 | 0.00                   | 21.83                       | 0.00                     | 21.83                         | 0.20                        | 17.47                            | 0.10                         | 15.72                       |
| Canal 2 | Courtesy Chevrolet Borrow Pit | 02       | 01-04        | Wet Pond                  | None           | None    | Pond       | None       |                 |                |                       |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                  | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|----------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | B/D                   | 0.366      | 0.0       | 95.0                | 0.464          | 0.71                            | 0.00                           | 0.71                  | 0.00                   | 0.71                        | 0.20                     | 0.57                          | 0.00                        | 0.57                             | 0.10                         | 0.51                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | None                      | None           | Wetland | None       | None       | Canal           | WETLAND        | C/D                   | 1.474      | 0.0       | 95.0                | 0.464          | 2.85                            | 0.00                           | 2.85                  | 0.00                   | 2.85                        | 0.20                     | 2.28                          | 0.00                        | 2.28                             | 0.10                         | 2.06                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | A/D                   | 0.231      | 0.0       | 49.4                | 0.134          | 0.13                            | 0.20                           | 0.10                  | 0.00                   | 0.10                        | 0.20                     | 0.08                          | 0.00                        | 0.08                             | 0.10                         | 0.07                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | B/D                   | 1.030      | 37.0      | 63.9                | 0.324          | 1.39                            | 0.20                           | 1.11                  | 0.00                   | 1.11                        | 0.20                     | 0.89                          | 0.00                        | 0.89                             | 0.10                         | 0.80                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | COMMERCIAL     | C/D                   | 3.350      | 32.8      | 86.8                | 0.392          | 5.48                            | 0.20                           | 4.38                  | 0.00                   | 4.38                        | 0.20                     | 3.50                          | 0.00                        | 3.50                             | 0.10                         | 3.15                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | HDR            | B/D                   | 0.889      | 16.2      | 76.0                | 0.203          | 0.75                            | 0.20                           | 0.60                  | 0.00                   | 0.60                        | 0.20                     | 0.48                          | 0.00                        | 0.48                             | 0.10                         | 0.43                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | HDR            | C/D                   | 8.169      | 22.4      | 84.7                | 0.303          | 10.33                           | 0.20                           | 8.26                  | 0.00                   | 8.26                        | 0.20                     | 6.61                          | 0.00                        | 6.61                             | 0.10                         | 5.95                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | A/D                   | 0.142      | 0.0       | 84.0                | 0.249          | 0.15                            | 0.20                           | 0.12                  | 0.00                   | 0.12                        | 0.20                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | B/D                   | 0.281      | 0.0       | 84.0                | 0.249          | 0.29                            | 0.20                           | 0.23                  | 0.00                   | 0.23                        | 0.20                     | 0.19                          | 0.00                        | 0.19                             | 0.10                         | 0.17                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | None       | Canal           | OPEN           | C/D                   | 1.065      | 0.0       | 84.0                | 0.249          | 1.11                            | 0.20                           | 0.88                  | 0.00                   | 0.88                        | 0.20                     | 0.71                          | 0.00                        | 0.71                             | 0.10                         | 0.64                        |
| Canal 2 | Courtesy Chevrolet Wetland | 02       | 02-03        | Wet Pond                  | None           | Wetland | None       | Wet Pond   | Canal           | WATER          | W                     | 1.399      | 100.0     | 98.0                | 0.809          | 4.72                            | 0.20                           | 3.78                  | 0.00                   | 3.78                        | 0.20                     | 3.02                          | 0.00                        | 3.02                             | 0.10                         | 2.72                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | Dry Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 1.380      | 79.4      | 79.6                | 0.665          | 3.82                            | 0.80                           | 0.76                  | 0.00                   | 0.76                        | 0.00                     | 0.76                          | 0.20                        | 0.61                             | 0.10                         | 0.55                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 1.329      | 48.6      | 80.1                | 0.450          | 2.50                            | 0.00                           | 2.50                  | 0.00                   | 2.50                        | 0.00                     | 2.50                          | 0.20                        | 2.00                             | 0.10                         | 1.80                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | B/D                   | 0.768      | 58.3      | 74.3                | 0.503          | 1.61                            | 0.00                           | 1.61                  | 0.00                   | 1.61                        | 0.00                     | 1.61                          | 0.20                        | 1.29                             | 0.10                         | 1.16                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 19.320     | 83.2      | 83.0                | 0.697          | 56.16                           | 0.00                           | 56.16                 | 0.00                   | 56.16                       | 0.00                     | 56.16                         | 0.20                        | 44.93                            | 0.10                         | 40.44                       |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | B/D                   | 0.022      | 0.0       | 61.0                | 0.149          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.20                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | C/D                   | 0.007      | 0.0       | 74.0                | 0.185          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.20                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | INDUSTRIAL     | C/D                   | 4.412      | 65.7      | 79.1                | 0.568          | 10.45                           | 0.00                           | 10.45                 | 0.00                   | 10.45                       | 0.00                     | 10.45                         | 0.20                        | 8.36                             | 0.10                         | 7.52                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A/D                   | 0.414      | 0.0       | 84.0                | 0.249          | 0.43                            | 0.00                           | 0.43                  | 0.00                   | 0.43                        | 0.00                     | 0.43                          | 0.20                        | 0.34                             | 0.10                         | 0.31                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | B/D                   | 0.498      | 0.0       | 84.0                | 0.249          | 0.52                            | 0.00                           | 0.52                  | 0.00                   | 0.52                        | 0.00                     | 0.52                          | 0.20                        | 0.41                             | 0.10                         | 0.37                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 0.597      | 0.0       | 84.0                | 0.249          | 0.62                            | 0.00                           | 0.62                  | 0.00                   | 0.62                        | 0.00                     | 0.62                          | 0.20                        | 0.50                             | 0.10                         | 0.45                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | A/D                   | 0.165      | 84.9      | 63.4                | 0.693          | 0.48                            | 0.00                           | 0.48                  | 0.00                   | 0.48                        | 0.00                     | 0.48                          | 0.20                        | 0.38                             | 0.10                         | 0.34                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | B/D                   | 0.267      | 87.7      | 79.8                | 0.723          | 0.80                            | 0.00                           | 0.80                  | 0.00                   | 0.80                        | 0.00                     | 0.80                          | 0.20                        | 0.64                             | 0.10                         | 0.58                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | C/D                   | 1.314      | 85.1      | 84.9                | 0.713          | 3.91                            | 0.00                           | 3.91                  | 0.00                   | 3.91                        | 0.00                     | 3.91                          | 0.20                        | 3.12                             | 0.10                         | 2.81                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | None           | None    | Pond       | None       | Canal           | WETLAND        | A/D                   | 0.071      | 0.0       | 95.0                | 0.464          | 0.14                            | 0.00                           | 0.14                  | 0.00                   | 0.14                        | 0.00                     | 0.14                          | 0.20                        | 0.11                             | 0.10                         | 0.10                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | Swale          | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 1.380      | 24.3      | 75.4                | 0.258          | 1.49                            | 0.00                           | 1.49                  | 0.25                   | 1.11                        | 0.00                     | 1.11                          | 0.20                        | 0.89                             | 0.10                         | 0.80                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | Swale          | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 2.582      | 0.0       | 85.2                | 0.260          | 2.80                            | 0.00                           | 2.80                  | 0.25                   | 2.10                        | 0.00                     | 2.10                          | 0.20                        | 1.68                             | 0.10                         | 1.51                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | None                      | Swale          | None    | Pond       | None       | Canal           | TRANSPORTATION | C/D                   | 0.931      | 0.0       | 86.8                | 0.282          | 1.10                            | 0.00                           | 1.10                  | 0.25                   | 0.82                        | 0.00                     | 0.82                          | 0.20                        | 0.66                             | 0.10                         | 0.59                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 0.345      | 23.5      | 40.0                | 0.195          | 0.28                            | 0.20                           | 0.22                  | 0.00                   | 0.22                        | 0.00                     | 0.22                          | 0.20                        | 0.18                             | 0.10                         | 0.16                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 3.255      | 73.4      | 77.5                | 0.620          | 8.41                            | 0.20                           | 6.73                  | 0.00                   | 6.73                        | 0.00                     | 6.73                          | 0.20                        | 5.38                             | 0.10                         | 4.84                        |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | Wet Pond                  | None           | None    | Pond       | Pond       | Canal           | WATER          | W                     | 6.955      | 100.0     | 98.0                | 0.809          | 23.47                           | 0.20                           | 18.78                 | 0.00                   | 18.78                       | 0.00                     | 18.78                         | 0.20                        | 15.02                            | 0.10                         | 13.52                       |
| Canal 2 | N. Mercy Dr. Borrow Pit    | 02       | 02-04        | Wet Pond                  | None           | None    | Pond       | Wet Pond   | Canal           | WATER          | W                     | 0.297      | 100.0     | 98.0                | 0.809          | 1.00                            | 0.20                           | 0.80                  | 0.00                   | 0.80                        | 0.00                     | 0.80                          | 0.20                        | 0.64                             | 0.10                         | 0.58                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Dry Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 7.027      | 57.9      | 83.2                | 0.528          | 15.48                           | 0.80                           | 3.10                  | 0.00                   | 3.10                        | 0.00                     | 3.10                          | 0.20                        | 2.48                             | 0.10                         | 2.23                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 4.458      | 6.7       | 79.2                | 0.211          | 3.92                            | 0.00                           | 3.92                  | 0.00                   | 3.92                        | 0.00                     | 3.92                          | 0.20                        | 3.14                             | 0.10                         | 2.83                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A/D                   | 3.048      | 0.0       | 84.0                | 0.249          | 3.16                            | 0.00                           | 3.16                  | 0.00                   | 3.16                        | 0.00                     | 3.16                          | 0.20                        | 2.53                             | 0.10                         | 2.28                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 7.230      | 0.0       | 84.0                | 0.249          | 7.50                            | 0.00                           | 7.50                  | 0.00                   | 7.50                        | 0.00                     | 7.50                          | 0.20                        | 6.00                             | 0.10                         | 5.40                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | None                      | Swale          | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 2.960      | 17.9      | 85.6                | 0.284          | 3.51                            | 0.00                           | 3.51                  | 0.25                   | 2.63                        | 0.00                     | 2.63                          | 0.20                        | 2.10                             | 0.10                         | 1.89                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A/D                   | 16.486     | 69.1      | 46.2                | 0.563          | 38.70                           | 0.20                           | 30.96                 | 0.00                   | 30.96                       | 0.00                     | 30.96                         | 0.20                        | 24.77                            | 0.10                         | 22.29                       |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 37.231     | 81.9      | 79.9                | 0.683          | 106.01                          | 0.20                           | 84.81                 | 0.00                   | 84.81                       | 0.00                     | 84.81                         | 0.20                        | 67.85                            | 0.10                         | 61.06                       |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | INDUSTRIAL     | A/D                   | 0.927      | 32.5      | 42.2                | 0.269          | 1.04                            | 0.20                           | 0.83                  | 0.00                   | 0.83                        | 0.00                     | 0.83                          | 0.20                        | 0.66                             | 0.10                         | 0.60                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | INDUSTRIAL     | C/D                   | 3.129      | 57.0      | 78.8                | 0.506          | 6.60                            | 0.20                           | 5.28                  | 0.00                   | 5.28                        | 0.00                     | 5.28                          | 0.20                        | 4.22                             | 0.10                         | 3.80                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | OPEN           | A/D                   | 0.564      | 0.0       | 84.0                | 0.249          | 0.59                            | 0.20                           | 0.47                  | 0.00                   | 0.47                        | 0.00                     | 0.47                          | 0.20                        | 0.37                             | 0.10                         | 0.34                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 3.808      | 0.0       | 84.0                | 0.249          | 3.95                            | 0.20                           | 3.16                  | 0.00                   | 3.16                        | 0.00                     | 3.16                          | 0.20                        | 2.53                             | 0.10                         | 2.28                        |
| Canal 2 | S. Mercy Dr. Borrow Pit    | 02       | 02-05        | Wet Pond                  | None           | None    | Pond       | Wet Pond   | Canal           | WATER          | W                     | 8.053      | 100.0     | 98.0                | 0.809          | 27.17                           | 0.20                           | 21.74                 | 0.00                   | 21.74                       | 0.00                     | 21.74                         | 0.20                        | 17.39                            | 0.10                         | 15.65                       |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | OPEN           | C/D                   | 0.416      | 0.0       | 84.0                | 0.249          | 0.43                            | 0.80                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.099      | 62.1      | 98.0                | 0.728          | 3.34                            | 0.80                           | 0.67                  | 0.00                   | 0.67                        | 0.00                     | 0.67                          | 0.00                        | 0.67                             | 0.10                         | 0.60                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 2.543      | 0.0       | 84.0                | 0.249          | 2.64                            | 0.80                           | 0.53                  | 0.00                   | 0.53                        | 0.00                     | 0.53                          | 0.00                        | 0.53                             | 0.10                         | 0.47                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | INSTITUTIONAL  | C/D                   | 0.082      | 0.0       | 74.0                | 0.185          | 0.06                            | 0.80                           | 0.01                  | 0.25                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.023      | 1.6       | 81.7                | 0.230          | 0.98                            | 0.80                           | 0.20                  | 0.25                   | 0.15                        | 0.00                     | 0.15                          | 0.00                        | 0.15                             | 0.10                         | 0.13                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | C/D                   | 0.874      | 0.0       | 84.0                | 0.249          | 0.91                            | 0.80                           | 0.18                  | 0.25                   | 0.14                        | 0.00                     | 0.14                          | 0.00                        | 0.14                             | 0.10                         | 0.12                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A                     | 0.383      | 0.0       | 30.0                | 0.123          | 0.20                            | 0.00                           | 0.20                  | 0.00                   | 0.20                        | 0.00                     | 0.20                          | 0.00                        | 0.20                             | 0.10                         | 0.18                        |
| Canal 3 | Canal 3                    | 03       | 03-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 1.383      | 0.0       | 77.0                | 0.199          | 1.15                            | 0.00                           | 1.15                  | 0.00                   | 1.15                        | 0.00                     |                               |                             |                                  |                              |                             |



Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin   | Sub Basin                | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------|--------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 1.012      | 0.0       | 77.0                | 0.199          | 0.84                            | 0.00                           | 0.84                  | 0.00                   | 0.84                        | 0.00                     | 0.84                          | 0.00                        | 0.84                             | 0.10                         | 0.76                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | INDUSTRIAL     | C/D                   | 0.572      | 86.8      | 91.6                | 0.741          | 1.77                            | 0.00                           | 1.77                  | 0.00                   | 1.77                        | 0.00                     | 1.77                          | 0.00                        | 1.77                             | 0.10                         | 1.59                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 8.543      | 38.3      | 81.0                | 0.384          | 13.69                           | 0.00                           | 13.69                 | 0.00                   | 13.69                       | 0.00                     | 13.69                         | 0.00                        | 13.69                            | 0.10                         | 12.32                       |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.234      | 0.0       | 84.0                | 0.249          | 0.24                            | 0.00                           | 0.24                  | 0.00                   | 0.24                        | 0.00                     | 0.24                          | 0.00                        | 0.24                             | 0.10                         | 0.22                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 8.753      | 0.0       | 84.0                | 0.249          | 9.08                            | 0.00                           | 9.08                  | 0.00                   | 9.08                        | 0.00                     | 9.08                          | 0.00                        | 9.08                             | 0.10                         | 8.17                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 8.562      | 80.0      | 83.0                | 0.675          | 24.11                           | 0.00                           | 24.11                 | 0.00                   | 24.11                       | 0.00                     | 24.11                         | 0.00                        | 24.11                            | 0.10                         | 21.70                       |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | Swale          | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 4.268      | 31.5      | 78.9                | 0.326          | 5.80                            | 0.00                           | 5.80                  | 0.25                   | 4.35                        | 0.00                     | 4.35                          | 0.00                        | 4.35                             | 0.10                         | 3.92                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | Swale          | None    | None       | None       | Canal           | INDUSTRIAL     | C/D                   | 0.636      | 24.8      | 81.9                | 0.298          | 0.79                            | 0.00                           | 0.79                  | 0.25                   | 0.59                        | 0.00                     | 0.59                          | 0.00                        | 0.59                             | 0.10                         | 0.53                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.106      | 40.5      | 96.5                | 0.625          | 2.88                            | 0.00                           | 2.88                  | 0.25                   | 2.16                        | 0.00                     | 2.16                          | 0.00                        | 2.16                             | 0.10                         | 1.94                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | C/D                   | 10.862     | 0.0       | 84.2                | 0.250          | 11.33                           | 0.00                           | 11.33                 | 0.25                   | 8.50                        | 0.00                     | 8.50                          | 0.00                        | 8.50                             | 0.10                         | 7.65                        |
| Canal 4 | Canal 4                  | 04       | 04-01        | None                      | Swale          | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 0.849      | 0.0       | 88.7                | 0.309          | 1.10                            | 0.00                           | 1.10                  | 0.25                   | 0.82                        | 0.00                     | 0.82                          | 0.00                        | 0.82                             | 0.10                         | 0.74                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | Dry Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | INSTITUTIONAL  | A/D                   | 0.002      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.80                           | 0.00                  | 0.25                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | Dry Pond                  | Swale          | None    | None       | Dry Pond   | Canal           | OPEN           | A/D                   | 0.138      | 0.0       | 84.0                | 0.249          | 0.14                            | 0.80                           | 0.03                  | 0.25                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.10                         | 0.02                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 0.792      | 0.0       | 47.5                | 0.132          | 0.44                            | 0.80                           | 0.09                  | 0.25                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.10                         | 0.06                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 3.516      | 0.1       | 83.6                | 0.246          | 3.61                            | 0.80                           | 0.72                  | 0.25                   | 0.54                        | 0.00                     | 0.54                          | 0.00                        | 0.54                             | 0.10                         | 0.49                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | Dry Pond                  | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 0.174      | 0.0       | 84.0                | 0.249          | 0.18                            | 0.80                           | 0.04                  | 0.25                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.02                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | Canal      | Canal           | WATER          | W                     | 0.460      | 100.0     | 98.0                | 0.809          | 1.55                            | 0.00                           | 1.55                  | 0.00                   | 1.55                        | 0.00                     | 1.55                          | 0.00                        | 1.55                             | 0.10                         | 1.40                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 23.634     | 61.9      | 83.4                | 0.555          | 54.73                           | 0.00                           | 54.73                 | 0.00                   | 54.73                       | 0.00                     | 54.73                         | 0.00                        | 54.73                            | 0.10                         | 49.26                       |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | A/D                   | 0.032      | 0.0       | 77.0                | 0.199          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.02                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 9.261      | 0.0       | 77.0                | 0.199          | 7.70                            | 0.00                           | 7.70                  | 0.00                   | 7.70                        | 0.00                     | 7.70                          | 0.00                        | 7.70                             | 0.10                         | 6.93                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | INDUSTRIAL     | C/D                   | 4.720      | 77.2      | 83.0                | 0.657          | 12.93                           | 0.00                           | 12.93                 | 0.00                   | 12.93                       | 0.00                     | 12.93                         | 0.00                        | 12.93                            | 0.10                         | 11.64                       |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A                     | 0.076      | 0.0       | 39.0                | 0.127          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 0.290      | 0.0       | 41.3                | 0.128          | 0.15                            | 0.00                           | 0.15                  | 0.00                   | 0.15                        | 0.00                     | 0.15                          | 0.00                        | 0.15                             | 0.10                         | 0.14                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.708      | 0.0       | 80.4                | 0.219          | 1.56                            | 0.00                           | 1.56                  | 0.00                   | 1.56                        | 0.00                     | 1.56                          | 0.00                        | 1.56                             | 0.10                         | 1.40                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 8.876      | 15.3      | 80.5                | 0.222          | 8.20                            | 0.00                           | 8.20                  | 0.00                   | 8.20                        | 0.00                     | 8.20                          | 0.00                        | 8.20                             | 0.10                         | 7.38                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A                     | 2.250      | 0.0       | 49.3                | 0.134          | 1.26                            | 0.00                           | 1.26                  | 0.00                   | 1.26                        | 0.00                     | 1.26                          | 0.00                        | 1.26                             | 0.10                         | 1.13                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 2.681      | 0.0       | 84.0                | 0.249          | 2.78                            | 0.00                           | 2.78                  | 0.00                   | 2.78                        | 0.00                     | 2.78                          | 0.00                        | 2.78                             | 0.10                         | 2.50                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 8.705      | 0.0       | 84.1                | 0.249          | 9.06                            | 0.00                           | 9.06                  | 0.00                   | 9.06                        | 0.00                     | 9.06                          | 0.00                        | 9.06                             | 0.10                         | 8.15                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | RECREATIONAL   | A                     | 0.965      | 0.0       | 60.2                | 0.148          | 0.59                            | 0.00                           | 0.59                  | 0.00                   | 0.59                        | 0.00                     | 0.59                          | 0.00                        | 0.59                             | 0.10                         | 0.53                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | RECREATIONAL   | C/D                   | 0.101      | 0.0       | 79.2                | 0.211          | 0.09                            | 0.00                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | C/D                   | 7.547      | 80.8      | 83.2                | 0.682          | 21.44                           | 0.00                           | 21.44                 | 0.00                   | 21.44                       | 0.00                     | 21.44                         | 0.00                        | 21.44                            | 0.10                         | 19.30                       |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | UTILITY        | A/D                   | 0.379      | 84.8      | 79.3                | 0.702          | 1.11                            | 0.00                           | 1.11                  | 0.00                   | 1.11                        | 0.00                     | 1.11                          | 0.00                        | 1.11                             | 0.10                         | 1.00                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | None           | None    | None       | None       | Canal           | UTILITY        | C/D                   | 2.260      | 89.0      | 96.2                | 0.773          | 7.28                            | 0.00                           | 7.28                  | 0.00                   | 7.28                        | 0.00                     | 7.28                          | 0.00                        | 7.28                             | 0.10                         | 6.56                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | A                     | 0.687      | 51.6      | 50.1                | 0.425          | 1.22                            | 0.00                           | 1.22                  | 0.25                   | 0.91                        | 0.00                     | 0.91                          | 0.00                        | 0.91                             | 0.10                         | 0.82                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | A/D                   | 2.117      | 34.7      | 46.6                | 0.288          | 2.55                            | 0.00                           | 2.55                  | 0.25                   | 1.91                        | 0.00                     | 1.91                          | 0.00                        | 1.91                             | 0.10                         | 1.72                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | INSTITUTIONAL  | C/D                   | 8.232      | 6.1       | 79.4                | 0.213          | 7.30                            | 0.00                           | 7.30                  | 0.25                   | 5.47                        | 0.00                     | 5.47                          | 0.00                        | 5.47                             | 0.10                         | 4.92                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | A                     | 3.457      | 0.0       | 49.2                | 0.134          | 1.93                            | 0.00                           | 1.93                  | 0.25                   | 1.45                        | 0.00                     | 1.45                          | 0.00                        | 1.45                             | 0.10                         | 1.30                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | A/D                   | 10.809     | 0.0       | 84.0                | 0.249          | 11.22                           | 0.00                           | 11.22                 | 0.25                   | 8.41                        | 0.00                     | 8.41                          | 0.00                        | 8.41                             | 0.10                         | 7.57                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | OPEN           | C/D                   | 12.438     | 0.0       | 84.1                | 0.250          | 12.95                           | 0.00                           | 12.95                 | 0.25                   | 9.71                        | 0.00                     | 9.71                          | 0.00                        | 9.71                             | 0.10                         | 8.74                        |
| Canal 5 | Canal 5                  | 05       | 05-01        | None                      | Swale          | None    | None       | None       | Canal           | RECREATIONAL   | A                     | 2.080      | 7.9       | 55.5                | 0.141          | 1.22                            | 0.00                           | 1.22                  | 0.25                   | 0.91                        | 0.00                     | 0.91                          | 0.00                        | 0.91                             | 0.10                         | 0.82                        |
| Canal 5 | Direct                   | 05       | 05-02        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 8.953      | 28.8      | 80.0                | 0.312          | 11.64                           | 0.00                           | 11.64                 | 0.00                   | 11.64                       | 0.00                     | 11.64                         | 0.00                        | 11.64                            | 0.10                         | 10.48                       |
| Canal 5 | Direct                   | 05       | 05-02        | None                      | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 1.684      | 0.0       | 77.0                | 0.199          | 1.40                            | 0.00                           | 1.40                  | 0.00                   | 1.40                        | 0.00                     | 1.40                          | 0.00                        | 1.40                             | 0.10                         | 1.26                        |
| Canal 5 | Direct                   | 05       | 05-02        | None                      | None           | None    | None       | None       | Canal           | INDUSTRIAL     | C/D                   | 6.152      | 63.1      | 78.6                | 0.548          | 14.07                           | 0.00                           | 14.07                 | 0.00                   | 14.07                       | 0.00                     | 14.07                         | 0.00                        | 14.07                            | 0.10                         | 12.66                       |
| Canal 5 | Direct                   | 05       | 05-02        | None                      | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 3.951      | 0.0       | 78.7                | 0.209          | 3.44                            | 0.00                           | 3.44                  | 0.00                   | 3.44                        | 0.00                     | 3.44                          | 0.00                        | 3.44                             | 0.10                         | 3.09                        |
| Canal 5 | Direct                   | 05       | 05-02        | None                      | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 0.082      | 0.0       | 84.0                | 0.249          | 0.09                            | 0.00                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 5 | Pickfield Ct. Borrow Pit | 05       | 05-03        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | C/D                   | 0.535      | 0.0       | 95.4                | 0.487          | 1.09                            | 0.00                           | 1.09                  | 0.00                   | 1.09                        | 0.00                     | 1.09                          | 0.00                        | 1.09                             | 0.10                         | 0.98                        |
| Canal 5 | Pickfield Ct. Borrow Pit | 05       | 05-03        | None                      | None           | None    | None       | None       | Canal           | MDR            | C/D                   | 2.000      | 20.0      | 79.5                | 0.248          | 2.07                            | 0.00                           | 2.07                  | 0.00                   | 2.07                        | 0.00                     | 2.07                          | 0.00                        | 2.07                             | 0.10                         | 1.86                        |
| Canal 5 | Pickfield Ct. Borrow Pit | 05       | 05-03        | None                      | None           | None    | None       | None       | Canal           | OPEN           | C/D                   | 1.297      | 0.0       | 84.1                | 0.250          | 1.35                            | 0.00                           | 1.35                  | 0.00                   | 1.35                        | 0.00                     | 1.35                          | 0.00                        | 1.35                             | 0.10                         | 1.22                        |
| Canal 5 | Pickfield Ct. Borrow Pit | 05       | 05-03        | None                      | None           | None    | Pond       | Pond       | Canal           | WATER          | W                     | 0.354      | 100.0     | 98.0                | 0.809          | 1.19                            | 0.00                           | 1.19                  | 0.00                   | 1.19                        | 0.00                     | 1.19                          | 0.20                        | 0.96                             | 0.10                         | 0.86                        |
| Canal 6 | Canal 6                  | 06       | 06-01        | Dry Pond                  | None           | None    | None       | Dry Pond   | Canal           | RECREATIONAL   | A                     | 0.060      | 0.0       | 49.0                | 0.134          | 0.03                            | 0.80                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.10                         | 0.01                        |
| Canal 6 | Canal 6                  | 06       | 06-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | FOREST         | A                     | 0.323      | 0.0       | 30.0                | 0.123          | 0.17                            | 0.80                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.10                         | 0.03                        |
| Canal 6 | Canal 6                  | 06       | 06-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | FOREST         | C/D                   | 1.741      | 0.0       | 77.0                | 0.199          | 1.45                            | 0.80                           | 0.29                  | 0.00                   | 0.29                        | 0.00                     | 0.29                          | 0.00                        | 0.29                             | 0.10                         | 0.26                        |
| Canal 6 | Canal 6                  | 06       | 06-01        | Dry Pond                  | None           | None    | None       | None       | Canal           | RECREATIONAL   | A</                   |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin           | Sub Basin       | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|-----------------|-----------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | Lake       | Canal           | WATER          | W                     | 2.556      | 100.0     | 98.0                | 0.809          | 8.63                            | 0.00                           | 8.63                  | 0.00                   | 8.63                        | 0.00                     | 8.63                          | 0.20                        | 6.90                             | 0.10                         | 6.21                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A                     | 3.129      | 62.6      | 53.1                | 0.514          | 6.70                            | 0.00                           | 6.70                  | 0.00                   | 6.70                        | 0.00                     | 6.70                          | 0.20                        | 5.36                             | 0.10                         | 4.82                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 2.421      | 45.9      | 80.5                | 0.434          | 4.38                            | 0.00                           | 4.38                  | 0.00                   | 4.38                        | 0.00                     | 4.38                          | 0.20                        | 3.51                             | 0.10                         | 3.16                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | A                     | 0.003      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.20                        | 0.00                             | 0.10                         | 0.00                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | HDR            | C/D                   | 2.117      | 5.9       | 84.9                | 0.256          | 2.26                            | 0.00                           | 2.26                  | 0.00                   | 2.26                        | 0.00                     | 2.26                          | 0.20                        | 1.81                             | 0.10                         | 1.63                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | INSTITUTIONAL  | C/D                   | 3.595      | 25.7      | 78.9                | 0.285          | 4.28                            | 0.00                           | 4.28                  | 0.00                   | 4.28                        | 0.00                     | 4.28                          | 0.20                        | 3.42                             | 0.10                         | 3.08                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | A                     | 61.586     | 20.0      | 57.4                | 0.183          | 46.90                           | 0.00                           | 46.90                 | 0.00                   | 46.90                       | 0.00                     | 46.90                         | 0.20                        | 37.52                            | 0.10                         | 33.77                       |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | C/D                   | 14.023     | 20.0      | 81.5                | 0.262          | 15.33                           | 0.00                           | 15.33                 | 0.00                   | 15.33                       | 0.00                     | 15.33                         | 0.20                        | 12.26                            | 0.10                         | 11.03                       |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A                     | 5.359      | 0.0       | 49.0                | 0.134          | 2.99                            | 0.00                           | 2.99                  | 0.00                   | 2.99                        | 0.00                     | 2.99                          | 0.20                        | 2.39                             | 0.10                         | 2.15                        |
| Canal 6         | Lake June       | 06       | 06-02        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 0.693      | 0.0       | 84.0                | 0.249          | 0.72                            | 0.00                           | 0.72                  | 0.00                   | 0.72                        | 0.00                     | 0.72                          | 0.20                        | 0.58                             | 0.10                         | 0.52                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | Canal      | Canal           | WATER          | W                     | 0.099      | 100.0     | 98.0                | 0.809          | 0.33                            | 0.00                           | 0.33                  | 0.00                   | 0.33                        | 0.00                     | 0.33                          | 0.20                        | 0.27                             | 0.10                         | 0.24                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | Lake       | Canal           | WATER          | W                     | 2.468      | 100.0     | 98.0                | 0.809          | 8.33                            | 0.00                           | 8.33                  | 0.00                   | 8.33                        | 0.00                     | 8.33                          | 0.20                        | 6.66                             | 0.10                         | 6.00                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | A                     | 10.699     | 31.9      | 54.8                | 0.273          | 12.16                           | 0.00                           | 12.16                 | 0.00                   | 12.16                       | 0.00                     | 12.16                         | 0.20                        | 9.72                             | 0.10                         | 8.75                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | COMMERCIAL     | C/D                   | 3.421      | 30.9      | 79.8                | 0.325          | 4.64                            | 0.00                           | 4.64                  | 0.00                   | 4.64                        | 0.00                     | 4.64                          | 0.20                        | 3.71                             | 0.10                         | 3.34                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | INSTITUTIONAL  | A                     | 1.651      | 34.5      | 70.0                | 0.317          | 2.18                            | 0.00                           | 2.18                  | 0.00                   | 2.18                        | 0.00                     | 2.18                          | 0.20                        | 1.74                             | 0.10                         | 1.57                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | INSTITUTIONAL  | C/D                   | 1.900      | 71.9      | 77.4                | 0.608          | 4.82                            | 0.00                           | 4.82                  | 0.00                   | 4.82                        | 0.00                     | 4.82                          | 0.20                        | 3.85                             | 0.10                         | 3.47                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | A                     | 19.142     | 20.0      | 57.4                | 0.183          | 14.58                           | 0.00                           | 14.58                 | 0.00                   | 14.58                       | 0.00                     | 14.58                         | 0.20                        | 11.67                            | 0.10                         | 10.50                       |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | MDR            | C/D                   | 9.519      | 18.7      | 80.9                | 0.249          | 9.88                            | 0.00                           | 9.88                  | 0.00                   | 9.88                        | 0.00                     | 9.88                          | 0.20                        | 7.90                             | 0.10                         | 7.11                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | A                     | 0.131      | 0.0       | 49.0                | 0.134          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.00                     | 0.07                          | 0.20                        | 0.06                             | 0.10                         | 0.05                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | OPEN           | C/D                   | 1.345      | 8.1       | 85.5                | 0.265          | 1.49                            | 0.00                           | 1.49                  | 0.00                   | 1.49                        | 0.00                     | 1.49                          | 0.20                        | 1.19                             | 0.10                         | 1.07                        |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | A                     | 10.579     | 92.3      | 80.0                | 0.756          | 33.33                           | 0.00                           | 33.33                 | 0.00                   | 33.33                       | 0.00                     | 33.33                         | 0.20                        | 26.67                            | 0.10                         | 24.00                       |
| Canal 6         | Lake Marylin    | 06       | 06-03        | None                      | None           | None    | Pond       | None       | Canal           | TRANSPORTATION | C/D                   | 2.974      | 92.7      | 91.7                | 0.772          | 9.57                            | 0.00                           | 9.57                  | 0.00                   | 9.57                        | 0.00                     | 9.57                          | 0.20                        | 7.66                             | 0.10                         | 6.89                        |
| Canal 7         | Canal 7         | 07       | 07-01        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | A                     | 0.280      | 45.8      | 88.9                | 0.492          | 0.57                            | 0.00                           | 0.57                  | 0.00                   | 0.57                        | 0.00                     | 0.57                          | 0.00                        | 0.57                             | 0.10                         | 0.52                        |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | FOREST         | A                     | 4.084      | 0.0       | 30.0                | 0.123          | 2.10                            | 0.20                           | 1.68                  | 0.00                   | 1.68                        | 0.00                     | 1.68                          | 0.00                        | 1.68                             | 0.10                         | 1.51                        |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | INSTITUTIONAL  | A                     | 2.239      | 32.0      | 62.4                | 0.283          | 2.65                            | 0.20                           | 2.12                  | 0.00                   | 2.12                        | 0.00                     | 2.12                          | 0.00                        | 2.12                             | 0.10                         | 1.91                        |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | MDR            | A                     | 81.264     | 20.0      | 57.4                | 0.183          | 61.91                           | 0.20                           | 49.53                 | 0.00                   | 49.53                       | 0.00                     | 49.53                         | 0.00                        | 49.53                            | 0.10                         | 44.57                       |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | MDR            | A/D                   | 20.824     | 20.0      | 57.4                | 0.183          | 15.86                           | 0.20                           | 12.69                 | 0.00                   | 12.69                       | 0.00                     | 12.69                         | 0.00                        | 12.69                            | 0.10                         | 11.42                       |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | OPEN           | A                     | 9.436      | 0.0       | 49.0                | 0.134          | 5.26                            | 0.20                           | 4.21                  | 0.00                   | 4.21                        | 0.00                     | 4.21                          | 0.00                        | 4.21                             | 0.10                         | 3.79                        |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 1.755      | 0.0       | 84.0                | 0.249          | 1.82                            | 0.20                           | 1.46                  | 0.00                   | 1.46                        | 0.00                     | 1.46                          | 0.00                        | 1.46                             | 0.10                         | 1.31                        |
| Canal 7         | Canal 7         | 07       | 07-01        | Wet Pond                  | None           | None    | None       | Wet Pond   | Canal           | WATER          | W                     | 3.763      | 100.0     | 98.0                | 0.809          | 12.70                           | 0.20                           | 10.16                 | 0.00                   | 10.16                       | 0.00                     | 10.16                         | 0.00                        | 10.16                            | 0.10                         | 9.14                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | Canal      | Canal           | WATER          | W                     | 0.259      | 100.0     | 98.0                | 0.809          | 0.87                            | 0.00                           | 0.87                  | 0.00                   | 0.87                        | 0.00                     | 0.87                          | 0.00                        | 0.87                             | 0.10                         | 0.79                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | COMMERCIAL     | A                     | 0.277      | 28.3      | 62.3                | 0.255          | 0.29                            | 0.00                           | 0.29                  | 0.00                   | 0.29                        | 0.00                     | 0.29                          | 0.00                        | 0.29                             | 0.10                         | 0.26                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | HDR            | A/D                   | 0.738      | 38.5      | 57.5                | 0.328          | 1.01                            | 0.00                           | 1.01                  | 0.00                   | 1.01                        | 0.00                     | 1.01                          | 0.00                        | 1.01                             | 0.10                         | 0.91                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | A                     | 42.785     | 20.0      | 57.4                | 0.183          | 32.59                           | 0.00                           | 32.59                 | 0.00                   | 32.59                       | 0.00                     | 32.59                         | 0.00                        | 32.59                            | 0.10                         | 29.34                       |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | A/D                   | 58.083     | 20.0      | 57.4                | 0.183          | 44.28                           | 0.00                           | 44.28                 | 0.00                   | 44.28                       | 0.00                     | 44.28                         | 0.00                        | 44.28                            | 0.10                         | 39.85                       |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | MDR            | B/D                   | 0.058      | 13.9      | 68.4                | 0.166          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.10                         | 0.04                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A                     | 0.155      | 0.0       | 49.0                | 0.134          | 0.09                            | 0.00                           | 0.09                  | 0.00                   | 0.09                        | 0.00                     | 0.09                          | 0.00                        | 0.09                             | 0.10                         | 0.08                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | OPEN           | A/D                   | 2.597      | 0.0       | 84.0                | 0.249          | 2.69                            | 0.00                           | 2.69                  | 0.00                   | 2.69                        | 0.00                     | 2.69                          | 0.00                        | 2.69                             | 0.10                         | 2.43                        |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | TRANSPORTATION | A                     | 0.002      | 0.0       | 49.0                | 0.134          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.10                             | 0.00                         |                             |
| Canal 8         | Canal 8         | 08       | 08-01        | None                      | None           | None    | None       | None       | Canal           | WETLAND        | A/D                   | 0.214      | 0.0       | 95.0                | 0.464          | 0.42                            | 0.00                           | 0.42                  | 0.00                   | 0.42                        | 0.00                     | 0.42                          | 0.00                        | 0.42                             | 0.10                         | 0.37                        |
| Cal Ct.         | Cal Ct.         | 09       | 09-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A                     | 1.496      | 20.0      | 57.4                | 0.183          | 1.14                            | 0.00                           | 1.14                  | 0.00                   | 1.14                        | 0.00                     | 1.14                          | 0.00                        | 1.14                             | 0.00                         | 1.14                        |
| Cal Ct.         | Cal Ct.         | 09       | 09-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 5.399      | 20.0      | 57.4                | 0.183          | 4.11                            | 0.00                           | 4.11                  | 0.00                   | 4.11                        | 0.00                     | 4.11                          | 0.00                        | 4.11                             | 0.00                         | 4.11                        |
| Cal Ct.         | Cal Ct.         | 09       | 09-01        | None                      | None           | None    | None       | None       | Direct          | OPEN           | A/D                   | 0.016      | 0.0       | 84.0                | 0.249          | 0.02                            | 0.00                           | 0.02                  | 0.00                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.00                         | 0.02                        |
| Cape Cove Blvd. | Cape Cove Blvd. | 10       | 10-01        | Dry Pond                  | None           | None    | None       | None       | Direct          | TRANSPORTATION | C/D                   | 0.006      | 0.0       | 79.0                | 0.210          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.00                         | 0.00                        |
| Cape Cove Blvd. | Cape Cove Blvd. | 10       | 10-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | C/D                   | 0.078      | 14.4      | 74.4                | 0.187          | 0.06                            | 0.00                           | 0.06                  | 0.00                   | 0.06                        | 0.00                     | 0.06                          | 0.00                        | 0.06                             | 0.00                         | 0.06                        |
| Cape Cove Blvd. | Cape Cove Blvd. | 10       | 10-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 0.633      | 20.0      | 57.4                | 0.183          | 0.48                            | 0.00                           | 0.48                  | 0.00                   | 0.48                        | 0.00                     | 0.48                          | 0.00                        | 0.48                             | 0.00                         | 0.48                        |
| Cape Cove Blvd. | Cape Cove Blvd. | 10       | 10-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | B/D                   | 1.665      | 20.0      | 72.6                | 0.217          | 1.50                            | 0.00                           | 1.50                  | 0.00                   | 1.50                        | 0.00                     | 1.50                          | 0.00                        | 1.50                             | 0.00                         | 1.50                        |
| Cape Cove Blvd. | Cape Cove Blvd. | 10       | 10-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | C/D                   | 11.089     | 20.0      | 81.5                | 0.262          | 12.13                           | 0.00                           | 12.13                 | 0.00                   | 12.13                       | 0.00                     | 12.13                         | 0.00                        | 12.13                            | 0.00                         | 12.13                       |
| Carousel Rd.    | Carousel Rd.    | 11       | 11-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 2.292      | 40.0      | 58.7                | 0.341          | 3.26                            | 0.00                           | 3.26                  | 0.00                   | 3.26                        | 0.00                     | 3.26                          | 0.00                        | 3.26                             | 0.00                         | 3.26                        |
| Carousel Rd.    | Carousel Rd.    | 11       | 11-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | B/D                   | 0.073      | 40.0      | 73.3                | 0.367          | 0.11                            | 0.00                           | 0.11                  | 0.00                   | 0.11                        | 0.00                     | 0.11                          | 0.00                        | 0.11                             | 0.00                         | 0.11                        |
| Carousel Rd.    | Carousel Rd.    | 11       | 11-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 16.795     | 20.0      | 57.4                | 0.183          | 12.79                           | 0.00                           | 12.79                 | 0.00                   | 12.79                       | 0.00                     | 12.79                         | 0.00                        | 12.79                            | 0.00                         | 12.79                       |
| Carousel Rd.    | Carousel Rd.    | 11       | 11-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | B/D                   | 2.557      | 20.0      | 72.6                | 0.217          | 2.31                            | 0.00                           | 2.31                  | 0.00                   | 2.31                        | 0.00                     | 2.31                          | 0.00                        | 2.31                             | 0.00                         | 2.31                        |
| Chateau Rd.     | Chateau Rd.     | 12       | 12-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 5.989      | 20.0      | 57.4                | 0.183          | 4.56                            | 0.00                           | 4.56                  | 0.00                   | 4.56                        |                          |                               |                             |                                  |                              |                             |



Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin                   | Sub Basin               | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|-------------------------|-------------------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Judge Dr.               | Judge Dr.               | 15       | 15-01        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | C/D                   | 0.350      | 0.0       | 72.6                | 0.180          | 0.26                            | 0.00                           | 0.26                  | 0.00                   | 0.26                        | 0.00                     | 0.26                          | 0.00                        | 0.26                             | 0.00                         | 0.26                        |
| Lake Lawne Ave.         | Lake Lawne Ave.         | 16       | 16-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A                     | 6.436      | 20.0      | 57.4                | 0.183          | 4.90                            | 0.00                           | 4.90                  | 0.00                   | 4.90                        | 0.00                     | 4.90                          | 0.00                        | 4.90                             | 0.00                         | 4.90                        |
| Lake Lawne Ave.         | Lake Lawne Ave.         | 16       | 16-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | B/D                   | 0.026      | 20.0      | 72.6                | 0.217          | 0.02                            | 0.00                           | 0.02                  | 0.00                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.00                         | 0.02                        |
| Lake Lawne Ave.         | Lake Lawne Ave.         | 16       | 16-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | C/D                   | 14.083     | 20.0      | 81.5                | 0.262          | 15.40                           | 0.00                           | 15.40                 | 0.00                   | 15.40                       | 0.00                     | 15.40                         | 0.00                        | 15.40                            | 0.00                         | 15.40                       |
| Lake Lawne Ave.         | Lake Lawne Ave.         | 16       | 16-01        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | C/D                   | 0.211      | 1.0       | 77.9                | 0.204          | 0.18                            | 0.00                           | 0.18                  | 0.00                   | 0.18                        | 0.00                     | 0.18                          | 0.00                        | 0.18                             | 0.00                         | 0.18                        |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | Lake       | Lake            | WATER          | W                     | 1.902      | 100.0     | 98.0                | 0.809          | 6.42                            | 0.00                           | 6.42                  | 0.00                   | 6.42                        | 0.00                     | 6.42                          | 0.20                        | 5.14                             | 0.00                         | 5.14                        |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | None       | Direct          | COMMERCIAL     | A                     | 1.798      | 21.6      | 52.4                | 0.189          | 1.42                            | 0.00                           | 1.42                  | 0.00                   | 1.42                        | 0.00                     | 1.42                          | 0.20                        | 1.14                             | 0.00                         | 1.14                        |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | None       | Direct          | INSTITUTIONAL  | A                     | 9.863      | 24.9      | 61.4                | 0.227          | 9.32                            | 0.00                           | 9.32                  | 0.00                   | 9.32                        | 0.00                     | 9.32                          | 0.20                        | 7.46                             | 0.00                         | 7.46                        |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | None       | Direct          | MDR            | A                     | 32.141     | 20.0      | 57.4                | 0.182          | 24.43                           | 0.00                           | 24.43                 | 0.00                   | 24.43                       | 0.00                     | 24.43                         | 0.20                        | 19.54                            | 0.00                         | 19.54                       |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | None       | Direct          | MDR            | A/D                   | 0.039      | 20.0      | 57.4                | 0.183          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.20                        | 0.02                             | 0.00                         | 0.02                        |
| Lake Pivot              | Lake Pivot              | 17       | 17-01        | None                      | None           | None    | Pond       | None       | Direct          | OPEN           | A                     | 4.807      | 0.0       | 49.0                | 0.134          | 2.68                            | 0.00                           | 2.68                  | 0.00                   | 2.68                        | 0.00                     | 2.68                          | 0.20                        | 2.14                             | 0.00                         | 2.14                        |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | C/D                   | 0.079      | 0.0       | 74.0                | 0.185          | 0.06                            | 0.00                           | 0.06                  | 0.00                   | 0.06                        | 0.00                     | 0.06                          | 0.00                        | 0.06                             | 0.00                         | 0.06                        |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A                     | 3.192      | 20.0      | 57.4                | 0.183          | 2.43                            | 0.00                           | 2.43                  | 0.00                   | 2.43                        | 0.00                     | 2.43                          | 0.00                        | 2.43                             | 0.00                         | 2.43                        |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 2.725      | 20.0      | 57.4                | 0.183          | 2.08                            | 0.00                           | 2.08                  | 0.00                   | 2.08                        | 0.00                     | 2.08                          | 0.00                        | 2.08                             | 0.00                         | 2.08                        |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | B/D                   | 0.037      | 20.0      | 72.6                | 0.217          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.00                        | 0.03                             | 0.00                         | 0.03                        |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | C/D                   | 11.914     | 20.0      | 81.5                | 0.262          | 13.03                           | 0.00                           | 13.03                 | 0.00                   | 13.03                       | 0.00                     | 13.03                         | 0.00                        | 13.03                            | 0.00                         | 13.03                       |
| Lawne Ct.               | Lawne Ct.               | 18       | 18-01        | None                      | None           | None    | None       | None       | Direct          | OPEN           | A                     | 0.065      | 0.0       | 49.0                | 0.134          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.00                         | 0.04                        |
| Mercy Dr. Apartments 01 | Mercy Dr. Apartments 01 | 19       | 19-01        | None                      | None           | None    | None       | Canal      | Direct          | WATER          | W                     | 0.152      | 100.0     | 98.0                | 0.809          | 0.51                            | 0.00                           | 0.51                  | 0.00                   | 0.51                        | 0.00                     | 0.51                          | 0.00                        | 0.51                             | 0.00                         | 0.51                        |
| Mercy Dr. Apartments 01 | Mercy Dr. Apartments 01 | 19       | 19-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 4.663      | 42.7      | 70.4                | 0.379          | 7.38                            | 0.00                           | 7.38                  | 0.00                   | 7.38                        | 0.00                     | 7.38                          | 0.00                        | 7.38                             | 0.00                         | 7.38                        |
| Mercy Dr. Apartments 02 | Mercy Dr. Apartments 02 | 20       | 20-01        | Dry Pond                  | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 0.001      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.00                         | 0.00                        |
| Mercy Dr. Apartments 02 | Mercy Dr. Apartments 02 | 20       | 20-01        | Dry Pond                  | None           | None    | None       | None       | Direct          | TRANSPORTATION | A/D                   | 0.013      | 0.0       | 93.5                | 0.423          | 0.02                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.00                         | 0.00                        |
| Mercy Dr. Apartments 02 | Mercy Dr. Apartments 02 | 20       | 20-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 3.528      | 37.6      | 74.6                | 0.353          | 5.19                            | 0.00                           | 5.19                  | 0.00                   | 5.19                        | 0.00                     | 5.19                          | 0.00                        | 5.19                             | 0.00                         | 5.19                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | None                      | None           | Wetland | Depression | None       | Direct          | FOREST         | A/D                   | 0.083      | 0.0       | 77.0                | 0.199          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.20                     | 0.06                          | 0.90                        | 0.01                             | 0.00                         | 0.01                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | None                      | None           | Wetland | Depression | None       | Direct          | OPEN           | A/D                   | 1.501      | 1.7       | 84.0                | 0.249          | 1.56                            | 0.00                           | 1.56                  | 0.00                   | 1.56                        | 0.20                     | 1.25                          | 0.90                        | 0.12                             | 0.00                         | 0.12                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | None                      | None           | Wetland | Depression | None       | Direct          | WETLAND        | A/D                   | 2.921      | 0.0       | 95.0                | 0.464          | 5.66                            | 0.00                           | 5.66                  | 0.00                   | 5.66                        | 0.20                     | 4.52                          | 0.90                        | 0.45                             | 0.00                         | 0.45                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | Wet Pond                  | None           | Wetland | Depression | None       | Direct          | HDR            | A/D                   | 4.023      | 41.6      | 63.1                | 0.359          | 6.01                            | 0.20                           | 4.81                  | 0.00                   | 4.81                        | 0.20                     | 3.85                          | 0.90                        | 0.38                             | 0.00                         | 0.38                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | Wet Pond                  | None           | Wetland | Depression | None       | Direct          | WATER          | W                     | 0.021      | 100.0     | 98.0                | 0.809          | 0.07                            | 0.20                           | 0.06                  | 0.00                   | 0.06                        | 0.20                     | 0.04                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | Wet Pond                  | None           | Wetland | Depression | Wet Pond   | Direct          | HDR            | A/D                   | 0.004      | 0.0       | 39.0                | 0.127          | 0.00                            | 0.20                           | 0.00                  | 0.00                   | 0.00                        | 0.20                     | 0.00                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| NE Lake Lawne Wetland   | Depression 03           | 21       | 21-02        | Wet Pond                  | None           | Wetland | Depression | Wet Pond   | Direct          | WATER          | W                     | 0.133      | 100.0     | 98.0                | 0.809          | 0.45                            | 0.20                           | 0.36                  | 0.00                   | 0.36                        | 0.20                     | 0.29                          | 0.90                        | 0.03                             | 0.00                         | 0.03                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | Dry Pond                  | None           | Wetland | Depression | Dry Pond   | Direct          | INSTITUTIONAL  | A/D                   | 0.155      | 0.0       | 39.0                | 0.127          | 0.08                            | 0.80                           | 0.02                  | 0.00                   | 0.02                        | 0.20                     | 0.01                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | Dry Pond                  | None           | Wetland | Depression | None       | Direct          | INSTITUTIONAL  | A/D                   | 2.758      | 24.2      | 57.8                | 0.216          | 2.48                            | 0.80                           | 0.50                  | 0.00                   | 0.50                        | 0.20                     | 0.40                          | 0.90                        | 0.04                             | 0.00                         | 0.04                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | Dry Pond                  | None           | Wetland | Depression | None       | Direct          | INSTITUTIONAL  | B/D                   | 0.799      | 33.7      | 79.8                | 0.346          | 1.15                            | 0.80                           | 0.23                  | 0.00                   | 0.23                        | 0.20                     | 0.18                          | 0.90                        | 0.02                             | 0.00                         | 0.02                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | None                      | None           | Wetland | Depression | None       | Direct          | FOREST         | A/D                   | 2.228      | 0.0       | 77.0                | 0.199          | 1.85                            | 0.00                           | 1.85                  | 0.00                   | 1.85                        | 0.20                     | 1.48                          | 0.90                        | 0.15                             | 0.00                         | 0.15                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | None                      | None           | Wetland | Depression | None       | Direct          | INSTITUTIONAL  | A/D                   | 0.020      | 0.0       | 39.0                | 0.127          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | None                      | None           | Wetland | Depression | None       | Direct          | OPEN           | A/D                   | 2.637      | 0.0       | 84.0                | 0.249          | 2.74                            | 0.00                           | 2.74                  | 0.00                   | 2.74                        | 0.20                     | 2.19                          | 0.90                        | 0.22                             | 0.00                         | 0.22                        |
| NE Lake Lawne Wetland   | Depression 04           | 21       | 21-03        | None                      | None           | Wetland | Depression | None       | Direct          | WETLAND        | A/D                   | 1.272      | 0.0       | 95.0                | 0.464          | 2.46                            | 0.00                           | 2.46                  | 0.00                   | 2.46                        | 0.20                     | 1.97                          | 0.90                        | 0.20                             | 0.00                         | 0.20                        |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | FOREST         | A/D                   | 1.571      | 0.0       | 77.0                | 0.199          | 1.31                            | 0.00                           | 1.31                  | 0.00                   | 1.31                        | 0.20                     | 1.05                          | 0.00                        | 1.05                             | 0.00                         | 1.05                        |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | INSTITUTIONAL  | A/D                   | 0.015      | 0.0       | 39.0                | 0.127          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.20                     | 0.01                          | 0.00                        | 0.01                             | 0.00                         | 0.01                        |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | OPEN           | A/D                   | 2.891      | 0.1       | 84.0                | 0.249          | 3.00                            | 0.00                           | 3.00                  | 0.00                   | 3.00                        | 0.20                     | 2.40                          | 0.00                        | 2.40                             | 0.00                         | 2.40                        |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | OPEN           | B/D                   | 0.388      | 0.6       | 84.0                | 0.249          | 0.40                            | 0.00                           | 0.40                  | 0.00                   | 0.40                        | 0.20                     | 0.32                          | 0.00                        | 0.32                             | 0.00                         | 0.32                        |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | WETLAND        | A/D                   | 35.032     | 0.0       | 95.0                | 0.464          | 67.84                           | 0.00                           | 67.84                 | 0.00                   | 67.84                       | 0.20                     | 54.27                         | 0.00                        | 54.27                            | 0.00                         | 54.27                       |
| NE Lake Lawne Wetland   | NE Lake Lawne Wetland   | 21       | 21-01        | None                      | None           | Wetland | None       | None       | Direct          | WETLAND        | B/D                   | 2.589      | 0.0       | 95.0                | 0.464          | 5.01                            | 0.00                           | 5.01                  | 0.00                   | 5.01                        | 0.20                     | 4.01                          | 0.00                        | 4.01                             | 0.00                         | 4.01                        |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | None                      | None           | None    | None       | None       | Direct          | HDR            | B/D                   | 0.034      | 40.0      | 73.3                | 0.367          | 0.05                            | 0.00                           | 0.05                  | 0.00                   | 0.05                        | 0.00                     | 0.05                          | 0.00                        | 0.05                             | 0.00                         | 0.05                        |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 0.022      | 20.0      | 57.4                | 0.183          | 0.02                            | 0.00                           | 0.02                  | 0.00                   | 0.02                        | 0.00                     | 0.02                          | 0.00                        | 0.02                             | 0.00                         | 0.02                        |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | None                      | None           | None    | None       | None       | Direct          | WETLAND        | A/D                   | 0.049      | 0.0       | 95.0                | 0.464          | 0.10                            | 0.00                           | 0.10                  | 0.00                   | 0.10                        | 0.00                     | 0.10                          | 0.00                        | 0.10                             | 0.00                         | 0.10                        |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | Wet Pond                  | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 8.956      | 39.9      | 58.6                | 0.340          | 12.69                           | 0.20                           | 10.15                 | 0.00                   | 10.15                       | 0.00                     | 10.15                         | 0.00                        | 10.15                            | 0.00                         | 10.15                       |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | Wet Pond                  | None           | None    | None       | None       | Direct          | OPEN           | A/D                   | 1.185      | 0.0       | 84.0                | 0.249          | 1.23                            | 0.20                           | 0.98                  | 0.00                   | 0.98                        | 0.00                     | 0.98                          | 0.00                        | 0.98                             | 0.00                         | 0.98                        |
| North Lawne Villas      | North Lawne Villas      | 22       | 22-01        | Wet Pond                  | None           | None    | None       | Wet Pond   | Direct          | WATER          | W                     | 3.049      | 100.0     | 98.0                | 0.809          | 10.29                           | 0.20                           | 8.23                  | 0.00                   | 8.23                        | 0.00                     | 8.23                          | 0.00                        | 8.23                             | 0.00                         | 8.23                        |
| Park                    | Park                    | 23       | 23-01        | Dry Pond                  | None           | None    | None       | None       | Direct          | RECREATIONAL   | A                     | 3.131      | 16.8      | 53.2                | 0.152          | 1.98                            | 0.80                           | 0.40                  | 0.00                   | 0.40                        | 0.00                     | 0.40                          | 0.00                        | 0.40                             | 0.00                         | 0.40                        |
| Park                    | Park                    | 23       | 23-01        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | A                     | 2.072      | 0.0       | 49.7                | 0.134          | 1.16                            | 0.00                           | 1.16                  | 0.00                   | 1.16                        | 0.00                     | 1.16                          | 0.00                        | 1.16                             | 0.00                         | 1.16                        |
| Park                    | Park                    | 23       | 23-01        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | A/D                   | 0.840      | 0.0       | 53.0                | 0.138          | 0.48                            | 0.00                           | 0.48                  | 0.00                   | 0.48                        | 0.00                     | 0.48                          | 0.00                        | 0.48                             | 0.00                         | 0.48                        |
| Park                    | Park                    | 23       | 23-01        | None                      | Swale          | None    | None       | None       | Direct          | RECREATIONAL   | A                     | 5.389      | 17.1      | 52.0                | 0.154          | 3.45                            | 0.00                           | 3.45                  | 0.25                   | 2.59                        | 0.00                     | 2.59                          | 0.00                        | 2.59                             | 0.00                         | 2.59                        |
| Park                    | Park                    | 23       | 23-01        | Wet Pond                  | None           | None    | None       | None       |                 |                |                       |            |           |                     |                |                                 |                                |                       |                        |                             |                          |                               |                             |                                  |                              |                             |

Runoff Generation and Attenuation Model for the Lake Lawne Drainage Basir

Meteorological Zone:

2

Annual Rainfall (inches):

50.03

| Basin         | Sub Basin     | Basin ID | Sub Basin ID | Stormwater Treatment Type | Drainage Swale | Wetland | Depression | Water Type | Conveyance Type | Land Use       | Hydrologic Soil Group | Area (ac.) | DCIA1 (%) | Non - DCIA CN Value | Runoff C Value | Generated Runoff Volume (ac-ft) | Runoff Volume Reduction Factor | Runoff Volume (ac-ft) | Swale Reduction Factor | Swale Runoff Volume (ac-ft) | Wetland Reduction Factor | Wetland Runoff Volume (ac-ft) | Depression Reduction Factor | Depression Runoff Volume (ac-ft) | Canal Conveyance Loss Factor | Final Runoff Volume (ac-ft) |
|---------------|---------------|----------|--------------|---------------------------|----------------|---------|------------|------------|-----------------|----------------|-----------------------|------------|-----------|---------------------|----------------|---------------------------------|--------------------------------|-----------------------|------------------------|-----------------------------|--------------------------|-------------------------------|-----------------------------|----------------------------------|------------------------------|-----------------------------|
| Depression 02 | Depression 02 | Direct   | Direct 05    | None                      | None           | None    | Depression | None       | Direct          | OPEN           | B/D                   | 0.034      | 0.0       | 84.0                | 0.249          | 0.04                            | 0.00                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | None                      | None           | None    | Depression | None       | Direct          | TRANSPORTATION | A/D                   | 0.011      | 0.0       | 98.0                | 0.627          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.00                     | 0.03                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | None                      | None           | None    | Depression | None       | Direct          | WETLAND        | A/D                   | 1.982      | 0.0       | 95.0                | 0.464          | 3.84                            | 0.00                           | 3.84                  | 0.00                   | 3.84                        | 0.00                     | 3.84                          | 0.90                        | 0.38                             | 0.00                         | 0.38                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | None                      | None           | Wetland | Depression | None       | Direct          | OPEN           | A/D                   | 0.012      | 0.0       | 98.0                | 0.627          | 0.03                            | 0.00                           | 0.03                  | 0.00                   | 0.03                        | 0.20                     | 0.02                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | Wet Pond                  | None           | None    | Depression | None       | Direct          | INSTITUTIONAL  | A/D                   | 1.052      | 7.3       | 46.9                | 0.132          | 0.58                            | 0.20                           | 0.46                  | 0.00                   | 0.46                        | 0.00                     | 0.46                          | 0.90                        | 0.05                             | 0.00                         | 0.05                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | Wet Pond                  | None           | None    | Depression | None       | Direct          | INSTITUTIONAL  | B/D                   | 0.597      | 39.1      | 68.6                | 0.349          | 0.87                            | 0.20                           | 0.69                  | 0.00                   | 0.69                        | 0.00                     | 0.69                          | 0.90                        | 0.07                             | 0.00                         | 0.07                        |
| Depression 02 | Depression 02 | Direct   | Direct 05    | Wet Pond                  | None           | None    | Depression | Wet Pond   | Direct          | WATER          | W                     | 0.104      | 100.0     | 98.0                | 0.809          | 0.35                            | 0.20                           | 0.28                  | 0.00                   | 0.28                        | 0.00                     | 0.28                          | 0.90                        | 0.03                             | 0.00                         | 0.03                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | COMMERCIAL     | B/D                   | 0.002      | 0.0       | 61.0                | 0.149          | 0.00                            | 0.00                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.90                        | 0.00                             | 0.00                         | 0.00                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | COMMERCIAL     | C/D                   | 0.220      | 0.0       | 78.5                | 0.208          | 0.19                            | 0.00                           | 0.19                  | 0.00                   | 0.19                        | 0.00                     | 0.19                          | 0.90                        | 0.02                             | 0.00                         | 0.02                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | FOREST         | B/D                   | 0.728      | 0.0       | 77.0                | 0.199          | 0.61                            | 0.00                           | 0.61                  | 0.00                   | 0.61                        | 0.00                     | 0.61                          | 0.90                        | 0.06                             | 0.00                         | 0.06                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | MDR            | B/D                   | 0.343      | 0.0       | 68.7                | 0.167          | 0.24                            | 0.00                           | 0.24                  | 0.00                   | 0.24                        | 0.00                     | 0.24                          | 0.90                        | 0.02                             | 0.00                         | 0.02                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | MDR            | C/D                   | 1.988      | 0.0       | 77.5                | 0.202          | 1.68                            | 0.00                           | 1.68                  | 0.00                   | 1.68                        | 0.00                     | 1.68                          | 0.90                        | 0.17                             | 0.00                         | 0.17                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | OPEN           | B/D                   | 0.080      | 0.0       | 84.0                | 0.249          | 0.08                            | 0.00                           | 0.08                  | 0.00                   | 0.08                        | 0.00                     | 0.08                          | 0.90                        | 0.01                             | 0.00                         | 0.01                        |
| Direct        | Depression 01 | Direct   | Direct 02    | None                      | None           | None    | Depression | None       | Direct          | OPEN           | C/D                   | 0.275      | 0.0       | 84.0                | 0.249          | 0.28                            | 0.00                           | 0.28                  | 0.00                   | 0.28                        | 0.00                     | 0.28                          | 0.90                        | 0.03                             | 0.00                         | 0.03                        |
| Direct        | Direct        | Direct   | 05-02        | Dry Pond                  | None           | None    | None       | None       | Direct          | RECREATIONAL   | A                     | 0.831      | 34.1      | 53.5                | 0.289          | 1.00                            | 0.80                           | 0.20                  | 0.00                   | 0.20                        | 0.00                     | 0.20                          | 0.00                        | 0.20                             | 0.00                         | 0.20                        |
| Direct        | Direct        | Direct   | 05-02        | Dry Pond                  | None           | None    | None       | None       | Direct          | RECREATIONAL   | A/D                   | 0.568      | 32.9      | 53.2                | 0.279          | 0.66                            | 0.80                           | 0.13                  | 0.00                   | 0.13                        | 0.00                     | 0.13                          | 0.00                        | 0.13                             | 0.00                         | 0.13                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | WATER          | W                     | 0.031      | 100.0     | 98.0                | 0.809          | 0.11                            | 0.00                           | 0.11                  | 0.00                   | 0.11                        | 0.00                     | 0.11                          | 0.00                        | 0.11                             | 0.00                         | 0.11                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | FOREST         | A                     | 2.545      | 0.0       | 30.0                | 0.123          | 1.31                            | 0.00                           | 1.31                  | 0.00                   | 1.31                        | 0.00                     | 1.31                          | 0.00                        | 1.31                             | 0.00                         | 1.31                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | FOREST         | A/D                   | 4.735      | 0.0       | 77.0                | 0.199          | 3.94                            | 0.00                           | 3.94                  | 0.00                   | 3.94                        | 0.00                     | 3.94                          | 0.00                        | 3.94                             | 0.00                         | 3.94                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | FOREST         | B/D                   | 1.388      | 0.0       | 77.0                | 0.199          | 1.15                            | 0.00                           | 1.15                  | 0.00                   | 1.15                        | 0.00                     | 1.15                          | 0.00                        | 1.15                             | 0.00                         | 1.15                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | FOREST         | C/D                   | 1.812      | 0.0       | 77.0                | 0.199          | 1.51                            | 0.00                           | 1.51                  | 0.00                   | 1.51                        | 0.00                     | 1.51                          | 0.00                        | 1.51                             | 0.00                         | 1.51                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | HDR            | A/D                   | 1.895      | 0.0       | 60.5                | 0.148          | 1.17                            | 0.00                           | 1.17                  | 0.00                   | 1.17                        | 0.00                     | 1.17                          | 0.00                        | 1.17                             | 0.00                         | 1.17                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | HDR            | B/D                   | 0.111      | 0.0       | 65.3                | 0.158          | 0.07                            | 0.00                           | 0.07                  | 0.00                   | 0.07                        | 0.00                     | 0.07                          | 0.00                        | 0.07                             | 0.00                         | 0.07                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | INSTITUTIONAL  | A/D                   | 3.675      | 0.0       | 55.8                | 0.141          | 2.16                            | 0.00                           | 2.16                  | 0.00                   | 2.16                        | 0.00                     | 2.16                          | 0.00                        | 2.16                             | 0.00                         | 2.16                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | INSTITUTIONAL  | C/D                   | 0.515      | 0.0       | 90.6                | 0.344          | 0.74                            | 0.00                           | 0.74                  | 0.00                   | 0.74                        | 0.00                     | 0.74                          | 0.00                        | 0.74                             | 0.00                         | 0.74                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | MDR            | A                     | 0.853      | 0.0       | 60.6                | 0.149          | 0.53                            | 0.00                           | 0.53                  | 0.00                   | 0.53                        | 0.00                     | 0.53                          | 0.00                        | 0.53                             | 0.00                         | 0.53                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | MDR            | A/D                   | 6.631      | 0.0       | 50.4                | 0.135          | 3.73                            | 0.00                           | 3.73                  | 0.00                   | 3.73                        | 0.00                     | 3.73                          | 0.00                        | 3.73                             | 0.00                         | 3.73                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | MDR            | B/D                   | 2.223      | 0.0       | 68.7                | 0.167          | 1.55                            | 0.00                           | 1.55                  | 0.00                   | 1.55                        | 0.00                     | 1.55                          | 0.00                        | 1.55                             | 0.00                         | 1.55                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | MDR            | C/D                   | 1.888      | 0.0       | 80.4                | 0.219          | 1.73                            | 0.00                           | 1.73                  | 0.00                   | 1.73                        | 0.00                     | 1.73                          | 0.00                        | 1.73                             | 0.00                         | 1.73                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | OPEN           | A                     | 1.737      | 0.0       | 49.0                | 0.134          | 0.97                            | 0.00                           | 0.97                  | 0.00                   | 0.97                        | 0.00                     | 0.97                          | 0.00                        | 0.97                             | 0.00                         | 0.97                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | OPEN           | A/D                   | 11.075     | 0.0       | 84.0                | 0.249          | 11.49                           | 0.00                           | 11.49                 | 0.00                   | 11.49                       | 0.00                     | 11.49                         | 0.00                        | 11.49                            | 0.00                         | 11.49                       |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | OPEN           | B/D                   | 0.389      | 0.0       | 84.0                | 0.249          | 0.40                            | 0.00                           | 0.40                  | 0.00                   | 0.40                        | 0.00                     | 0.40                          | 0.00                        | 0.40                             | 0.00                         | 0.40                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | OPEN           | C/D                   | 2.608      | 0.0       | 84.0                | 0.249          | 2.71                            | 0.00                           | 2.71                  | 0.00                   | 2.71                        | 0.00                     | 2.71                          | 0.00                        | 2.71                             | 0.00                         | 2.71                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | A                     | 14.285     | 7.5       | 53.0                | 0.138          | 8.20                            | 0.00                           | 8.20                  | 0.00                   | 8.20                        | 0.00                     | 8.20                          | 0.00                        | 8.20                             | 0.00                         | 8.20                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | A/D                   | 8.492      | 0.7       | 51.7                | 0.136          | 4.83                            | 0.00                           | 4.83                  | 0.00                   | 4.83                        | 0.00                     | 4.83                          | 0.00                        | 4.83                             | 0.00                         | 4.83                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | RECREATIONAL   | C/D                   | 1.540      | 0.0       | 72.9                | 0.181          | 1.16                            | 0.00                           | 1.16                  | 0.00                   | 1.16                        | 0.00                     | 1.16                          | 0.00                        | 1.16                             | 0.00                         | 1.16                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | WETLAND        | A                     | 0.376      | 0.0       | 95.0                | 0.464          | 0.73                            | 0.00                           | 0.73                  | 0.00                   | 0.73                        | 0.00                     | 0.73                          | 0.00                        | 0.73                             | 0.00                         | 0.73                        |
| Direct        | Direct        | Direct   | 05-02        | None                      | None           | None    | None       | None       | Direct          | WETLAND        | A/D                   | 16.822     | 0.0       | 95.0                | 0.464          | 32.57                           | 0.00                           | 32.57                 | 0.00                   | 32.57                       | 0.00                     | 32.57                         | 0.00                        | 32.57                            | 0.00                         | 32.57                       |
| Lakeside 01   | Lakeside 01   | Direct   | Direct 04    | Dry Pond                  | None           | None    | None       | None       | Direct          | FOREST         | A/D                   | 0.013      | 0.0       | 77.0                | 0.199          | 0.01                            | 0.80                           | 0.00                  | 0.00                   | 0.00                        | 0.00                     | 0.00                          | 0.00                        | 0.00                             | 0.00                         | 0.00                        |
| Lakeside 01   | Lakeside 01   | Direct   | Direct 04    | Dry Pond                  | None           | None    | None       | None       | Direct          | INSTITUTIONAL  | A/D                   | 4.473      | 49.6      | 45.4                | 0.407          | 7.58                            | 0.80                           | 1.52                  | 0.00                   | 1.52                        | 0.00                     | 1.52                          | 0.00                        | 1.52                             | 0.00                         | 1.52                        |
| Lakeside 01   | Lakeside 01   | Direct   | Direct 04    | Dry Pond                  | None           | None    | None       | None       | Direct          | OPEN           | A/D                   | 0.177      | 0.0       | 84.0                | 0.249          | 0.18                            | 0.80                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.00                         | 0.04                        |
| Lakeside 01   | Lakeside 01   | Direct   | Direct 04    | None                      | None           | None    | None       | None       | Direct          | FOREST         | A/D                   | 0.007      | 0.0       | 77.0                | 0.199          | 0.01                            | 0.00                           | 0.01                  | 0.00                   | 0.01                        | 0.00                     | 0.01                          | 0.00                        | 0.01                             | 0.00                         | 0.01                        |
| Lakeside 02   | Lakeside 02   | Direct   | Direct 03    | Dry Pond                  | None           | None    | None       | None       | Direct          | INSTITUTIONAL  | A/D                   | 4.758      | 81.3      | 67.5                | 0.667          | 13.24                           | 0.80                           | 2.65                  | 0.00                   | 2.65                        | 0.00                     | 2.65                          | 0.00                        | 2.65                             | 0.00                         | 2.65                        |
| Lakeside 02   | Lakeside 02   | Direct   | Direct 03    | Dry Pond                  | None           | None    | None       | None       | Direct          | OPEN           | A/D                   | 0.180      | 0.0       | 84.0                | 0.249          | 0.19                            | 0.80                           | 0.04                  | 0.00                   | 0.04                        | 0.00                     | 0.04                          | 0.00                        | 0.04                             | 0.00                         | 0.04                        |

## **APPENDIX D**

### **CHARACTERISTICS OF SHALLOW GROUNDWATER SEEPAGE COLLECTED IN LAKE LAWNE FROM MARCH 2011-MAY 2012**

#### **D.1 Field Measurements of Seepage Inflow Volumes**

#### **D.2 Chemical Characteristics of Collected Seepage Samples**

## **D.1 Field Measurements of Seepage Inflow Volumes**

# Seepage Meter Field Measurements

Location: Lake Lawne

Site: 1

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                        |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|------------------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                                |
| 3/16/11  | 10:15          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                 |
| 4/17/11  | 13:10          | 3.75                      | 3/16/11                   | 10:15 | 32.1                | 0.43                                 | Measured volume, no sample collected           |
| 6/22/11  | 12:03          | 25.5                      | 4/17/11                   | 13:10 | 66.0                | 1.43                                 | Sample collected, bag in good condition        |
| 7/21/11  | 11:27          | ---                       | 6/22/11                   | 12:03 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced |
| 8/28/11  | 10:50          | 10.25                     | 7/21/11                   | 11:27 | 38.0                | 1.00                                 | Sample collected, bag in good condition        |
| 9/30/11  | 11:10          | 50.75                     | 8/28/11                   | 10:50 | 33.0                | 5.69                                 | Sample collected, bag in good condition        |
| 11/28/11 | 9:47           | 85.25                     | 9/30/11                   | 11:10 | 58.9                | 5.36                                 | Sample collected, bag in good condition        |
| 2/17/12  | 9:18           | 12.75                     | 11/28/11                  | 9:47  | 81.0                | 0.58                                 | Sample collected, bag in good condition        |
| 3/23/12  | 10:10          | 29.75                     | 2/17/12                   | 9:18  | 35.0                | 3.14                                 | Sample collected, bag in good condition        |
| 5/31/12  | 9:20           | 20.75                     | 3/23/12                   | 10:10 | 69.0                | 1.11                                 | Sample collected, bag in good condition        |
| Mean:    |                |                           |                           |       | 2.14                |                                      |                                                |



# Seepage Meter Field Measurements

Location: Lake Lawne

Site: 2

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                        |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|------------------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                                |
| 3/16/11  | 10:30          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                 |
| 4/17/11  | 13:15          | 4.5                       | 3/16/11                   | 10:30 | 32.1                | 0.52                                 | Measured volume, no sample collected           |
| 6/22/11  | 12:07          | ---                       | 4/17/11                   | 13:15 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced |
| 7/21/11  | 11:32          | 15.5                      | 6/22/11                   | 12:07 | 29.0                | 1.98                                 | Sample collected, bag in good condition        |
| 8/28/11  | 10:55          | 7.25                      | 7/21/11                   | 11:32 | 38.0                | 0.71                                 | Sample collected, bag in good condition        |
| 9/30/11  | 11:15          | 8.75                      | 8/28/11                   | 10:55 | 33.0                | 0.98                                 | Sample collected, bag in good condition        |
| 11/28/11 | 9:55           | 20.5                      | 9/30/11                   | 11:15 | 58.9                | 1.29                                 | Sample collected, bag in good condition        |
| 2/17/12  | 9:23           | 11.5                      | 11/28/11                  | 9:55  | 81.0                | 0.53                                 | Sample collected, bag in good condition        |
| 3/23/12  | 10:15          | 8.75                      | 2/17/12                   | 9:23  | 35.0                | 0.92                                 | Sample collected, bag in good condition        |
| 5/31/12  | 9:25           | 11.25                     | 3/23/12                   | 10:15 | 69.0                | 0.60                                 | Sample collected, bag in good condition        |
| Mean:    |                |                           |                           |       | 0.87                |                                      |                                                |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 3

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                        |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|------------------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                                |
| 3/16/11      | 10:45          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                 |
| 4/17/11      | 13:20          | 6.25                      | 3/16/11                   | 10:45 | 32.1                | 0.72                                 | Measured volume, no sample collected           |
| 6/22/11      | 12:11          | ---                       | 4/17/11                   | 13:20 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced |
| 7/21/11      | 11:36          | 6.5                       | 6/22/11                   | 12:11 | 29.0                | 0.83                                 | Sample collected, bag in good condition        |
| 8/28/11      | 11:00          | 10.5                      | 7/21/11                   | 11:36 | 38.0                | 1.02                                 | Sample collected, bag in good condition        |
| 9/30/11      | 11:20          | 18.25                     | 8/28/11                   | 11:00 | 33.0                | 2.05                                 | Sample collected, bag in good condition        |
| 11/28/11     | 10:00          | 7.25                      | 9/30/11                   | 11:20 | 58.9                | 0.46                                 | Sample collected, bag in good condition        |
| 2/17/12      | 9:26           | 8.75                      | 11/28/11                  | 10:00 | 81.0                | 0.40                                 | Sample collected, bag in good condition        |
| 3/23/12      | 10:19          | 15.25                     | 2/17/12                   | 9:26  | 35.0                | 1.61                                 | Sample collected, bag in good condition        |
| 5/31/12      | 9:35           | 15.5                      | 3/23/12                   | 10:19 | 69.0                | 0.83                                 | Sample collected, bag in good condition        |
| <b>Mean:</b> |                |                           |                           |       | <b>0.87</b>         |                                      |                                                |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 4

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                            |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                                    |
| 3/16/11  | 11:00          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                     |
| 4/17/11  | 13:25          | 11.25                     | 3/16/11                   | 11:00 | 32.1                | 1.30                                 | Measured volume, no sample collected               |
| 6/22/11  | 12:14          | 18.25                     | 4/17/11                   | 13:25 | 66.0                | 1.02                                 | Sample collected, bag in good condition            |
| 7/21/11  | 11:41          | 17.25                     | 6/22/11                   | 12:14 | 29.0                | 2.20                                 | Sample collected, bag in good condition            |
| 8/28/11  | 11:03          | 9.75                      | 7/21/11                   | 11:41 | 38.0                | 0.95                                 | Sample collected, bag in good condition            |
| 9/30/11  | 11:24          | 16.5                      | 8/28/11                   | 11:03 | 33.0                | 1.85                                 | Sample collected, bag in good condition            |
| 11/28/11 | 10:04          | 13.5                      | 9/30/11                   | 11:24 | 58.9                | 0.85                                 | Sample collected, bag in good condition            |
| 2/17/12  | 9:31           | 14.25                     | 11/28/11                  | 10:04 | 81.0                | 0.65                                 | Sample collected, bag in good condition            |
| 3/23/12  | 10:22          | 8.75                      | 2/17/12                   | 9:31  | 35.0                | 0.92                                 | Sample collected, bag in good condition            |
| 5/31/12  | 8:40           | ---                       | 3/23/12                   | 10:22 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| Mean:    |                |                           |                           |       | 1.09                |                                      |                                                    |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 5

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11      | 11:15          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11      | 13:31          | 10.5                      | 3/16/11                   | 11:15 | 32.1                | 1.21                                 | Measured volume, no sample collected    |
| 6/22/11      | 12:20          | 16.75                     | 4/17/11                   | 13:31 | 66.0                | 0.94                                 | Sample collected, bag in good condition |
| 7/21/11      | 11:50          | 13.5                      | 6/22/11                   | 12:20 | 29.0                | 1.73                                 | Sample collected, bag in good condition |
| 8/28/11      | 11:10          | 13.75                     | 7/21/11                   | 11:50 | 38.0                | 1.34                                 | Sample collected, bag in good condition |
| 9/30/11      | 11:26          | 6.25                      | 8/28/11                   | 11:10 | 33.0                | 0.70                                 | Sample collected, bag in good condition |
| 11/28/11     | 10:11          | 14.75                     | 9/30/11                   | 11:26 | 58.9                | 0.93                                 | Sample collected, bag in good condition |
| 2/17/12      | 9:45           | 10.75                     | 11/28/11                  | 10:11 | 81.0                | 0.49                                 | Sample collected, bag in good condition |
| 3/23/12      | 10:34          | 14.5                      | 2/17/12                   | 9:45  | 35.0                | 1.53                                 | Sample collected, bag in good condition |
| 5/31/12      | 9:47           | 7.5                       | 3/23/12                   | 10:34 | 69.0                | 0.40                                 | Sample collected, bag in good condition |
| <b>Mean:</b> |                |                           |                           |       | <b>0.91</b>         |                                      |                                         |

Location: Lake Lawne

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

Site: 6

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 11:30          | ---                       | ---                       | ---   | ---                 |                                      | Bags Installed                          |
| 4/17/11  | 13:37          | 6.25                      | 3/16/11                   | 11:30 | 32.1                | 0.72                                 | Measured volume, no sample collected    |
| 6/22/11  | 12:25          | 25.5                      | 4/17/11                   | 13:37 | 65.9                | 1.43                                 | Sample collected, bag in good condition |
| 7/21/11  | 11:53          | 10.25                     | 6/22/11                   | 12:25 | 29.0                | 1.31                                 | Sample collected, bag in good condition |
| 8/28/11  | 11:15          | 6.75                      | 7/21/11                   | 11:53 | 38.0                | 0.66                                 | Sample collected, bag in good condition |
| 9/30/11  | 11:31          | 6.75                      | 8/28/11                   | 11:15 | 33.0                | 0.76                                 | Sample collected, bag in good condition |
| 11/28/11 | 10:16          | 7.25                      | 9/30/11                   | 11:31 | 58.9                | 0.46                                 | Sample collected, bag in good condition |
| 2/17/12  | 9:50           | 5.25                      | 11/28/11                  | 10:16 | 81.0                | 0.24                                 | Sample collected, bag in good condition |
| 3/23/12  | 10:44          | 9.75                      | 2/17/12                   | 9:50  | 35.0                | 1.03                                 | Sample collected, bag in good condition |
| 5/31/12  | 10:00          | 15.25                     | 3/23/12                   | 10:44 | 69.0                | 0.82                                 | Sample collected, bag in good condition |
|          |                |                           |                           |       | Mean:               | 0.78                                 |                                         |



## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 7

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 11:45          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 13:42          | 7.5                       | 3/16/11                   | 11:45 | 32.1                | 0.87                                 | Measured volume, no sample collected    |
| 6/22/11  | 12:35          | 11.5                      | 4/17/11                   | 13:42 | 66.0                | 0.65                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:07          | 5.75                      | 6/22/11                   | 12:35 | 29.0                | 0.73                                 | Sample collected, bag in good condition |
| 8/28/11  | 11:25          | 19.5                      | 7/21/11                   | 12:07 | 38.0                | 1.90                                 | Sample collected, bag in good condition |
| 9/30/11  | 11:36          | 5.25                      | 8/28/11                   | 11:25 | 33.0                | 0.59                                 | Sample collected, bag in good condition |
| 11/28/11 | 10:25          | 7.75                      | 9/30/11                   | 11:36 | 59.0                | 0.49                                 | Sample collected, bag in good condition |
| 2/17/12  | 9:56           | 12.5                      | 11/28/11                  | 10:25 | 81.0                | 0.57                                 | Sample collected, bag in good condition |
| 3/23/12  | 10:50          | 7.75                      | 2/17/12                   | 9:56  | 35.0                | 0.82                                 | Sample collected, bag in good condition |
| 5/31/12  | 10:08          | 8.5                       | 3/23/12                   | 10:50 | 69.0                | 0.46                                 | Sample collected, bag in good condition |
| Mean:    |                |                           |                           |       | 0.72                |                                      |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 8

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                      |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                              |
| 3/16/11      | 12:00          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                               |
| 4/17/11      | 13:50          | 5.25                      | 3/16/11                   | 12:00 | 32.1                | 0.61                                 | Measured volume, no sample collected         |
| 6/22/11      | 12:38          | ---                       | 4/17/11                   | 13:50 | ---                 | ---                                  | No sample collected, meter missing, replaced |
| 7/21/11      | 12:20          | ---                       | 6/22/11                   | 12:38 | ---                 | ---                                  | No sample collected, meter missing, replaced |
| 8/28/11      | 11:30          | 6.5                       | 7/21/11                   | 12:20 | 38.0                | 0.63                                 | Sample collected, bag in good condition      |
| 9/30/11      | 11:42          | 3.75                      | 8/28/11                   | 11:30 | 33.0                | 0.42                                 | Sample collected, bag in good condition      |
| 11/28/11     | 10:32          | 5.5                       | 9/30/11                   | 11:42 | 59.0                | 0.35                                 | Sample collected, bag in good condition      |
| 2/17/12      | 10:32          | 5.5                       | 11/28/11                  | 10:32 | 81.0                | 0.25                                 | Sample collected, bag in good condition      |
| 3/23/12      | 10:02          | 5.5                       | 2/17/12                   | 10:32 | 35.0                | 0.58                                 | Sample collected, bag in good condition      |
| 5/31/12      | 10:16          | 7.75                      | 3/23/12                   | 10:02 | 69.0                | 0.42                                 | Sample collected, bag in good condition      |
| <b>Mean:</b> |                |                           |                           |       |                     | <b>0.42</b>                          |                                              |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 9

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 12:15          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 13:55          | 9.5                       | 3/16/11                   | 12:15 | 32.1                | 1.10                                 | Measured volume, no sample collected    |
| 6/22/11  | 12:41          | 12.5                      | 4/17/11                   | 13:55 | 65.9                | 0.70                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:12          | 10.25                     | 6/22/11                   | 12:41 | 29.0                | 1.31                                 | Sample collected, bag in good condition |
| 8/28/11  | 11:35          | 9.25                      | 7/21/11                   | 12:12 | 38.0                | 0.90                                 | Sample collected, bag in good condition |
| 9/30/11  | 11:45          | 7.5                       | 8/28/11                   | 11:35 | 33.0                | 0.84                                 | Sample collected, bag in good condition |
| 11/28/11 | 10:36          | 3.5                       | 9/30/11                   | 11:45 | 59.0                | 0.22                                 | Sample collected, bag in good condition |
| 2/17/12  | 10:06          | 9.75                      | 11/28/11                  | 10:36 | 81.0                | 0.45                                 | Sample collected, bag in good condition |
| 3/23/12  | 10:59          | 6.5                       | 2/17/12                   | 10:06 | 35.0                | 0.69                                 | Sample collected, bag in good condition |
| 5/31/12  | 12:10          | ---                       | 3/23/12                   | 10:59 | ---                 | ---                                  | No sample collected, meter missing      |
| Mean:    |                |                           |                           |       | 0.68                |                                      |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 10

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 12:30          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 14:00          | 6.75                      | 3/16/11                   | 12:30 | 32.1                | 0.78                                 | Measured volume, no sample collected    |
| 6/22/11  | 12:46          | 11.75                     | 4/17/11                   | 14:00 | 65.9                | 0.66                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:25          | 13.25                     | 6/22/11                   | 12:46 | 29.0                | 1.69                                 | Sample collected, bag in good condition |
| 8/28/11  | 11:40          | 10.5                      | 7/21/11                   | 12:25 | 38.0                | 1.02                                 | Sample collected, bag in good condition |
| 9/30/11  | 12:00          | 3.5                       | 8/28/11                   | 11:40 | 33.0                | 0.39                                 | Sample collected, bag in good condition |
| 11/28/11 | 10:43          | 4.25                      | 9/30/11                   | 12:00 | 58.9                | 0.27                                 | Sample collected, bag in good condition |
| 2/17/12  | 10:10          | 7.5                       | 11/28/11                  | 10:43 | 81.0                | 0.34                                 | Sample collected, bag in good condition |
| 3/23/12  | 11:05          | 10.5                      | 2/17/12                   | 10:10 | 35.0                | 1.11                                 | Sample collected, bag in good condition |
| 5/31/12  | 10:25          | 5.75                      | 3/23/12                   | 11:05 | 69.0                | 0.31                                 | Sample collected, bag in good condition |
| Mean:    |                |                           |                           |       | 0.62                |                                      |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 11

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                        |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|------------------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                                |
| 3/16/11  | 12:45          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                 |
| 4/17/11  | 14:06          | ---                       | 3/16/11                   | 12:45 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced |
| 6/22/11  | 12:51          | 15.5                      | 4/17/11                   | 14:06 | 65.9                | 0.87                                 | Sample collected, bag in good condition        |
| 7/21/11  | 12:30          | 8.75                      | 6/22/11                   | 12:51 | 29.0                | 1.12                                 | Sample collected, bag in good condition        |
| 8/28/11  | 11:45          | 13.75                     | 7/21/11                   | 12:30 | 38.0                | 1.34                                 | Sample collected, bag in good condition        |
| 9/30/11  | 12:05          | 21.75                     | 8/28/11                   | 11:45 | 33.0                | 2.44                                 | Sample collected, bag in good condition        |
| 11/28/11 | 10:48          | 70.75                     | 9/30/11                   | 12:05 | 58.9                | 4.45                                 | Sample collected, bag in good condition        |
| 2/17/12  | 10:17          | 9.75                      | 11/28/11                  | 10:48 | 81.0                | 0.45                                 | Sample collected, bag in good condition        |
| 3/23/12  | 11:10          | 9.75                      | 2/17/12                   | 10:17 | 35.0                | 1.03                                 | Sample collected, bag in good condition        |
| 5/31/12  | 10:42          | 8.5                       | 3/23/12                   | 11:10 | 69.0                | 0.46                                 | Sample collected, bag in good condition        |
| Mean:    |                |                           |                           |       | 1.43                |                                      |                                                |



## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 12

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 13:00          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 14:11          | 10.5                      | 3/16/11                   | 13:00 | 32.0                | 1.21                                 | Measured volume, no sample collected    |
| 6/22/11  | 12:56          | 13.25                     | 4/17/11                   | 14:11 | 65.9                | 0.74                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:35          | 4.25                      | 6/22/11                   | 12:56 | 29.0                | 0.54                                 | Sample collected, bag in good condition |
| 8/28/11  | 11:50          | 6.5                       | 7/21/11                   | 12:35 | 38.0                | 0.63                                 | Sample collected, bag in good condition |
| 9/30/11  | 12:10          | 4.25                      | 8/28/11                   | 11:50 | 33.0                | 0.48                                 | Sample collected, bag in good condition |
| 11/28/11 | 10:53          | 7.25                      | 9/30/11                   | 12:10 | 58.9                | 0.46                                 | Sample collected, bag in good condition |
| 2/17/12  | 10:24          | 8.25                      | 11/28/11                  | 10:53 | 81.0                | 0.38                                 | Sample collected, bag in good condition |
| 3/23/12  | 11:15          | 5.5                       | 2/17/12                   | 10:24 | 35.0                | 0.58                                 | Sample collected, bag in good condition |
| 5/31/12  | 10:50          | 12.5                      | 3/23/12                   | 11:15 | 69.0                | 0.67                                 | Sample collected, bag in good condition |
| Mean:    |                |                           |                           |       |                     | <b>0.61</b>                          |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 13

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11      | 13:15          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11      | 14:16          | 9.75                      | 3/16/11                   | 13:15 | 32.0                | 1.13                                 | Measured volume, no sample collected    |
| 6/22/11      | 13:06          | 14.5                      | 4/17/11                   | 14:16 | 66.0                | 0.81                                 | Sample collected, bag in good condition |
| 7/21/11      | 12:43          | 4.5                       | 6/22/11                   | 13:06 | 29.0                | 0.58                                 | Sample collected, bag in good condition |
| 8/28/11      | 11:57          | 7.25                      | 7/21/11                   | 12:43 | 38.0                | 0.71                                 | Sample collected, bag in good condition |
| 9/30/11      | 12:15          | 5.25                      | 8/28/11                   | 11:57 | 33.0                | 0.59                                 | Sample collected, bag in good condition |
| 11/28/11     | 11:04          | 9.75                      | 9/30/11                   | 12:15 | 59.0                | 0.61                                 | Sample collected, bag in good condition |
| 2/17/12      | 10:34          | 6.5                       | 11/28/11                  | 11:04 | 81.0                | 0.30                                 | Sample collected, bag in good condition |
| 3/23/12      | 11:27          | 5.5                       | 2/17/12                   | 10:34 | 35.0                | 0.58                                 | Sample collected, bag in good condition |
| 5/31/12      | 11:07          | 7.75                      | 3/23/12                   | 11:27 | 69.0                | 0.42                                 | Sample collected, bag in good condition |
| <b>Mean:</b> |                |                           |                           |       |                     | <b>0.59</b>                          |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 14

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 13:30          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 14:20          | 5.5                       | 3/16/11                   | 13:30 | 32.0                | 0.64                                 | Measured volume, no sample collected    |
| 6/22/11  | 13:12          | 17.25                     | 4/17/11                   | 14:20 | 66.0                | 0.97                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:51          | 8.75                      | 6/22/11                   | 13:12 | 29.0                | 1.12                                 | Sample collected, bag in good condition |
| 8/28/11  | 12:05          | 7.75                      | 7/21/11                   | 12:51 | 38.0                | 0.76                                 | Sample collected, bag in good condition |
| 9/30/11  | 12:19          | 7.75                      | 8/28/11                   | 12:05 | 33.0                | 0.87                                 | Sample collected, bag in good condition |
| 11/28/11 | 11:11          | 4.25                      | 9/30/11                   | 12:19 | 59.0                | 0.27                                 | Sample collected, bag in good condition |
| 2/17/12  | 10:43          | 3.75                      | 11/28/11                  | 11:11 | 81.0                | 0.17                                 | Sample collected, bag in good condition |
| 3/23/12  | 11:38          | 7.75                      | 2/17/12                   | 10:43 | 35.0                | 0.82                                 | Sample collected, bag in good condition |
| 5/31/12  | 11:12          | 8.25                      | 3/23/12                   | 11:38 | 69.0                | 0.44                                 | Sample collected, bag in good condition |
| Mean:    |                |                           |                           |       |                     | <b>0.60</b>                          |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 15

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                         |
| 3/16/11  | 13:45          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 4/17/11  | 14:25          | 4.75                      | 3/16/11                   | 13:45 | 32.0                | 0.55                                 | Measured volume, no sample collected    |
| 6/22/11  | 13:20          | 11.5                      | 4/17/11                   | 14:25 | 66.0                | 0.65                                 | Sample collected, bag in good condition |
| 7/21/11  | 12:56          | 7.25                      | 6/22/11                   | 13:20 | 29.0                | 0.93                                 | Sample collected, bag in good condition |
| 8/28/11  | 12:14          | 9.75                      | 7/21/11                   | 12:56 | 38.0                | 0.95                                 | Sample collected, bag in good condition |
| 9/30/11  | 12:22          | 8.25                      | 8/28/11                   | 12:14 | 33.0                | 0.93                                 | Sample collected, bag in good condition |
| 11/28/11 | 11:16          | 7.75                      | 9/30/11                   | 12:22 | 59.0                | 0.49                                 | Sample collected, bag in good condition |
| 2/17/12  | 10:47          | 8.25                      | 11/28/11                  | 11:16 | 81.0                | 0.38                                 | Sample collected, bag in good condition |
| 3/23/12  | 11:40          | 5.5                       | 2/17/12                   | 10:47 | 35.0                | 0.58                                 | Sample collected, bag in good condition |
| 5/31/12  | 12:22          | 6.75                      | 3/23/12                   | 11:40 | 69.0                | 0.36                                 | Sample collected, bag in good condition |
| Mean:    |                |                           |                           |       | 0.58                |                                      |                                         |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 16

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                 |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|-----------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                         |
| 6/22/11      | 13:25          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                          |
| 7/21/11      | 11:46          | 13.75                     | 6/22/11                   | 13:25 | 28.9                | 1.76                                 | Measured volume, no sample collected    |
| 8/26/11      | 11:07          | 9.25                      | 7/21/11                   | 11:46 | 36.0                | 0.95                                 | Sample collected, bag in good condition |
| 9/30/11      | 12:26          | 12.5                      | 8/26/11                   | 11:07 | 35.1                | 1.32                                 | Sample collected, bag in good condition |
| 11/28/11     | 10:08          | 5.75                      | 9/30/11                   | 12:26 | 58.9                | 0.36                                 | Sample collected, bag in good condition |
| 2/17/12      | 9:40           | 27.5                      | 11/28/11                  | 10:08 | 81.0                | 1.26                                 | Sample collected, bag in good condition |
| 3/23/12      | 10:30          | 10.25                     | 2/17/12                   | 9:40  | 35.0                | 1.08                                 | Sample collected, bag in good condition |
| 5/31/12      | 11:50          | ---                       | 3/23/12                   | 10:30 | ---                 | ---                                  | No sample collected, meter overturned   |
| <b>Mean:</b> |                |                           |                           |       | <b>1.06</b>         |                                      |                                         |



## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 17

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                            |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                                    |
| 6/22/11      | 12:33          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                     |
| 7/21/11      | 11:56          | ---                       | 6/22/11                   | 12:33 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| 8/26/11      | 12:10          | ---                       | 7/21/11                   | 11:56 | ---                 | ---                                  | No sample collected, bag missing, bag replaced     |
| 9/30/11      | 12:30          | 11.25                     | 8/26/11                   | 12:10 | 35.0                | 1.19                                 | Sample collected, bag in good condition            |
| 11/28/11     | 10:13          | ---                       | 9/30/11                   | 12:30 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced     |
| 2/17/12      | 9:36           | ---                       | 11/28/11                  | 10:13 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| 3/23/12      | 10:40          | 5.5                       | 2/17/12                   | 9:36  | 35.0                | 0.58                                 | Sample collected, bag in good condition            |
| 5/31/12      | 11:55          | ---                       | 3/23/12                   | 10:40 | ---                 | ---                                  | No sample collected, meter overturned              |
| <b>Mean:</b> |                |                           |                           |       | <b>0.89</b>         |                                      |                                                    |

# Seepage Meter Field Measurements

Location: Lake Lawne

Site: 18

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date     | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                      |
|----------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------|
|          |                |                           | Date                      | Time  |                     |                                      |                                              |
| 3/16/11  | 14:30          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                               |
| 4/17/11  | 14:30          | 4.75                      | 3/16/11                   | 14:30 | 32.0                | 0.55                                 | Measured volume, no sample collected         |
| 6/22/11  | 12:29          | 9.75                      | 4/17/11                   | 14:30 | 65.9                | 0.55                                 | Sample collected, bag in good condition      |
| 7/21/11  | 12:01          | 11.75                     | 6/22/11                   | 12:29 | 29.0                | 1.50                                 | Sample collected, bag in good condition      |
| 8/26/11  | 11:20          | 25.75                     | 7/21/11                   | 12:01 | 36.0                | 2.65                                 | Sample collected, bag in good condition      |
| 9/30/11  | 12:40          | ---                       | 8/26/11                   | 11:20 | ---                 | ---                                  | No sample collected, meter missing, replaced |
| 11/28/11 | 10:20          | 9.5                       | 9/30/11                   | 12:40 | 58.9                | 0.60                                 | Sample collected, bag in good condition      |
| 2/17/12  | 10:48          | ---                       | 11/28/11                  | 10:20 | ---                 | ---                                  | No sample collected, meter missing, replaced |
| 3/23/12  | 11:29          | ---                       | 2/17/12                   | 10:48 | ---                 | ---                                  | No sample collected, meter missing, replaced |
| 5/31/12  | 11:40          | ---                       | 3/23/12                   | 11:29 | ---                 | ---                                  | No sample collected, meter missing           |
| Mean:    |                |                           |                           |       | 1.03                |                                      |                                              |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 19

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                            |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                                    |
| 3/16/11      | 14:45          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                     |
| 4/17/11      | 14:35          | 5.5                       | 3/16/11                   | 14:45 | 32.0                | 0.64                                 | Measured volume, no sample collected               |
| 6/22/11      | 13:15          | ---                       | 4/17/11                   | 14:35 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced     |
| 7/21/11      | 12:47          | 54.25                     | 6/22/11                   | 13:15 | 29.0                | 6.93                                 | Sample collected, bag in good condition            |
| 8/26/11      | 12:00          | 30.75                     | 7/21/11                   | 12:47 | 36.0                | 3.17                                 | Sample collected, bag in good condition            |
| 9/30/11      | 12:35          | 80.75                     | 8/26/11                   | 12:00 | 35.0                | 8.54                                 | Sample collected, bag in good condition            |
| 11/28/11     | 11:06          | ---                       | 9/30/11                   | 12:35 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced     |
| 2/17/12      | 10:39          | ---                       | 11/28/11                  | 11:06 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| 3/23/12      | 11:33          | ---                       | 2/17/12                   | 10:39 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| 5/31/12      | 11:37          | ---                       | 3/23/12                   | 11:33 | ---                 | ---                                  | No sample collected, meter overturned              |
| <b>Mean:</b> |                |                           |                           |       |                     | <b>4.81</b>                          |                                                    |

## Seepage Meter Field Measurements

Location: Lake Lawne

Site: 20

Date Installed: 3/16/11

Chamber Diameter: 0.58 m

Sediment Area Covered: 0.27 m<sup>2</sup>

| Date         | Time Collected | Volume Collected (liters) | Previous Collection Event |       | Seepage Time (days) | Seepage (liters/m <sup>2</sup> -day) | Comments / Observations                            |
|--------------|----------------|---------------------------|---------------------------|-------|---------------------|--------------------------------------|----------------------------------------------------|
|              |                |                           | Date                      | Time  |                     |                                      |                                                    |
| 3/16/11      | 15:00          | ---                       | ---                       | ---   | ---                 | ---                                  | Bags Installed                                     |
| 4/17/11      | 14:40          | 3.5                       | 3/16/11                   | 15:00 | 32.0                | 0.41                                 | Measured volume, no sample collected               |
| 6/22/11      | 13:02          | 10.5                      | 4/17/11                   | 14:40 | 65.9                | 0.59                                 | Sample collected, bag in good condition            |
| 7/21/11      | 12:40          | 11.75                     | 6/22/11                   | 13:02 | 29.0                | 1.50                                 | Sample collected, bag in good condition            |
| 8/26/11      | 11:53          | ---                       | 7/21/11                   | 12:40 | ---                 | ---                                  | No sample collected, bag damaged, bag replaced     |
| 9/30/11      | 12:45          | ---                       | 8/26/11                   | 11:53 | ---                 | ---                                  | No sample collected, meter overturned, reinstalled |
| 11/28/11     | 10:59          | 3.75                      | 9/30/11                   | 12:45 | 58.9                | 0.24                                 | Sample collected, bag in good condition            |
| 2/17/12      | 10:31          | 10.25                     | 11/28/11                  | 10:59 | 81.0                | 0.47                                 | Sample collected, bag in good condition            |
| 3/23/12      | 11:24          | 3.75                      | 2/17/12                   | 10:31 | 35.0                | 0.40                                 | Sample collected, bag in good condition            |
| 5/31/12      | 11:00          | ---                       | 3/23/12                   | 11:24 | ---                 | ---                                  | No sample collected, meter overturned              |
| <b>Mean:</b> |                |                           |                           |       | <b>0.53</b>         |                                      |                                                    |

## **D.2 Chemical Characteristics of Collected Seepage Samples**



# Characteristics of Groundwater Seepage Samples Collected from Lake Lawne from April 2011 - March 2012

| Site                         | Date Collected | Seepage (L/m <sup>2</sup> -day) | pH (s.u.)   | Alkalinity (mg/l) | Cond. (µmho/cm) | Total N (µg/l) | Total P (µg/l) |
|------------------------------|----------------|---------------------------------|-------------|-------------------|-----------------|----------------|----------------|
| SP 1                         | 6/22/11        | 1.43                            | 6.89        | 66.1              | 366             | 3,643          | 520            |
| SP 1                         | 8/26/11        | 1.00                            | 6.39        | 72.8              | 210             | 2,454          | 432            |
| SP 1                         | 9/30/11        | 5.69                            | 7.22        | 168               | 417             | 3,471          | 678            |
| SP 1                         | 11/28/11       | 5.36                            | 6.80        | 166               | 378             | 3,720          | 749            |
| SP 1                         | 2/17/12        | 0.58                            | 7.54        | 163               | 403             | 2,968          | 700            |
| SP 1                         | 3/23/12        | 3.14                            | 7.28        | 156               | 377             | 1,858          | 737            |
| SP 1                         | 5/31/12        | 1.11                            | 6.81        | 124               | 314             | 834            | 981            |
| <b>Volume Weighted Mean:</b> |                |                                 | <b>7.02</b> | <b>149</b>        | <b>377</b>      | <b>3,049</b>   | <b>702</b>     |

|                              |          |      |             |            |            |              |            |
|------------------------------|----------|------|-------------|------------|------------|--------------|------------|
| SP 2                         | 7/21/11  | 1.98 | 7.17        | 86.0       | 296        | 3,444        | 312        |
| SP 2                         | 8/26/11  | 0.71 | 7.00        | 94.6       | 265        | 2,510        | 148        |
| SP 2                         | 9/30/11  | 0.98 | 7.17        | 79.8       | 213        | 1,494        | 130        |
| SP 2                         | 11/28/11 | 1.29 | 7.25        | 103        | 269        | 3,481        | 358        |
| SP 2                         | 2/17/12  | 0.53 | 7.58        | 177        | 430        | 3,635        | 347        |
| SP 2                         | 3/23/12  | 0.92 | 7.68        | 165        | 409        | 3,891        | 420        |
| SP 2                         | 5/31/12  | 0.60 | 7.53        | 158        | 404        | 2068         | 514        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.30</b> | <b>113</b> | <b>311</b> | <b>3,038</b> | <b>313</b> |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 3                         | 7/21/11  | 0.83 | 6.99        | 84.0        | 242        | 2,026        | 97         |
| SP 3                         | 8/26/11  | 1.02 | 7.04        | 115         | 307        | 4,737        | 152        |
| SP 3                         | 9/30/11  | 2.05 | 7.05        | 76.6        | 223        | 1,677        | 74         |
| SP 3                         | 11/28/11 | 0.46 | 7.22        | 82.0        | 207        | 1,820        | 99         |
| SP 3                         | 2/17/12  | 0.40 | 7.55        | 152         | 383        | 4,061        | 105        |
| SP 3                         | 3/23/12  | 1.61 | 7.77        | 81.0        | 407        | 1,576        | 140        |
| SP 3                         | 5/31/12  | 0.83 | 7.32        | 82.8        | 399        | 1845         | 172        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.27</b> | <b>89.1</b> | <b>307</b> | <b>2,291</b> | <b>117</b> |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 4                         | 6/22/11  | 1.02 | 7.49        | 101         | 296        | 4,564        | 361        |
| SP 4                         | 7/21/11  | 2.20 | 7.43        | 133         | 325        | 3,325        | 412        |
| SP 4                         | 8/26/11  | 0.95 | 6.99        | 81.2        | 237        | 3,292        | 224        |
| SP 4                         | 9/30/11  | 1.85 | 7.23        | 83.6        | 255        | 2,912        | 240        |
| SP 4                         | 11/28/11 | 0.85 | 7.13        | 104         | 267        | 4,058        | 335        |
| SP 4                         | 2/17/12  | 0.65 | 7.15        | 72.4        | 225        | 2,810        | 247        |
| SP 4                         | 3/23/12  | 0.92 | 7.16        | 78.6        | 243        | 1,549        | 138        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.26</b> | <b>99.0</b> | <b>274</b> | <b>3,221</b> | <b>297</b> |

|                              |          |      |             |            |            |              |            |
|------------------------------|----------|------|-------------|------------|------------|--------------|------------|
| SP 5                         | 6/22/11  | 0.94 | 7.51        | 86.7       | 301        | 3,825        | 420        |
| SP 5                         | 7/21/11  | 1.73 | 7.41        | 93.4       | 285        | 3,881        | 262        |
| SP 5                         | 8/26/11  | 1.34 | 7.42        | 156        | 422        | 9,336        | 517        |
| SP 5                         | 9/30/11  | 0.70 | 7.39        | 124        | 305        | 4,988        | 302        |
| SP 5                         | 11/28/11 | 0.93 | 7.33        | 106        | 281        | 4,582        | 183        |
| SP 5                         | 2/17/12  | 0.49 | 7.17        | 68.8       | 223        | 1,054        | 64         |
| SP 5                         | 3/23/12  | 1.53 | 7.30        | 75.8       | 244        | 941          | 135        |
| SP 5                         | 5/31/12  | 0.40 | 7.42        | 79.8       | 254        | 505          | 61         |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.38</b> | <b>102</b> | <b>298</b> | <b>4,059</b> | <b>271</b> |

# Characteristics of Groundwater Seepage Samples Collected from Lake Lawne from April 2011 - March 2012

| Site                  | Date Collected | Seepage (L/m <sup>2</sup> -day) | pH (s.u.) | Alkalinity (mg/l) | Cond. (µmho/cm) | Total N (µg/l) | Total P (µg/l) |
|-----------------------|----------------|---------------------------------|-----------|-------------------|-----------------|----------------|----------------|
| SP 6                  | 6/22/11        | 1.43                            | 7.41      | 105               | 285             | 4,151          | 377            |
| SP 6                  | 7/21/11        | 1.31                            | 7.30      | 116               | 360             | 7,194          | 513            |
| SP 6                  | 8/26/11        | 0.66                            | 7.09      | 70.2              | 205             | 1,789          | 120            |
| SP 6                  | 9/30/11        | 0.76                            | 7.56      | 162               | 486             | 12,057         | 1,024          |
| SP 6                  | 11/28/11       | 0.46                            | 7.40      | 153               | 427             | 10,882         | 1,047          |
| SP 6                  | 2/17/12        | 0.24                            | 7.49      | 110               | 336             | 5,726          | 458            |
| SP 6                  | 3/23/12        | 1.03                            | 7.09      | 74.4              | 233             | 1,252          | 77             |
| SP 6                  | 5/31/12        | 0.82                            | 7.38      | 95.6              | 296             | 1680           | 208            |
| Volume Weighted Mean: |                |                                 | 7.32      | 108               | 319             | 5,173          | 433            |

|                       |          |      |      |      |     |       |     |
|-----------------------|----------|------|------|------|-----|-------|-----|
| SP 7                  | 6/22/11  | 0.65 | 7.11 | 134  | 264 | 2,363 | 202 |
| SP 7                  | 7/21/11  | 0.73 | 7.23 | 182  | 439 | 1,968 | 373 |
| SP 7                  | 8/26/11  | 1.90 | 6.90 | 74.0 | 204 | 1,589 | 86  |
| SP 7                  | 9/30/11  | 0.59 | 7.08 | 264  | 201 | 1,690 | 120 |
| SP 7                  | 11/28/11 | 0.49 | 7.26 | 144  | 406 | 9,214 | 383 |
| SP 7                  | 2/17/12  | 0.57 | 7.38 | 101  | 300 | 4,649 | 271 |
| SP 7                  | 3/23/12  | 0.82 | 7.57 | 101  | 290 | 2,128 | 198 |
| SP 7                  | 5/31/12  | 0.46 | 7.10 | 82.6 | 254 | 743   | 76  |
| Volume Weighted Mean: |          |      | 7.15 | 123  | 278 | 2,613 | 190 |

|                       |          |      |      |      |     |       |     |
|-----------------------|----------|------|------|------|-----|-------|-----|
| SP 8                  | 8/26/11  | 0.63 | 6.99 | 83.0 | 228 | 1,488 | 57  |
| SP 8                  | 9/30/11  | 0.42 | 7.27 | 78.2 | 220 | 1,091 | 29  |
| SP 8                  | 11/28/11 | 0.35 | 7.06 | 71.2 | 195 | 1,268 | 58  |
| SP 8                  | 2/17/12  | 0.25 | 7.59 | 140  | 394 | 7,006 | 300 |
| SP 8                  | 3/23/12  | 0.58 | 7.53 | 81.2 | 254 | 1,608 | 120 |
| SP 8                  | 5/31/12  | 0.42 | 7.29 | 81.2 | 255 | 521   | 64  |
| Volume Weighted Mean: |          |      | 7.27 | 85   | 248 | 1,795 | 91  |

|                       |          |      |      |      |     |        |     |
|-----------------------|----------|------|------|------|-----|--------|-----|
| SP 9                  | 6/22/11  | 0.70 | 7.42 | 89.3 | 229 | 1,017  | 127 |
| SP 9                  | 7/21/11  | 1.31 | 7.27 | 105  | 329 | 6,468  | 268 |
| SP 9                  | 8/26/11  | 0.90 | 7.26 | 208  | 505 | 11,306 | 420 |
| SP 9                  | 9/30/11  | 0.84 | 6.99 | 64.2 | 193 | 1,501  | 86  |
| SP 9                  | 11/28/11 | 0.22 | 7.00 | 90.0 | 253 | 4,821  | 120 |
| SP 9                  | 2/17/12  | 0.45 | 7.54 | 74.8 | 234 | 1,571  | 79  |
| SP 9                  | 3/23/12  | 0.69 | 7.38 | 167  | 509 | 10,696 | 282 |
| Volume Weighted Mean: |          |      | 7.27 | 119  | 337 | 5,825  | 225 |

|                       |          |      |      |      |     |       |     |
|-----------------------|----------|------|------|------|-----|-------|-----|
| SP 10                 | 6/22/11  | 0.66 | 6.98 | 55.5 | 224 | 767   | 111 |
| SP 10                 | 7/21/11  | 1.69 | 6.92 | 61.2 | 189 | 757   | 76  |
| SP 10                 | 8/26/11  | 1.02 | 7.11 | 84.0 | 204 | 2,146 | 114 |
| SP 10                 | 9/30/11  | 0.39 | 7.28 | 96.8 | 278 | 4,807 | 337 |
| SP 10                 | 11/28/11 | 0.27 | 7.39 | 98.2 | 232 | 2,083 | 181 |
| SP 10                 | 2/17/12  | 0.34 | 7.45 | 77.2 | 239 | 1,961 | 111 |
| SP 10                 | 3/23/12  | 1.11 | 7.03 | 78.4 | 241 | 1,767 | 167 |
| SP 10                 | 5/31/12  | 0.31 | 7.49 | 99.4 | 295 | 1375  | 195 |
| Volume Weighted Mean: |          |      | 7.09 | 75.0 | 222 | 1,636 | 135 |

# Characteristics of Groundwater Seepage Samples Collected from Lake Lawne from April 2011 - March 2012

| Site                         | Date Collected | Seepage (L/m <sup>2</sup> -day) | pH (s.u.)   | Alkalinity (mg/l) | Cond. (µmho/cm) | Total N (µg/l) | Total P (µg/l) |
|------------------------------|----------------|---------------------------------|-------------|-------------------|-----------------|----------------|----------------|
| SP 11                        | 6/22/11        | 0.87                            | 7.12        | 113               | 220             | 951            | 154            |
| SP 11                        | 7/21/11        | 1.12                            | 7.26        | 129               | 351             | 4,833          | 436            |
| SP 11                        | 8/26/11        | 1.34                            | 7.16        | 104               | 312             | 5,028          | 367            |
| SP 11                        | 9/30/11        | 2.44                            | 7.10        | 96.2              | 303             | 4,668          | 316            |
| SP 11                        | 11/28/11       | 4.45                            | 7.21        | 94.6              | 261             | 2,944          | 143            |
| SP 11                        | 2/17/12        | 0.45                            | 7.52        | 92.4              | 314             | 2,948          | 167            |
| SP 11                        | 3/23/12        | 1.03                            | 7.13        | 74.8              | 240             | 1,440          | 92             |
| SP 11                        | 5/31/12        | 0.46                            | 7.45        | 80.2              | 252             | 584            | 77             |
| <b>Volume Weighted Mean:</b> |                |                                 | <b>7.19</b> | <b>98.1</b>       | <b>280</b>      | <b>3,335</b>   | <b>224</b>     |

|                              |          |      |             |            |            |              |            |
|------------------------------|----------|------|-------------|------------|------------|--------------|------------|
| SP 12                        | 6/22/11  | 0.74 | 7.08        | 66.8       | 283        | 1,717        | 194        |
| SP 12                        | 7/21/11  | 0.54 | 7.00        | 72.2       | 199        | 589          | 114        |
| SP 12                        | 8/26/11  | 0.63 | 6.86        | 66.4       | 212        | 1,118        | 157        |
| SP 12                        | 9/30/11  | 0.48 | 6.89        | 94.8       | 248        | 905          | 86         |
| SP 12                        | 11/28/11 | 0.46 | 7.09        | 82.0       | 215        | 1,435        | 72         |
| SP 12                        | 2/17/12  | 0.38 | 7.89        | 222        | 482        | 1,560        | 95         |
| SP 12                        | 3/23/12  | 0.58 | 7.47        | 182        | 423        | 1,220        | 93         |
| SP 12                        | 5/31/12  | 0.67 | 7.25        | 80.6       | 256        | 420          | 66         |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.16</b> | <b>102</b> | <b>283</b> | <b>1,109</b> | <b>115</b> |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 13                        | 6/22/11  | 0.81 | 7.23        | 125         | 342        | 6,150        | 418        |
| SP 13                        | 7/21/11  | 0.58 | 7.41        | 137         | 413        | 8,290        | 487        |
| SP 13                        | 8/26/11  | 0.71 | 6.91        | 68.0        | 188        | 1,380        | 124        |
| SP 13                        | 9/30/11  | 0.59 | 6.77        | 75.6        | 217        | 1,368        | 103        |
| SP 13                        | 11/28/11 | 0.61 | 7.06        | 79.6        | 214        | 1,601        | 61         |
| SP 13                        | 2/17/12  | 0.30 | 7.58        | 72.6        | 235        | 1,194        | 86         |
| SP 13                        | 3/23/12  | 0.58 | 7.21        | 72.8        | 225        | 1,046        | 52         |
| SP 13                        | 5/31/12  | 0.42 | 7.56        | 90.4        | 277        | 1073         | 135        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.17</b> | <b>92.2</b> | <b>266</b> | <b>3,037</b> | <b>200</b> |

|                              |          |      |             |            |            |              |            |
|------------------------------|----------|------|-------------|------------|------------|--------------|------------|
| SP 14                        | 6/22/11  | 0.97 | 7.35        | 187        | 327        | 3,804        | 343        |
| SP 14                        | 7/21/11  | 1.12 | 7.50        | 192        | 442        | 4,746        | 346        |
| SP 14                        | 8/26/11  | 0.76 | 7.61        | 218        | 514        | 11,028       | 391        |
| SP 14                        | 9/30/11  | 0.87 | 7.15        | 90.6       | 266        | 3,124        | 155        |
| SP 14                        | 11/28/11 | 0.27 | 7.14        | 62.0       | 185        | 1,242        | 126        |
| SP 14                        | 2/17/12  | 0.17 | 7.61        | 175        | 398        | 1,181        | 47         |
| SP 14                        | 3/23/12  | 0.82 | 7.22        | 70.2       | 228        | 1,039        | 54         |
| SP 14                        | 5/31/12  | 0.44 | 7.58        | 92.8       | 273        | 478          | 54         |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.38</b> | <b>145</b> | <b>343</b> | <b>3,998</b> | <b>233</b> |

Characteristics of Groundwater Seepage Samples Collected from  
Lake Lawne from April 2011 - March 2012

| Site                         | Date Collected | Seepage (L/m <sup>2</sup> -day) | pH (s.u.)   | Alkalinity (mg/l) | Cond. (µmho/cm) | Total N (µg/l) | Total P (µg/l) |
|------------------------------|----------------|---------------------------------|-------------|-------------------|-----------------|----------------|----------------|
| SP 15                        | 6/22/11        | 0.65                            | 7.06        | 125               | 283             | 4,165          | 292            |
| SP 15                        | 7/21/11        | 0.93                            | 7.00        | 109               | 301             | 4,651          | 336            |
| SP 15                        | 8/26/11        | 0.95                            | 7.47        | 259               | 575             | 8,575          | 710            |
| SP 15                        | 9/30/11        | 0.93                            | 6.93        | 62.4              | 195             | 2,191          | 121            |
| SP 15                        | 11/28/11       | 0.49                            | 7.30        | 116               | 330             | 6,773          | 399            |
| SP 15                        | 2/17/12        | 0.38                            | 7.26        | 68.0              | 229             | 1,894          | 540            |
| SP 15                        | 3/23/12        | 0.58                            | 7.69        | 233               | 539             | 2,336          | 618            |
| SP 15                        | 5/31/12        | 0.36                            | 7.64        | 77.8              | 250             | 490            | 48             |
| <b>Volume Weighted Mean:</b> |                |                                 | <b>7.25</b> | <b>139</b>        | <b>350</b>      | <b>4,324</b>   | <b>392</b>     |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 16                        | 7/21/11  | 1.76 | 7.40        | 101         | 264        | 1,311        | 108        |
| SP 16                        | 8/26/11  | 0.95 | 7.12        | 164         | 429        | 9,021        | 223        |
| SP 16                        | 9/30/11  | 1.32 | 6.91        | 81.4        | 215        | 1,415        | 74         |
| SP 16                        | 11/28/11 | 0.36 | 6.92        | 73.4        | 199        | 1,361        | 22         |
| SP 16                        | 2/17/12  | 1.26 | 7.37        | 67.8        | 228        | 3,274        | 131        |
| SP 16                        | 3/23/12  | 1.08 | 7.05        | 77.0        | 233        | 1,990        | 79         |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.18</b> | <b>94.5</b> | <b>263</b> | <b>2,900</b> | <b>113</b> |

|                              |         |      |             |             |            |              |            |
|------------------------------|---------|------|-------------|-------------|------------|--------------|------------|
| SP 17                        | 9/30/11 | 1.19 | 7.33        | 101         | 279        | 4,748        | 240        |
| SP 17                        | 3/23/12 | 0.58 | 7.12        | 66.2        | 218        | 2,240        | 71         |
| <b>Volume Weighted Mean:</b> |         |      | <b>7.26</b> | <b>89.6</b> | <b>259</b> | <b>3,925</b> | <b>185</b> |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 18                        | 6/22/11  | 0.55 | 7.06        | 99.6        | 228        | 986          | 126        |
| SP 18                        | 7/21/11  | 1.50 | 7.13        | 81.8        | 244        | 2,200        | 211        |
| SP 18                        | 8/26/11  | 2.65 | 7.03        | 70.4        | 188        | 1,878        | 125        |
| SP 18                        | 11/28/11 | 0.60 | 7.27        | 65.2        | 198        | 4,842        | 112        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.09</b> | <b>76.1</b> | <b>209</b> | <b>2,211</b> | <b>148</b> |

|                              |         |      |             |             |            |              |            |
|------------------------------|---------|------|-------------|-------------|------------|--------------|------------|
| SP 19                        | 7/21/11 | 6.93 | 7.29        | 97.2        | 267        | 2,544        | 372        |
| SP 19                        | 8/26/11 | 3.17 | 7.20        | 91.4        | 260        | 3,339        | 421        |
| SP 19                        | 9/30/11 | 8.54 | 7.41        | 99.2        | 272        | 3,806        | 353        |
| <b>Volume Weighted Mean:</b> |         |      | <b>7.33</b> | <b>97.1</b> | <b>268</b> | <b>3,257</b> | <b>372</b> |

|                              |          |      |             |             |            |              |            |
|------------------------------|----------|------|-------------|-------------|------------|--------------|------------|
| SP 20                        | 6/22/11  | 0.59 | 7.32        | 106         | 259        | 1,919        | 255        |
| SP 20                        | 7/21/11  | 1.50 | 7.14        | 110         | 267        | 1,825        | 194        |
| SP 20                        | 11/28/11 | 0.24 | 7.07        | 76.4        | 218        | 4,467        | 110        |
| SP 20                        | 2/17/12  | 0.47 | 7.12        | 74.4        | 225        | 1,164        | 66         |
| SP 20                        | 3/23/12  | 0.40 | 7.29        | 90.0        | 258        | 419          | 124        |
| <b>Volume Weighted Mean:</b> |          |      | <b>7.18</b> | <b>99.1</b> | <b>255</b> | <b>1,766</b> | <b>172</b> |

**APPENDIX E**

**CHARACTERISTICS OF MONITORED  
INFLOWS TO LAKE LAWNE**



Chemical Characteristics of Stormwater Runoff Samples Collected in the Lake Lawne Watershed from April - October 2011

| Site            | Date Collected | pH<br>(s.u.) | Alkalinity<br>(mg/l) | Cond<br>(µmho/cm) | Ammonia<br>(µg/l) | NO <sub>x</sub> -N<br>(µg/l) | Diss Org N<br>(µg/l) | Part N<br>(µg/l) | Total N<br>(µg/l) | SRP<br>(µg/l) | Diss Org P<br>(µg/l) | Part P<br>(µg/l) | Total P<br>(µg/l) | Turbidity<br>(NTU) | Color<br>(Pt-Co) | TSS<br>(mg/l) |
|-----------------|----------------|--------------|----------------------|-------------------|-------------------|------------------------------|----------------------|------------------|-------------------|---------------|----------------------|------------------|-------------------|--------------------|------------------|---------------|
| Canal 1         | 4/6/11         | 6.41         | 52.8                 | 224               | 184               | 475                          | 388                  | 148              | 1,195             | 9             | 23                   | 16               | 48                | 3.7                | 228              | 5.1           |
| Canal 1         | 7/11/11        | 6.84         | 71.8                 | 261               | 103               | 127                          | 829                  | 59               | 829               | 37            | 18                   | 14               | 69                | 2.2                | 228              | 1.0           |
| Canal 1         | 7/25/11        | 6.66         | 65.4                 | 229               | 125               | 168                          | 635                  | 104              | 1,032             | 34            | 26                   | 18               | 78                | 3.6                | 349              | 5.0           |
| Canal 1         | 8/8/11         | 6.49         | 58.0                 | 243               | 203               | 407                          | 783                  | 213              | 1,606             | 32            | 12                   | 17               | 61                | 2.8                | 513              | 1.9           |
| Canal 1         | 8/23/11        | 6.60         | 69.4                 | 226               | 385               | 150                          | 802                  | 169              | 1,506             | 30            | 38                   | 5                | 73                | 2.6                | 612              | 5.1           |
| Canal 1         | 9/6/11         | 6.66         | 105.0                | 292               | 1,536             | 107                          | 627                  | 146              | 2,416             | 27            | 8                    | 25               | 60                | 2.3                | 365              | 2.1           |
| Canal 1         | 10/17/11       | 6.50         | 54.0                 | 212               | 94                | 9                            | 1,487                | 12               | 1,602             | 13            | 14                   | 15               | 42                | 3.2                | 408              | 2.4           |
| Canal 1         | 11/7/11        | 6.49         | 71.4                 | 262               | 35                | 355                          | 1,185                | 122              | 1,697             | 7             | 17                   | 14               | 38                | 3.4                | 390              | 3.2           |
| Canal 1         | 11/30/11       | 7.13         | 110.0                | 215               | 150               | 406                          | 170                  | 120              | 846               | 5             | 2                    | 24               | 31                | 3.9                | 205              | 9.1           |
| Canal 1         | 12/14/11       | 7.04         | 92.2                 | 257               | 2                 | 67                           | 471                  | 39               | 579               | 17            | 16                   | 20               | 53                | 2.3                | 133              | 0.9           |
| Canal 1         | 1/19/12        | 7.19         | 110                  | 347               | 167               | 6                            | 101                  | 44               | 318               | 1             | 15                   | 17               | 33                | 4.3                | 167              | 3.9           |
| Canal 1         | 3/19/12        | 6.92         | 96                   | 197               | 64                | 2                            | 60                   | 102              | 228               | 21            | 17                   | 25               | 63                | 4.6                | 92               | 4.6           |
| Minimum Value:  |                | 6.41         | 52.8                 | 197               | 2                 | 2                            | 60                   | 12               | 228               | 1             | 2                    | 5                | 31                | 2.2                | 92               | 0.9           |
| Maximum Value:  |                | 7.19         | 110                  | 347               | 1,536             | 475                          | 1,487                | 213              | 2,416             | 37            | 38                   | 25               | 78                | 4.6                | 612              | 9.1           |
| Geometric Mean: |                | 6.74         | 76.9                 | 244               | 110               | 80                           | 434                  | 85               | 955               | 14            | 14                   | 16               | 52                | 3.1                | 268              | 3.0           |
|                 |                |              |                      |                   |                   |                              |                      |                  |                   |               |                      |                  |                   |                    |                  |               |
| Canal 2         | 4/6/11         | 6.88         | 64.2                 | 220               | 125               | 219                          | 152                  | 199              | 695               | 27            | 21                   | 15               | 63                | 3.9                | 143              | 3.4           |
| Canal 2         | 4/27/11        | 6.59         | 59.2                 | 197               | 100               | 40                           | 101                  | 205              | 446               | 23            | 13                   | 16               | 52                | 2.3                | 141              | 3.0           |
| Canal 2         | 6/7/11         | 6.69         | 64.6                 | 252               | 219               | 31                           | 329                  | 54               | 633               | 33            | 27                   | 14               | 74                | 2.1                | 119              | 1.1           |
| Canal 2         | 6/15/11        | 6.25         | 30.0                 | 213               | 524               | 169                          | 218                  | 61               | 972               | 61            | 12                   | 11               | 84                | 4.3                | 192              | 0.8           |
| Canal 2         | 7/11/11        | 6.63         | 32.2                 | 204               | 394               | 277                          | 191                  | 531              | 1,393             | 79            | 15                   | 11               | 105               | 4.6                | 183              | 1.3           |
| Canal 2         | 7/25/11        | 6.76         | 69.6                 | 232               | 77                | 48                           | 176                  | 296              | 597               | 31            | 6                    | 8                | 45                | 2.1                | 137              | 1.5           |
| Canal 2         | 8/8/11         | 6.37         | 30.6                 | 199               | 184               | 215                          | 160                  | 369              | 928               | 61            | 39                   | 1                | 101               | 3.7                | 182              | 1.1           |
| Canal 2         | 8/23/11        | 6.46         | 32.8                 | 195               | 259               | 269                          | 182                  | 219              | 929               | 91            | 10                   | 39               | 140               | 3.8                | 217              | 1.0           |
| Canal 2         | 10/17/11       | 6.53         | 36.0                 | 180               | 193               | 262                          | 409                  | 118              | 982               | 62            | 34                   | 30               | 126               | 6.4                | 206              | 1.7           |
| Canal 2         | 1/19/12        | 7.31         | 71                   | 188               | 50                | 30                           | 132                  | 36               | 248               | 4             | 18                   | 15               | 37                | 3.9                | 112              | 3.2           |
| Canal 2         | 3/19/12        | 6.62         | 56                   | 221               | 89                | 34                           | 119                  | 98               | 340               | 41            | 14                   | 12               | 67                | 2.0                | 106              | 1.1           |
| Minimum Value:  |                | 6.25         | 30.0                 | 180               | 50                | 30                           | 101                  | 36               | 248               | 4             | 6                    | 1                | 37                | 2.0                | 106              | 0.8           |
| Maximum Value:  |                | 7.31         | 71.4                 | 252               | 524               | 277                          | 409                  | 531              | 1,393             | 91            | 39                   | 39               | 140               | 6.4                | 217              | 3.4           |
| Geometric Mean: |                | 6.64         | 46.9                 | 208               | 160               | 99                           | 181                  | 147              | 665               | 37            | 17                   | 12               | 75                | 3.3                | 154              | 1.5           |
|                 |                |              |                      |                   |                   |                              |                      |                  |                   |               |                      |                  |                   |                    |                  |               |
| Canal 4         | 4/6/11         | 6.45         | 117                  | 293               | 111               | 120                          | 187                  | 273              | 691               | 29            | 6                    | 36               | 71                | 2.4                | 43               | 2.2           |
| Canal 4         | 4/27/11        | 6.34         | 93.0                 | 288               | 73                | 10                           | 93                   | 298              | 474               | 37            | 5                    | 43               | 85                | 2.4                | 42               | 1.7           |
| Canal 4         | 6/15/11        | 6.71         | 80.6                 | 191               | 145               | 5                            | 428                  | 265              | 843               | 46            | 4                    | 101              | 151               | 1.6                | 38               | 1.8           |
| Canal 4         | 7/11/11        | 6.71         | 127                  | 336               | 142               | 128                          | 395                  | 311              | 976               | 38            | 8                    | 30               | 76                | 2.2                | 41               | 1.0           |
| Canal 4         | 8/8/11         | 6.46         | 102                  | 298               | 22                | 75                           | 153                  | 299              | 549               | 59            | 3                    | 37               | 99                | 2.3                | 45               | 0.9           |
| Canal 4         | 8/23/11        | 6.69         | 119                  | 300               | 51                | 21                           | 513                  | 60               | 645               | 21            | 2                    | 40               | 63                | 2.7                | 71               | 1.5           |
| Canal 4         | 10/17/11       | 6.79         | 113                  | 259               | 23                | 130                          | 422                  | 27               | 602               | 22            | 10                   | 15               | 47                | 2.8                | 32               | 1.1           |
| Minimum Value:  |                | 6.34         | 80.6                 | 191               | 22                | 5                            | 93                   | 27               | 474               | 21            | 2                    | 15               | 47                | 1.6                | 32               | 0.9           |
| Maximum Value:  |                | 6.79         | 127.0                | 336               | 145               | 130                          | 513                  | 311              | 976               | 59            | 10                   | 101              | 151               | 2.8                | 71               | 2.2           |
| Geometric Mean: |                | 6.59         | 106.2                | 277               | 64                | 40                           | 267                  | 164              | 665               | 34            | 5                    | 37               | 80                | 2.3                | 43               | 1.4           |

Chemical Characteristics of Stormwater Runoff Samples Collected in the Lake Lawne Watershed from April - October 2011

| Site            | Date Collected | pH<br>(s.u.) | Alkalinity<br>(mg/l) | Cond<br>(µmho/cm) | Ammonia<br>(µg/l) | NO <sub>3</sub> -N<br>(µg/l) | Diss Org N<br>(µg/l) | Part N<br>(µg/l) | Total N<br>(µg/l) | SRP<br>(µg/l) | Diss Org P<br>(µg/l) | Part P<br>(µg/l) | Total P<br>(µg/l) | Turbidity<br>(NTU) | Color<br>(Pt-Co) | TSS<br>(mg/l) |
|-----------------|----------------|--------------|----------------------|-------------------|-------------------|------------------------------|----------------------|------------------|-------------------|---------------|----------------------|------------------|-------------------|--------------------|------------------|---------------|
| Canal 5         | 4/6/11         | 7.04         | 161                  | 371               | 153               | 361                          | 346                  | 407              | 1,267             | 5             | 8                    | 39               | 52                | 2.8                | 37               | 4.6           |
| Canal 5         | 7/11/11        | 7.01         | 149                  | 316               | 365               | 25                           | 449                  | 228              | 1,067             | 15            | 4                    | 34               | 53                | 1.9                | 37               | 2.2           |
| Canal 5         | 8/8/11         | 6.29         | 50.8                 | 188               | 34                | 67                           | 72                   | 658              | 831               | 24            | 12                   | 57               | 93                | 3.3                | 53               | 3.6           |
| Minimum Value:  |                | 6.29         | 50.8                 | 188               | 34                | 25                           | 72                   | 228              | 831               | 5             | 4                    | 34               | 52                | 1.9                | 37               | 2.2           |
| Maximum Value:  |                | 7.04         | 161                  | 371               | 365               | 361                          | 449                  | 658              | 1,267             | 24            | 12                   | 57               | 93                | 3.3                | 53               | 4.6           |
| Geometric Mean: |                | 6.77         | 107                  | 280               | 124               | 85                           | 224                  | 394              | 1,040             | 12            | 7                    | 42               | 64                | 2.6                | 42               | 3.3           |
| Canal 6         | 4/6/11         | 6.23         | 39.6                 | 187               | 130               | 78                           | 298                  | 211              | 717               | 3             | 8                    | 26               | 37                | 5.8                | 65               | 10.8          |
| Canal 6         | 4/27/11        | 5.68         | 20.0                 | 187               | 129               | 123                          | 329                  | 185              | 766               | 2             | 3                    | 37               | 42                | 3.7                | 50               | 4.7           |
| Canal 6         | 6/7/11         | 5.66         | 17.2                 | 163               | 221               | 23                           | 266                  | 138              | 648               | 7             | 45                   | 18               | 70                | 1.0                | 45               | 1.2           |
| Canal 6         | 6/15/11        | 6.36         | 47.4                 | 155               | 149               | 3                            | 301                  | 249              | 702               | 9             | 52                   | 62               | 123               | 3.3                | 53               | 5.0           |
| Canal 6         | 7/11/11        | 6.47         | 37.8                 | 166               | 178               | 38                           | 278                  | 406              | 900               | 10            | 8                    | 55               | 73                | 4.9                | 67               | 4.3           |
| Canal 6         | 7/25/11        | 6.23         | 32.2                 | 171               | 84                | 125                          | 73                   | 514              | 796               | 13            | 15                   | 33               | 61                | 3.6                | 49               | 3.9           |
| Canal 6         | 8/8/11         | 6.61         | 45.6                 | 178               | 12                | 62                           | 339                  | 222              | 635               | 9             | 18                   | 45               | 72                | 4.9                | 55               | 3.9           |
| Canal 6         | 8/23/11        | 6.32         | 35.2                 | 171               | 128               | 100                          | 153                  | 138              | 519               | 16            | 10                   | 31               | 57                | 2.1                | 52               | 3.1           |
| Canal 6         | 9/6/11         | 5.86         | 35.4                 | 167               | 115               | 32                           | 304                  | 247              | 698               | 17            | 15                   | 49               | 81                | 1.8                | 63               | 1.0           |
| Canal 6         | 10/6/11        | 6.34         | 22.2                 | 183               | 98                | 97                           | 425                  | 41               | 661               | 6             | 10                   | 20               | 36                | 3.5                | 63               | 3.3           |
| Canal 6         | 10/17/11       | 6.45         | 33.8                 | 178               | 115               | 129                          | 484                  | 133              | 861               | 6             | 15                   | 49               | 70                | 3.7                | 57               | 4.8           |
| Canal 6         | 11/7/11        | 5.82         | 31.8                 | 171               | 202               | 131                          | 359                  | 292              | 984               | 2             | 15                   | 20               | 37                | 2.1                | 53               | 2.9           |
| Canal 6         | 11/30/11       | 5.71         | 28.0                 | 180               | 41                | 22                           | 263                  | 265              | 591               | 5             | 5                    | 370              | 380               | 3.3                | 52               | 3.9           |
| Canal 6         | 12/14/11       | 6.00         | 44.4                 | 170               | 3                 | 11                           | 292                  | 335              | 641               | 10            | 19                   | 107              | 136               | 6.7                | 48               | 6.8           |
| Canal 6         | 1/19/12        | 6.19         | 38                   | 182               | 73                | 17                           | 244                  | 60               | 394               | 4             | 14                   | 12               | 30                | 3.7                | 49               | 2.7           |
| Canal 6         | 2/7/12         | 6.23         | 24                   | 139               | 65                | 6                            | 308                  | 22               | 401               | 4             | 18                   | 10               | 32                | 1.9                | 67               | 2.3           |
| Canal 6         | 3/19/12        | 5.51         | 21                   | 161               | 49                | 3                            | 272                  | 100              | 424               | 7             | 10                   | 13               | 30                | 2.4                | 44               | 7.8           |
| Minimum Value:  |                | 5.51         | 17.2                 | 139               | 3                 | 3                            | 73                   | 22               | 394               | 2             | 3                    | 10               | 30                | 1.0                | 44               | 1.0           |
| Maximum Value:  |                | 6.61         | 47.4                 | 187               | 221               | 131                          | 484                  | 514              | 984               | 17            | 52                   | 370              | 380               | 6.7                | 67               | 10.8          |
| Geometric Mean: |                | 6.09         | 31.2                 | 171               | 76                | 33                           | 275                  | 163              | 645               | 6             | 13                   | 35               | 62                | 3.1                | 54               | 3.7           |
| Canal 7         | 4/6/11         | 6.81         | 47.2                 | 165               | 59                | 88                           | 477                  | 392              | 1,016             | 10            | 12                   | 22               | 44                | 4.7                | 106              | 5.6           |
| Canal 7         | 4/27/11        | 6.52         | 58.8                 | 207               | 67                | 2                            | 502                  | 304              | 875               | 8             | 5                    | 15               | 28                | 1.8                | 137              | 1.2           |
| Canal 7         | 6/15/11        | 6.67         | 61.8                 | 204               | 225               | 6                            | 288                  | 208              | 727               | 6             | 15                   | 39               | 60                | 4.7                | 114              | 1.3           |
| Canal 7         | 7/11/11        | 6.97         | 63.0                 | 176               | 176               | 33                           | 789                  | 192              | 1,190             | 23            | 13                   | 39               | 75                | 2.9                | 102              | 0.6           |
| Canal 7         | 7/25/11        | 6.51         | 58.2                 | 163               | 160               | 46                           | 178                  | 263              | 647               | 32            | 18                   | 15               | 65                | 1.6                | 123              | 1.4           |
| Canal 7         | 8/8/11         | 6.63         | 60.6                 | 179               | 154               | 38                           | 369                  | 341              | 902               | 21            | 35                   | 2                | 58                | 2.0                | 100              | 2.9           |
| Canal 7         | 8/23/11        | 6.77         | 58.4                 | 154               | 178               | 17                           | 234                  | 152              | 581               | 30            | 4                    | 48               | 82                | 2.2                | 114              | 1.7           |
| Canal 7         | 9/6/11         | 6.30         | 58.4                 | 169               | 1,037             | 6                            | 327                  | 291              | 1,661             | 28            | 17                   | 32               | 77                | 2.4                | 122              | 4.3           |
| Canal 7         | 10/6/11        | 6.38         | 53.0                 | 148               | 128               | 22                           | 671                  | 206              | 1,027             | 2             | 11                   | 36               | 49                | 4.7                | 135              | 3.3           |
| Canal 7         | 10/17/11       | 6.99         | 52.0                 | 162               | 84                | 34                           | 568                  | 526              | 1,212             | 7             | 5                    | 122              | 134               | 17.9               | 111              | 18.8          |
| Canal 7         | 11/7/11        | 6.56         | 51.8                 | 166               | 104               | 21                           | 424                  | 1,045            | 1,594             | 2             | 9                    | 98               | 109               | 27.3               | 121              | 23.2          |
| Canal 7         | 11/30/11       | 6.59         | 54.8                 | 174               | 234               | 18                           | 388                  | 614              | 1,254             | 1             | 11                   | 88               | 100               | 26.9               | 141              | 27.1          |
| Canal 7         | 12/14/11       | 6.51         | 60.0                 | 169               | 19                | 75                           | 393                  | 131              | 618               | 1             | 13                   | 76               | 90                | 12.8               | 148              | 4.6           |
| Minimum Value:  |                | 6.30         | 47.2                 | 148               | 19                | 2                            | 178                  | 131              | 581               | 1             | 4                    | 2                | 28                | 1.6                | 100              | 0.6           |
| Maximum Value:  |                | 6.99         | 63.0                 | 207               | 1,037             | 88                           | 789                  | 1,045            | 1,661             | 32            | 35                   | 122              | 134               | 27.3               | 148              | 27.1          |
| Geometric Mean: |                | 6.63         | 56.6                 | 171               | 132               | 21                           | 400                  | 302              | 969               | 7             | 11                   | 33               | 69                | 5.1                | 120              | 3.7           |



**APPENDIX F**

**RESULTS OF SEDIMENT PHOSPHORUS  
RELEASE EXPERIMENTS CONDUCTED ON  
LAKE LAWNE CORE SAMPLES**

**F.1 Laboratory Analyses**

**F.2 Regression Relationships of Sediment Phosphorus Release**

## **F.1 Laboratory Analyses**



## Sediment Benthic Phosphorus Release Rate Studies in Lake Lawne

| Site                                 | Redox Condition | Date Collected | Time (days) | NH3 (µg/L)                         | NO <sub>x</sub> (µg/L) | Organic N (µg/L) | Total N (µg/L) | SRP (µg/L) | Organic P (µg/L) | Total P (µg/L) | Volume (L) | Total N (µg) | SRP (µg) | Total P (µg) |
|--------------------------------------|-----------------|----------------|-------------|------------------------------------|------------------------|------------------|----------------|------------|------------------|----------------|------------|--------------|----------|--------------|
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 1                                    | Anoxic          | 7/18/11        | 0           | 277                                | 6                      | 92               | 375            | 2          | 150              | 152            | 4.84       | 1,815        | 10       | 736          |
| 1                                    | Anoxic          | 7/19/11        | 1           | 353                                | 17                     | 87               | 457            | 5          | 159              | 164            | 4.82       | 2,205        | 24       | 791          |
| 1                                    | Anoxic          | 7/20/11        | 2           | 346                                | 14                     | 81               | 441            | 5          | 151              | 156            | 4.81       | 2,120        | 24       | 750          |
| 1                                    | Anoxic          | 7/21/11        | 3           | 452                                | 4                      | 94               | 550            | 8          | 166              | 174            | 4.79       | 2,636        | 38       | 834          |
| 1                                    | Anoxic          | 7/22/11        | 4           | 692                                | 3                      | 80               | 775            | 8          | 159              | 167            | 4.78       | 3,701        | 38       | 798          |
| 1                                    | Anoxic          | 7/25/11        | 7           | 824                                | 7                      | 70               | 901            | 17         | 151              | 168            | 4.73       | 4,259        | 80       | 794          |
| 1                                    | Anoxic          | 7/27/11        | 9           | 849                                | 25                     | 70               | 944            | 17         | 158              | 175            | 4.69       | 4,432        | 80       | 822          |
| 1                                    | Anoxic          | 7/29/11        | 11          | 899                                | 17                     | 70               | 986            | 17         | 169              | 186            | 4.66       | 4,597        | 79       | 867          |
| 1                                    | Anoxic          | 8/1/11         | 14          | 810                                | 81                     | 70               | 961            | 17         | 150              | 167            | 4.61       | 4,434        | 78       | 770          |
| 1                                    | Anoxic          | 8/5/11         | 18          | 503                                | 474                    | 80               | 1057           | 18         | 140              | 158            | 4.55       | 4,808        | 82       | 719          |
| 1                                    | Anoxic          | 8/8/11         | 21          | 100                                | 1126                   | 80               | 1306           | 17         | 134              | 151            | 4.50       | 5,877        | 77       | 680          |
| 1                                    | Anoxic          | 8/10/11        | 23          | 104                                | 1154                   | 92               | 1350           | 17         | 145              | 162            | 4.47       | 6,032        | 76       | 724          |
| 1                                    | Anoxic          | 8/12/11        | 25          | 14                                 | 991                    | 70               | 1075           | 17         | 159              | 176            | 4.44       | 4,768        | 75       | 781          |
| 1                                    | Anoxic          | 8/15/11        | 28          | 16                                 | 939                    | 71               | 1026           | 15         | 165              | 180            | 4.39       | 4,501        | 66       | 790          |
| 1                                    | Anoxic          | 8/17/11        | 30          | 22                                 | 992                    | 74               | 1088           | 14         | 166              | 180            | 4.35       | 4,738        | 61       | 784          |
| 1                                    | Anoxic          | 8/19/11        | 32          | 27                                 | 972                    | 77               | 1076           | 12         | 161              | 173            | 4.32       | 4,650        | 52       | 748          |
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 1                                    | Aerobic         | 8/25/11        | 0           | 72                                 | 35                     | 69               | 176            | 2          | 159              | 161            | 4.84       | 852          | 10       | 779          |
| 1                                    | Aerobic         | 8/26/11        | 1           | 85                                 | 38                     | 51               | 174            | 2          | 163              | 165            | 4.83       | 840          | 10       | 796          |
| 1                                    | Aerobic         | 8/29/11        | 4           | 115                                | 129                    | 73               | 317            | 3          | 166              | 169            | 4.79       | 1,518        | 14       | 809          |
| 1                                    | Aerobic         | 8/30/11        | 5           | 173                                | 191                    | 73               | 437            | 5          | 159              | 164            | 4.77       | 2,086        | 24       | 783          |
| 1                                    | Aerobic         | 8/31/11        | 6           | 190                                | 227                    | 71               | 488            | 8          | 142              | 150            | 4.76       | 2,323        | 38       | 714          |
| 1                                    | Aerobic         | 9/2/11         | 8           | 182                                | 238                    | 70               | 490            | 6          | 155              | 161            | 4.73       | 2,320        | 28       | 762          |
| 1                                    | Aerobic         | 9/6/11         | 12          | 172                                | 282                    | 62               | 516            | 11         | 152              | 163            | 4.68       | 2,415        | 51       | 763          |
| 1                                    | Aerobic         | 9/8/11         | 14          | 27                                 | 314                    | 70               | 411            | 10         | 176              | 186            | 4.65       | 1,913        | 47       | 866          |
| 1                                    | Aerobic         | 9/12/11        | 18          | 51                                 | 332                    | 70               | 453            | 14         | 170              | 184            | 4.60       | 2,084        | 64       | 846          |
| 1                                    | Aerobic         | 9/14/11        | 20          | 53                                 | 308                    | 83               | 444            | 16         | 165              | 181            | 4.57       | 2,031        | 73       | 828          |
| 1                                    | Aerobic         | 9/16/11        | 22          | 25                                 | 367                    | 70               | 462            | 15         | 179              | 194            | 4.55       | 2,101        | 68       | 882          |
| 1                                    | Aerobic         | 9/19/11        | 25          | 36                                 | 429                    | 70               | 535            | 15         | 186              | 201            | 4.51       | 2,411        | 68       | 906          |
| 1                                    | Aerobic         | 9/21/11        | 27          | 31                                 | 440                    | 73               | 544            | 15         | 177              | 192            | 4.48       | 2,437        | 67       | 860          |
| 1                                    | Aerobic         | 9/23/11        | 29          | 15                                 | 446                    | 72               | 533            | 21         | 184              | 205            | 4.45       | 2,374        | 94       | 913          |
| 1                                    | Aerobic         | 9/28/11        | 34          | 15                                 | 448                    | 71               | 534            | 20         | 177              | 197            | 4.39       | 2,343        | 88       | 864          |

## Sediment Benthic Phosphorus Release Rate Studies in Lake Lawne

| Site                                 | Redox Condition | Date Collected | Time (days) | NH3 (µg/L)                         | NO <sub>x</sub> (µg/L) | Organic N (µg/L) | Total N (µg/L) | SRP (µg/L) | Organic P (µg/L) | Total P (µg/L) | Volume (L) | Total N (µg) | SRP (µg) | Total P (µg) |
|--------------------------------------|-----------------|----------------|-------------|------------------------------------|------------------------|------------------|----------------|------------|------------------|----------------|------------|--------------|----------|--------------|
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 2                                    | Anoxic          | 7/18/11        | 0           | 40                                 | 5                      | 213              | 258            | 2          | 187              | 189            | 4.84       | 1,249        | 10       | 915          |
| 2                                    | Anoxic          | 7/19/11        | 1           | 69                                 | 5                      | 179              | 253            | 5          | 178              | 183            | 4.83       | 1,221        | 24       | 883          |
| 2                                    | Anoxic          | 7/20/11        | 2           | 32                                 | 7                      | 251              | 290            | 12         | 167              | 179            | 4.81       | 1,396        | 58       | 861          |
| 2                                    | Anoxic          | 7/21/11        | 3           | 34                                 | 4                      | 221              | 259            | 20         | 173              | 193            | 4.80       | 1,243        | 96       | 926          |
| 2                                    | Anoxic          | 7/22/11        | 4           | 26                                 | 3                      | 195              | 224            | 19         | 180              | 199            | 4.78       | 1,072        | 91       | 952          |
| 2                                    | Anoxic          | 7/25/11        | 7           | 15                                 | 26                     | 195              | 236            | 31         | 172              | 203            | 4.74       | 1,119        | 147      | 962          |
| 2                                    | Anoxic          | 7/27/11        | 9           | 10                                 | 67                     | 233              | 310            | 42         | 168              | 210            | 4.71       | 1,461        | 198      | 990          |
| 2                                    | Anoxic          | 7/29/11        | 11          | 5                                  | 221                    | 155              | 381            | 43         | 169              | 212            | 4.68       | 1,785        | 201      | 993          |
| 2                                    | Anoxic          | 8/1/11         | 14          | 5                                  | 284                    | 173              | 462            | 44         | 167              | 211            | 4.64       | 2,145        | 204      | 979          |
| 2                                    | Anoxic          | 8/5/11         | 18          | 99                                 | 263                    | 170              | 532            | 42         | 169              | 211            | 4.59       | 2,439        | 193      | 967          |
| 2                                    | Anoxic          | 8/8/11         | 21          | 86                                 | 271                    | 160              | 517            | 47         | 163              | 210            | 4.54       | 2,349        | 214      | 954          |
| 2                                    | Anoxic          | 8/10/11        | 23          | 94                                 | 247                    | 170              | 511            | 37         | 178              | 215            | 4.51       | 2,307        | 167      | 971          |
| 2                                    | Anoxic          | 8/12/11        | 25          | 16                                 | 179                    | 199              | 394            | 29         | 165              | 194            | 4.49       | 1,767        | 130      | 870          |
| 2                                    | Anoxic          | 8/15/11        | 28          | 23                                 | 160                    | 199              | 382            | 27         | 159              | 186            | 4.44       | 1,697        | 120      | 826          |
| 2                                    | Anoxic          | 8/17/11        | 30          | 23                                 | 151                    | 159              | 333            | 22         | 175              | 197            | 4.42       | 1,470        | 97       | 870          |
| 2                                    | Anoxic          | 8/19/11        | 32          | 11                                 | 192                    | 158              | 361            | 20         | 163              | 183            | 4.39       | 1,584        | 88       | 803          |
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 2                                    | Aerobic         | 8/25/11        | 0           | 16                                 | 46                     | 114              | 176            | 1          | 166              | 167            | 4.84       | 852          | 5        | 808          |
| 2                                    | Aerobic         | 8/26/11        | 1           | 20                                 | 46                     | 88               | 154            | 4          | 164              | 168            | 4.83       | 743          | 19       | 811          |
| 2                                    | Aerobic         | 8/29/11        | 4           | 23                                 | 100                    | 70               | 193            | 4          | 173              | 177            | 4.79       | 924          | 19       | 847          |
| 2                                    | Aerobic         | 8/30/11        | 5           | 194                                | 144                    | 70               | 408            | 6          | 164              | 170            | 4.77       | 1,948        | 29       | 812          |
| 2                                    | Aerobic         | 8/31/11        | 6           | 188                                | 172                    | 70               | 430            | 9          | 200              | 209            | 4.76       | 2,047        | 43       | 995          |
| 2                                    | Aerobic         | 9/2/11         | 8           | 186                                | 185                    | 78               | 449            | 7          | 234              | 241            | 4.73       | 2,125        | 33       | 1,141        |
| 2                                    | Aerobic         | 9/6/11         | 12          | 175                                | 238                    | 70               | 483            | 8          | 206              | 214            | 4.68       | 2,261        | 37       | 1,002        |
| 2                                    | Aerobic         | 9/8/11         | 14          | 37                                 | 326                    | 73               | 436            | 15         | 197              | 212            | 4.65       | 2,029        | 70       | 987          |
| 2                                    | Aerobic         | 9/12/11        | 18          | 54                                 | 331                    | 73               | 458            | 12         | 186              | 198            | 4.60       | 2,107        | 55       | 911          |
| 2                                    | Aerobic         | 9/14/11        | 20          | 48                                 | 334                    | 86               | 468            | 12         | 193              | 205            | 4.57       | 2,140        | 55       | 938          |
| 2                                    | Aerobic         | 9/16/11        | 22          | 36                                 | 415                    | 79               | 530            | 14         | 194              | 208            | 4.55       | 2,410        | 64       | 946          |
| 2                                    | Aerobic         | 9/19/11        | 25          | 36                                 | 471                    | 82               | 589            | 12         | 214              | 226            | 4.51       | 2,655        | 54       | 1,019        |
| 2                                    | Aerobic         | 9/21/11        | 27          | 29                                 | 512                    | 73               | 614            | 13         | 210              | 223            | 4.48       | 2,751        | 58       | 999          |
| 2                                    | Aerobic         | 9/23/11        | 29          | 15                                 | 577                    | 70               | 662            | 19         | 209              | 228            | 4.45       | 2,948        | 85       | 1,015        |
| 2                                    | Aerobic         | 9/28/11        | 34          | 18                                 | 635                    | 83               | 736            | 18         | 217              | 235            | 4.39       | 3,229        | 79       | 1,031        |

## Sediment Benthic Phosphorus Release Rate Studies in Lake Lawne

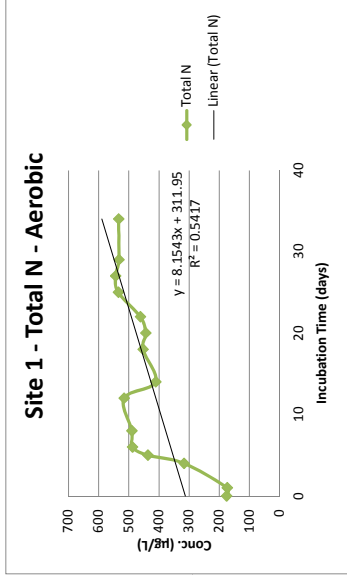
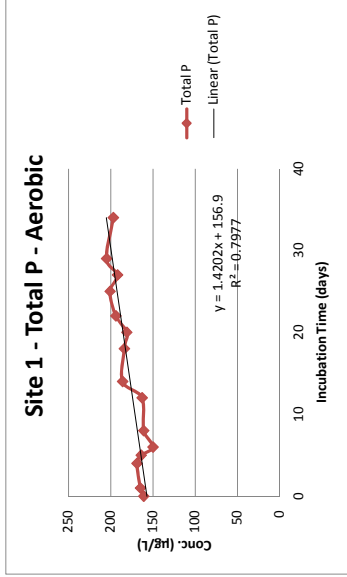
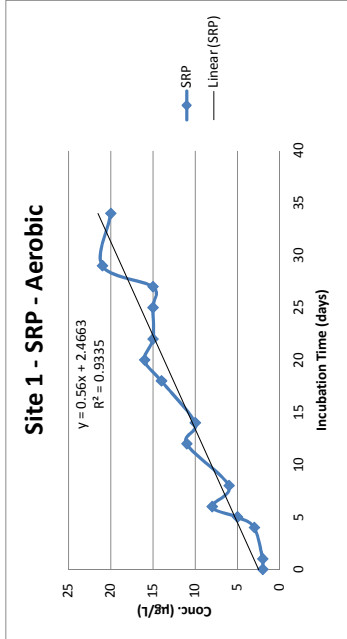
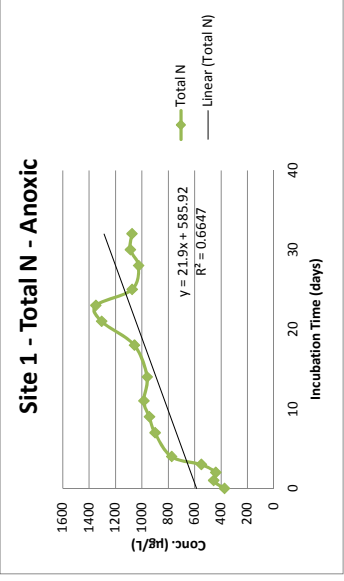
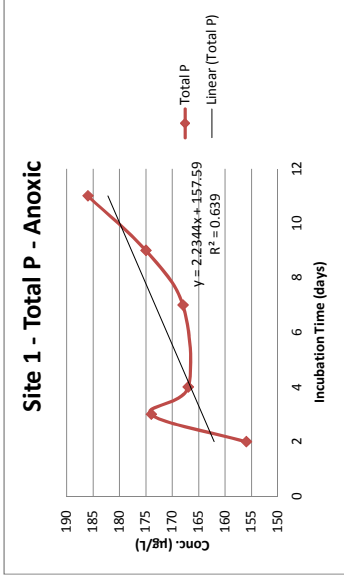
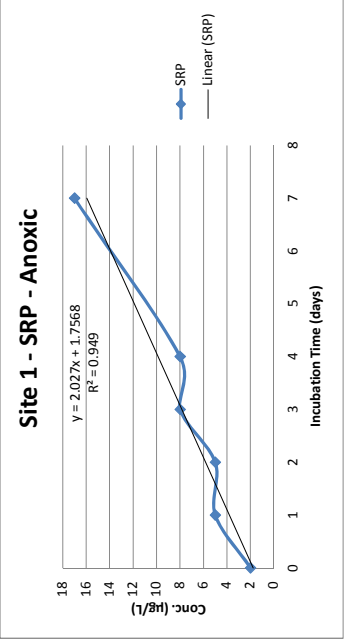
| Site                                 | Redox Condition | Date Collected | Time (days) | NH3 (µg/L)                         | NO <sub>x</sub> (µg/L) | Organic N (µg/L) | Total N (µg/L) | SRP (µg/L) | Organic P (µg/L) | Total P (µg/L) | Volume (L) | Total N (µg) | SRP (µg) | Total P (µg) |
|--------------------------------------|-----------------|----------------|-------------|------------------------------------|------------------------|------------------|----------------|------------|------------------|----------------|------------|--------------|----------|--------------|
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 3                                    | Anoxic          | 7/18/11        | 0           | 43                                 | 9                      | 359              | 411            | 3          | 172              | 175            | 4.84       | 1,989        | 15       | 847          |
| 3                                    | Anoxic          | 7/19/11        | 1           | 79                                 | 5                      | 289              | 373            | 16         | 162              | 178            | 4.83       | 1,800        | 77       | 859          |
| 3                                    | Anoxic          | 7/20/11        | 2           | 108                                | 8                      | 213              | 329            | 15         | 166              | 181            | 4.81       | 1,583        | 72       | 871          |
| 3                                    | Anoxic          | 7/21/11        | 3           | 119                                | 5                      | 208              | 332            | 24         | 179              | 203            | 4.80       | 1,593        | 115      | 974          |
| 3                                    | Anoxic          | 7/22/11        | 4           | 145                                | 2                      | 190              | 337            | 24         | 174              | 198            | 4.78       | 1,612        | 115      | 947          |
| 3                                    | Anoxic          | 7/25/11        | 7           | 202                                | 8                      | 193              | 403            | 36         | 165              | 201            | 4.74       | 1,911        | 171      | 953          |
| 3                                    | Anoxic          | 7/27/11        | 9           | 353                                | 4                      | 199              | 556            | 55         | 165              | 220            | 4.71       | 2,620        | 259      | 1,037        |
| 3                                    | Anoxic          | 7/29/11        | 11          | 419                                | 3                      | 181              | 603            | 51         | 182              | 233            | 4.68       | 2,825        | 239      | 1,092        |
| 3                                    | Anoxic          | 8/1/11         | 14          | 449                                | 4                      | 189              | 642            | 57         | 197              | 254            | 4.64       | 2,980        | 265      | 1,179        |
| 3                                    | Anoxic          | 8/5/11         | 18          | 203                                | 66                     | 214              | 483            | 78         | 164              | 242            | 4.59       | 2,215        | 358      | 1,110        |
| 3                                    | Anoxic          | 8/8/11         | 21          | 108                                | 158                    | 209              | 475            | 79         | 161              | 240            | 4.54       | 2,158        | 359      | 1,090        |
| 3                                    | Anoxic          | 8/10/11        | 23          | 98                                 | 259                    | 168              | 525            | 88         | 162              | 250            | 4.51       | 2,370        | 397      | 1,129        |
| 3                                    | Anoxic          | 8/12/11        | 25          | 11                                 | 390                    | 125              | 526            | 69         | 160              | 229            | 4.49       | 2,360        | 310      | 1,027        |
| 3                                    | Anoxic          | 8/15/11        | 28          | 15                                 | 529                    | 173              | 717            | 79         | 170              | 249            | 4.44       | 3,186        | 351      | 1,106        |
| 3                                    | Anoxic          | 8/17/11        | 30          | 20                                 | 554                    | 171              | 745            | 81         | 122              | 203            | 4.42       | 3,289        | 358      | 896          |
| 3                                    | Anoxic          | 8/19/11        | 32          | 24                                 | 631                    | 174              | 829            | 84         | 152              | 236            | 4.39       | 3,637        | 368      | 1,035        |
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 3                                    | Aerobic         | 8/25/11        | 0           | 3                                  | 71                     | 93               | 167            | 1          | 184              | 185            | 4.84       | 808          | 5        | 896          |
| 3                                    | Aerobic         | 8/26/11        | 1           | 3                                  | 64                     | 118              | 185            | 1          | 187              | 188            | 4.83       | 893          | 5        | 908          |
| 3                                    | Aerobic         | 8/29/11        | 4           | 9                                  | 129                    | 70               | 208            | 1          | 183              | 184            | 4.79       | 996          | 5        | 881          |
| 3                                    | Aerobic         | 8/30/11        | 5           | 110                                | 144                    | 74               | 328            | 3          | 181              | 184            | 4.77       | 1,566        | 14       | 878          |
| 3                                    | Aerobic         | 8/31/11        | 6           | 174                                | 208                    | 70               | 452            | 5          | 180              | 185            | 4.76       | 2,152        | 24       | 881          |
| 3                                    | Aerobic         | 9/2/11         | 8           | 105                                | 250                    | 71               | 426            | 6          | 181              | 187            | 4.73       | 2,017        | 28       | 885          |
| 3                                    | Aerobic         | 9/6/11         | 12          | 181                                | 301                    | 70               | 552            | 8          | 177              | 185            | 4.68       | 2,584        | 37       | 866          |
| 3                                    | Aerobic         | 9/8/11         | 14          | 46                                 | 371                    | 80               | 497            | 8          | 169              | 177            | 4.65       | 2,313        | 37       | 824          |
| 3                                    | Aerobic         | 9/12/11        | 18          | 45                                 | 329                    | 74               | 448            | 9          | 160              | 169            | 4.60       | 2,061        | 41       | 777          |
| 3                                    | Aerobic         | 9/14/11        | 20          | 49                                 | 313                    | 70               | 432            | 9          | 168              | 177            | 4.57       | 1,976        | 41       | 810          |
| 3                                    | Aerobic         | 9/16/11        | 22          | 34                                 | 347                    | 78               | 459            | 7          | 166              | 173            | 4.55       | 2,087        | 32       | 787          |
| 3                                    | Aerobic         | 9/19/11        | 25          | 35                                 | 409                    | 74               | 518            | 11         | 189              | 200            | 4.51       | 2,335        | 50       | 901          |
| 3                                    | Aerobic         | 9/21/11        | 27          | 33                                 | 397                    | 63               | 493            | 13         | 188              | 201            | 4.48       | 2,209        | 58       | 901          |
| 3                                    | Aerobic         | 9/23/11        | 29          | 7                                  | 471                    | 80               | 558            | 17         | 200              | 217            | 4.45       | 2,485        | 76       | 966          |
| 3                                    | Aerobic         | 9/28/11        | 34          | 5                                  | 426                    | 71               | 502            | 11         | 191              | 202            | 4.39       | 2,202        | 48       | 886          |

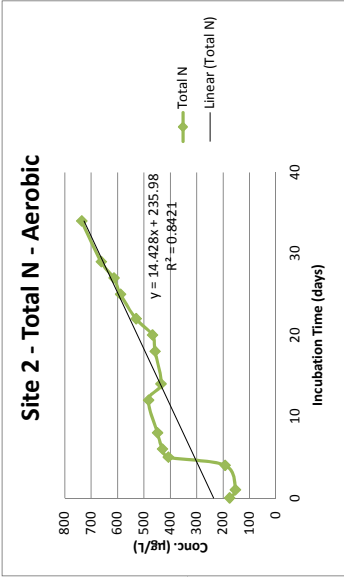
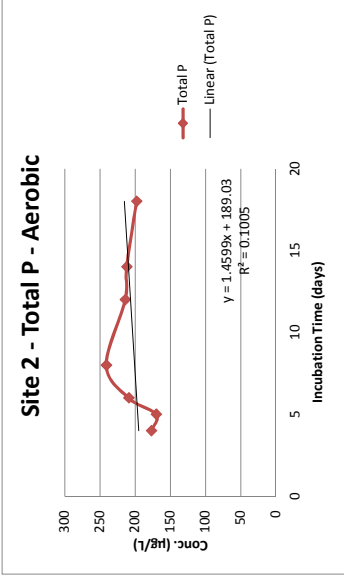
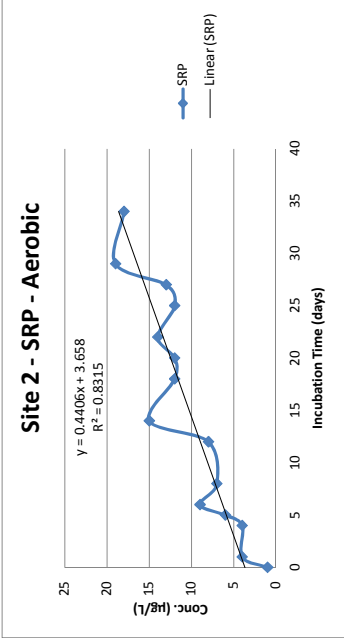
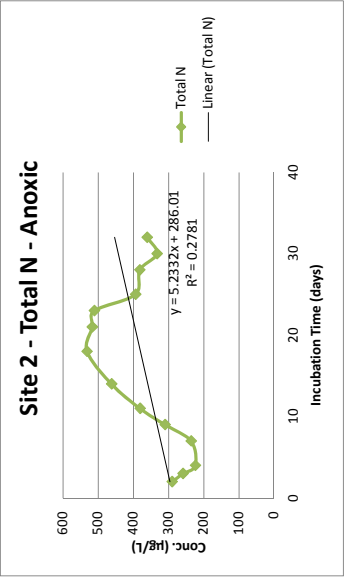
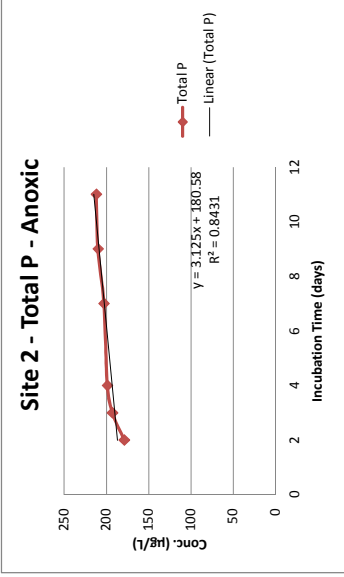
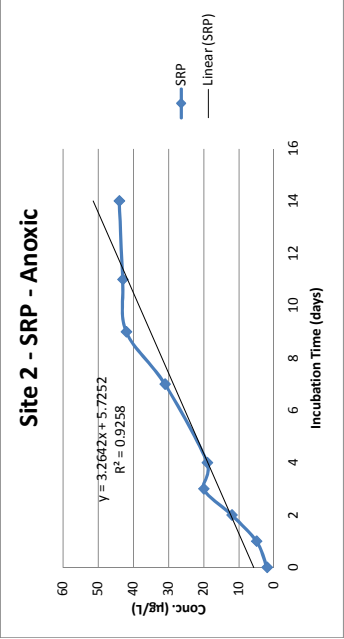
## Sediment Benthic Phosphorus Release Rate Studies in Lake Lawne

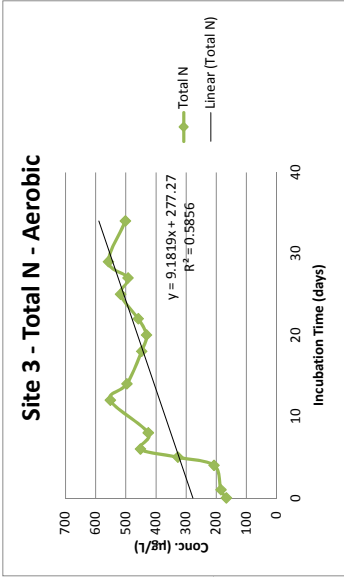
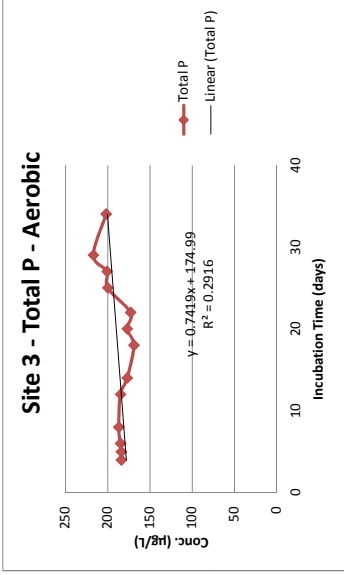
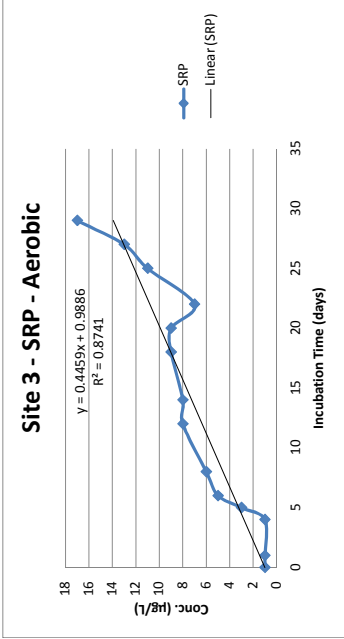
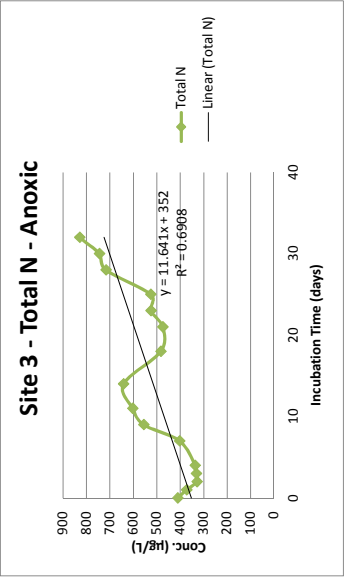
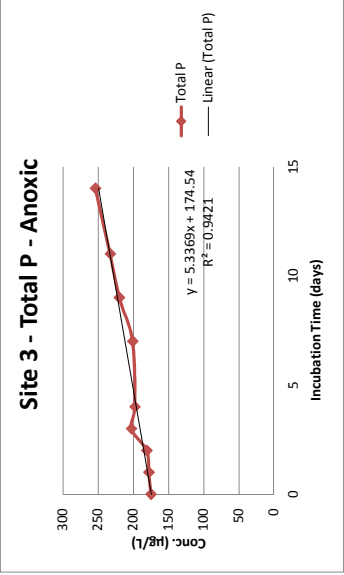
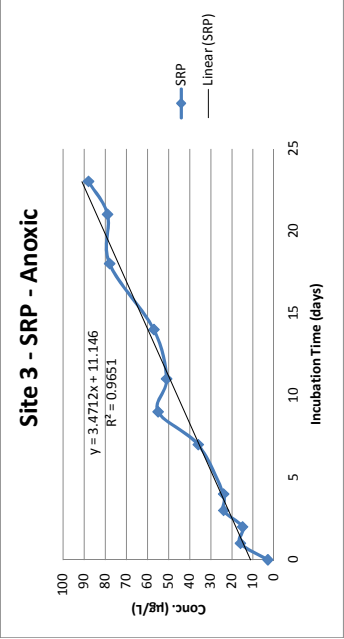
| Site                                 | Redox Condition | Date Collected | Time (days) | NH3 (µg/L)                         | NO <sub>x</sub> (µg/L) | Organic N (µg/L) | Total N (µg/L) | SRP (µg/L) | Organic P (µg/L) | Total P (µg/L) | Volume (L) | Total N (µg) | SRP (µg) | Total P (µg) |
|--------------------------------------|-----------------|----------------|-------------|------------------------------------|------------------------|------------------|----------------|------------|------------------|----------------|------------|--------------|----------|--------------|
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 4                                    | Anoxic          | 7/18/11        | 0           | 272                                | 6                      | 80               | 358            | 2          | 168              | 170            | 4.84       | 1,733        | 10       | 823          |
| 4                                    | Anoxic          | 7/19/11        | 1           | 161                                | 3                      | 92               | 256            | 4          | 162              | 166            | 4.83       | 1,236        | 19       | 801          |
| 4                                    | Anoxic          | 7/20/11        | 2           | 100                                | 6                      | 127              | 233            | 6          | 157              | 163            | 4.81       | 1,121        | 29       | 784          |
| 4                                    | Anoxic          | 7/21/11        | 3           | 142                                | 3                      | 142              | 287            | 8          | 158              | 166            | 4.80       | 1,377        | 38       | 796          |
| 4                                    | Anoxic          | 7/22/11        | 4           | 174                                | 3                      | 129              | 306            | 8          | 151              | 159            | 4.78       | 1,464        | 38       | 761          |
| 4                                    | Anoxic          | 7/25/11        | 7           | 551                                | 5                      | 112              | 668            | 15         | 168              | 183            | 4.74       | 3,167        | 71       | 868          |
| 4                                    | Anoxic          | 7/27/11        | 9           | 748                                | 12                     | 106              | 866            | 18         | 163              | 181            | 4.71       | 4,081        | 85       | 853          |
| 4                                    | Anoxic          | 7/29/11        | 11          | 921                                | 11                     | 88               | 1020           | 13         | 160              | 173            | 4.68       | 4,778        | 61       | 810          |
| 4                                    | Anoxic          | 8/5/11         | 18          | 605                                | 230                    | 102              | 937            | 16         | 140              | 156            | 4.59       | 4,296        | 73       | 715          |
| 4                                    | Anoxic          | 8/8/11         | 21          | 102                                | 1252                   | 110              | 1464           | 14         | 148              | 162            | 4.54       | 6,651        | 64       | 736          |
| 4                                    | Anoxic          | 8/10/11        | 23          | 99                                 | 1362                   | 111              | 1572           | 13         | 133              | 146            | 4.51       | 7,097        | 59       | 659          |
| 4                                    | Anoxic          | 8/12/11        | 25          | 8                                  | 1185                   | 108              | 1301           | 11         | 147              | 158            | 4.49       | 5,836        | 49       | 709          |
| 4                                    | Anoxic          | 8/15/11        | 28          | 20                                 | 1140                   | 104              | 1264           | 6          | 151              | 157            | 4.44       | 5,617        | 27       | 698          |
| 4                                    | Anoxic          | 8/17/11        | 30          | 14                                 | 1134                   | 121              | 1269           | 3          | 168              | 171            | 4.42       | 5,603        | 13       | 755          |
| 4                                    | Anoxic          | 8/19/11        | 32          | 29                                 | 1205                   | 103              | 1337           | 9          | 157              | 166            | 4.39       | 5,865        | 39       | 728          |
| Starting water level (inches): 24.00 |                 |                |             | Ending water level (inches): 21.75 |                        |                  |                |            |                  |                |            |              |          |              |
| 4                                    | Aerobic         | 8/25/11        | 0           | 44                                 | 53                     | 83               | 180            | 0          | 164              | 164            | 4.84       | 871          | 0        | 794          |
| 4                                    | Aerobic         | 8/26/11        | 1           | 69                                 | 52                     | 85               | 206            | 2          | 180              | 182            | 4.83       | 994          | 10       | 879          |
| 4                                    | Aerobic         | 8/29/11        | 4           | 93                                 | 187                    | 77               | 357            | 5          | 167              | 172            | 4.79       | 1,709        | 24       | 823          |
| 4                                    | Aerobic         | 8/30/11        | 5           | 141                                | 233                    | 60               | 434            | 6          | 163              | 169            | 4.77       | 2,072        | 29       | 807          |
| 4                                    | Aerobic         | 8/31/11        | 6           | 187                                | 280                    | 70               | 537            | 8          | 167              | 175            | 4.76       | 2,556        | 38       | 833          |
| 4                                    | Aerobic         | 9/2/11         | 8           | 136                                | 303                    | 69               | 508            | 8          | 174              | 182            | 4.73       | 2,405        | 38       | 862          |
| 4                                    | Aerobic         | 9/6/11         | 12          | 118                                | 391                    | 66               | 575            | 11         | 174              | 185            | 4.68       | 2,691        | 51       | 866          |
| 4                                    | Aerobic         | 9/8/11         | 14          | 47                                 | 482                    | 59               | 588            | 11         | 173              | 184            | 4.65       | 2,736        | 51       | 856          |
| 4                                    | Aerobic         | 9/12/11        | 18          | 52                                 | 461                    | 70               | 583            | 11         | 165              | 176            | 4.60       | 2,682        | 51       | 810          |
| 4                                    | Aerobic         | 9/14/11        | 20          | 49                                 | 431                    | 70               | 550            | 13         | 185              | 198            | 4.57       | 2,515        | 59       | 906          |
| 4                                    | Aerobic         | 9/16/11        | 22          | 37                                 | 517                    | 80               | 634            | 14         | 185              | 199            | 4.55       | 2,883        | 64       | 905          |
| 4                                    | Aerobic         | 9/19/11        | 25          | 35                                 | 572                    | 70               | 677            | 13         | 185              | 198            | 4.51       | 3,051        | 59       | 892          |
| 4                                    | Aerobic         | 9/21/11        | 27          | 3                                  | 603                    | 67               | 673            | 13         | 188              | 201            | 4.48       | 3,015        | 58       | 901          |
| 4                                    | Aerobic         | 9/23/11        | 29          | 3                                  | 649                    | 63               | 715            | 19         | 187              | 206            | 4.45       | 3,184        | 85       | 917          |
| 4                                    | Aerobic         | 9/28/11        | 34          | 13                                 | 649                    | 70               | 732            | 18         | 192              | 210            | 4.39       | 3,211        | 79       | 921          |

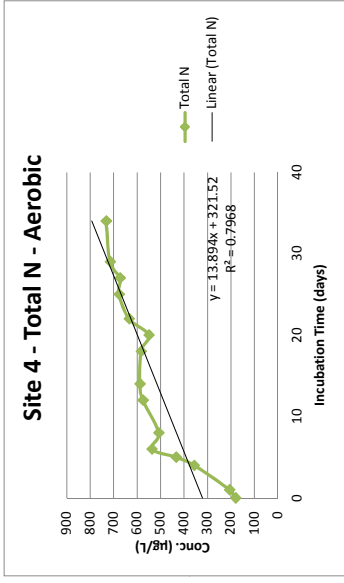
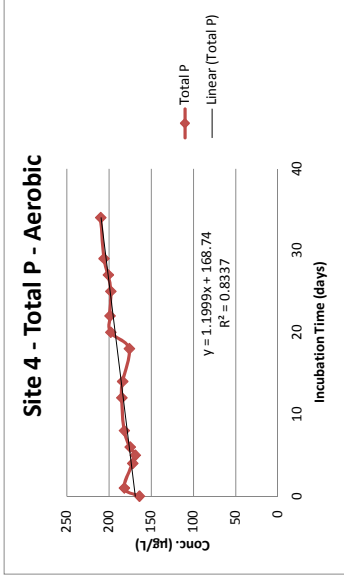
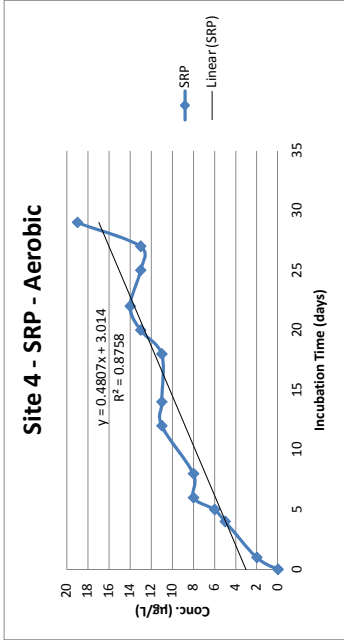
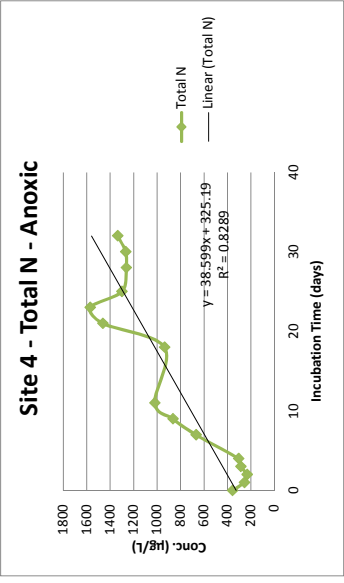
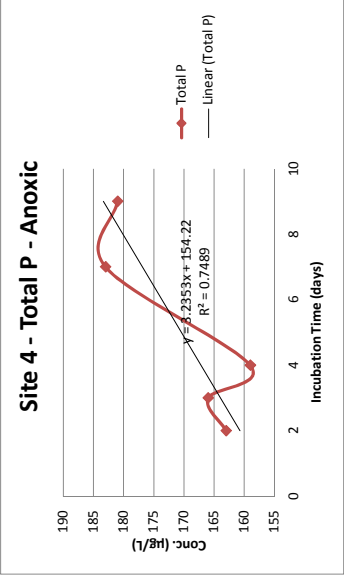
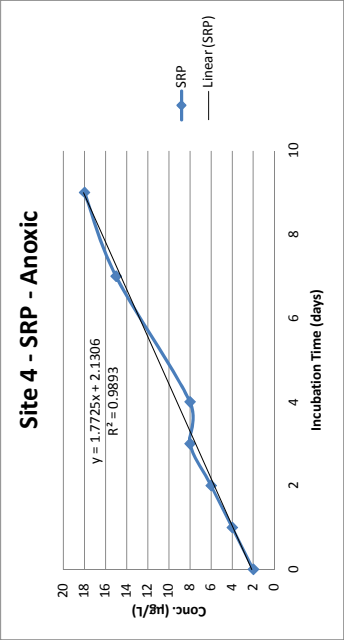
## **F.2 Regression Relationships of Sediment Phosphorus Release**











**APPENDIX G**  
**WATER QUALITY MODEL FOR LAKE LAWNE**

**G.1 Calibrated Current Conditions Model**

**G.2 Evaluation of Water Quality Impacts from Evaluated Treatment Options**



## **G.1 Calibrated Current Conditions Model**



## **G.2 Evaluation of Water Quality Impacts from Evaluated Treatment Options**



Mass Balance Phosphorus Limitation Model for Lake Lawne - Alum Treatment of C-1 Canal + Sediment Inactivation

| Initial P<br>Conc.<br>(mg/l) | Hydrologic and Mass Inputs |         |      |                         |      |              |      |               |      |                       |              |      |        |
|------------------------------|----------------------------|---------|------|-------------------------|------|--------------|------|---------------|------|-----------------------|--------------|------|--------|
|                              | Direct Precipitation       |         |      | Stormwater/<br>Baseflow |      | G.W. Seepage |      | Overland Flow |      | Internal<br>Recycling | Total Inputs |      |        |
|                              | (in)                       | (ac-ft) | (kg) | (ac-ft)                 | (kg) | (ac-ft)      | (kg) | (ac-ft)       | (kg) | (kg)                  | (ac-ft)      | (kg) | (mg/l) |
| 0.033                        | 50.03                      | 617     | 46   | 3,270                   | 213  | 206          | 12.7 | 89.5          | 27.5 | 14.3                  | 4,182        | 313  | 0.061  |

| Hydrologic and Mass Losses |         |       |                   |      |                              |       |              |      |                       |       |                    |                                        |
|----------------------------|---------|-------|-------------------|------|------------------------------|-------|--------------|------|-----------------------|-------|--------------------|----------------------------------------|
| Evaporation                |         |       | Outfall Structure |      | Deep Recharge/ Drainage Well |       | Total Losses |      | Detention Time (days) |       | P Retention Coeff. | Areal P Loading (g/m <sup>2</sup> -yr) |
| (in)                       | (ac-ft) | (kg)  | (ac-ft)           | (kg) | (ac-ft)                      | (kg)  | (ac-ft)      | (kg) | (days)                |       |                    | (g/m <sup>2</sup> -yr)                 |
| 49.98                      | 616     | 2,590 | 105               | 976  | 39.5                         | 4,182 | 144          |      | 81                    | 0.880 | 0.523              | 0.033                                  |
|                            |         |       |                   |      |                              |       |              |      |                       |       |                    | 14.0                                   |
|                            |         |       |                   |      |                              |       |              |      |                       |       |                    | 0.99                                   |
|                            |         |       |                   |      |                              |       |              |      |                       |       |                    | 55                                     |

Calibration Numerator Coefficient:

63

Calibration Denominator Coefficient:

63

Mass Balance Phosphorus Limitation Model for Lake Lawne - Alum Treatment of C-1 and C-2 Canals

| Initial P<br>Conc.<br>(mg/l) | Hydrologic and Mass Inputs |         |      |                         |      |              |      |               |      |                       |              |      |        |
|------------------------------|----------------------------|---------|------|-------------------------|------|--------------|------|---------------|------|-----------------------|--------------|------|--------|
|                              | Direct Precipitation       |         |      | Stormwater/<br>Baseflow |      | G.W. Seepage |      | Overland Flow |      | Internal<br>Recycling | Total Inputs |      |        |
|                              | (in)                       | (ac-ft) | (kg) | (ac-ft)                 | (kg) | (ac-ft)      | (kg) | (ac-ft)       | (kg) | (kg)                  | (ac-ft)      | (kg) | (mg/l) |
| 0.037                        | 50.03                      | 617     | 46   | 3,270                   | 146  | 206          | 63.4 | 89.5          | 27.5 | 71.4                  | 4,182        | 355  | 0.069  |

| Hydrologic and Mass Losses |         |       |                   |      |                              |       |              |      |                       |
|----------------------------|---------|-------|-------------------|------|------------------------------|-------|--------------|------|-----------------------|
| Evaporation                |         |       | Outfall Structure |      | Deep Recharge/ Drainage Well |       | Total Losses |      | Detention Time (days) |
| (in)                       | (ac-ft) | (kg)  | (ac-ft)           | (kg) | (ac-ft)                      | (kg)  | (ac-ft)      | (kg) | (days)                |
| 49.98                      | 616     | 2,590 | 119               | 976  | 44.7                         | 4,182 | 163          |      | 81                    |
|                            |         |       |                   |      |                              |       |              |      | 0.880                 |
|                            |         |       |                   |      |                              |       |              |      | 0.592                 |
|                            |         |       |                   |      |                              |       |              |      | 0.037                 |
|                            |         |       |                   |      |                              |       |              |      | 16.3                  |
|                            |         |       |                   |      |                              |       |              |      | 0.91                  |
|                            |         |       |                   |      |                              |       |              |      | 57                    |

Calibration Numerator Coefficient:

63

Calibration Denominator Coefficient:

63



Mass Balance Phosphorus Limitation Model for Lake Lawne - Alum Treatment of C-1 and C-2 Canals + Sediment Inactivation

| Hydrologic and Mass Inputs |                      |         |      |                      |      |              |      |               |      |                    |              |      |        |
|----------------------------|----------------------|---------|------|----------------------|------|--------------|------|---------------|------|--------------------|--------------|------|--------|
| Initial P Conc. (mg/l)     | Direct Precipitation |         |      | Stormwater/ Baseflow |      | G.W. Seepage |      | Overland Flow |      | Internal Recycling | Total Inputs |      |        |
|                            | (in)                 | (ac-ft) | (kg) | (ac-ft)              | (kg) | (ac-ft)      | (kg) | (ac-ft)       | (kg) | (kg)               | (ac-ft)      | (kg) | (mg/l) |
|                            | 50.03                | 617     | 46   | 3,270                | 146  | 206          | 12.7 | 89.5          | 27.5 | 14.3               | 4,182        | 247  | 0.048  |
| 0.026                      |                      |         |      |                      |      |              |      |               |      |                    |              |      |        |

| Hydrologic and Mass Losses |         |                   |      |                                 |      |              |      |                             |                          |                                              |                            |                                         |                             |                         |
|----------------------------|---------|-------------------|------|---------------------------------|------|--------------|------|-----------------------------|--------------------------|----------------------------------------------|----------------------------|-----------------------------------------|-----------------------------|-------------------------|
| Evaporation                |         | Outfall Structure |      | Deep Recharge/<br>Drainage Well |      | Total Losses |      | Detention<br>Time<br>(days) | P<br>Retention<br>Coeff. | Areal P<br>Loading<br>(g/m <sup>2</sup> -yr) | Final P<br>Conc.<br>(mg/l) | Chyl-a<br>Conc.<br>(mg/m <sup>3</sup> ) | Secchi<br>Disk<br>Depth (m) | Florida<br>TSI<br>Value |
| (in)                       | (ac-ft) | (ac-ft)           | (kg) | (ac-ft)                         | (kg) | (ac-ft)      | (kg) |                             |                          |                                              |                            |                                         |                             |                         |
| 49.98                      | 616     | 2,590             | 83   | 976                             | 31.1 | 4,182        | 114  | 81                          | 0.880                    | 0.412                                        | 0.026                      | 10.4                                    | 1.16                        | 51                      |

Calibration Numerator Coefficient:

63

Calibration Denominator Coefficient:

63

Mass Balance Phosphorus Limitation Model for Lake Lawne - C-6 Canal Treatment System

| Hydrologic and Mass Inputs |                      |         |      |                      |      |              |      |               |      |                    |              |      |        |
|----------------------------|----------------------|---------|------|----------------------|------|--------------|------|---------------|------|--------------------|--------------|------|--------|
| Initial P Conc. (mg/l)     | Direct Precipitation |         |      | Stormwater/ Baseflow |      | G.W. Seepage |      | Overland Flow |      | Internal Recycling | Total Inputs |      |        |
|                            | (in)                 | (ac-ft) | (kg) | (ac-ft)              | (kg) | (ac-ft)      | (kg) | (ac-ft)       | (kg) | (kg)               | (ac-ft)      | (kg) | (mg/l) |
|                            | 50.03                | 617     | 46   | 3,270                | 278  | 206          | 63   | 89.5          | 27.5 | 71.4               | 4,182        | 487  | 0.094  |
| 0.051                      |                      |         |      |                      |      |              |      |               |      |                    |              |      |        |

| Hydrologic and Mass Losses |         |                   |      |                                 |      |              |      |                             |                          |                                              |                            |                                         |                             |                         |
|----------------------------|---------|-------------------|------|---------------------------------|------|--------------|------|-----------------------------|--------------------------|----------------------------------------------|----------------------------|-----------------------------------------|-----------------------------|-------------------------|
| Evaporation                |         | Outfall Structure |      | Deep Recharge/<br>Drainage Well |      | Total Losses |      | Detention<br>Time<br>(days) | P<br>Retention<br>Coeff. | Areal P<br>Loading<br>(g/m <sup>2</sup> -yr) | Final P<br>Conc.<br>(mg/l) | Chyl-a<br>Conc.<br>(mg/m <sup>3</sup> ) | Secchi<br>Disk<br>Depth (m) | Florida<br>TSI<br>Value |
| (in)                       | (ac-ft) | (ac-ft)           | (kg) | (ac-ft)                         | (kg) | (ac-ft)      | (kg) |                             |                          |                                              |                            |                                         |                             |                         |
| 49.98                      | 616     | 2,590             | 163  | 976                             | 61.3 | 4,182        | 224  | 81                          | 0.880                    | 0.812                                        | 0.051                      | 24.1                                    | 0.73                        | 63                      |

Calibration Numerator Coefficient:

63

Calibration Denominator Coefficient:

63

