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Ecologic Evaluation and Hydrologic Evaluation Sections
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Cover Page: Aerial view of Lake Wimauma with source imagery collected on January 2, 2010. The red and orange contours depict the approximate lake stage corresponding with the Minimum Lake Level (79.2 NGVD) and High Minimum Lake Level (83.9 NGVD).

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Minimum and Guidance Levels for Lake Wimauma

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 for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum flow for a given watercourse "shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area", and 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". Minimum flows and levels are established and used by the Southwest Florida Water Management District (SWFWMD) for water resource planning, as one of the criteria used for evaluating water use permit applications, and for the design, construction and use of surface water management systems.

Development of a minimum flow or level does not in itself protect a water body from significant harm; however, resource protection, recovery and regulatory compliance can be supported once the flow or level standards are established. State law governing implementation of minimum flows and levels (Chapter 373.0421, F.S.) requires development of a recovery or prevention strategy for water bodies if the " existing flow or level in a water body is below, or is projected to fall within 20 years below, the applicable minimum flow or level". Recovery or prevention strategies are developed to: "(a) achieve recovery to the established minimum flow or level as soon as practicable; or (b) prevent the existing flow or level from falling below the established minimum flow or level." Periodic re-evaluation and as necessary, revision of established minimum flows and levels are also required by state law.

Minimum flows and levels are to be established based upon the best available information with consideration given to "…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.). The Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.) provides additional guidance for the establishment of minimum flows and levels, requiring 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; and j) navigation." The Water Resource Implementation Rule also indicates that "minimum flows and levels should be expressed as multiple flows or levels defining a minimum hydrologic regime, to the extent practical and necessary to establish the limit beyond

which further withdrawals would be significantly harmful to the water resources or the ecology of the area".

The Southwest Florida Water Management District has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, subjected the methodologies to independent, scientific peer-review, and incorporated the methods into its Water Level 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-dominated wetlands greater than 0.5 acre in size, and for those without fringing cypress wetlands. 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 levels expected to fully maintain the integrity of the wetlands are classified as Category 2 Lakes. Lakes without at least 0.5 acre of 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, lakeshore residents and local governments, or to aid in the management or control of adjustable water level structures. Information regarding the development of adopted methods for establishing Minimum and Guidance lake levels is provided in Southwest Florida Water Management District (1999a, b), Leeper *et al.* (2001) and Leeper (2006). Peer-review findings regarding the lake level methods are available in Bedient *et al.* (1999), Dierberg and Wagner (2001) and Wagner and Dierberg (2006).

Two Minimum Levels and two Guidance Levels have typically been established for lakes, and upon adoption by the District Governing Board, 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 **High Guidance Level** is provided as an advisory guideline for construction of lakeshore 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 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 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 on a long-term basis.

- The **Low Guidance Level** is provided as an advisory guideline for water dependent structures, information for lakeshore 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 on a long-term basis.

In accordance with Chapter 40D-8, F.A.C., Minimum and Guidance Levels were developed for Lake Wimauma (Table 1), a Category 3 Lake located in Hillsborough County, Florida. The levels were established using best available information, including field data that were obtained specifically for the purpose of minimum levels development. The data and analyses used for development of the levels shown in Table 1 are described in the remainder of this report. All elevation data values shown within this report on graphs, bathymetric maps, and within tables are expressed as elevations in feet above the National Geodetic Vertical Datum of 1929 (NGVD 29). In some circumstances notations are made for data that was collected as North American Vertical Datum of 1988 (NAVD 88) and converted to NGVD 29. All datum conversions were derived using Corpscon 6.0, a computer software program developed by the United States Army Corps of Engineers**.**

Following a public input process, the District Governing Board approved the minimum and guidance levels developed for Lake Wimauma (Table 1) for adoption and incorporation into Chapter 40D-8, F.A.C. The levels were approved as a consent item during the Governing Board's December 2011 meeting. Public input included a public workshop held on September 20, 2011 near Lake Wimauma within the community of Sun City Center. Upon approval by the District Governing Board, staff prepared an amendment to Rule 40D-8.624, F.A.C. that establishes minimum and guidance levels for Lake Wimauma based on current methodologies and repeals the previously adopted guidance levels established in 1980 (see Table 2). The rule amendment was submitted to the Joint Administrative Procedures Committee and notice was provided to the Governor's Office of Fiscal Accountability and Regulatory Reform (OFARR). Approval of the rule amendment was received by March 15, 2012.

Table 1. Minimum and Guidance Levels for Lake Wimauma.

Minimum and Guidance Levels	Elevation in Feet
	NGVD 29
High Guidance Level	83.9
High Minimum Lake Level	83.9
Minimum Lake Level	79.2
Low Guidance Level	74.0

Data and Analyses Supporting Development of Minimum and Guidance Levels for Lake Wimauma

Lake Setting and Description

Lake Wimauma (Figure 1) is located in Hillsborough County, Florida (Sections 9 and 16, Township 32 South, Range 20 East), in the Alafia River Basin of the Southwest Florida Water Management District. White (1970) classified the area of west-central Florida containing Lake Wimauma as the Polk Upland physiographic region. Brooks (1981) identified the area surrounding the lake as the Bone Valley Uplands in the Southwestern Flatwoods Physiographic District and described the region as a poorly drained plateau underlain by deeply weathered sand and clayey sand of the Bone Valley Formation. As part of the Florida Department of Environmental Protection's Lake Bioassessment/ Regionalization Initiative, the area has been identified as the Wimauma Lakes lake region, and described as a region of two clear, acidic, low nutrient, water bodies (Griffith *et al.* 1997).

Most of the lake shoreline has been cleared as a result of agricultural or residential development (Figure 2). No forested wetlands or their remnants contiguous with the lake are discernable, although some shrubby, wetland vegetation occurs between the two main lake basins. Public access to the shoreline is not available.

Lake Wimauma is located in the Lake Wimauma Drainage Basin in the Little Manatee River watershed. The contributing drainage area for the lake is 0.75 square miles (SWFWMD 1996). There are no inlets or outlets at Lake Wimauma. There are no surface water withdrawals from the lake currently permitted by the District. There are seventeen permitted groundwater withdrawals within a one mile radius of the lake (Figure 3), with each of these classified as "small general" water use permits with permitted water use under 100,000 gallons per day. Within a two mile radius of the lake there are total of 71 "small general" permitted groundwater withdrawals.

The 1956 (photorevised 1981) United States Geological Survey 1:24,000 Wimauma quadrangle map indicates an elevation of 85 ft NGVD for Lake Wimauma. The "Gazetteer of Florida Lakes" (Shafer *et al.* 1986) lists the lake area as 135 acres at this elevation. A topographic map of the basin generated in support of minimum levels development indicates that the lake extends over 137 acres at an elevation of 84 ft NGVD (Figure 4). The topographic map and corresponding depth contour map (Figure 5) show that the lake basin slope is gradual with no obvious dredge holes.

Figure 1. General location of Lake Wimauma in Hillsborough County, Florida.

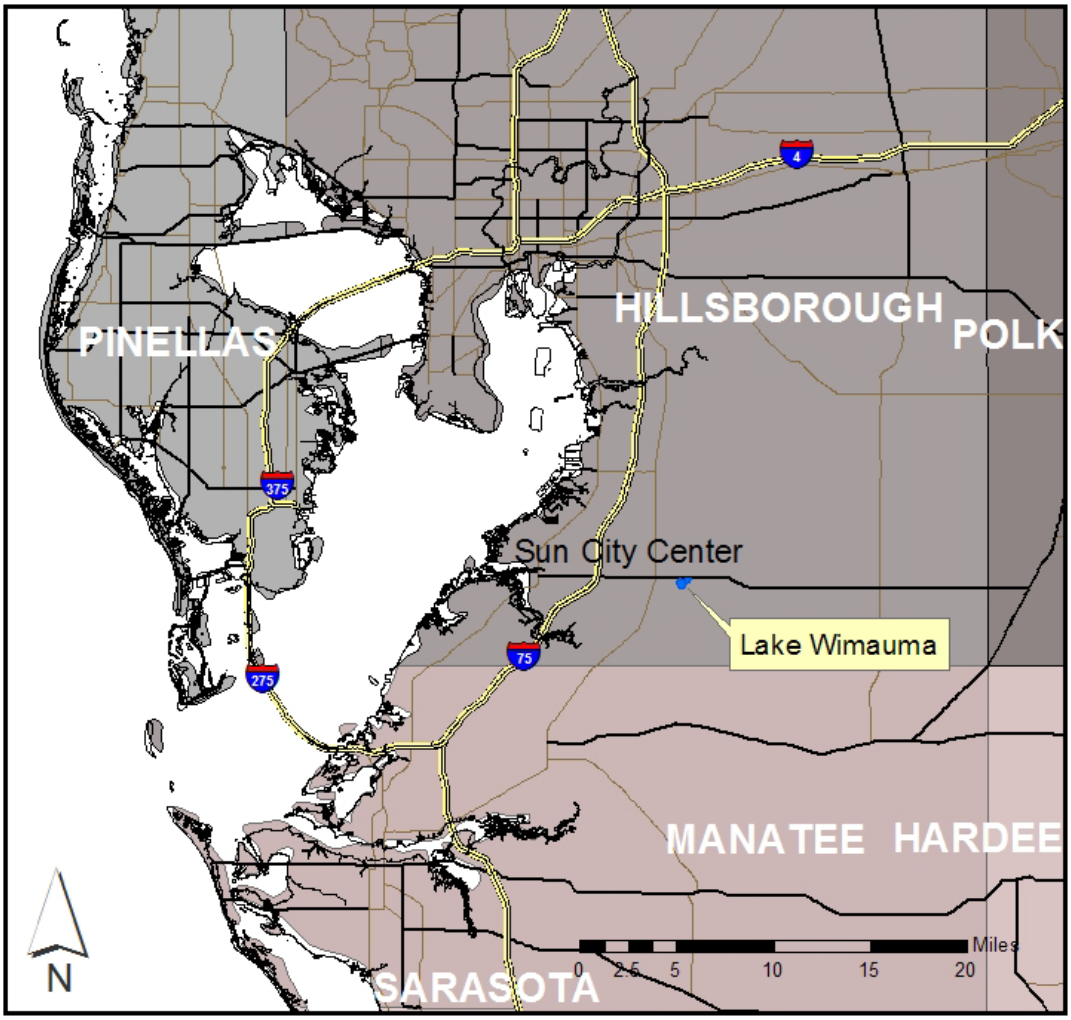


Figure 2. Location of the lake water level gage and hydrologic indicators at Lake Wimauma.

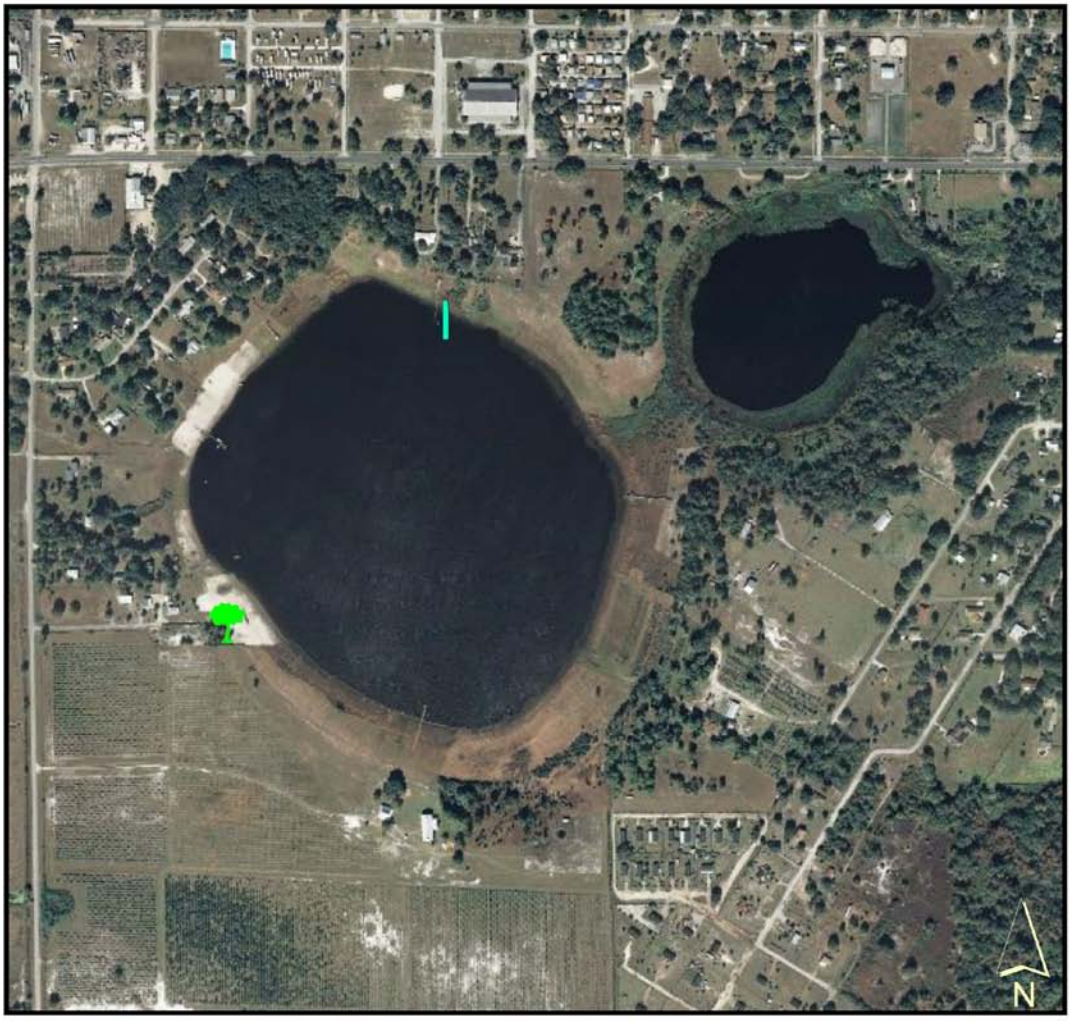


Figure 3. Permitted groundwater withdrawals within a one mile and two mile radius of Lake Wimauma, Hillsborough County.

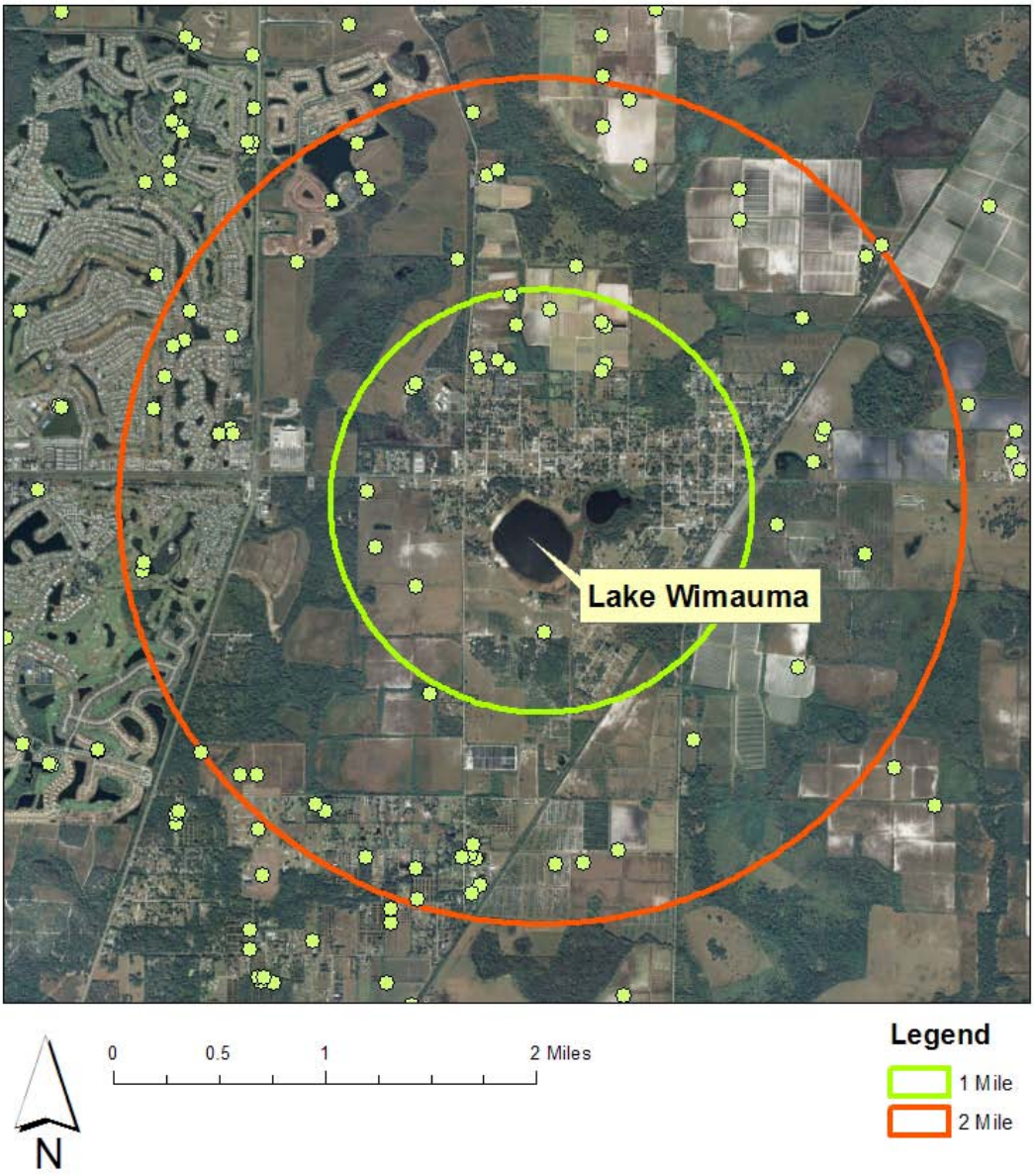
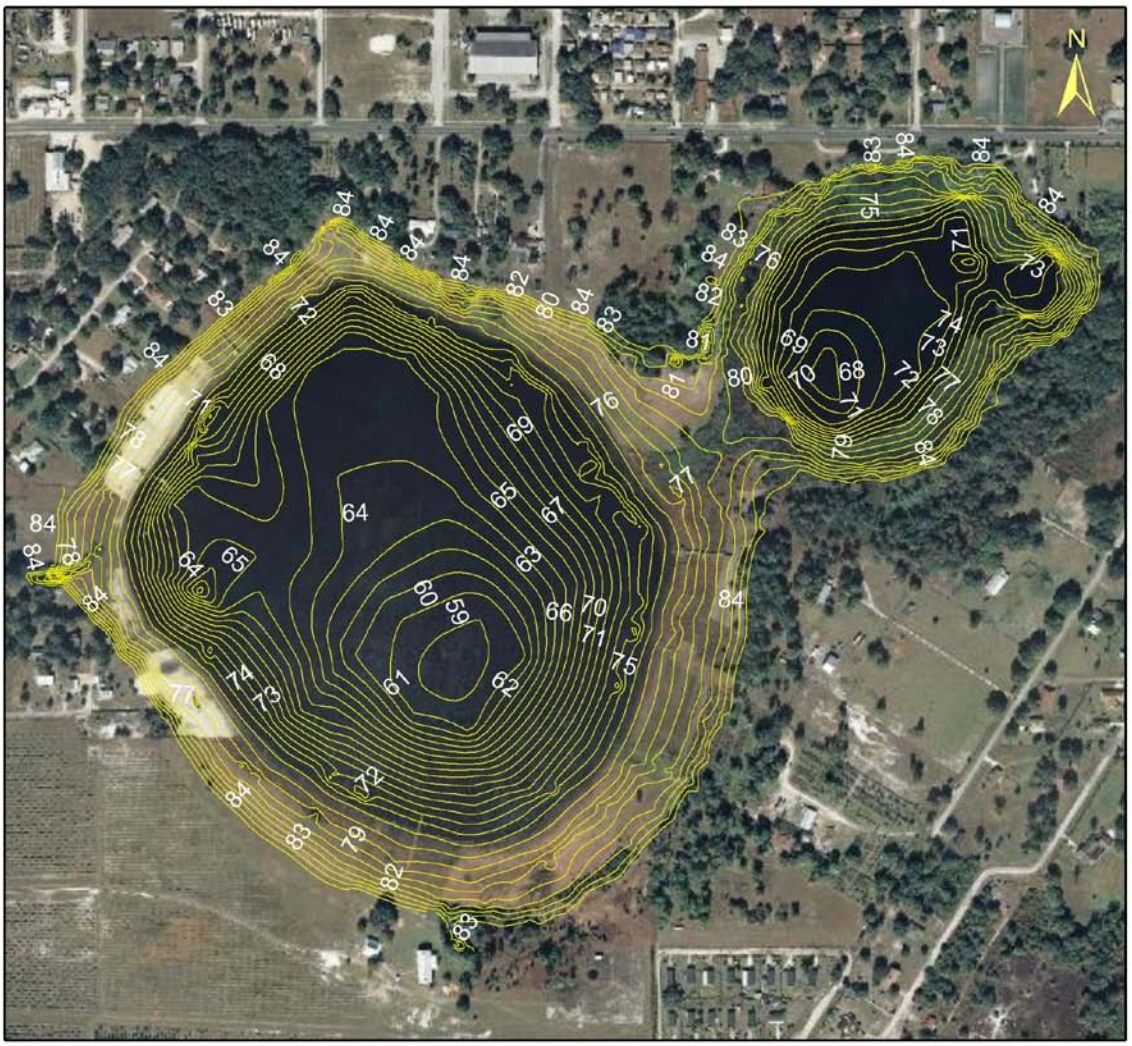
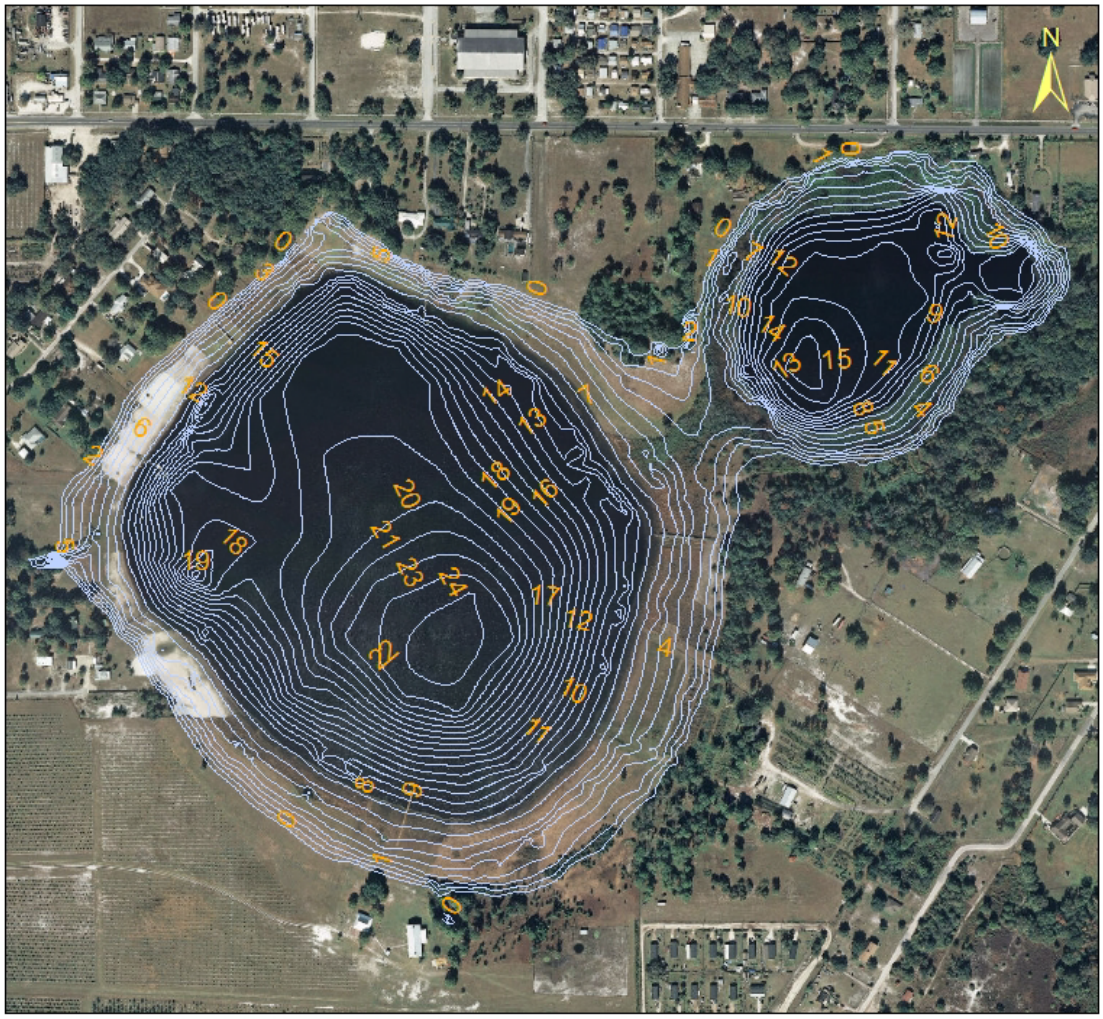


Figure 4. One-foot contours within the Lake Wimauma basin. Values shown are elevations as NGVD 29.



One-foot contours (as NGVD) within the Lake Wimauma basin. Contours were prepared using a combination of LiDAR data and lake bottom elevation data. LiDAR data was collected in early 2007 by Earth, LLC. Lake bottom data were collected by the Hillsborough County Lake Management program in July 2000 and by SWFWMD staff in October 2002 and June of 2003. Background imageryis true color digital ortho photography collected on January 02, 2010.

Figure 5. Bathymetric map of Lake Wimauma showing the approximate bottom depth based on lake stage elevation of 83.1 NGVD or the High Minimum Lake Level.



Approximate one-foot depth contours within the Lake Wimauma basin as established using the HMLL lake stage elevation of 83.1 (NGVD) as the 0 ft depth or lake margin. Depth contours were prepared using the lake stage elevation (NGVD) contours shown inFigure 3. The background imagery is true color digital imagery collected on Jan. 2, 2010.

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 Wimauma in September 1980 (Table 2). A Maximum Desirable Level of 86.00 NGVD was also developed, but was not adopted by the Governing Board. 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. One of the management levels, a Ten Year Flood Guidance Level of 87.20 NGVD, was removed from Chapter 40D-8 in 2007, when the District Governing Board determined that flood-stage elevations should not be included in the District's Water Levels and Rates of Flow rules

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 Wimauma has been listed as stressed since 1991 (Gant *et al*. 1999) with the exception of 2006 (Gant *et al.* 2006, and Gant *et al.* 2010).

Table 2. Adopted Guidance Levels for Lake Wimauma as listed in Table 8-3 of subsection 40D-8.624, F.A.C.

Guidance Levels	Elevation in Feet NGVD 29
Ten Year Flood Guidance Level	87.20
High Level	86.75
Low Level	83.00
Extreme Low Level	81.00

Summary Data Used for Development of Minimum and Guidance Levels

Minimum and Guidance Levels for Lake Wimauma were developed using the methodology for Category 3 Lakes described in Chapter 40D-8, F.A.C. levels and additional information are listed in Table 3, along with lake surface areas for each level or feature/standard elevation. Detailed descriptions of the development and use of these data are provided in the subsequent sections of this report.

Table 3. Minimum and Guidance Levels, lake stage exceedance percentiles, normal pool and control point elevations, significant change standards, and associated surface areas for Lake Wimauma.

Levels	Elevation in Feet NGVD 29	Lake Area (acres)
Lake Stage Percentiles		
Period of Record (POR) P10 (1973 to 2010)	81.6	125.7
Period of Record (POR) P50 (1973 to 2010)	77.0	93.1
Period of Record (POR) P90 (1973 to 2010)	73.4	69.7
Historic P10 * (1946 to 2010)	**83.9**	136.7
Historic P50 * (1946 to 2010)	**79.2**	108.8
Historic P90 * (1946 to 2010)	**74.0**	72.5
Normal Pool and Control Point		
Normal Pool	83.8	136.2
Control Point	NA	NA
Significant Change Standards		
Basin Connectivity Standard	82.5**	130.1
Wetland Offset Elevation	78.4	102.9
Species Richness Standard	77.0	93.1
Aesthetics Standard	74.0	72.5
Recreation/Ski Standard	74.5	75.1
Lake Mixing Standard	NA	2.6
Dock-Use Standard	NA	NA
Minimum and Guidance Levels		
High Guidance Level	**83.9**	136.7
High Minimum Lake Level	**83.9**	136.7
Minimum Lake Level	**79.2**	108.8
Low Guidance Level	**74.0**	72.5

NA = not available/not appropriate;

* - Long term Historic based on a composite of modeled pre-POR (1946-1974) and POR (1974-2010).

** - Alternative standard recommended. See page 22 for explanation.

Lake Stage Data and Exceedance Percentiles

Lake stage data, *i.e.,* surface water elevations for Lake Wimauma relative to NGVD 29 were obtained from the District's Water Management Information System (WMIS) data base (Site Identification Number 18194). The period of record (POR) for the data extends from December 1973 through December 2010 (Figure 6, see Figure 2 for current location of the SWFWMD lake water level gauge). Using the available lake stage data monthly mean lake surface elevations were calculated and graphed (Figure 7). The highest surface water elevation (daily shown in Figure 6) for the lake recorded in the Water Management Information System was 84.38 NGVD 29 and occurred on March 23, 1998 (Figure 8). Lake Wimauma is known to have exceeded this elevation; the United States Geological Survey 1:24,000 Wimauma quadrangle map indicates an elevation of 85 NGVD for the lake. The low of record, 70.12 NGVD 29 occurred on both May 20, 1990 and March 27, 2001 (Figure 8). The vertical range between the highest and lowest recorded lake stage is 14.26 feet. The horizontal distance between the POR high and low generally ranges from 300 ft to 500 ft along the north, west, and south shorelines of the west basin of lake (Figure 8, see transects A to B, and C to D), and increases to approximately 700 feet within the region between the two basins.

Figure 6. Daily surface water elevations (NGVD 29) through December 2010 for Lake Wimauma.

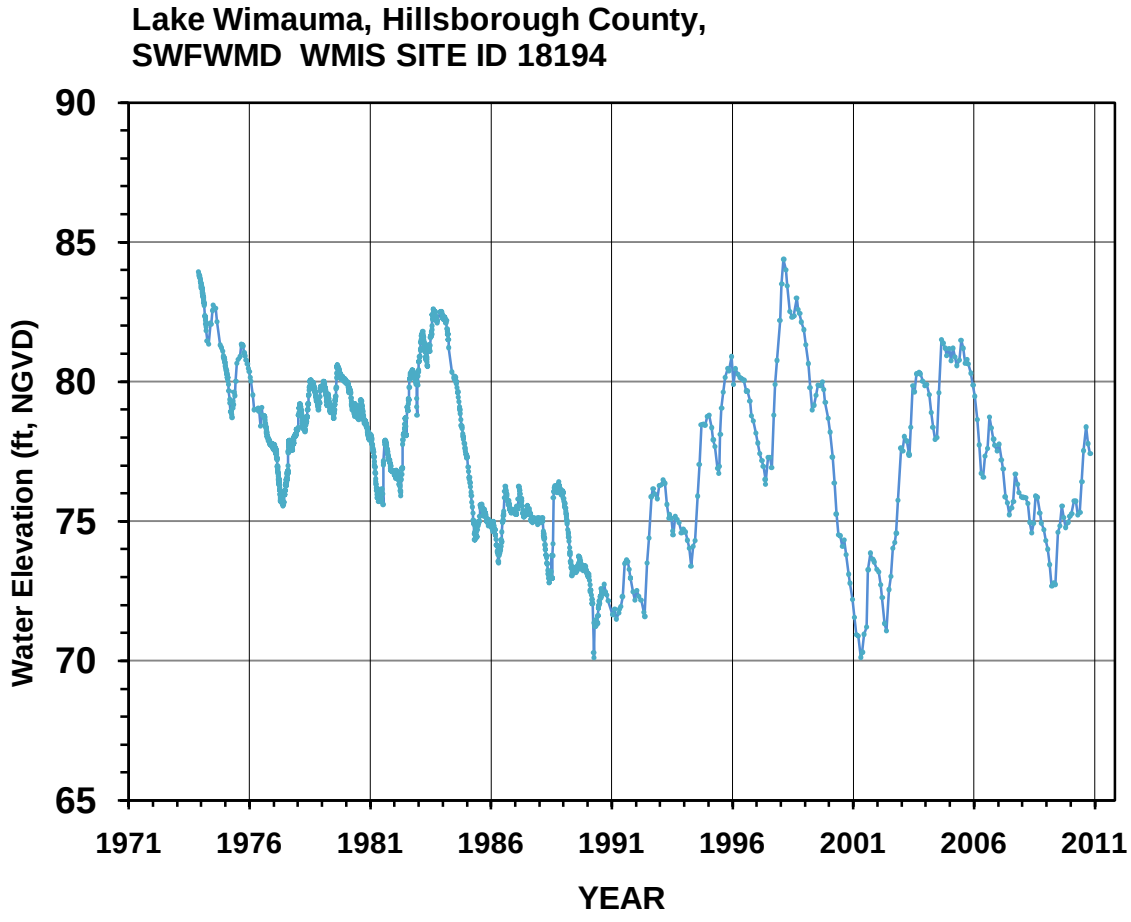


Figure 7. Monthly mean surface water elevations (NGVD 29) through December 2010 for Lake Wimauma.

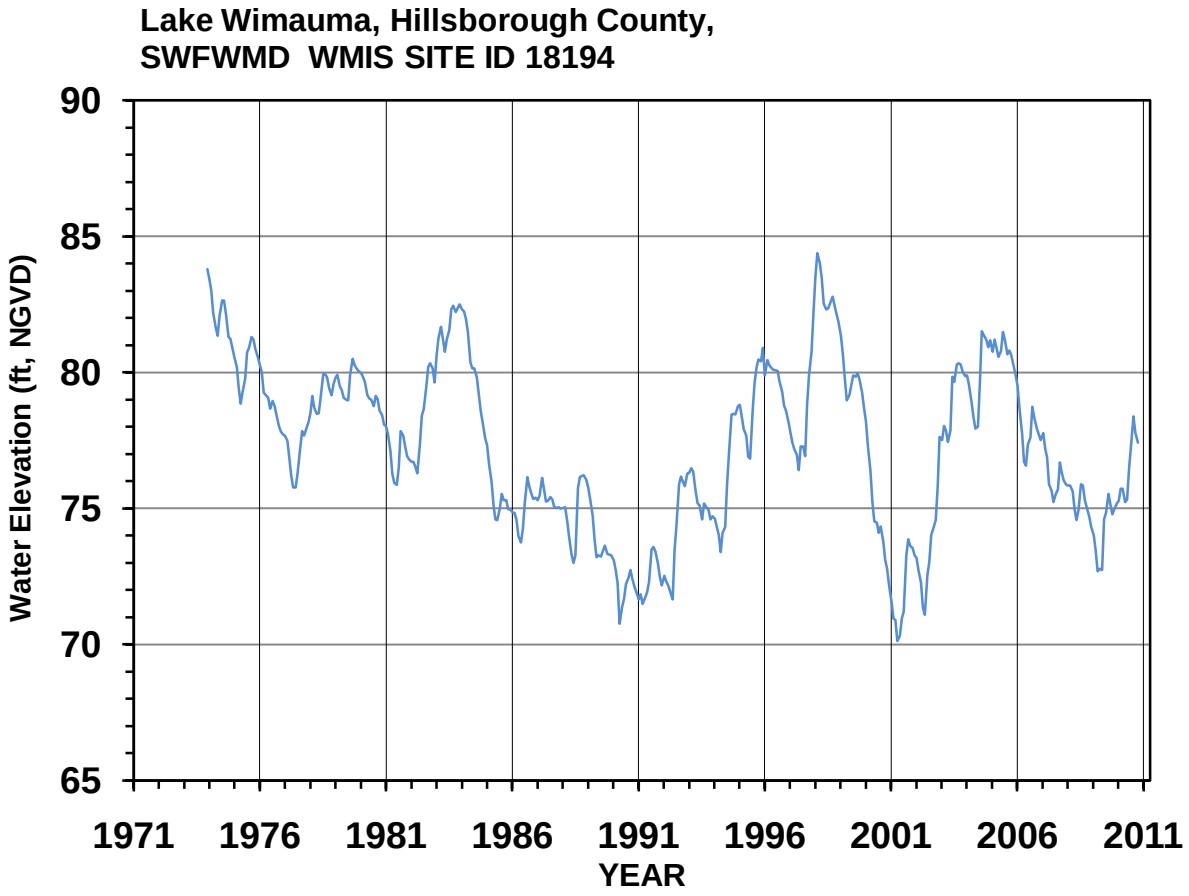
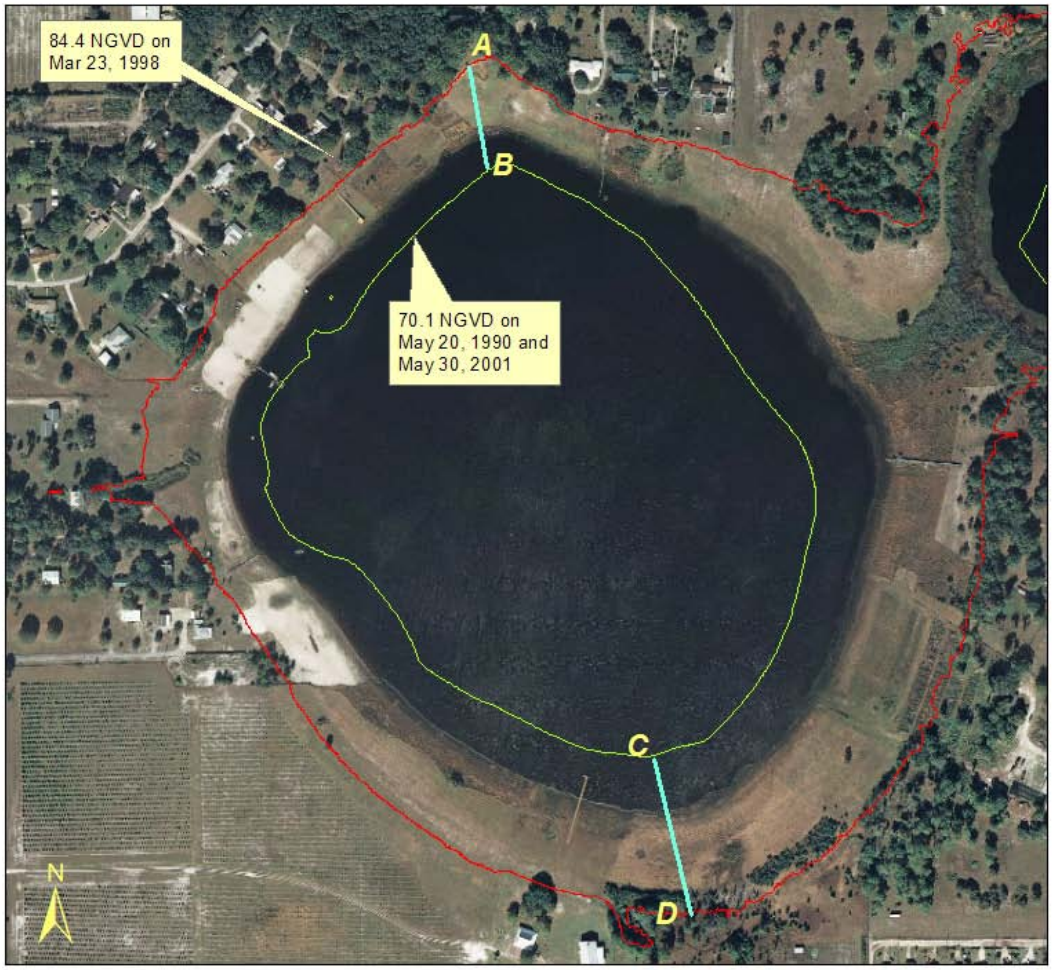


Figure 8. Approximate location of the lake basin contours associated with the lake stage period of record high (84.4 NGVD) and low (70.1 NGVD) for Lake Wimauma in Hillsborough County. Background imagery was collected on January 2, 2010.



Transects A to B and C to D depict the approximate horizontal distance between the POR High (84.4 NGVD) and POR Low (70.1 NGVD). The distance from A to B is approximately 300 ft, and the distance from C to D is roughly 500 ft.

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. A hydrologic analysis (SWFWMD 2010, draft report) completed for Lake Wimauma indicated that the lake was determined to be have no measureable impacts due to regional groundwater withdrawals. The results of the analysis indicated that lake stage data for the entire period of record (1974 to 2010) for Lake Wimauma are classified as Historic.

Although the period of record of lake stage data (1974 to 2010) for Lake Wimauma are classified as the Historic data, it was determined that Historic lake-stage exceedance percentiles would be better estimated using a longer data record. A longer Historic data record was developed by an analysis of the relationship between rainfall and area rainfall and constructing a rainfall model. A composite rainfall data set was developed for the time period of 1946 to present using data from five rainfall data collection sites. The rain gage sites included the Wimauma gage, Wimauma airport, Romp 23, Parrish, and Fort Green (WMIS Site ID's 17958, 18135, 26085, 25756, respectively). The resulting lake level rainfall model had a correlation coefficient of determination (r^2) equal to 0.588 based on use of a four-year linear decay series of cumulative monthly rainfall values. The model was then applied to predict the lake stage for the long term Historic time period of the 1946 to 1974 (Figure 9a). This sixty-four-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). The pre-period of record modeled lake stage (1946 to 1974) was combined with the measured or period of lake stage (1974 to present) to provide a final composite long term Historic lake stage (Figure 9b)

The final composite long term Historic lake stage data set comprised of the modeled lake stage and measured lake stage (Figure 9b) was used to calculate the **Historic P10, P50, and P90** lake stage percentile elevations (Figure 9b). The Historic P10 elevation, the elevation the lake water surface equaled or exceeded ten percent of the time during the historic period, was **83.9 NGVD 29.** The Historic P50 elevation, the elevation the lake water surface equaled or exceeded fifty percent of the time during the historic period, was **79.2 NGVD 29**. The Historic P90 elevation, the elevation the lake water surface equaled or exceeded 90 percent of the time during the historic period, was **74.0 NGVD 29.**

Figures 9a. and 9b. 9a. Modeled long term Historic lake stage (as monthly means, see blue line) and measured lake stage (also as monthly means, see red line) for Lake Wimauma. 9b. Composite of modeled long term Historic lake stage and measured lake stage (both as monthly means) used to calculate the Historic P10, P50, and P90 lake stage percentile elevations for Lake Wimauma from January 1946 through February 2010. The Long Term Historic P10, P50, and P90 are depicted as horizontal lines. Lake stage elevations are in feet above NGVD 29.

Figure 9a.

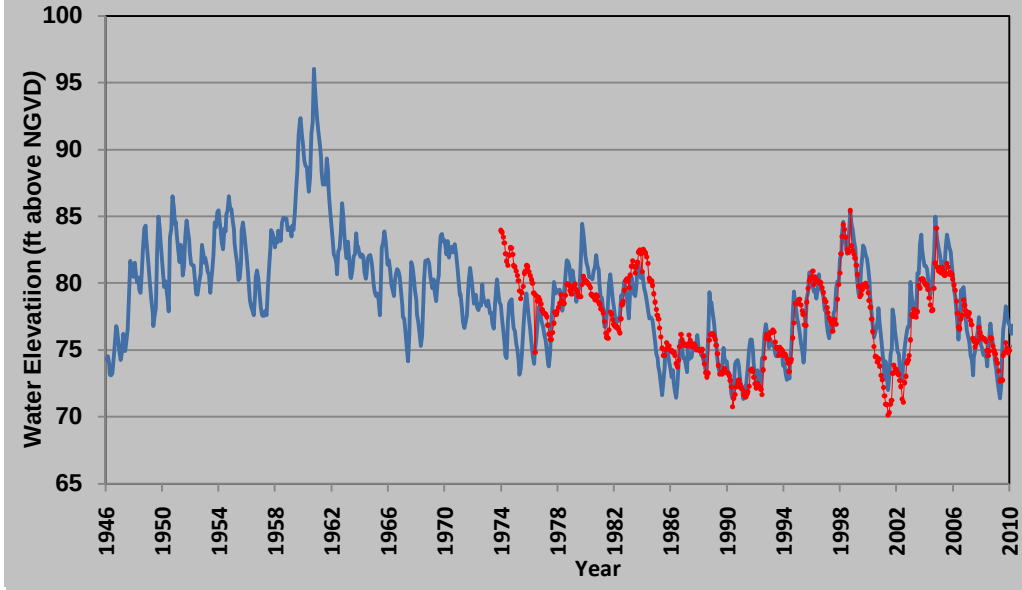
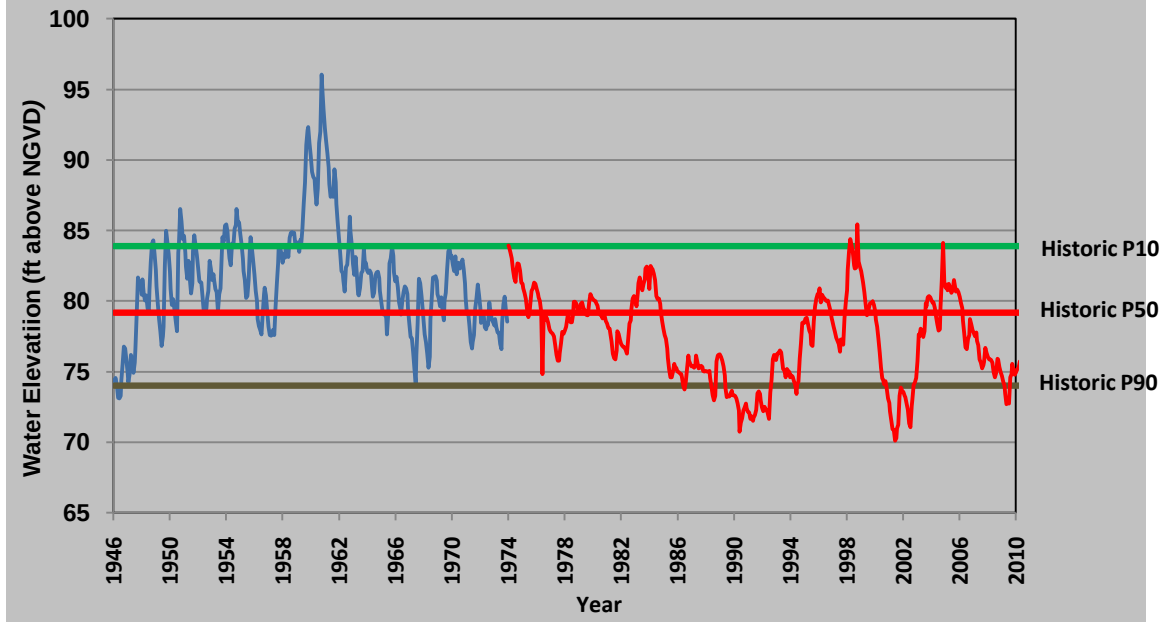


Figure 9b.



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, including biological and physical features. Based on ground elevations measured in October 2004 at the base of saw palmetto (*Serenoa repens*) along the west shore of the lake (Figure 2), the Normal Pool elevation was established at 83.8 NGVD. The Normal Pool is slightly lower than other physical and cultural features within the lake basin, including shoreline scarps, old seawalls and a building formerly used as a boathouse (SWFWMD 1996, Emery and Leslie 2004).

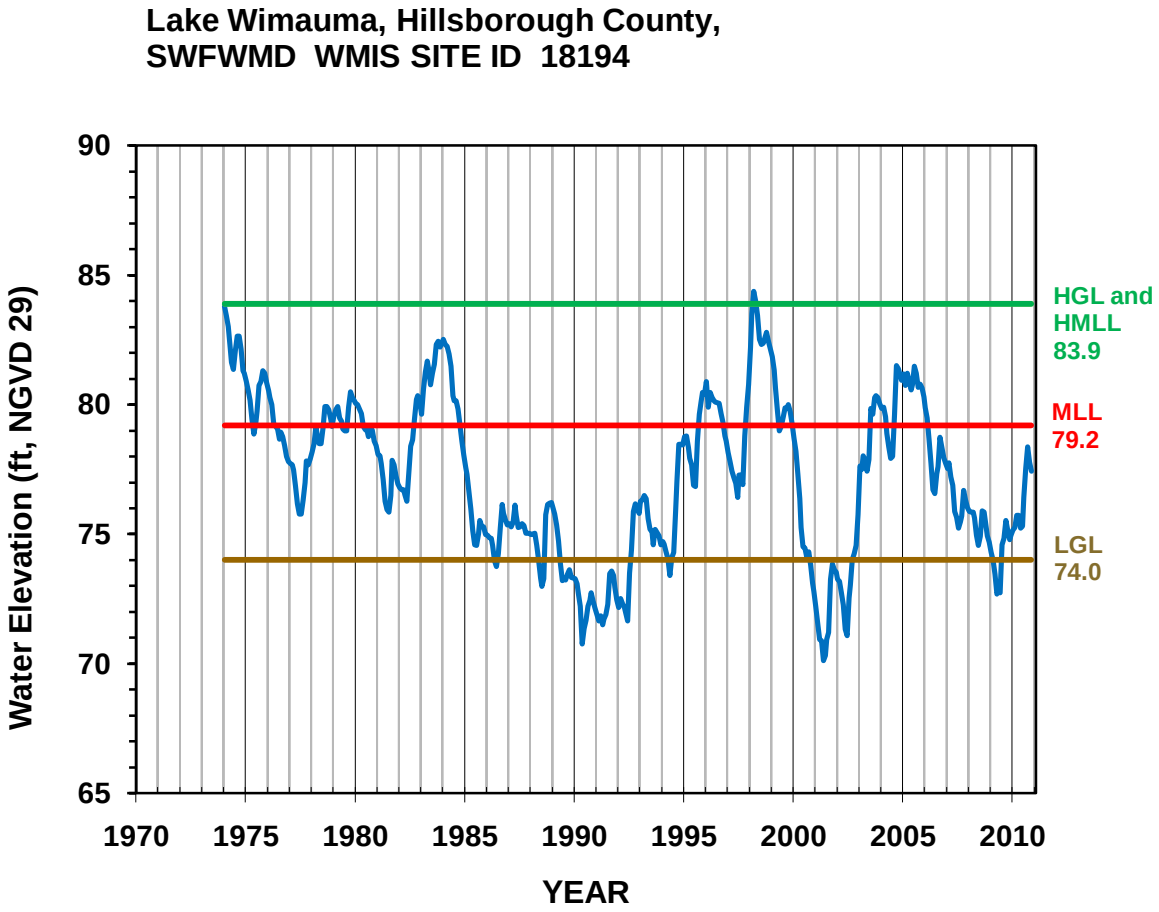
The Control Point elevation is the elevation of the highest stable point along the outlet profile of a surface water conveyance system (*e.g.,* weir, ditch, culvert, or pipe) that is the principal control of water level fluctuations in the lake. Based on review of one-foot contour interval aerial maps and field survey data collected in June 2003, it was determined that Lake Wimauma does not have a natural surface outlet. Because the lake is a closed-basin system, a control point elevation was not established.

Guidance Levels

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 and is established using historic lake stage data if it is available, or is estimated using the Current P10, the control point, and the normal pool elevation. Based on the availability of the long term Historic data record for Lake Wimauma, the High Guidance Level was established at **83.9 NGVD 29** (Figure 10). This elevation is very similar to the normal pool elevation estimated at 83.8 NGVD 29

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 lake stage data, and in some cases, the Reference Lake Water Regime (RLWR) statistics. Based on the availability of the long term Historic data set for Lake Wimauma, the Low Guidance Level was established at **74.0 NGVD 29** (Figure 10, Table 3).

Figure 10. Mean monthly lake stage for the period of record and Minimum and Guidance Levels for Lake Wimauma, in feet above NGVD 29. levels include the High Guidance Level (HGL), High Minimum Lake Level (HMLL), Minimum Lake Level (MLL), and the Low Guidance Level (LGL).



Lake Classification

Lakes are classified as Category 1, 2, or 3 for the purpose of Minimum Levels development. Those with fringing cypress wetlands greater than 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 Wimauma does not have fringing cypress wetlands, it is classified as a **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 for Category 3 Lakes, including an Aesthetics Standard, a Species Richness Standard, a Recreation/Ski Standard, a Dock-Use Standard, a Basin Connectivity Standard, and a Lake Mixing Standard. A Wetland Offset Elevation is also developed and used along with the significant change standards to identify desired median lake stage elevations that if achieved, are intended to preserve various natural system and human-use lake values.

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 lake-use. The standard is based on the elevation of lake sediments at a critical high-spot between lake basins or lake, in this case the east and west pools, clearance values 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. A review of the LiDAR elevation data and spot elevation data indicated that the critical high spot between the two basins (west and east pool) was approximately 80.5 NGVD. An approximated elevation profile graph of the lake bottom elevation (as NGVD) extending across both basins (west pool to the east pool) is shown in Figure 11. The Basin Connectivity Standard was established at 87.9 NGVD, based on the sum of the elevation that ensures connectivity among the east and west pools (80.5 NGVD as critical high spot), a two-foot clearance value for movement of biota and use of powerboats on the lake, and the difference between the

Historic P50 and Historic P90 (5.2 ft). An elevation of 87.9 ft is not practical as the connectivity standard since flooding of several residential structures would occur at this elevation. This elevation is also slightly greater than the Ten Year Flood Guidance Level of 87.2 NGVD established in 1992 for Lake Wimauma (SWFWMD 1992). The Connectivity Standard (as defined in Chapter 40D-8) was therefore determined as not appropriate for Lake Wimauma. Although the Connectivity Standard is not appropriate, historical imagery of Lake Wimauma (Figures 15, 16, 17, 18 and 19) and review of the lake stage record indicates that the east and west basins were connected during various wet periods. To ensure this history of connectivity and passage of biota between the basins an alternative lower Connectivity Standard should be considered. For Lake Wimauma this alternative was based on adding a two-foot clearance value to the critical high spot elevation between the two basins (80.5 NGVD plus 2 feet, Figure 11). An alternative Connectivity Standard of 82.5 NGVD 29 is therefore recommended for Lake Wimauma.

Based on a review (Hancock 2006) of the development of minimum level methods for cypress-dominated wetlands, it was determined that up to an 0.8 foot decrease (or Wetland Offset) in the Historic P50 elevation would not likely be associated with significant changes in the herbaceous wetlands occurring within lake basins. Because herbaceous wetlands are common within the Lake Wimauma basin, the **Wetland Offset** was determined by subtracting 0.8 feet from the Historic P50 elevation. A **Wetland Offset** elevation of 78.4 NGVD was therefore established for Lake Wimauma and was equaled or exceeded 59.1 percent of the time, based on the Historic, composite water level record. The standard elevation therefore corresponds to the Historic P59.

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 (see Figure 12) for a plot of lake surface area versus lake stage). For Lake Wimauma, the Species Richness Standard was established at **77.0 NGVD 29**. The Species Richness Standard was equaled or exceeded 69.6 percent of the time, based on the long term composite Historic water level record. The standard therefore corresponds to the Historic P70.

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 ft, or a rectangular ski area 200 ft in width and 2,000 ft in length, and use of Historic lake stage data or region-specific reference lake water regime statistics. The Recreation/Ski Standard was established at **74.5 ft NGVD**, based on the sum of the elevation at which the lake could contain an area suitable for safe skiing (69.3 NGVD) and the difference between the Historic P50 and Historic P90 (5.2 ft). The Recreation/Ski Standard was equaled or

exceeded 88.4 percent of the time, based on the long term composite Historic water level record. The standard therefore corresponds to the Historic P88.

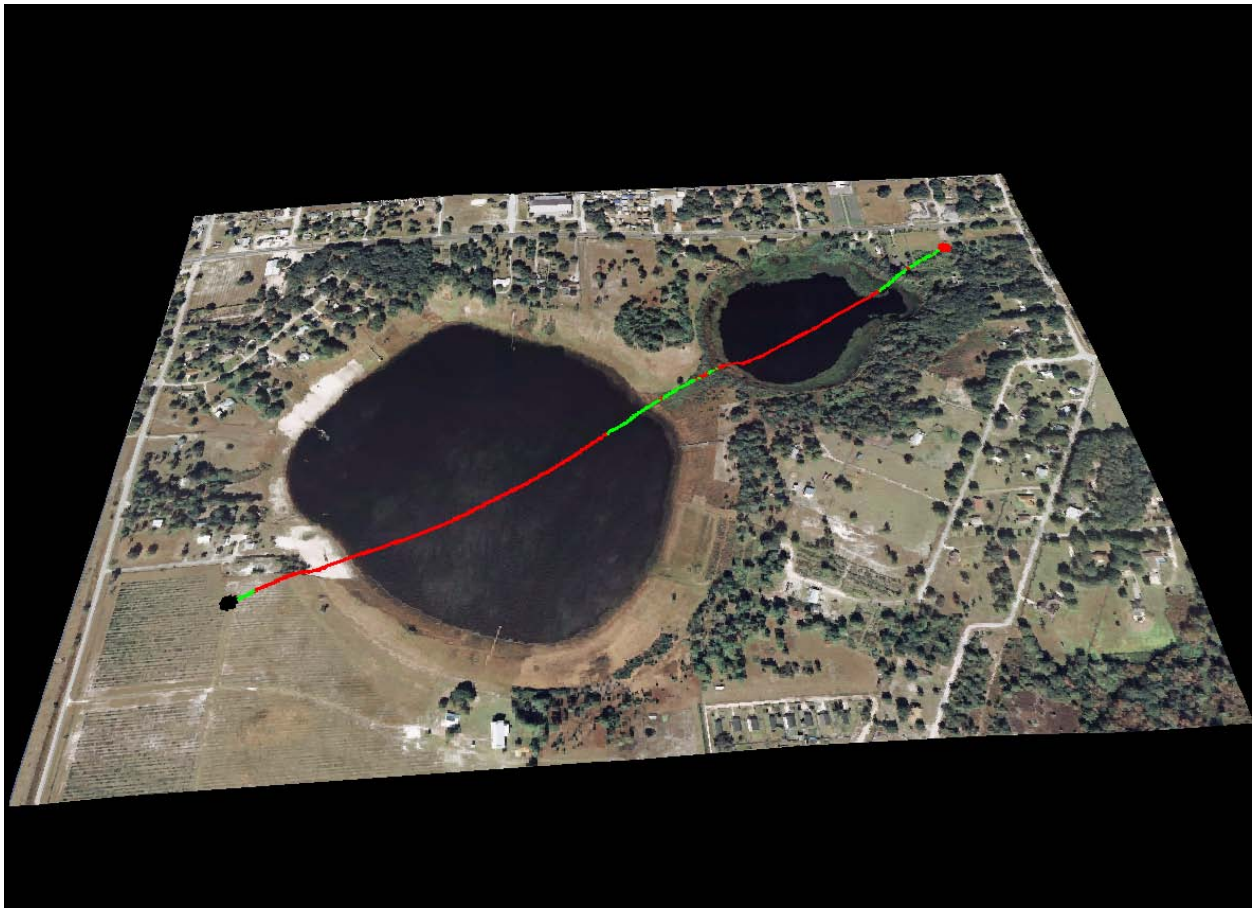
The **Aesthetics Standard** is developed to protect aesthetic values associated with the inundation of lake basins. The standard is intended to protect aesthetic values associated with the median lake stage from becoming degraded below the values associated with the lake when it is staged at the Low Guidance Level. The Aesthetic Standard was established at the Low Guidance Level, which for Lake Wimauma is **74.0 NGVD 29**. Because the Low Guidance Level was established at the Historic P90 elevation, water levels equaled or exceeded the Aesthetics Standard ninety percent of the time during the composite Historic long term period (1946 to present, Figure 9b).

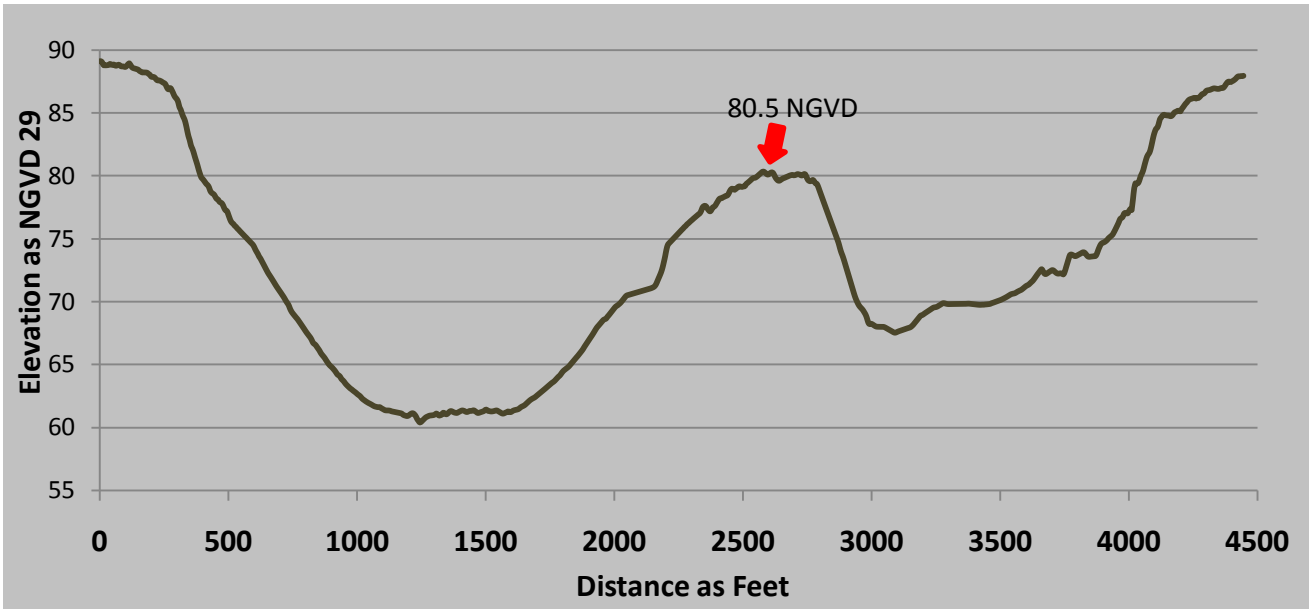
The Dock-Use Standard is developed to provide for sufficient water depth at the end of existing docks to permit mooring of boats and prevent adverse impacts to bottom-dwelling plants and animals caused by boat operation. The standard is based on the elevation of lake sediments at the end of existing docks, a clearance value for boat mooring, and use of Historic lake stage data or region-specific reference lake water regime statistics. Development of the Dock Use Standard was not appropriate for Lake Wimauma because only two non-floating docks (in usable condition) exist on the lake.

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 of <0.8. Because the dynamic ratio does not shift across the 0.8 threshold as the lake level changes (Figure 13), a Mixing Standard was not developed for the lake.

Information on herbaceous wetlands is taken into consideration when determining the elevation at which changes in lake stage would result in substantial changes in potential wetland area within the lake basin (*i.e*., basin area with a water depth of four or less feet). Similarly, changes in lake stage associated with changes in lake area available for colonization by rooted submersed or floating-leaved macrophytes are also evaluated, based on water transparency values (*i.e*., basin area with a water depth of 9.1 feet or less feet). Review of changes in potential herbaceous wetland area or area available for submersed aquatic plant colonization in relation to change in lake stage did not indicate that of use of any of the significant change standards would be inappropriate for establishment of the Minimum Lake Level (Figure 13).

Figure 11. Simulated cross section and corresponding profile graph created using ArcGIS 3D Analyst. The profile graph is for illustration purposes only and represents the approximate lake bottom elevation and the critical high spot between the east and west basin.





Minimum Levels

Minimum Lake Levels are developed using specific lake-category significant change standards and other available information or unique factors, including: 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. Minimum Levels development is also contingent upon lake classification*, i.e.,* whether a lake is classified as a Category 1, 2 or 3 lake.

The **Minimum Lake Level (MLL)** 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. For Category 3 Lakes, the Minimum Lake Level is typically 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. Because the Basin Connectivity Standard for Lake Wimauma is higher than the Historic P50 elevation, the Minimum Level was established at the Historic P50 elevation, 79.2 NGVD (Figures 10 and 14). This level is expected to afford protection to the natural system and human-use values associated with the identified significant change standards and also provide protection for wetlands occurring within the basin.

The **High Minimum Lake Level** (HMLL) 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. For Category 3 lakes, the High Minimum Lake Level is developed using the Minimum Lake Level, Historic data or reference lake water regime statistics. If Historic Data are available, the High Minimum Lake Level is established at an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and Historic P50. If Historic data are not available, the High Minimum Lake Level is set at an elevation corresponding to the Minimum Lake Level plus the region-specific RLWR50. Based on the availability of long term composite Historic data for Lake Wimauma, the High Minimum Lake Level was established at 83.9 NGVD 29 (Figures 10 and 14), by adding the difference between the Historic P50 and Historic P10 (4.7 feet) to the Minimum Lake Level. Since the Minimum Lake Level was established at the Historic P50, the High Minimum Lake Level is equivalent to the Historic P10.

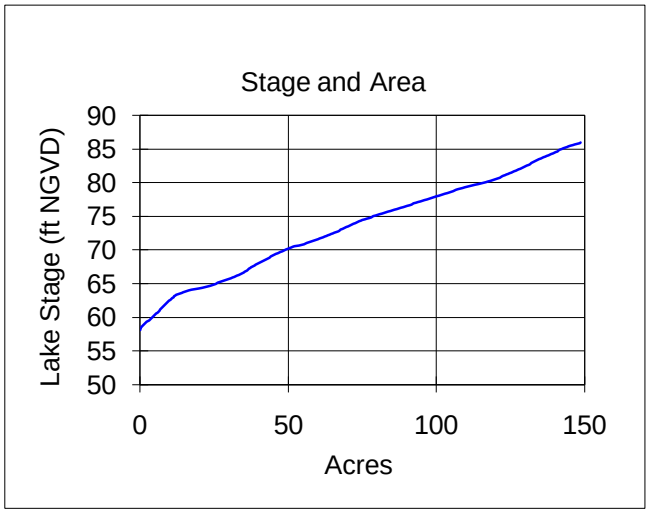
The Minimum and Guidance levels for Lake Wimauma are shown in Figure 10 along with monthly mean water surface elevations based on period of record water level measurements. Staging of the lake at Minimum levels (Figure 14) would not be expected to flood any man-made features within the immediate lake basin (see Figures 15 – 19). The High Minimum Lake Level (83.1 NGVD 29) is approximately 4.4 feet lower than the lowest floor slab (83.9 NGVD 29) within the lake basin (Table 4). The High Minimum Lake Level is also approximately 3.8 ft lower than the lowest spot on the paved roads (87.7 NGVD 29) encircling the lake. A period of record high of 84.38

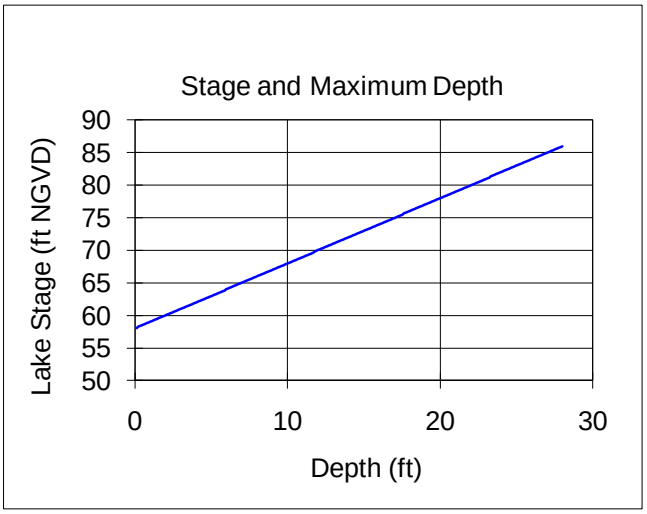
NGVD was measured on March 23, 1998 during the heavy rains associated with the “El Niño” event. This period of record high was 0.48 feet higher than the High Minimum Lake Level.

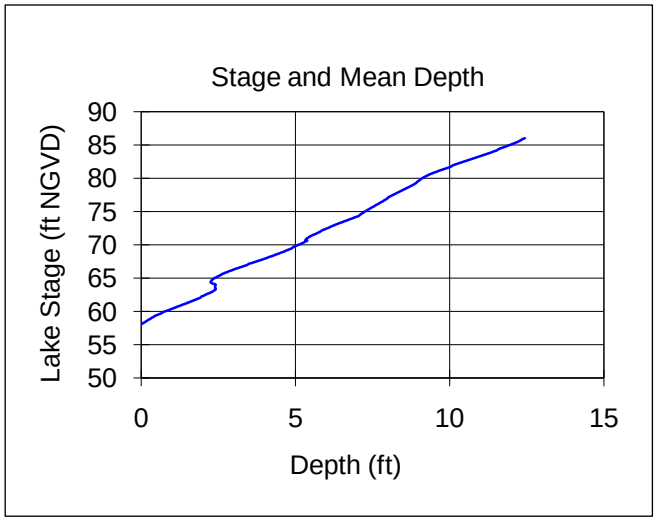
Table 4. Elevations of lake basin features in the immediate Lake Wimauma basin.

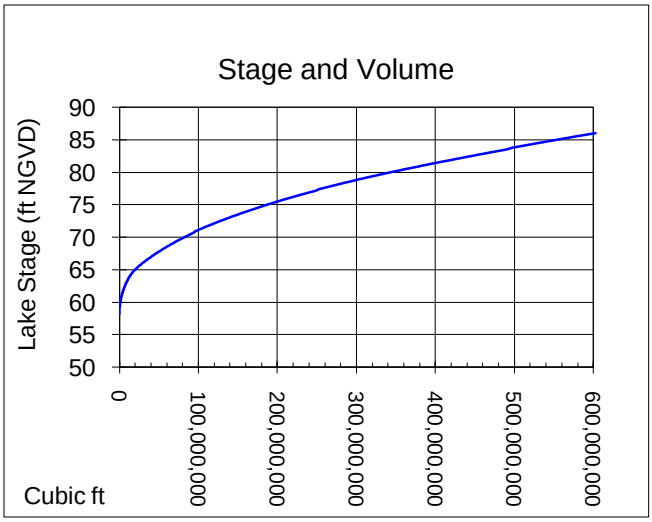
Lake Basin Features	Elevation in Feet NGVD 29
Low Road (Lake View Drive)	87.7
Low Floor Slab	87.5

Figure 12. Surface area, maximum depth, mean depth, volume, dynamic ratio (basin slope) in feet above NGVD 29 for Lake Wimauma.









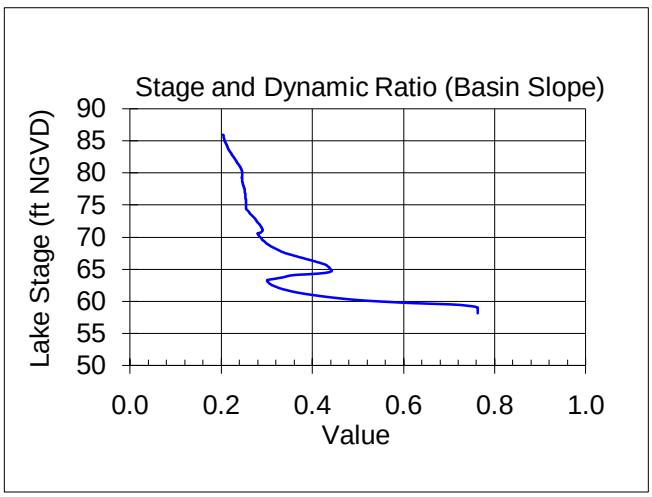
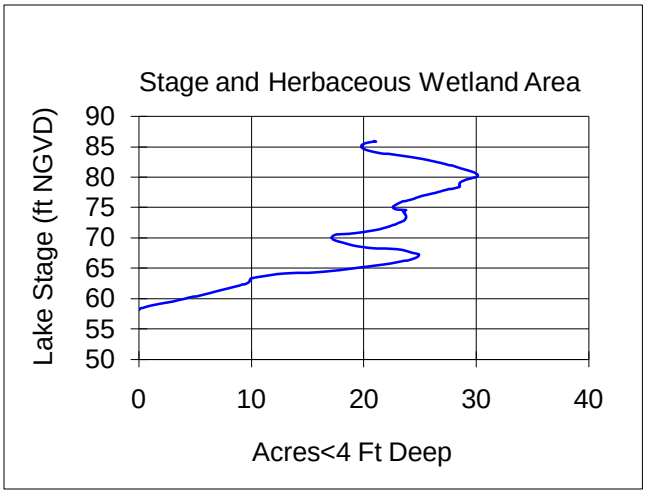


Figure 13. Potential herbaceous wetland area and area available for submersed macrophyte colonization in Lake Wimauma as a function of lake stage (water surface elevation).



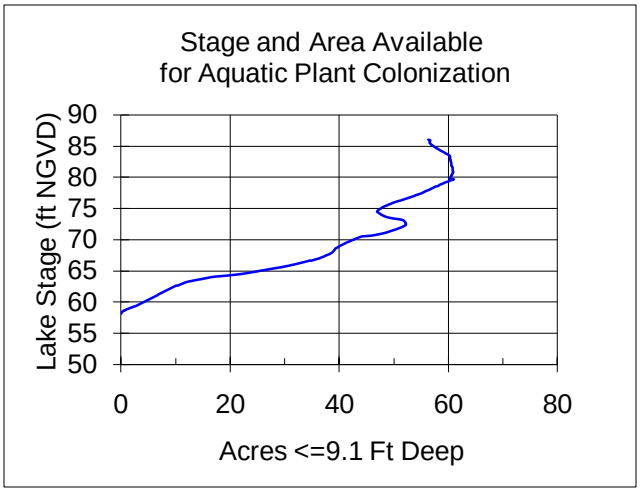
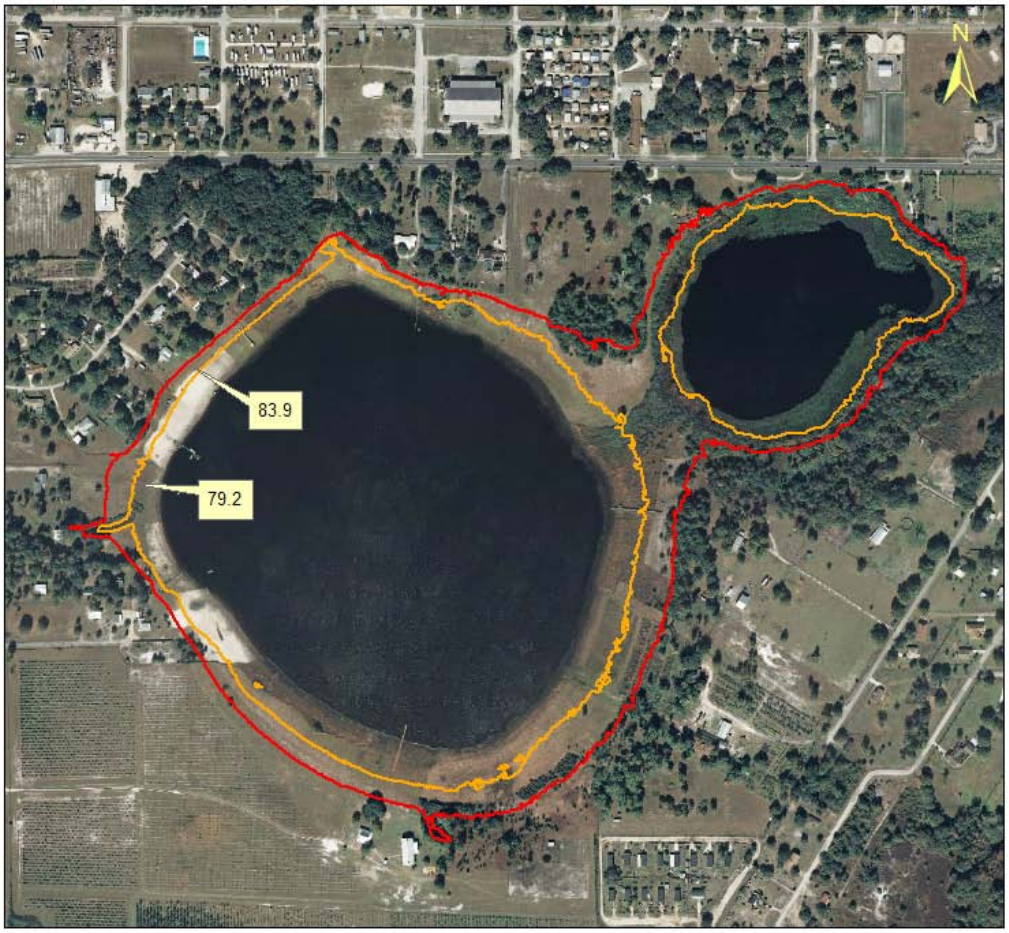


Figure 14. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma in Hillsborough County, during recent conditions shown within the 2010 aerial imagery. Based on gage readings the estimated lake stage was 75.06 NGVD 29 on the date of the imagery.



Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

High Minimum Lake Level (HMLL) - 83.9

0 135 270 540 810 1,080

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is true color digital ortho photography collected on January 02, 2010. The lake elevation based on gage readings was 75.06.

Figure 15. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma as associated with conditions observed in January 2005. Based on gage readings the estimated lake stage was 81.0 NGVD29.

Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

High Minimum Lake Level (HMLL) - 83.9

0 135 270 540 810 1,080

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is true color digital ortho photography collected in January 2005. The lake elevation based on gage readings was 81.06

Figure 16. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma as associated with conditions observed on 12/21/2003. Based on gage readings the estimated lake stage was 80.0 NGVD29.

Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

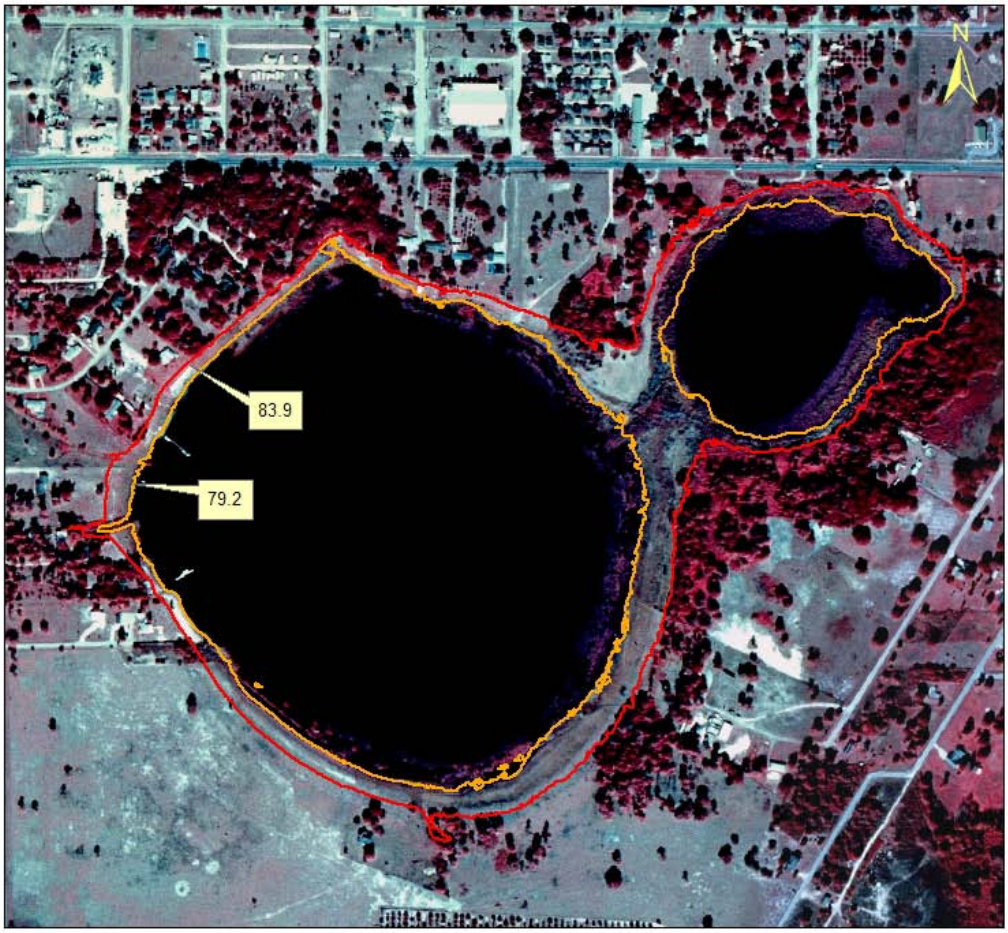
High Minimum Lake Level (HMLL) - 83.9

0 135 270 540 810 1,080

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is color infrared digital ortho photography collected on December 21, 2003. The lake elevation based on gage readings was 80.02

Figure 17. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma as associated with conditions observed on November 30, 1999. Based on gage readings the estimated elevation was 79.49 NGVD 29.



Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

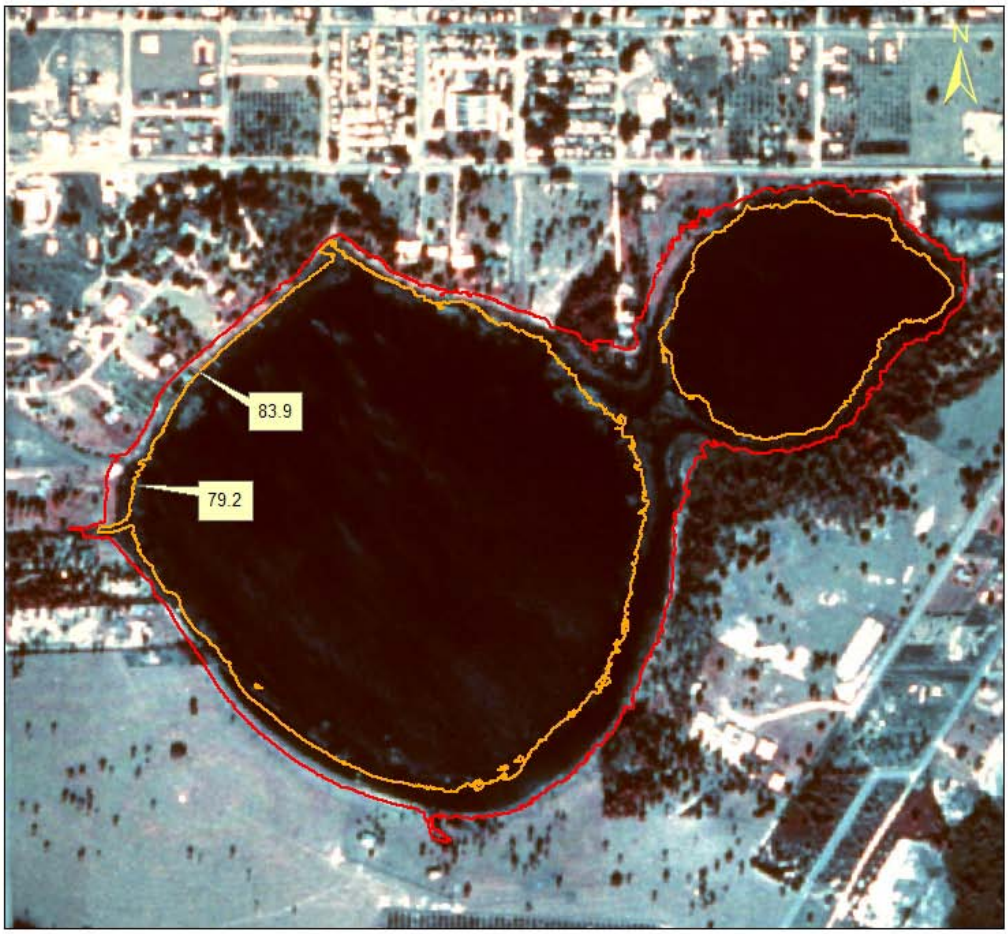
High Minimum Lake Level (HMLL) - 83.9

0 135 270 540 810 1,080

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is color infrared digital ortho photography collected on November 30, 1999. The lake elevation based on gage readings was 79.49

Figure 18. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma as associated with conditions observed in 1984.



Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

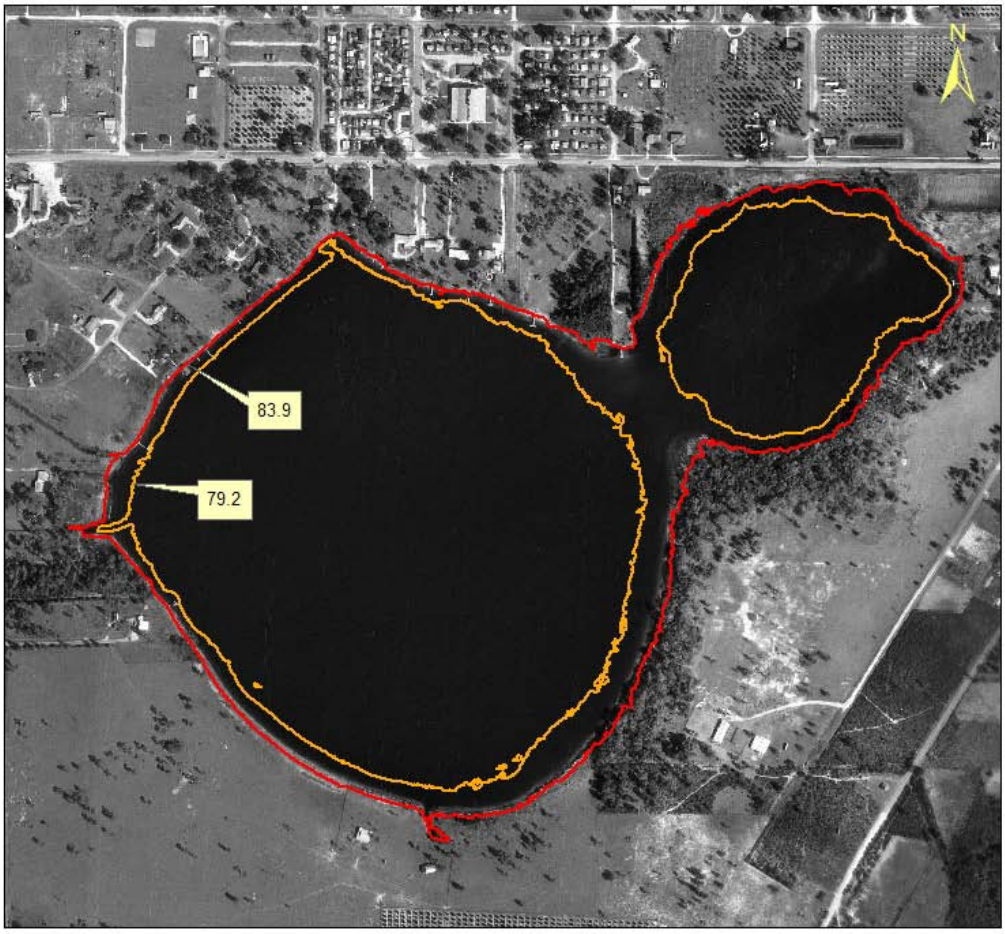
High Minimum Lake Level (HMLL) - 83.9

0 125 250 500 750 1,000

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is color infrared digital ortho photography collected in 1984.

Figure 19. Approximate location of the Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) for Lake Wimauma as associated with conditions observed in March 1970. Lake stage records are not available during this period; however, the estimated elevation was 82.5 to 83.0 NGVD 29 based on lake basin contours.



Legend

Lake Wimauma Minimum Levels

Elevation as NGVD 29

Minimum Lake Level (MLL) - 79.2

High Minimum Lake Level (HMLL) - 83.9

0 125 250 500 750 1,000

Feet

The red and orange contours shown depict the approximate level or stage of the lake that corresponds to Minimum Lake Level (79.2) and the High Minimum Lake Level (83.9). These lake basin contours were prepared using acombination of LiDAR data and spot elevation. LiDAR data was collected in early 2007 by Earth, LLC. Lake depth data were collected by the Hillsborough County Lake Management program in July 2000 and in June 2003 by SWFWMD staff. Background imagery is black and white photography collected in 1970.

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