Minimum and Guidance Levels for

Lake Miona and Black Lake

in Sumter County, Florida

Draft – September 2006

Ecologic Evaluation Section

Resource Conservation and Development Department

Southwest Florida
Water Management District

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State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum level of an aquifer or surface water body is "the level of groundwater in the aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area". Adoption of a minimum water level does not necessarily protect a water body from significant harm, however, protection, recovery or regulatory compliance can be gauged once a standard has been established.

Minimum flows and levels are to be established based upon the best available information and shall be developed with consideration of "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed on the hydrology of the affected watershed, surface water, or aquifer…", with the caveat that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421, F.S.). Additional guidance for the establishment of minimum flows and levels is provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.), which requires that "consideration shall be given to the protection of water resources, natural seasonal fluctuations in water flows, and environmental values associated with coastal, estuarine, aquatic and wetland ecology, including: a) recreation in and on the water; b) fish and wildlife habitats and the passage of fish; c) estuarine resources; d) transfer of detrital material; e) maintenance of freshwater storage and supply; f) aesthetic and scenic attributes; g) filtration and absorption of nutrients and other pollutants; h) sediment loads; i) water quality; j) and navigation."

To address this legislative mandate within its jurisdictional boundaries, the Southwest Florida Water Management District (District or SWFWMD) has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, and adopted them into the Water Levels and Rates of Flow Rule (Chapter 40D-8, F.A.C.). For lakes, methodologies have been developed for establishing Minimum Levels for systems with fringing cypress wetlands 0.5 acres or greater in size and for those without fringing cypress wetlands 0.5 acres or greater in size. Lakes with fringing cypress wetlands where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands are classified as Category 1 Lakes. Lakes with fringing cypress wetlands that have been structurally altered such that lake water levels do not rise to former levels are classified as Category 2 Lakes. Lakes without fringing cypress wetlands are classified as Category 3 Lakes. Chapter 40D-8, F.A.C. also provides for the establishment of Guidance Levels, which serve as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable water level structures. Typically two Minimum

Levels and three Guidance Levels are established for lakes, and upon adoption by the District Governing Board, are incorporated into Chapter 40D-8, F.A.C. The levels, which are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD), are described below.

The **Ten Year Flood Guidance Level** is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year.

The **High Guidance Level** is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ten percent of the time (P10) on a long-term basis.

The **High Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed ten percent of the time (P10) on a long-term basis.

The **Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time (P50) on a long-term basis.

The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lake shore residents and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis.

In accordance with Chapter 40D-8, F.A.C., proposed Minimum and Guidance Levels were developed for Lake Miona and Black Lake (Table 1), a Category 3 Lake system located in Sumter County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of Minimum Levels development. Data and analyses used for development of the proposed Minimum and Guidance Levels are described in the remainder of this report.

Table 1. Proposed Minimum and Guidance Levels for Lake Miona and Black Lake.

Minimum and Guidance Levels	Elevation (feet above NGVD)
Ten Year Flood Guidance Level	57.5
High Guidance Level	54.7
High Minimum Lake Level	53.9
Minimum Lake Level	51.3
Low Guidance Level	49.6

Data and Analyses Supporting Proposed Minimum and Guidance Levels for Lake Miona and Black Lake

Lake Setting and Description

Lake Miona and Black Lake are located in Sumter County, Florida (Sections 21 - 23, and 26 - 28, Township 18 South, Range 23 East), in the Withlacoochee River Basin of the Southwest Florida Water Management District (Figure 1). White (1970) classified the area of west-central Florida containing Lake Miona and Black Lake as the Sumter Upland physiographic region. Brooks (1981) characterized the area surrounding the lake as the Anthony Hills unit of the Marion Hills subdivision of the Ocala Uplift physiographic district and described the subdivision as low hills developed where lower Miocene clay is thin or nonexistent and sands and clayey sands of Upper Miocene rest directly on the limestones. As part of the Florida Department of Environmental Protection's Lake Bioassessment/Regionalization Initiative, the area has been identified as the Central Valley region, and described as an area with large, shallow, and euthrophic lakes (although lake size and type are variable) that have abundant macrophytes or are green with algae (Griffith *et al.* 1997).

The lakes are located in the Lake Miona Outlet drainage basin in the Withlacoochee River watershed. Surface water inflow to Lake Miona and Black Lake occurs from developed areas surrounding the lakes. Because Lake Miona and Black Lake do not discharge, they are considered a closed basin lake system (Figure 2). There are permitted ground water withdrawals within the surrounding lake area, but there are no surface water withdrawals from the lakes currently permitted by the District. A public boat ramp within a county park located on the north shore of Lake Miona provides access to the lakes.

The 1966 United States Geological Survey 1:24,000 Oxford, Fla. and Lady Lake quadrangle maps indicate an elevation of 56 feet above NGVD for Lake Miona. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 418 acres at this elevation. A topographic map of the lake basin generated in support of Minimum Levels development (Figure 3) indicates that at an elevation of 56 feet above NGVD, Lake Miona and Black Lake form one lake basin that extends over 845 acres in size.

Medium and high density residential development dominates the landscape within the surrounding lake region and near shore environment. Dominant plant species observed along the shoreline of Lake Miona and marsh of Black Lake include, cattail (*Typha sp.*), torpedo grass (*Panicum repens*), saw grass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), fuirena (*Fuirena scirpoidea*), spikerush (*Eleocharis sp.*), pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria lancifolia*), fanwort (*Cabomba caroliniana*), Illinois pondweed (*Potamogeton illinoensis*), spatterdock (*Nuphar luteum*) and fragrant water lily (*Nymphaea odorata*).

Figure 1. Location of Lake Miona (adjacent Black Lake not shown) in Sumter County, Florida.

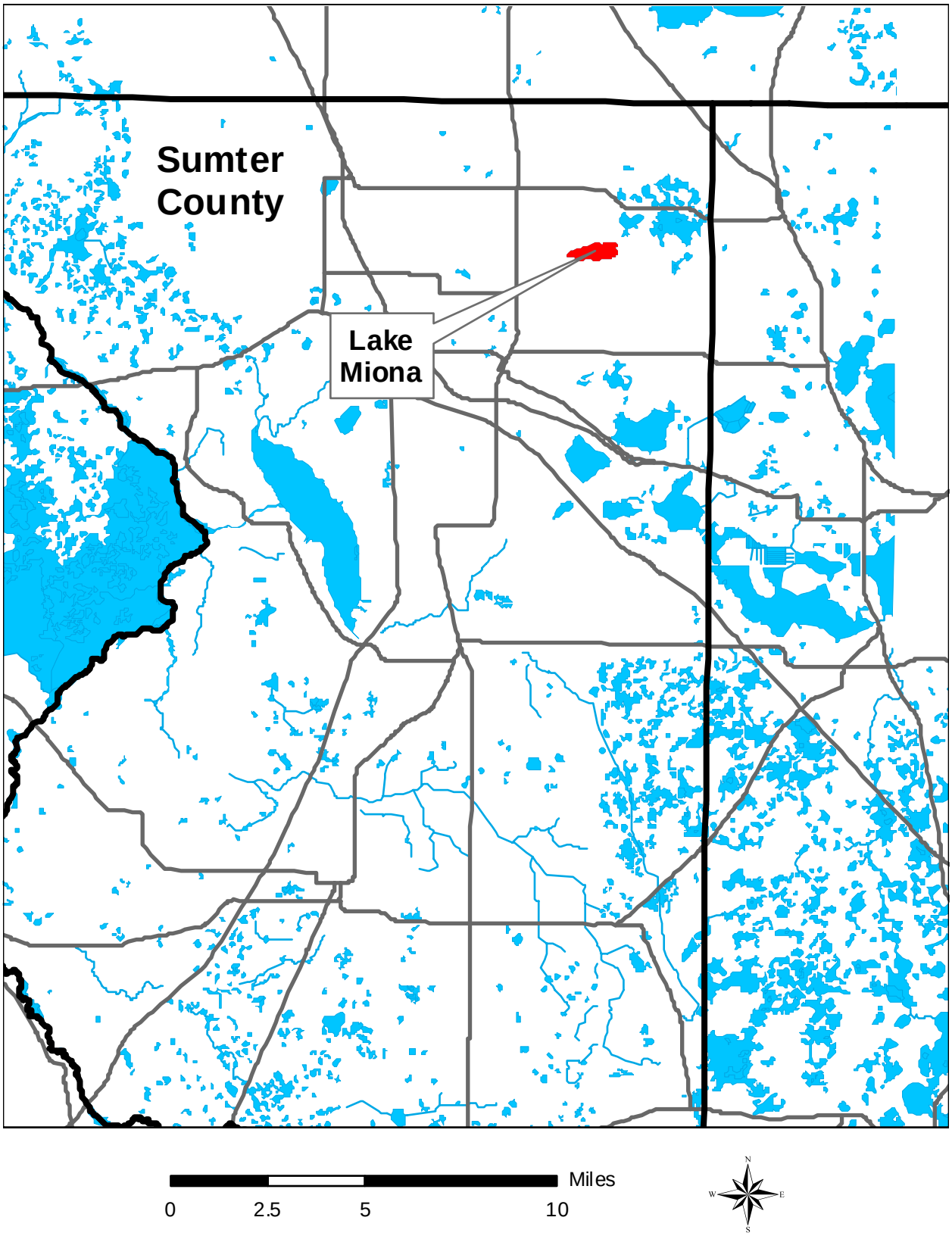
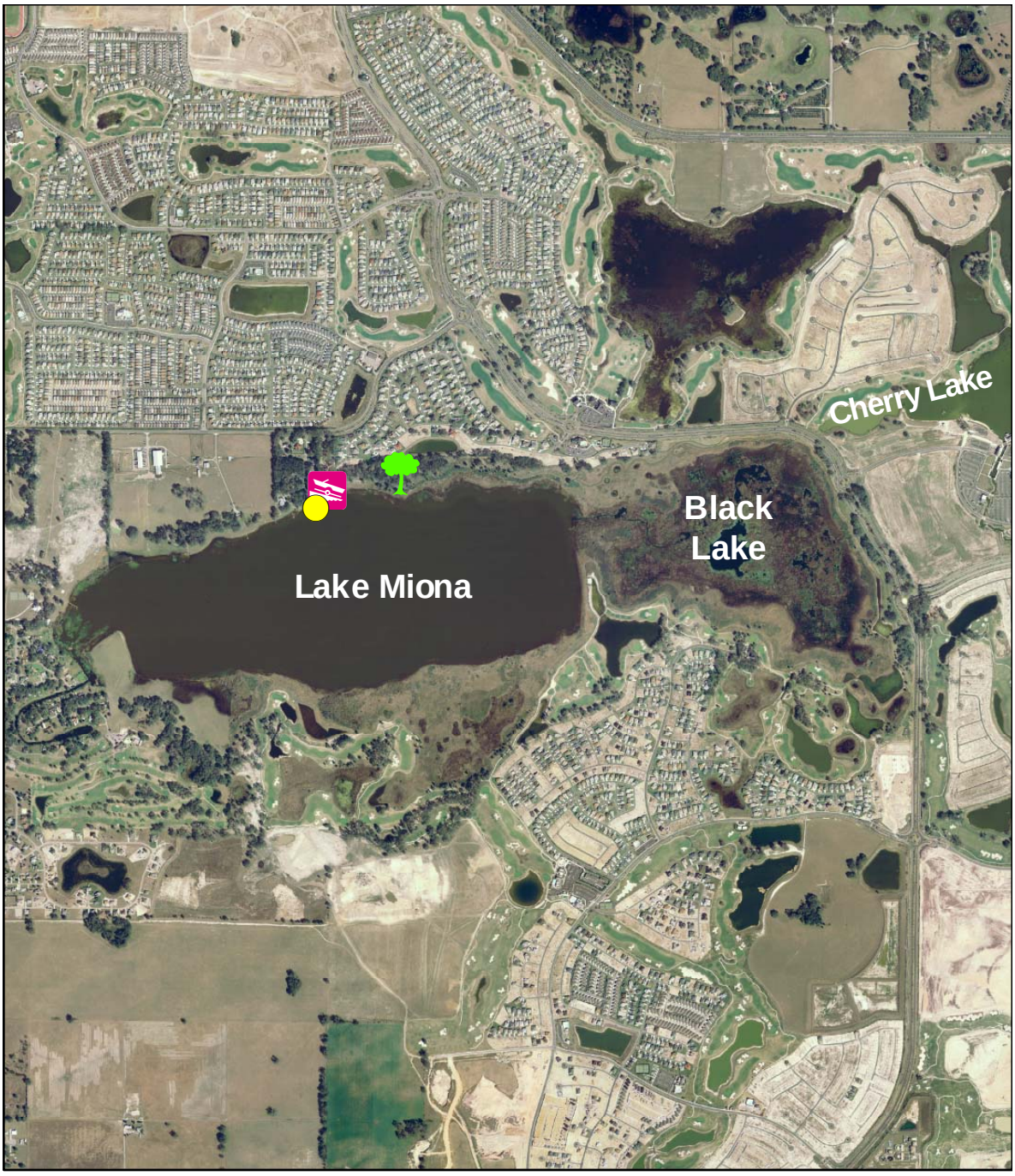


Figure 2. Location of the lake water level gauge, public boat ramp, and historic high water indicators for Lake Miona and Black Lake.



Legend

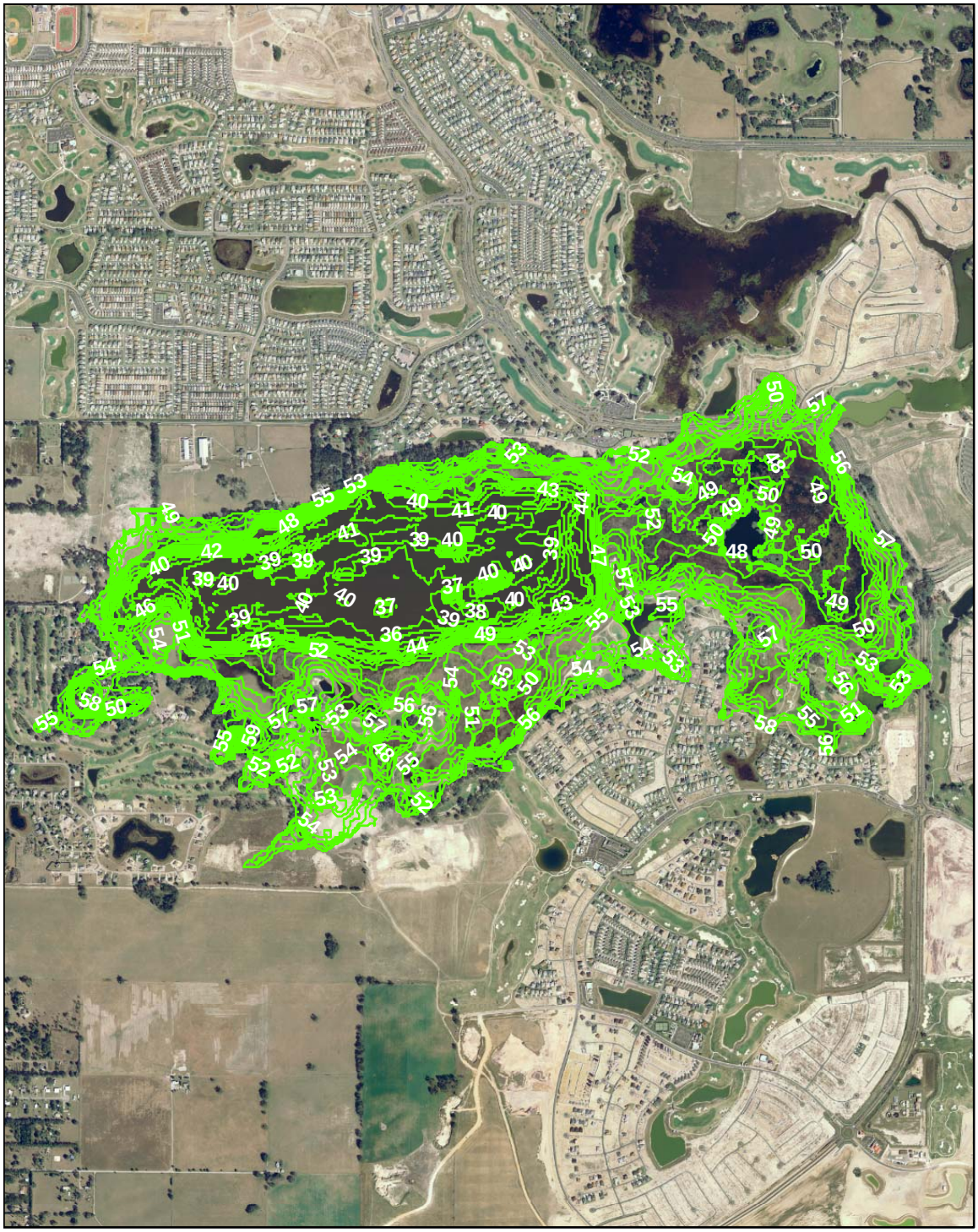
- Lake Level Gauge
- Boat Ramp
- Historic High Water Indicators

Feet

0 1,500 3,000 6,000

Map prepared using 2005 true color digital ortho photography.

Figure 3. One-foot contours within the Lake Miona and Black Lake basin. Values shown are elevations in feet above the National Geodetic Vertical Datum of 1929.



Map prepared using 2005 true color digital ortho photography, elevation data from 2002 SWFWMD aerial photography with contours maps (Secs. 21-23, and 26-28, Twp. 18 S, Rge. 23 E), and elevation data collected by D.C. Johnson and Associates, Inc.

N
W E
S

0 1,000 2,000 4,000 Feet

Currently Adopted Guidance Levels

The Southwest Florida Water Management District has a long history of water resource protection through the establishment of lake management levels. With the development of the Lake Levels Program in the mid-1970s, the District began an initiative for establishing lake management levels based on hydrologic, biological, physical and cultural aspects of lake ecosystems. By 1996, management levels for nearly 400 lakes had been established.

Based on work conducted in the 1970s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Lake Miona and Black Lake in November 1983. These levels have been incorporated into Chapter 40D-8, F.A.C. (Table 2). A Maximum Desirable Level of 55.00 feet above NGVD was also developed, but was not adopted. The adopted Guidance Levels and Maximum Desirable Level were developed using a methodology that differs from the current District approach for establishing Minimum and Guidance Levels. The levels do not, therefore, necessarily correspond with levels developed using current methods. Minimum and Guidance Levels developed using current methods will replace existing Guidance Levels upon adoption by the District Governing Board into Chapter 40D-8, F.A.C.

Annually since 1991, a list of stressed lakes has been developed to support the District's consumptive water use permitting program. As described in the District's Consumptive Use of Water Rule (Chapter 40D-2, F.A.C.), "a stressed condition for a lake is defined to be chronic fluctuation below the normal range of lake level fluctuations". For lakes with adopted Guidance Levels, chronic fluctuation below the Low Level is considered a stressed condition. For lakes without adopted levels, evaluation of stressed condition is conducted on a case-by-case basis. Lake Miona and Black Lake are included on the current Stressed Lakes List (Gant *et al.* 1999, 2006), and have been classified as stressed lakes since 1991.

Table 2. Adopted Guidance Levels and associated surface areas for Lake Miona and Black Lake.

Management Levels	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	56.70	887
High Level	55.00	766
Low Level	53.00	607
Extreme Low Level	51.00	484

Development of Minimum and Guidance Levels

Proposed Minimum and Guidance Levels for Lake Miona and Black Lake were developed using the methodology for Category 3 Lakes described in Chapter 40D-8, F.A.C. and best available information in accordance with Section 373.042, F.S. Additional information gathered through field evaluations and survey work in 2004 through 2006 was also used. The levels and additional information are listed in Table 3, along with surface areas for each elevation. Detailed descriptions of the development and use of these data are provided in the remainder of this report.

Table 3. Proposed Minimum and Guidance Levels, Historic P50, lake stage percentiles, normal pool and control point elevations, and significant change standards for Lake Miona and Black Lake.

Levels	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	54.7	618
Historic P50	52.1	515
Historic P90	49.6	347
Other Levels		
Normal Pool	NA	NA
Control Point	NA	NA
Guidance Levels and Historic P50		
Ten Year Flood Guidance Level	57.5	945
High Guidance Level	54.7	618
Historic P50	52.1	515
Low Guidance Level	49.6	347
Significant Change Standards		
Basin Connectivity Standard	54.2	695
Dock-Use Standard	54.1	689
Wetland Offset Elevation	51.3	500
Species Richness Standard	50.9	440
Aesthetics Standard	49.6	350
Recreation/Ski Standard	47.5	281
Lake Mixing Standard	44.8	258
Minimum Levels		
High Minimum Lake Level	53.9	657
Minimum Lake Level	51.3	500

NA = not available/not appropriate

Lake Stage Data and Percentiles

Lake stage data, *i.e.,* surface water elevations for Lake Miona (District Universal Identification Number STA 253 253) are available from the District's Water Management Data Base from April 1978 through the present date (Figure 4, see Figure 2 for current location of the SWFWMD lake water level gauge). There are no lake stage data for Black Lake, however, Lake Miona and Black Lake become hydrologically connected at 49.7 feet above NGVD. The highest surface water elevation for Lake Miona recorded in the Water Management Data Base, 56.60 feet above NGVD, occurred on October 1, 1982. The low of record, 47.88 feet above NGVD, occurred on May 23, 2002.

For the purpose of Minimum Levels determination, lake stage data are classified as "Historic" for periods when there were no measurable impacts due to water withdrawals, and impacts due to structural alterations were similar to existing conditions. In the context of Minimum Levels development, "structural alterations" means man's physical alteration of the control point, or highest stable point along the outlet conveyance system of a lake, to the degree that water level fluctuations are affected. Lake stage data are classified as "Current" for periods when there were measurable, stable impacts due to water withdrawals, and impacts due to structural alterations were stable.

Based on water-use estimates and analysis of lake water levels and regional ground water fluctuations, available lake stage data for Lake Miona from January 1986 through December 2005 were classified as Historic data. These data, however, were considered insufficient for calculating Historic lake stage exceedance percentiles, because the record only extends over a 20-year period. Historic lake stage exceedance percentiles were, instead, developed using a composite sixty-year record of monthly mean lake surface elevations based on available stage records that were supplemented with modeled estimates. The sixty-year period was considered sufficient for incorporating the range of lake stage fluctuations that would be expected based on long-term climatic cycles that have been shown to be associated with changes in regional hydrology (Enfield et al. 2001, Basso and Schultz 2003, Kelly 2004).

Modeled monthly mean lake stage values for the composite data set were estimated using a linear fitting procedure known as the line or organic correlation (see Helsel and Hirsch 1992). The procedure was used to describe the relationship between available lake stage data for Lake Miona and potentiometric surface elevations for the Upper Floridan Aquifer system, as measured at the Sharpes Ferry West Floridan well site (District Universal Identification Number WEL 255 1834: USGS Number 29111508592501) in Marion County. The line of organic correlation equation developed for the two data sets was utilized to estimate water surface elevation values for Lake Miona and Black Lake for the period from January 1946 through December 2005 (SWFWMD draft report, 2006). A Historic, composite data set of monthly mean water surface elevations for Lake Miona and Black Lake was then developed using available lake stage records from January 1986 through December 2005, and modeled water surface elevations for the remainder of the sixty-year period (Figure 5).

Composite Historic data from January 1946 through December 2005 were used to calculate **the Historic P10, P50, and P90** lake stage percentile elevations. The Historic P10 elevation, the elevation the lake water surface equaled or exceeded ten percent of the time during the historic period, was **54.7 feet above NGVD**. The Historic P50 elevation, the elevation the lake water surface equaled or exceeded fifty percent of the time during the historic period, was **52.1 feet above NGVD**. The Historic P90 elevation, the elevation the lake water surface equaled or exceeded 90 percent of the time during the historic period, was **49.6 feet above NGVD**.

Normal Pool Elevation, Control Point Elevation and Structural Alteration Status

The **Normal Pool** elevation, a reference elevation used for development of minimum lake and wetland levels, is established based on the elevation of Hydrologic Indicators of sustained inundation. Because Hydrologic Indicators of Normal Pool do not exist on Lake Miona and Black Lake, **establishment of the Normal Pool elevation is not possible**. Based on the median elevation of 19 live oak trees located along the north shore of Lake Miona, a historic seasonal high water elevation was estimated at 59.4 feet above NGVD (Figure 2). Staff from the District's Brooksville Resource Regulation Department estimated the current seasonal high water elevation between 54.0 and 54.5 feet above NGVD based primarily on soil seasonal high water indicators such as stripped matrix (S6) and dark surface (S7), adventitious rooting, and the approximate elevation of the wetland line. Stain lines, lichen lines, and the elevations of trees such and live oak and laurel oak along the lake shoreline were also evaluated (Aycrigg and Bartos 2006).

The **Control Point** elevation is the elevation of the highest stable point along the outlet profile of a surface water conveyance system (*e.g.,* structure, ditch, culvert, or pipe) that is the principal control of water level fluctuation in the lake. Based on review of one-foot contour interval maps and field survey data, it was determined that Lake Miona and Black do not have an outlet to discharge surface water flow. Because the lakes are considered a closed-basin system, **there is no Control Point elevation** (Figure 2).

Structual Alteration Status is determined to support development of Minimum and Guidance Levels. Because there is no outlet or Control Point elevation, **Lake Miona and Black Lake are not considered to be Structurally Altered**.

Proposed Guidance Levels and the Historic P50

The **Ten Year Flood Guidance Level** is provided as an advisory guideline for lake shore development. It is the level of flooding expected on a frequency of not less than the ten year recurring interval, or on a frequency of not greater than a ten percent probability of occurrence in any given year. The Ten Year Flood Guidance Level for was established at **57.5 feet above NGVD** using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, F.A.C). For the analysis, various frequency distributions and probability plots were compared to establish the

best estimate of flood frequency elevations, based on a probability analysis of annual peak stages for a 64-year period, from 1941 through 2004. Peak lake stages for this period were derived from available water level data and simulated data developed using a continuous simulation model. Simulated data were developed using rainfall records from the Bushnell National Weather Service Station (District Universal Identification Number RNF 265 265), and pan evaporation records from sites at the Archbold Biological Station (District Universal Identification Number EVT 8 8), Lake Alfred (District Universal Identification Numbers EVT 9 9 and EVT 31 31) and Belle Glade. Based on available lake stage data, the Ten Year Flood Guidance Level has not been exceeded.

The **High Guidance Level** is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. The High Guidance Level is the expected Historic P10 of the lake. Because Historic data are available, the High Guidance Level was established at **54.7 feet above NGVD**, the Historic P10 elevation.

The **Historic P50** elevation is the elevation that a lake's water levels are expected to equal or exceed fifty percent of the time on a long-term basis. The level is derived to support development of minimum lake levels, and is established using Historic or Current data and, in some cases, reference lake water regime statistics. Reference lake water regime (RLWR) statistics are used to describe expected water level fluctuations for lakes that lack adequate Historic or Current data and are derived using lake stage data for typical, regional lakes that exhibit little or no impacts from water withdrawals. The statistics include the RLWR50, RLWR5090, and RLWR90, which are, respectively, median differences between the P10 and P50, P50 and P90, and P10 and P90 percentiles. Because Historic data are available, the Historic P50 was established at **52.1 feet above NGVD.**

The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lake shore residents, and operation of water management structures. The Low Guidance Level is the elevation that a lake's water levels are expected to equal or exceed ninety percent of the time (P90) on a long-term basis. The level is established using Historic or Current data, and in some cases, reference lake water regime statistics. Because Historic data are available, the Low Guidance Level was established at **49.6 feet above NGVD**, the Historic P90 elevation.

Lake Categories

Lakes are classified as Category 1, 2, or 3 for the purpose of Minimum Levels development. Those with fringing cypress wetlands greater that 0.5 acres in size where water levels currently rise to an elevation expected to fully maintain the integrity of the wetlands (*i.e*., the Historic P50 is equal to or higher than an elevation 1.8 feet below the Normal Pool elevation) are classified as Category 1 Lakes. Lakes with fringing cypress wetlands greater than 0.5 acres in size that have been structurally altered such that the Historic P50 elevation is more than 1.8 feet below the Normal Pool elevation are

classified as Category 2 Lakes. Lakes without fringing cypress wetlands or with cypress wetlands less than 0.5 acres in size are classified as Category 3 Lakes. Because Lake Miona and Black Lake do not have fringing cypress wetlands, the lakes are classified as a **Category 3 Lake** system.

Category 3 Lake Significant Change Standards and Other Information for Consideration

Lake-specific significant change standards and other available information are developed for establishing Minimum Levels for Category 3 Lakes. The standards are used to identify thresholds for preventing significant harm to cultural and natural system values associated with lakes in accordance with guidance provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, F.A.C.). Other information taken into consideration includes potential changes in the coverage of herbaceous wetland vegetation and aquatic plants.

Six significant change standards are developed, including a Species Richness Standard, an Aesthetics Standard, a Lake Mixing Standard, a Recreation/Ski Standard, a Dock-Use Standard, and a Basin Connectivity Standard. Although potential changes in the coverage of herbaceous wetland vegetation and aquatic plants associated with use of the standards is taken into consideration in the development of Minimum Levels, there is no significant change standard to determine a threshold for preventing significant harm to fringing non-cypress wetlands. Based on the Cypress Wetland Standard for Category 1 Lakes, however, a Wetland Offset Elevation was developed for Category 3 Lakes to provide protection for non-cypress fringing wetlands. Since Lake Miona and Black Lake are a Category 3 Lake system, the applicable significant change standards and the Wetland Offset Elevation were developed (Table 3).

The **Basin Connectivity Standard** is developed to protect surface water connections between lake basins or among sub-basins within lake basins to allow for movement of aquatic biota, such as fish, and support recreational uses. The standard is based on the elevation of lake sediments at a critical high spot between lake basins or lake sub-basins, a water depth requirement for movement of aquatic biota or powerboats and other watercraft, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are available, the Basin Connectivity Standard was established at **54.2 feet above NGVD**, based on the sum of the critical high spot elevation in the canal between Lake Miona and Black Lake (49.7 feet above NGVD), the clearance value for power boats and movement of biota (2.0 feet), and the difference between the Historic P50 and the Historic P90 (2.5 feet).

The **Dock-Use Standard** is developed to provide for sufficient water depth at the end of existing docks to permit mooring of boats and prevent adverse impacts to bottom-dwelling plants and animals caused by boat operation. The standard is based on the elevation of lake sediments at the end of existing docks, a two-foot water depth requirement for boat mooring, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are available, the Dock-

Use Standard was established at **54.1 feet above NGVD** by adding 2 feet and the difference between the Historic P50 and Historic P90 (2.5 feet), to the elevation of sediments at the end of 90 percent of 8 docks (49.6 feet above NGVD) (Table 5).

Table 5. Summary statistics for elevations associated with docks in Lake Miona. Percentiles (P10 and P90) represent elevations exceeded by 10 and 90 percent of the docks.

Statistics	Elevation of Sediments at Waterward End of Docks (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
N	8	7
Mean (SD)	48.2 (1.5)	55.5 (0.9)
P10	49.6	56.5
P90	46.5	54.5
Maximum	50.0	56.6
Minimum	45.5	54.4

The **Wetland Offset Elevation** is developed to protect fringing non-cypress wetlands. Based on the rational used to develop the Cypress Wetland Standard for Category 1 Lakes (1.8 feet below the Normal Pool elevation), a Wetland Offset Elevation for Category 3 Lakes was developed. Because Hydrologic Indicators of sustained inundation used to determine the Normal Pool elevation usually do not exist on Category 3 Lakes, another datum, in this case the Historic P50 elevation, was used in the development of the Wetland Offset Elevation. Based on an evaluation of the relationship of the Cypress Wetland Standard with the Historic P50 for hydrologically unimpacted cypress wetlands, the Wetland Offset Elevation for Category 3 Lakes was established at an elevation 0.8 feet below the Historic P50 elevation (Hancock, draft memorandum, 2006). For Lake Miona and Black Lake, the Wetland Offset Elevation was established at **51.3 feet above NGVD**.

The **Species Richness Standard** is developed to prevent a decline in the number of bird species that may be expected to occur at or utilize a lake. Based on an empirical relationship between lake surface area and the number of birds expected to occur at Florida lakes, the standard is established at the lowest elevation associated with less than a 15 percent reduction in lake surface area relative to the lake area at the Historic P50 elevation. For Lake Miona and Black Lake, the Species Richness Standard was established at **50.9 feet above NGVD**.

The **Aesthetics Standard** is developed to protect aesthetic values associated with the inundation of lake basins. The standard is intended to protect aesthetic values associated with the median lake stage from becoming degraded below the values associated with the lake when it is staged at the Low Guidance Level. The Aesthetic Standard was established at the Low Guidance Level, which is **49.6 feet above NGVD**.

The **Recreation/Ski Standard** is developed to identify the lowest elevation within the lake basin that will contain an area suitable for safe water skiing. The standard is based on the lowest elevation (the Ski elevation) within the basin that can contain a five-foot deep ski corridor delineated as a circular area with a radius of 418 feet, or a rectangular area 200 feet in width and 2,000 feet in length, and use of Historic lake stage data or region-specific reference lake water regime statistics. Because Historic data are available, the Recreation-Ski Standard was established at **47.5 feet above NGVD** based on the sum of the ski elevation (45.0 feet above NGVD) and the difference between the Historic P50 and the Historic P90 (2.5 feet).

The **Lake Mixing Standard** is developed to prevent significant changes in patterns of wind-driven mixing of the lake water column and sediment resuspension. The standard is established at the highest elevation at or below the Historic P50 elevation where the dynamic ratio (see Bachmann *et al*. 2000) shifts from a value of <0.8 to a value >0.8, or from a value >0.8 to a value <0.8. The Lake Mixing Standard was established at **44.8 feet above NGVD**, the elevation at which the dynamic ratio shifts across the 0.8 threshold (Figure 6).

Herbaceous Wetland Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in potential area of herbaceous wetland vegetation within the lake basin (*i.e*., basin area with a water depth less than or equal to four feet) relative to the potential herbaceous wetland area at the Historic P50 elevation. Review of changes in potential wetland area in relation to change in lake stage indicated there would not be a substantial increase or decrease in potential wetland area within the lake basin at the Wetland Offset Elevation (44% of the lake basin) relative to the potential wetland area at the Historic P50 elevation (45% of the lake basin) (Figure 6).

Submersed Aquatic Plant Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in potential area of submersed aquatic plants within the lake basin relative to the potential aquatic plant area at the Historic P50 elevation. Because colonization of aquatic plants is dependent on sufficient light penetration, but data on the depth of light penetration into the lake water column is insufficient, it is not possible to determine the depth and potential area of submersed aquatic plants.

Proposed Minimum Levels

The method used for establishing Minimum Levels for a lake is dependent on its lake category. For Category 1 Lakes, the High Minimum Lake Level and Minimum Lake Level are established 0.4 feet and 1.8 feet below the Normal Pool elevation, respectively. For Category 2 Lakes, the High Minimum Lake Level is established at the High Guidance Level, and the Minimum Lake Level at the Historic P50 elevation. For Category 3 Lakes, the High Minimum Lake Level is established using Historic data or region-specific reference lake water regime statistics, and the Minimum Lake Level using lake-specific significant change standards or the Historic P50 elevation. Other

available information taken into consideration in the establishment of Minimum Levels for all three lake categories includes: substantial changes in the coverage of herbaceous wetland vegetation and aquatic macrophytes; elevations associated with residential dwellings, roads or other structures; frequent submergence of dock platforms; faunal surveys; aerial photographs; typical uses of lakes (*e.g.,* recreation, aesthetics, navigation, and irrigation); surrounding land-uses; socio-economic effects; and public health, safety and welfare matters.

The **Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed fifty percent of the time on a long-term basis. The Minimum Lake Level for Category 3 Lakes is established at the elevation corresponding to the most conservative significant change standard, *i.e*., the standard with the highest elevation, except where that elevation is above the Historic P50 elevation, in which case, the Minimum Lake Level is established at the Historic P50 elevation. For Lake Miona and Black Lake, the Dock-Use and Basin Connectivity Standards are higher than the Historic P50 elevation, therefore, using current rule criteria, the Minimum Lake Level would be established at the Historic P50 elevation (52.1 feet above NGVD). However, because establishing the Minimum Level at the Historic P50 does not allow any change to lake stage elevations, the Wetland Offset Elevation, which is lower than the Historic P50, but higher than the significant change standards below the Historic P50, was used to establish the Minimum Lake Level at **51.3 feet above NGVD** (Figures 5 and 7).

The **High Minimum Lake Level** is the elevation that a lake's water levels are required to equal or exceed ten percent of the time on a long-term basis. Because Lake Miona and Black Lake are a Category 3 Lake system and Historic data are available, the High Minimum Lake Level was established at **53.9 feet above NGVD**, an elevation corresponding to the Minimum Lake Level elevation plus the difference between the Historic P10 and the Historic P50 (2.6 feet) (Figures 5 and 7).

Comparison of the High Minimum Lake Level with Lake Basin Features

The elevations of various man-made features within the immediate Lake Miona and Black Lake basin were determined to evaluate the potential for flooding when the lake surface is at the proposed High Minimum Lake Level. Based on review of available one-foot contour interval aerial maps for the region and field survey data collected in July 2005, the proposed High Minimum Lake Level is 3.1 feet below the floor of the lowest residential home southeast of the lake, 3.6 feet below the lowest road southeast of the lake, 5.2 feet below the top of the public boat ramp along the northern shoreline, and 6.1 feet above the bottom of the public boat ramp (Table 8).

Table 8. Elevations of selected features in the Lake Miona and Black Lake basin.

Lake Basin Features	Elevation (feet above NGVD)
House finished floor	57.02
Road	57.52
Top of public boat ramp	59.13
Bottom of public boat ramp	47.80

Figure 4. Surface water elevations for Lake Miona from the District's Water Management Data Base from April 1978 through December 2005.

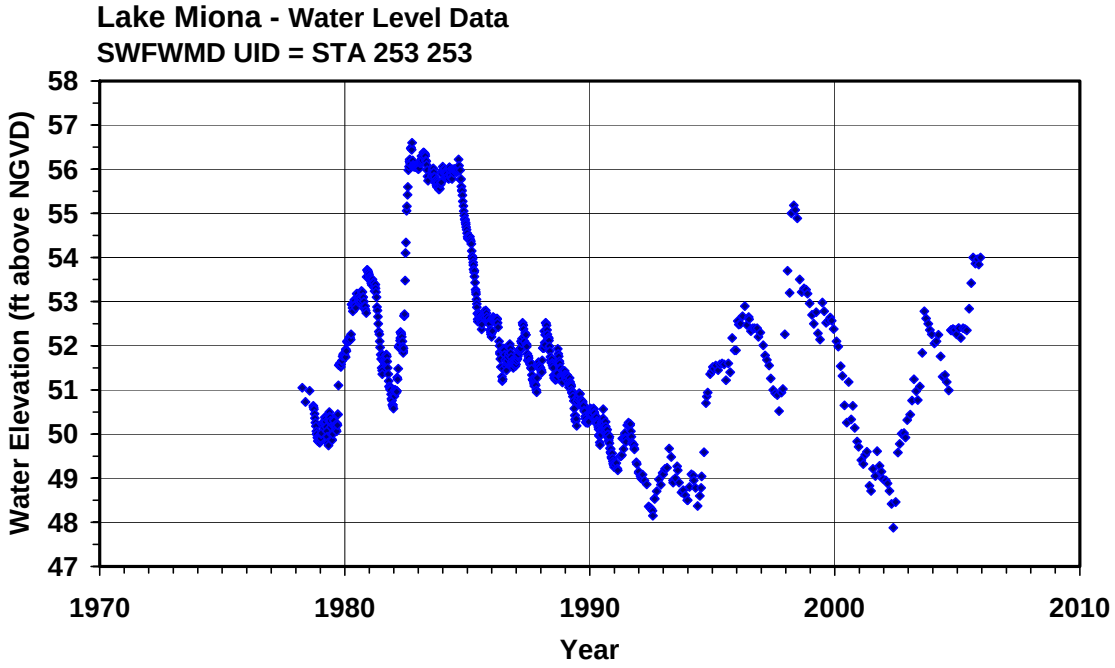


Figure 5. Composite monthly-means surface water elevations (modeled data - light blue, lake data - dark blue) for Lake Miona and Black Lake from January 1946 through December 2005, and Guidance and Minimum Levels. Levels include the Ten-Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).

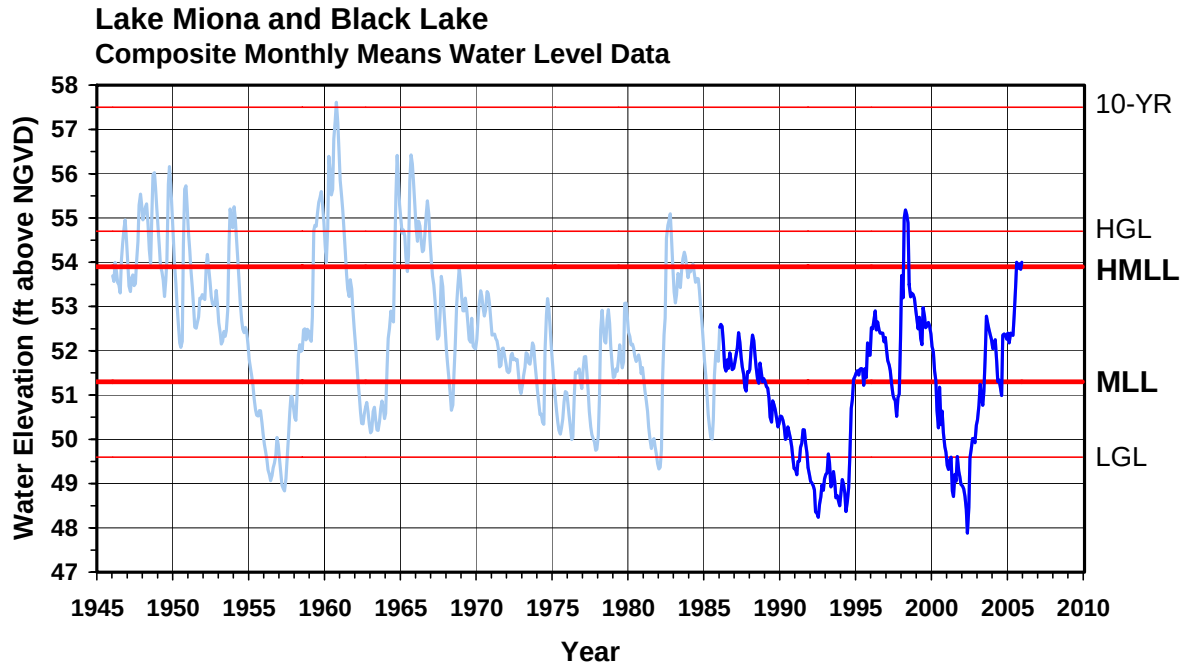
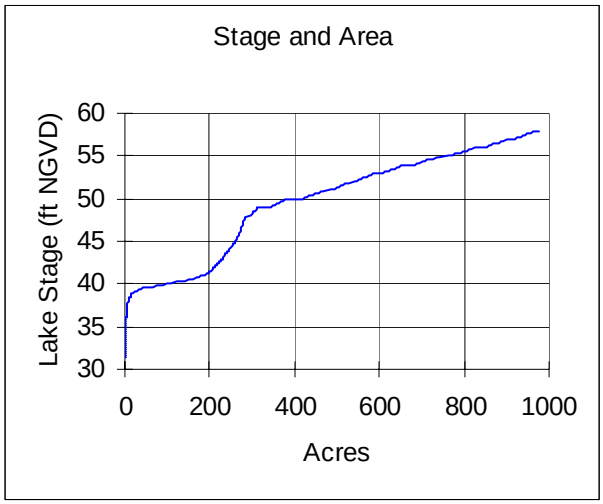
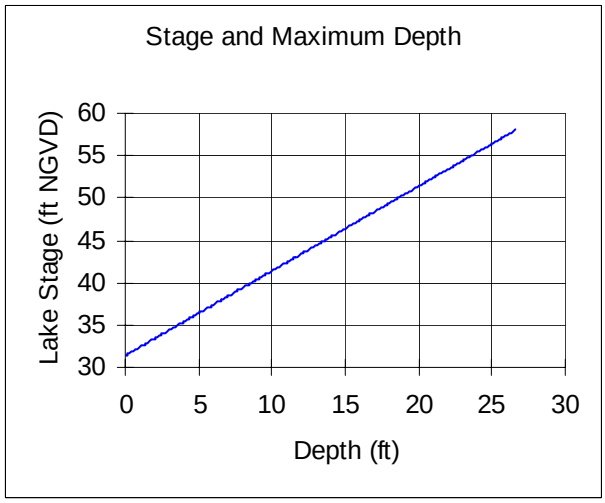
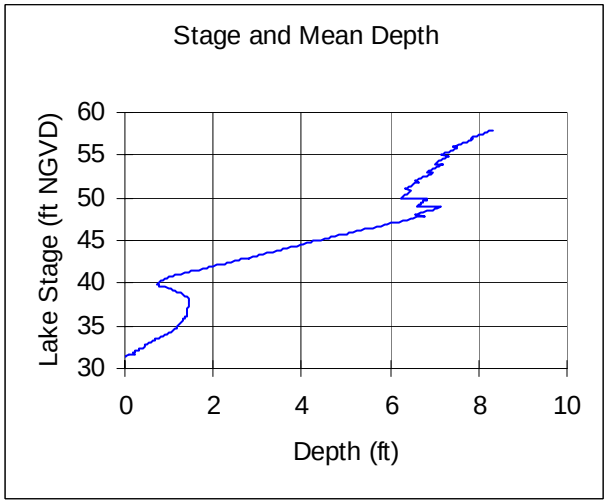
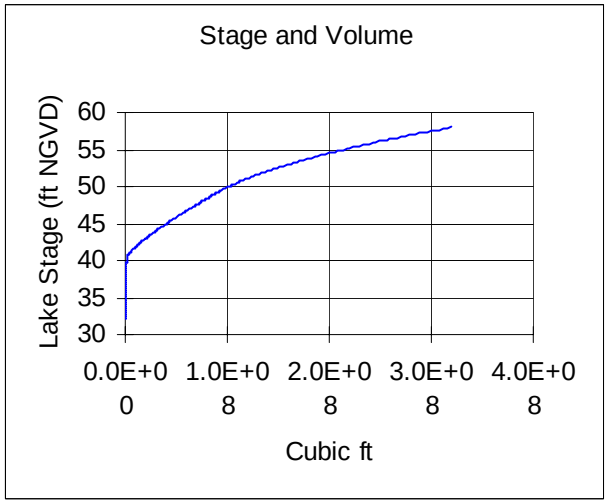


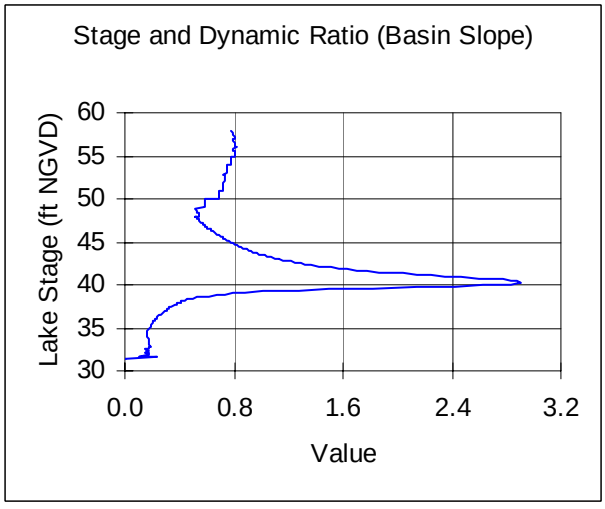
Figure 6. Surface area, maximum depth, mean depth, volume, dynamic ratio (basin slope), and potential herbaceous wetland area versus lake stage for Lake Miona and Black Lake.











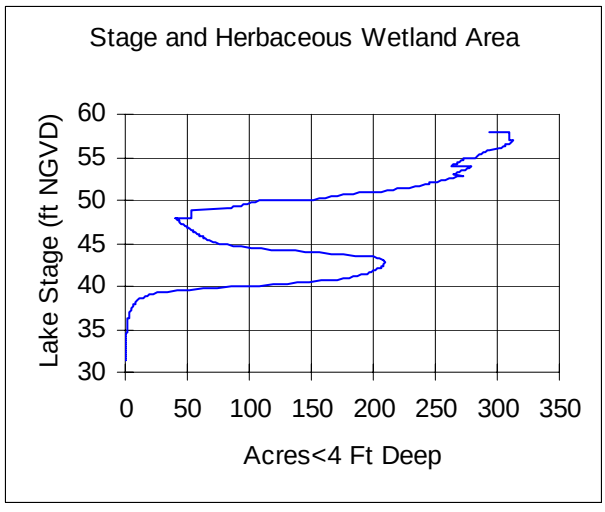
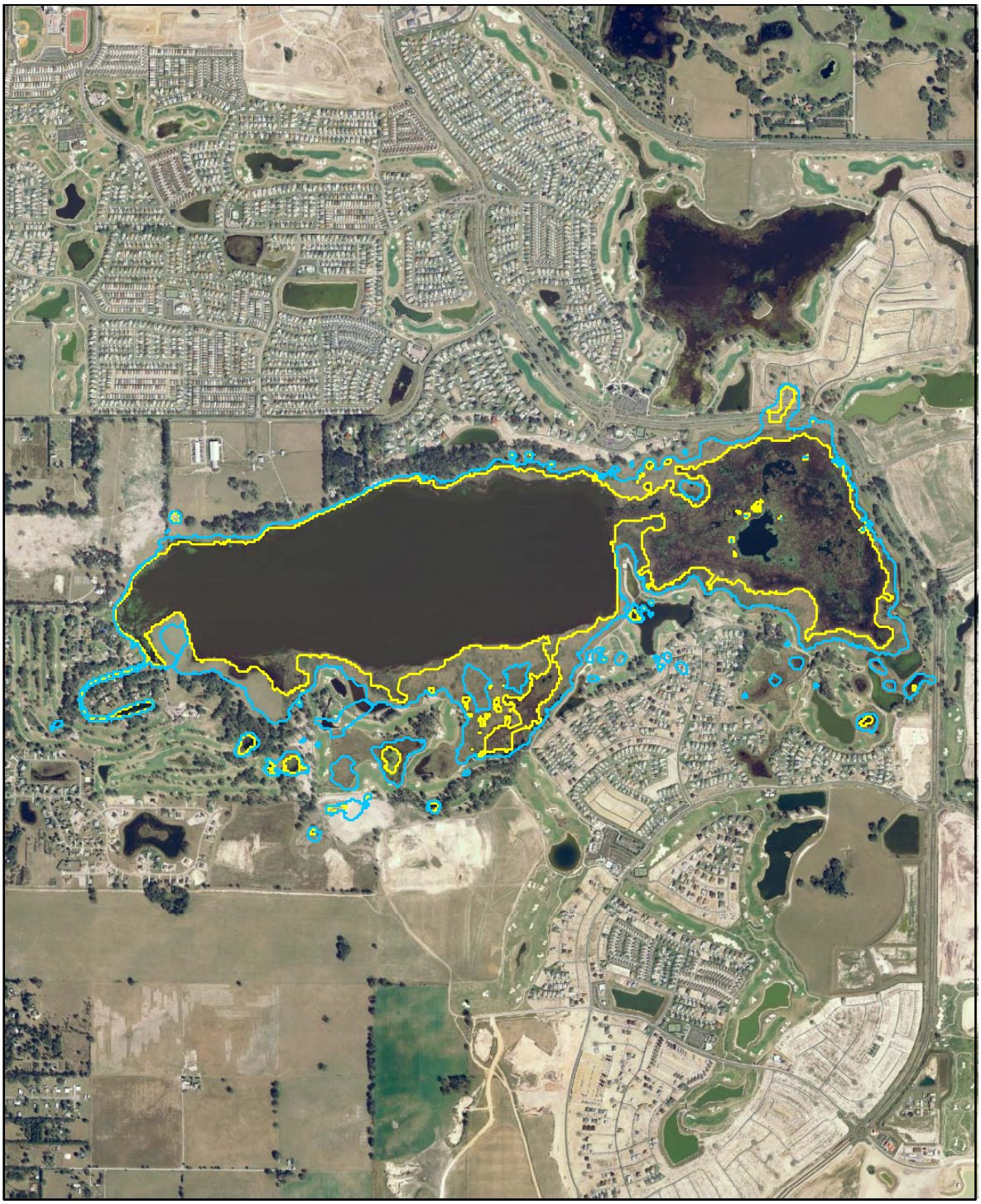


Figure 7. Approximate location of the proposed Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Miona and Black Lake.



Legend

Miona and Black Minimum Levels

51.3 feet above NGVD = MLL

53.9 feet above NGVD = HMLL

Map prepared using 2005 true color digital ortho photography, elevation data from 2002 SWFWMD aerial photography with contours maps (Secs. 21-23, and 26-28, Twp. 18 S, Rge. 23 E), and elevation data collected by D.C. Johnson and Associates, Inc.

Feet

0 1,500 3,000 6,000

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