

Minimum and Guidance Levels for Lake Allen in Hillsborough County, Florida



October 2005
Draft

Ecologic Evaluation Section
Resource Conservation and Development Department

Southwest Florida
Water Management District



Minimum and Guidance Levels for Lake Allen in Hillsborough County, Florida

October 2005
Draft

Ecologic Evaluation Section
Resource Conservation and Development Department
Southwest Florida Water Management District
Brooksville, Florida 34604-6899

The Southwest Florida Water Management District (District) does not discriminate upon the basis of any individual's disability status. This non-discriminatory policy involves every aspect of the District's functions, including one's access to, participation, employment, or treatment in its programs or activities. Anyone requiring accommodation as provided for in the American with Disabilities Act should contact (352) 796-7211 or 1-800-423-1476, extension 4215; TDD ONLY 1-800-231-6103; FAX (352) 754-6749.

On the cover: Aerial photograph of Lake Allen in 2004. Image is from United States Geological Survey digital orthophotography (USGS 2004).

Proposed Minimum and Guidance Levels for Lake Allen

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 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; and j) 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 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 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, lakeshore 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 lakeshore 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 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., proposed Minimum and Guidance Levels were developed for Lake Allen, a Category 1 Lake located in Hillsborough County, Florida. Levels were established using best available information, including data that were obtained specifically for the purpose of minimum levels development. The data and analyses used for development of the proposed levels are described in the remainder of this report.

Table 2. Proposed minimum and guidance levels for Lake Allen in Hillsborough County, Florida.

| Level | Elevation (feet above NGVD) |
|-------------------------------|--|
| Ten Year Flood Guidance Level | 63.1 |
| High Guidance Level | 61.8 |
| High Minimum Lake Level | 61.8 |
| Minimum Lake Level | 60.7 |
| Low Guidance Level | 59.7 |

Data and Analyses Supporting Proposed Minimum and Guidance Levels for Lake Allen

Lake Setting and Description

Lake Allen (Figure 1) is located in the Rocky/Brushy Creek watershed in the Northwest Hillsborough River Basin of the Southwest Florida Water Management District in Hillsborough County, Florida (Sections 3 and 10, Township 27 South, Range 18 East). White (1970) classified the area of west-central Florida containing Lake Allen as the Northern Gulf Coastal Lowlands physiographic region. Brooks (1981) characterized the area surrounding the lake as the Land-O-Lakes subdivision of the Tampa Plain in the Ocala Uplift Physiographic District, and described the subdivision as a region of many lakes on a moderately thick plain of silty sand overlying Tampa Limestone. As part of the Florida Department of Environmental Protection's Lake Bioassessment/Regionalization Initiative, the area has been identified as the Land-O-Lakes lake region, and described as an area of numerous neutral to slightly alkaline, low to moderate nutrient, clear-water lakes (Griffith *et al.* 1997).

Much of the shoreline of Lake Allen has been cleared for residential development (Figure 2; also refer to the cover of this report). Although most of the forested wetlands contiguous with the lake have been dredged or filled, an intact cypress (*Taxodium* sp.) dominated wetland remains along the north lakeshore. Other common hydrophytes include torpedograss (*Panicum repens*), cattail (*Typha* sp.), maidencaine (*Panicum hemitomom*), pennywort (*Hydrocotyle umbellata*), water primrose (*Ludwigia* sp.), and alligatorweed (*Alternanthera philoxeroides*). Public access to the shoreline is not available.

The drainage area for Lake Allen is 1.7 square miles (SWFWMD 1996). Inlets include a ditch/culvert system that drains from the Lake Thomas basin to the south, and a ditch/culvert system that connects the lake to a dredged wetland system to the west (Figure 2). Water may also enter Lake Allen along the north shore of the lake, through a canal that connects the lake with Lake Virginia. This canal may also serve as an outlet, with discharge from the lake ultimately flowing through Lake Virginia to a dredged wetland/pond system known locally as Sun Lake. Drainage from Lake Allen to the Sun Lake system also occurs through a ditch/culvert system located along the northwest shore of the lake. At higher lake stages, the canal connecting Lake Allen and Lake Virginia and another canal connecting Lake Virginia to Lake Harvey to the north, allow the three lakes surfaces to equalize. There are currently no District-permitted surface water withdrawals from Lake Allen, Lake Virginia or Lake Harvey.

The "Gazetteer of Florida Lakes" (Shafer *et al.* 1986) lists the lake area as 28 acres and also lists a water surface elevation of 65 feet. The 1943, 1974 and 1987 (photorevised) United States Geological Survey 1:24,000 Lutz quadrangle maps do not include an elevation for the lake surface. A topographic map of the Lake Allen basin that was generated to support of minimum levels development (Figure 4) indicates that the lake extends over 31 acres when the water surface is at 63 feet above NGVD.

Figure 1. Location of Lake Allen in Hillsborough County, Florida.

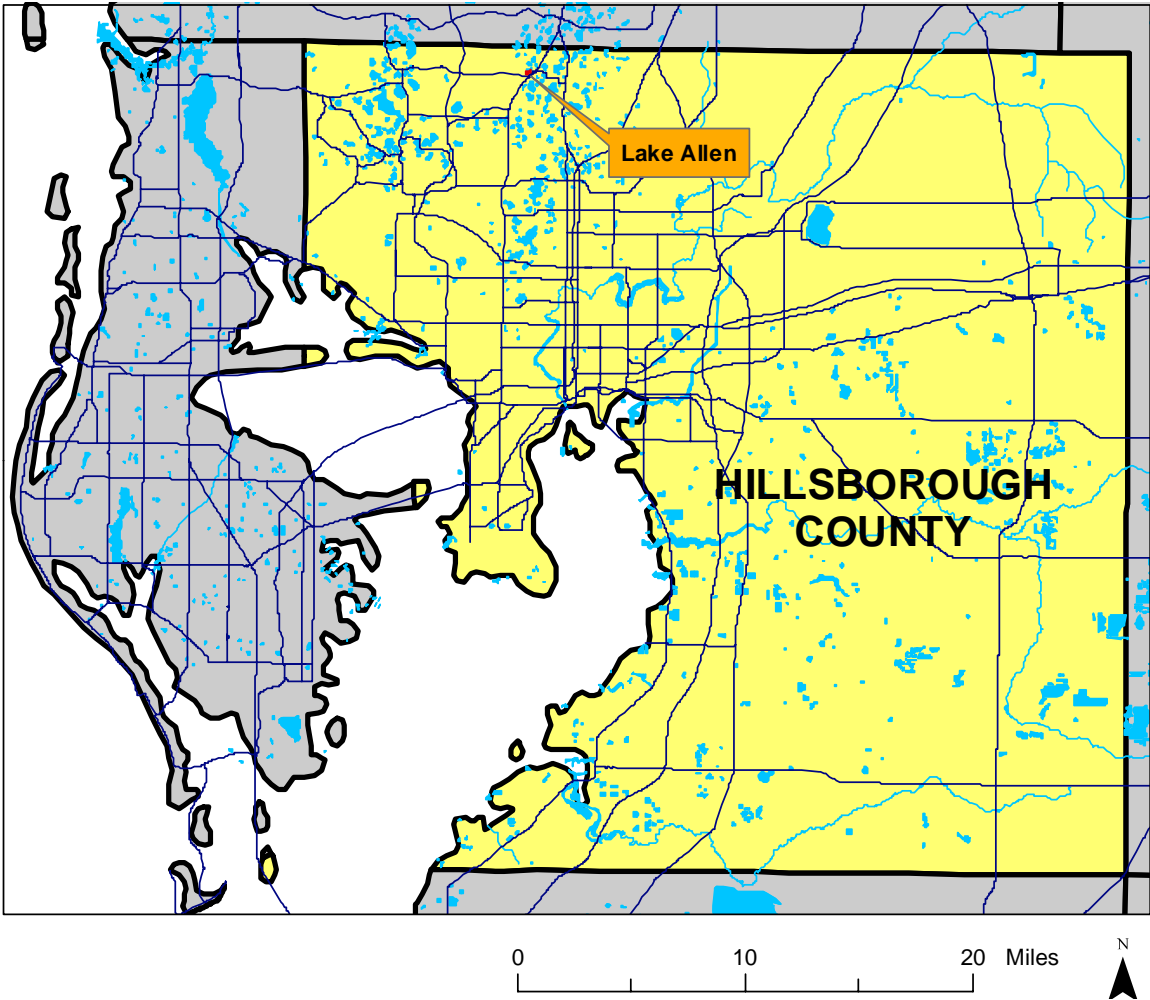
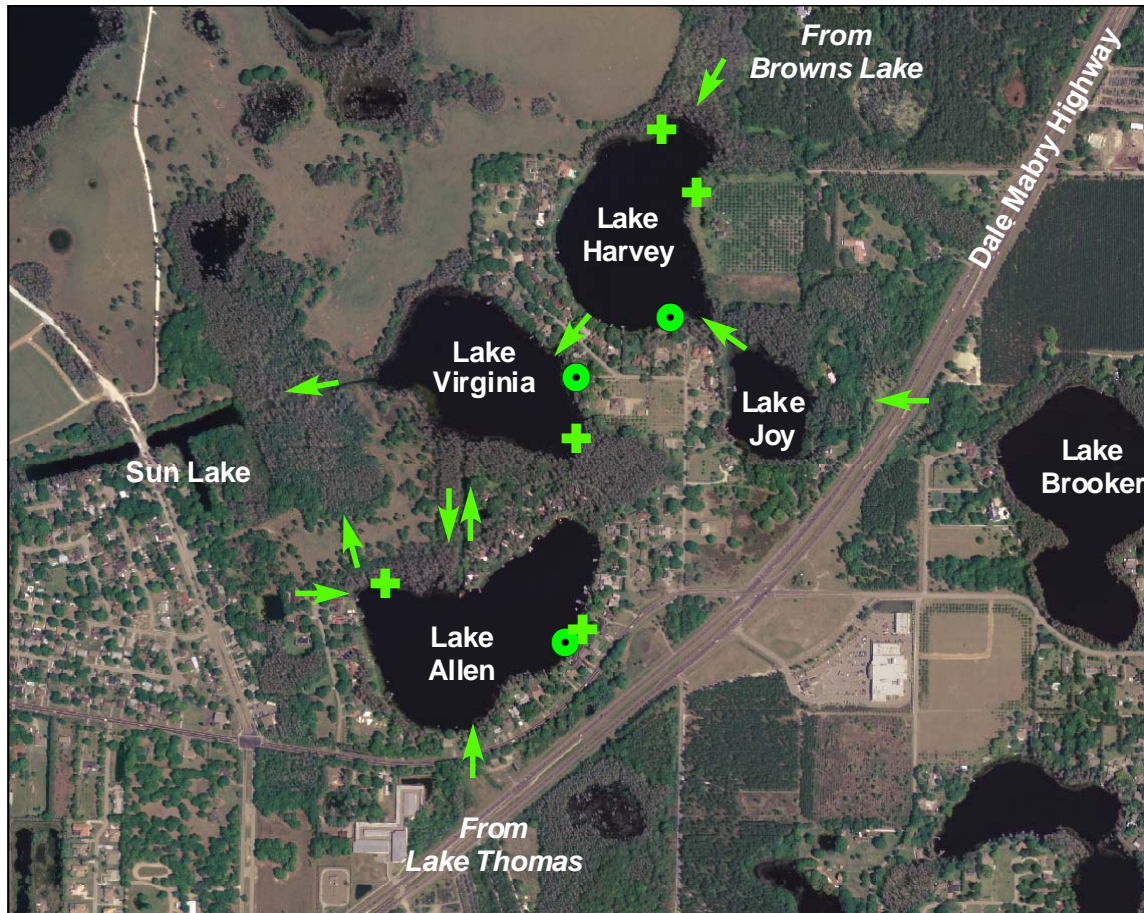





Figure 2. Location of District lake-level gauges, inlets, outlets and sites where hydrologic indicators were measured at Lakes Allen, Virginia and Harvey.



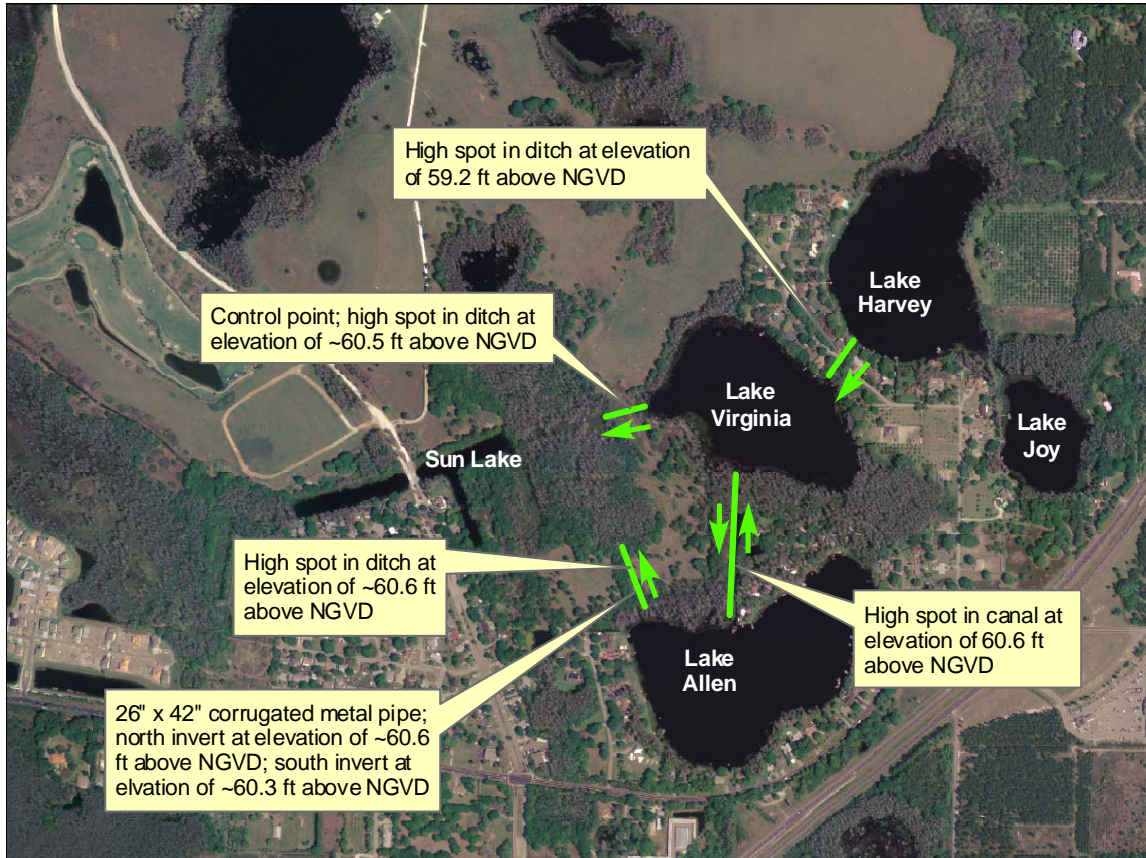
-  Lake gauges
-  Inlets/Outlets
-  Hydrologic Indicators

0 500 1,000 Feet



Map created October 11, 2005 using 2004 USGS Digital Orthophoto graphy.

Figure 3. Outlet conveyance system for Lake Allen. Ditched flow paths are shown as green lines; arrows indicate typical flow direction.

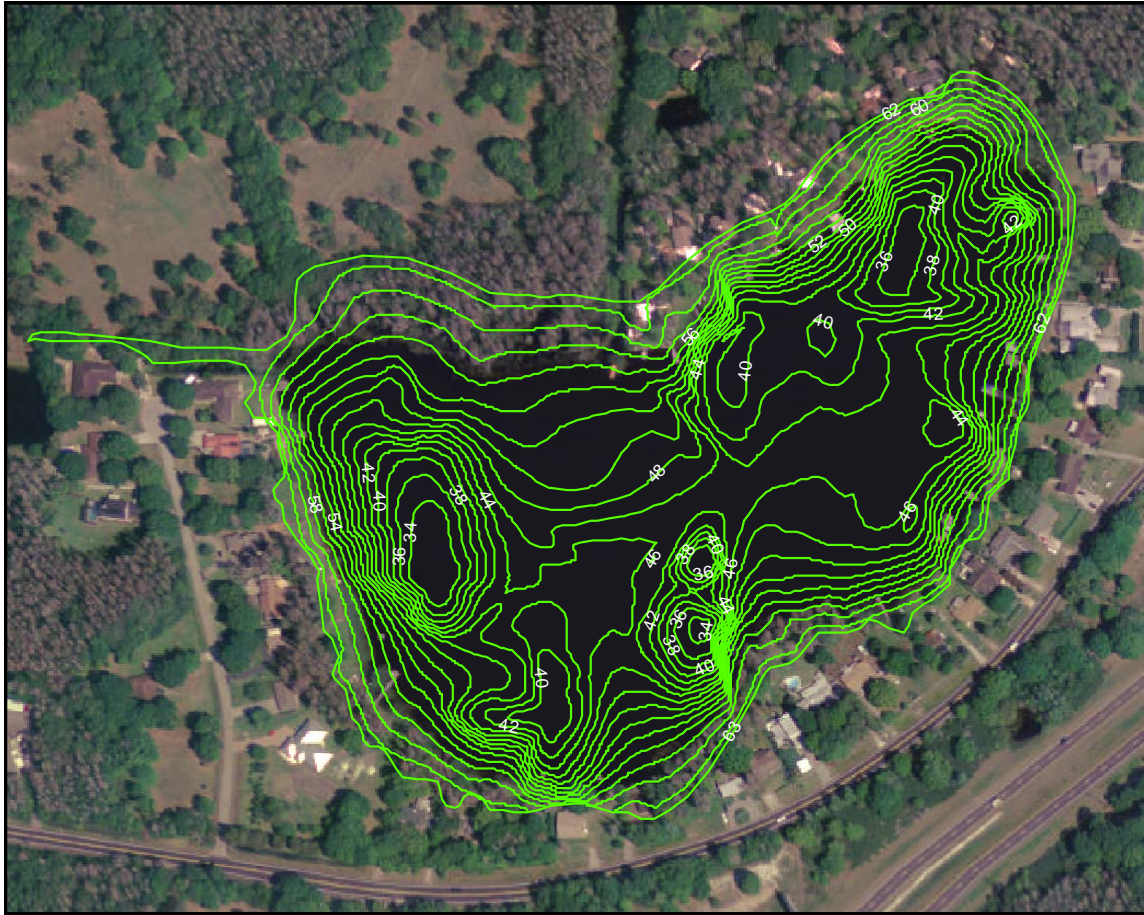


Map prepared October 11, 2005 using 2004 USGS Digital Orthophotography, elevation data collected in June 2003 by SWFWMD staff, and elevation data prepared in March 2004 by PBS&J for the Hillsborough County Public Works Department.

0 500 1,000 Feet

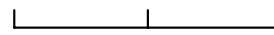


Figure 4. Two-foot contours within the Lake Allen basin. Values shown are elevations, expressed as feet above the National Geodetic Vertical Datum of 1929.



Map created July 18, 2005 using 2004 USGS digital orthophotography, elevation data from 1989 SWFWMD aerial photography with contours maps (Sheet Nos. 3-27-18 and 10-27-18), and elevation data collected by Hillsborough County Lake Management Program staff on June 25, 1998.

0 250 500 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 establishing 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 Allen in September 1980 (Table 2) and incorporated the levels into Chapter 40D-8, F.A.C. A Maximum Desirable Level of 62.25 feet above NGVD was also developed, but was not adopted by the Governing Board. The adopted Guidance Levels and the 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. Upon adoption by the District Governing Board, Minimum and Guidance Levels developed using current methods will replace the existing Guidance Levels.

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, the evaluation of stressed condition is conducted on a case-by-case basis. Lake Allen is not included on the current Stressed Lakes List (Gant *et al.* 2005), nor has it been previously classified as a stressed lake.

Table 2. Currently adopted guidance levels and associated surface areas for Lake Allen.

| Level | Elevation (feet above NGVD) | Lake Area (acres) |
|-------------------------------|--|------------------------------|
| Ten Year Flood Guidance Level | 62.60 | 30 |
| High Level | 62.50 | 30 |
| Low Level | 59.75 | 26 |
| Extreme Low Level | 57.50 | 24 |

Development of Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for Lake Allen using the methodology for Category 1 Lakes described in current District Rules (Chapter 40D-8, F.A.C.). Proposed levels and additional information are listed in Table 3, along with lake surface area values. Detailed descriptions of the development and use of these data are summarized in subsequent sections of this report.

Table 3. Proposed Minimum and Guidance Levels, lake stage percentiles, normal pool, control point elevation, Historic P50, significant change standards and associated surface areas for Lake Allen.

| Level or Feature | Elevation (feet above NGVD) | Lake Area (acres) |
|---|--------------------------------|----------------------|
| Lake Stage Percentiles | | |
| Current P10 | 61.8 | 29 |
| Current P50 | 60.5 | 27 |
| Current P90 | 57.9 | 24 |
| Other Levels | | |
| Normal Pool | 62.5 | 30 |
| Control Point | 60.6 | 27 |
| Guidance Levels and Historic P50 | | |
| Ten Year Flood Guidance Level | 63.1 | NA |
| High Guidance Level | 61.8 | 29 |
| Historic P50 | 60.8 | 28 |
| Low Guidance Level | 59.7 | 26 |
| Significant Change Standards | | |
| Cypress Standard | 60.7 | 27 |
| *Connectivity Standard | 63.7 | NA |
| *Dock-Use Standard | 60.0 | 27 |
| *Aesthetic Standard | 59.7 | 26 |
| *Species Richness Standard | 57.4 | 23 |
| *Recreation/Ski Standard | NA | NA |
| *Mixing Standard | NA | NA |
| Minimum Levels | | |
| High Minimum Lake Level | 61.8 | 29 |
| Minimum Lake Level | 60.7 | 27 |

NA = not available or not applicable

* = Developed for comparative purposes only; not used for minimum levels establishment

Lake Stage Data and Percentiles

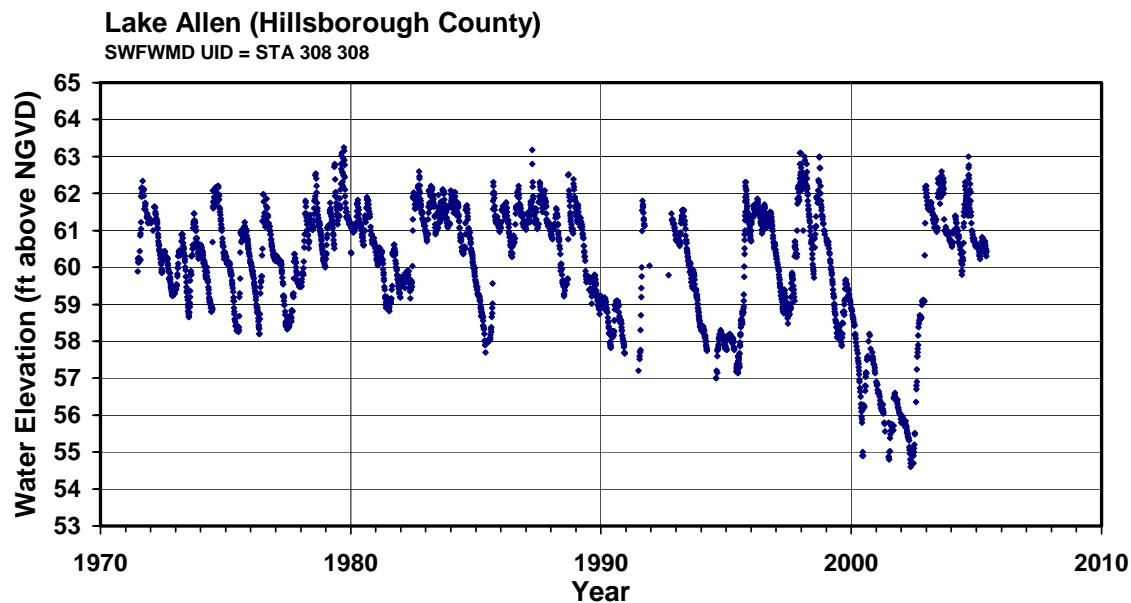
Lake stage data, *i.e.*, surface water elevations for Lake Allen (District Universal Identification Number STA 308 308) are available from the District's Water Management Data Base from June 1971 through the present date (Figure 6, see Figure 2 for current location of the District lake water level gauge in Lake Allen). The highest surface elevation for the lake included in the database, 63.24 feet above NGVD, occurred on September 25, 1979. The low of record, 54.60 feet above NGVD, was recorded on May 20, 2002.

For the purpose of minimum levels determination, lake stage data are categorized 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 (*i.e.*, the highest stable point along the outlet conveyance system of a lake), to the degree that water level fluctuations are affected. Lake stage data are categorized 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 stage and regional ground water fluctuations, hydrologic data collected prior to 1963 for many lakes in the vicinity of Lake Allen may be classified as Historic data, and data collected after 1973 may be classified as Current Data. Using these criteria, hydrologic data for Lake Allen that were collected from January 1974 through the present date were classified as Current data.

Monthly mean water surface elevations, based on Current data collected through May 2005, were used to calculate the Current P10, P50, and P90. The Current P10 elevation, the elevation the lake water surface equaled or exceeded ten percent of the time during the current period, was 61.78 feet above NGVD. The Current P50 elevation, the elevation the lake water surface equaled or exceeded fifty percent of the time during the current period, was 60.46 feet above NGVD. The Current P90 elevation, the elevation the lake water surface equaled or exceeded ninety percent of the time during the current period, was 57.94 feet above NGVD.

Figure 6. Surface water elevations of Lake Allen through May 2005.



Normal Pool, Control Point Elevation and Determination of Structural Alteration Status

The Normal Pool elevation, a reference elevation used for development of minimum lake and wetland levels, is established using elevation of Hydrologic Indicators of sustained inundation, including biological and physical features. Based on elevations associated with the buttressing of cypress (*Taxodium* sp.) trees along the shores of Lake Allen, Lake Virginia, and Lake Harvey (Table 4, Figure 2), the Normal Pool elevation was established at 62.5 feet above NGVD. Measurements for trees from the three lake basins were used to determine the Normal Pool elevation, because water levels in the basins are equalized by flow through the canals that interconnect the lakes.

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) that is the principal control of lake water level fluctuations. The control point elevation was established at 60.6 feet above NGVD, based on the ground elevation at high spots in the canal that convey flow from Lake Allen to Lake Virginia and in the ditch that conveys flow from Lake Allen to the Sun Lake wetland system (Figure 3). Based on the existence of these outlets, Lake Allen was classified as an open basin lake, *i.e.*, a system that is part of an ordered surface water conveyance system.

Structural alteration status is determined to support development of the High Guidance Level. Based on the existence of the ditch/culvert system that drains from the northwest

shore of the lake, the dredged canal connecting Lake Allen to Lake Virginia, and a Control Point elevation that is lower than the Normal Pool elevation, Lake Allen is considered to be structurally altered.

Table 4. Summary statistics for hydrologic indicator data (cypress buttress inflection points) used to establish the normal pool elevation for Lake Allen. Buttresses of trees along the shores of Lakes Allen, Virginia and Harvey were measured by SWFWMD staff in September 2002, July 2003 and August 2003.

| Statistic | Statistic Value (N) or Elevation (feet above NGVD) |
|---------------------------|---|
| N | 30 |
| Mean (Standard Deviation) | 62.5 (0.6) |
| Median | 62.5 |
| Minimum | 60.2 |
| Maximum | 64.2 |

Proposed Guidance Levels, the Historic P50 and Reference Lake Water Regime Statistics

The Ten Year Flood Guidance Level is provided as an advisory guideline for lakeshore development and 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 proposed Ten Year Flood Guidance Level for Lake Allen was established at 63.1 feet above NGVD using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, F.A.C). Although Lake Allen has outlets and was classified as an open basin lake, the closed-basin approach was considered appropriate because peak flood elevations within the basin are influenced more by long-term rainfall and evaporation patterns than single storm events. For the analysis, the long-term gauging record of Lake Allen was used to assess flooding potential. Flood frequency elevation estimates were based on probability analysis of annual peak stages recorded for a thirty-four year period between 1971 and 2004. The Ten Year Flood Guidance Level has been exceeded several times during the period for which lake stage data are available (Figure 6).

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 expected Historic P10 of the lake, and is established at the Historic P10, the Current P10, the control point, or the normal pool elevation. Because only Current data are available for Lake Allen and the

lake is structurally altered, the proposed High Guidance Level was established at 61.8 feet above NGVD, the higher of the Current P10 or Control Point elevations.

The Historic P50 elevation is the elevation that the lake surface is 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 statistics are necessary when adequate Historic or Current data are not available. Reference lake water regime statistics represent differences between P10, P50 and P90 elevations for typical, regional lakes that exhibit little or no impacts associated with water withdrawals (*i.e.*, reference lakes). The statistics include the RLWR50, RLWR90 and RLWR5090, which are, respectively, median differences between P10 and P50, P50 and P90, and P10 and P90 percentiles for the set of reference lakes. For the northern Tampa Bay area, RLWR50, RLWR90 and RLWR5090 statistics have been established at 1.0, 2.1 and 1.1 feet, respectively (SWFWMD 1999, Leeper *et. al* 2001).

Because Historic data are not available for Lake Allen, and the difference between the Current P10 and Current P50 (1.3 feet) is greater than the northern Tampa Bay area RLWR50 (1.0 feet), the Historic P50 was established at 60.8 feet above NGVD by subtracting the RLWR50 from the High Guidance Level (61.8 feet above NGVD).

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, and is established using Historic or Current data and, in some cases, reference lake water regime statistics. Because Historic data are not available for Lake Allen and the difference between the Current P10 and Current P90 (3.8 feet) exceeds the northern Tampa Bay RLWR90 (2.1 feet), the proposed Low Guidance Level was established at 59.7 feet above NGVD by subtracting the RLWR90 from the High Guidance Level.

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 the 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-dominated wetlands less than 0.5 acres in size are classified as Category 3 lakes.

Based on the occurrence of lake-fringing cypress wetlands within the basin, and a 1.7 foot difference between the Normal Pool elevation (62.5 feet above NGVD) and the Historic P50 (60.8 feet above NGVD), Lake Allen was classified as a Category 1 lake.

Significant Change Standards and Other Information for Consideration

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

For Category 1 or 2 lakes, a significant change standard is established at the elevation 1.8 feet below the Normal Pool elevation. This standard, referred to in this report as the Cypress Standard, is used to identify a desired median lake stage that may be expected to preserve the ecological integrity of lake-fringing cypress wetlands. For Lake Allen, the Cypress Standard was established at 60.7 feet above NGVD.

For Category 3 lakes, six significant change standards are developed, including a Basin Connectivity Standard, a Dock-Use Standard, an Aesthetics Standard, a Species Richness Standard, a Recreation/Ski Standard, and a Lake Mixing Standard. Potential changes in the coverage of herbaceous wetland vegetation and aquatic plants associated with use of standards for development of Minimum Levels for Category 3 lakes is also taken into consideration. Although Lake Allen is a Category 1 Lake, Category 3 standards were developed for comparative purposes, but were not used to establish proposed Minimum Levels.

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 sub-basins, sufficient water depths 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. The Basin Connectivity Standard for Lake Allen was established at 63.7 feet above NGVD, based on the elevation that ensures connectivity between Lake Allen and Lake Virginia (60.6 feet above NGVD), a two-foot water depth for movement of biota and watercraft, and the Northern Tampa Bay area RLWR5090 (1.1 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 for boat mooring, and use of Historic lake stage data or region-specific reference lake water regime statistics. The Dock-Use Standard for Lake Allen was established at 60.0 feet above NGVD, based on the elevation of sediments at the end of ninety percent of the 23 docks at the lake (56.9 feet above NGVD, Table 5), a two-foot water depth based on use of powerboats in the lake, and the northern Tampa Bay area RLWR5090 (1.1 feet).

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 degrading below the values associated with the lake when it is staged at the Low Guidance Level. For Lake Allen, the Aesthetic Standard was established at the Low Guidance Level, 59.7 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 a lake, the standard is established at the lowest elevation associated with less than a fifteen percent reduction in lake surface area relative to the lake area at the Historic P50 elevation. For Lake Allen, the Species Richness Standard was established at 57.4 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 ski area with a width of 200 feet and a length of 2,000 feet, and use of Historic lake stage data or region-specific reference lake water regime statistics. Meeting these criteria would require that the lake be staged higher than 66.1 feet above NGVD. Based on the morphology of the Lake Allen basin, development of Recreation/Ski Standard would, therefore, not be appropriate.

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 stage of Lake Allen changes from approximately 32 to 63 feet above NGVD (Figure 7), a Mixing Standard was not developed for the lake.

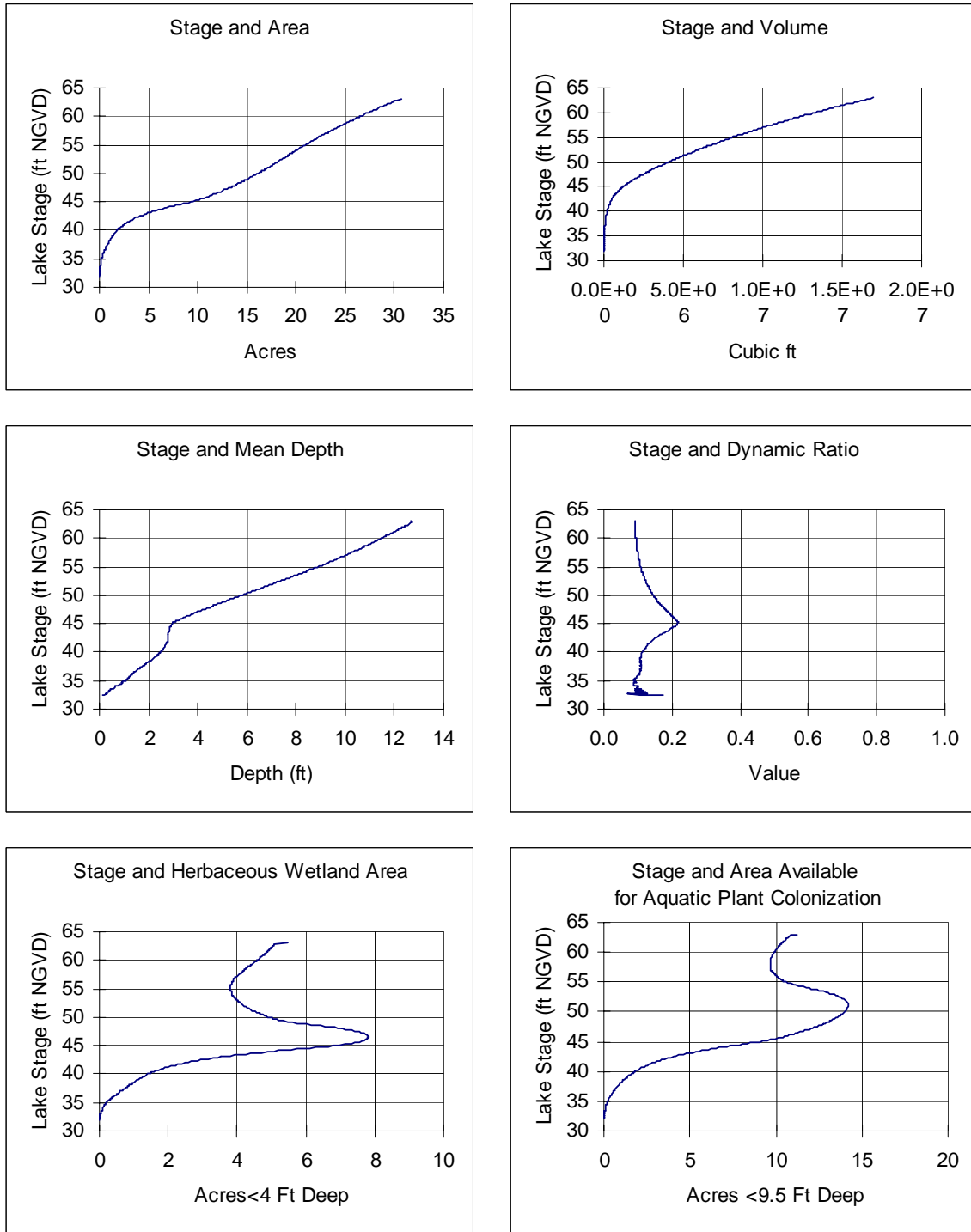
Herbaceous Wetland Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in potential wetland area within the lake basin (*i.e.*, basin area with a water depth of four or less feet). Review of changes in potential herbaceous wetland area in relation to change in lake stage did not indicate that use of the applicable significant change standards would be inappropriate for establishment of the Minimum Lake Level (Figure 7).

Submersed Aquatic Macrophyte Information is taken into consideration to determine the elevation at which change in lake stage would result in substantial change in the area available for colonization by submersed aquatic plants. Review of changes in potential submersed macrophyte coverage in relation to change in lake stage did not indicate that use of the applicable significant change standards would be inappropriate for establishment of the Minimum Lake Level (Figure 7).

Table 5. Summary statistics for elevations associated with docks at Lake Allen, based on data collected by District staff in September 2002. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

| Statistic | Statistic Value (N) or Elevation (feet above NGVD) of Sediments at the Waterward End of Docks | Statistic Value (N) or Elevation (feet above NGVD) of Dock Platform |
|---------------------------|--|--|
| N | 23 | 23 |
| Mean (Standard Deviation) | 55.7 (1.3) | 63.1 (0.5) |
| P10 | 56.9 | 63.7 |
| P50 | 55.6 | 63.2 |
| P90 | 54.7 | 62.6 |
| Maximum | 58.1 | 63.8 |
| Minimum | 51.7 | 62.0 |

Figure 7. Surface area, volume, mean depth, dynamic ratio (basin slope), potential herbaceous wetland area, and area available for colonization by aquatic macrophytes versus lake stage for Lake Allen.



Proposed Minimum Levels

The High Minimum Lake Level and the Minimum Lake Level are developed using lake-specific significant change standards and other available information, 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, irrigation); surrounding land-uses; socio-economic effects; and public health, safety and welfare matters. Minimum Level 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 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 1 Lakes, the Minimum Level is established at an elevation 1.8 feet below the Normal Pool elevation, *i.e.*, at the Cypress Standard elevation. For Lake Allen, the proposed Minimum Lake Level was established at 60.7 feet above NGVD.

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. For Category 1 lakes, the High Minimum Lake Level is established at an elevation 0.4 feet below the Normal Pool elevation. For Lake Allen, the High Minimum Lake level would, therefore, be established at 62.1 feet above NGVD.

Elevations of various man-made features within the Lake Allen, Virginia and Harvey basins were evaluated to determine the potential for flooding when water levels in the lakes equal or exceed 62.1 feet above NGVD. Based on review of 1983 one-foot contour interval aerial maps for the region and field survey data collected in 2003 and 2004, it was determined that the lowest floor slab in the Lake Allen basin occurs at 63.1 feet above NGVD (Table 6). It was also determined that a portion of the road located between Lake Virginia and Lake Allen is at an elevation of 62.3 feet above NGVD, only 0.2 feet above the potential High Minimum Lake Level. Hillsborough County Department of Public Works staff note that flooding complaints have been received from residents living along the shore of Lake Allen when the lake is staged above 62.0 feet above NGVD.

Based on potential flooding associated with the staging of Lake Harvey, Allen and Virginia at a High Minimum Lake Level of 62.1 feet above NGVD and consideration of structural alterations to the lake system outlets, an alternate High Minimum Lake Level was developed. The alternate, proposed High Minimum Lake Level was established at 61.8 feet above NGVD, an elevation corresponding to the proposed High Guidance Level. This alternative level would be expected to mitigate flooding potential expected when the lake stages above 62 feet above NGVD and maintain the health of cypress-dominated wetlands within the system. Mean monthly water surface elevations and the proposed Minimum and Guidance Levels for Lake Allen are shown in Figure 8.

The approximate locations of the proposed Minimum Lake Level and High Minimum Lake Level in the Lake Allen basin are shown in Figure 9.

Table 6. Elevations of selected features in the basins of Lakes Harvey, Virginia and Allen.

| Features (Lake Basin) | Elevation (feet above NGVD) |
|--|-----------------------------|
| Low Floor Slab (Lake Harvey basin) | 64.1 |
| Low Floor Slab (Lake Allen basin) | 63.1 |
| Low Swimming Pool slab (Lake Harvey basin) | 64.4 |
| Low Road (Lake Harvey basin) | 65.5 |
| Low Road (Lake Allen basin) | 62.3 |

Figure 8. Mean monthly surface water elevations through June 2005 and proposed guidance and minimum levels for Lake Allen. Proposed 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.

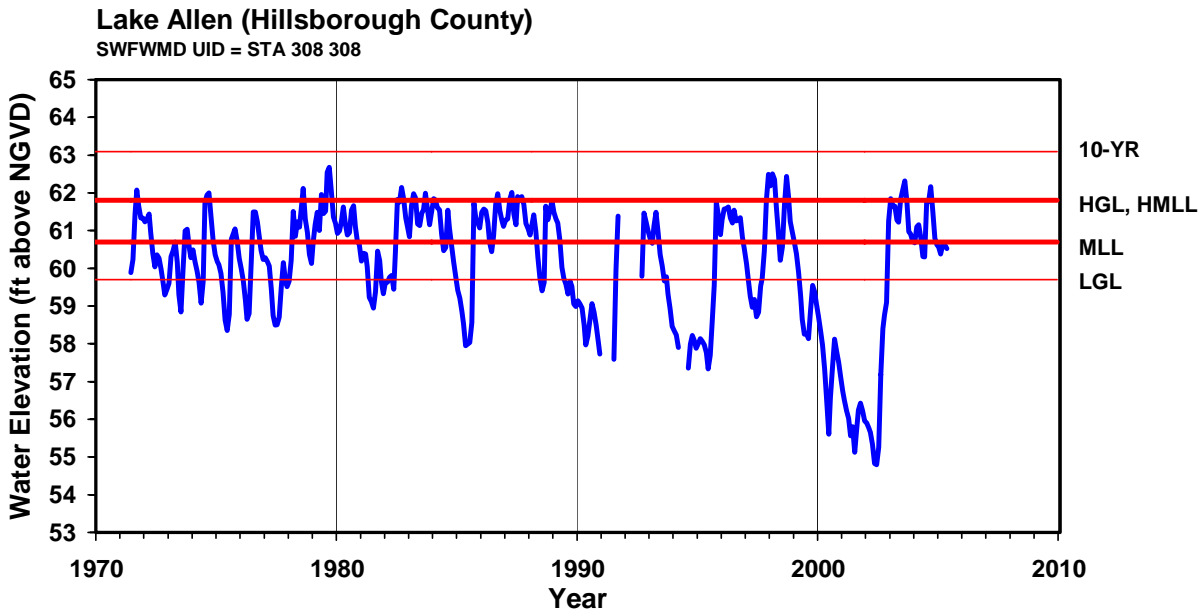
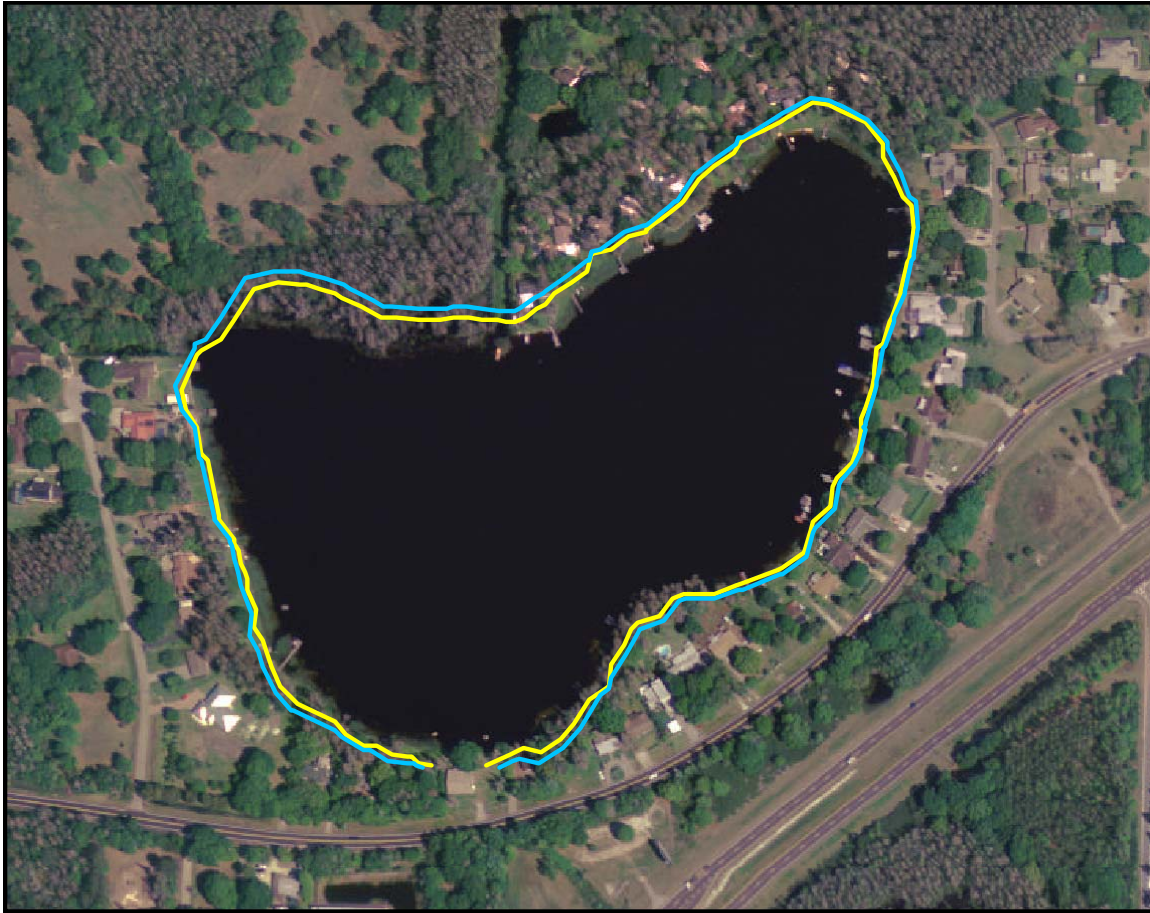


Figure 9. Approximate location of the proposed Minimum Lake Level (MLL) and High Minimum Lake Level (HMLL) within the Lake Allen basin.



Minimum Level Contours

- MLL = 60.7 ft above NGVD
- HMLL = 61.8 ft above NGVD

Map created October 11, 2005 using 2004 USGS digital orthophotography, elevation data from 1989 SWFWMD aerial photography with contours maps (Sheet Nos. 3-27-18 and 10-27-18), and elevation data collected by Hillsborough County Lake Management Program staff on June 25, 1998.

0 250 500 Feet



Comparison of Proposed Minimum Levels to Long-Term Percent Exceedance Statistics

The Minimum Lake Level is the elevation that the lake's water levels are required to equal or exceed fifty percent of the time on a long-term basis. For the last six long-term (ten-year) periods, water surface elevations equaled or exceeded fifty percent of the time (P50) in the Lake Allen basin have been below the proposed Minimum Lake Level (Table 7).

Table 7. Comparisons between the water surface elevations equaled or exceeded fifty percent of the time (P50) over the last six 10-year periods and the proposed Minimum Lake Level (MLL) for Lake Allen.

| Ten-year Period | MLL Equaled or Exceeded by Ten-Year P50? | Feet P50 is above (+) or below (-) MLL |
|------------------------------------|--|--|
| January 1995 through December 2004 | No | -1.0 |
| January 1994 through December 2003 | No | -1.7 |
| January 1993 through December 2002 | No | -1.8 |
| January 1992 through December 2001 | No | -1.4 |
| January 1991 through December 2000 | No | -1.0 |
| January 1990 through December 1999 | No | -1.0 |

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. For the last two long-term (ten-year) periods, water surface elevations equaled or exceeded ten percent of the time (P10) in the Lake Allen basin have been at the proposed High Minimum Lake Level (Table 8). For the preceding four long-term periods, however, water surface elevations equaled or exceeded ten percent of the time (P10) were below the proposed High Minimum Lake Level.

Table 8. Comparisons between the water surface elevations equaled or exceeded ten percent of the time (P10) over the last six 10-year periods and the proposed High Minimum Lake Level (HMLL) for Lake Allen.

| Ten-year Period | HMLL Equaled or Exceeded by Ten Year P10? | Feet P10 is above (+) or below (-) HMLL |
|------------------------------------|---|---|
| January 1995 through December 2004 | Yes | 0 |
| January 1994 through December 2003 | Yes | 0 |
| January 1993 through December 2002 | No | -0.2 |
| January 1992 through December 2001 | No | -0.2 |
| January 1991 through December 2000 | No | -0.2 |
| January 1990 through December 1999 | No | -0.2 |

Documents Cited and Reviewed for Development of Proposed Guidance and Minimum Levels

- Bachmann, R. W., Hoyer, M. V., and Canfield, D. E., Jr. 2000. The potential for wave disturbance in shallow Florida lakes. *Lake and Reservoir Management* 16: 281-291.
- Boger, D. 2003. Letter to Mr. Bernardo Garcia, Hillsborough County Public Works Department, dated July 3, 2003. Subject: high water at Lake Allen.
- Brooks, H. K. 1981. Physiographic divisions of Florida: map and guide. Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.
- Dierberg, F. E. and Wagner, K. J. 2001. A review of "A multiple-parameter approach for establishing minimum levels for Category 3 Lakes of the Southwest Florida Water Management District" June 2001 draft by D. Leeper, M. Kelly, A. Munson, and R. Gant. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.
- Florida Board of Conservation. 1969. Florida lakes, part III: gazetteer. Division of Water Resources. Tallahassee, Florida.
- Florida Department of Agriculture and Consumer Services. 1938. Aerial photography of Sections 2, 3, 20 and 11, Township 27 S, Range 18 E, dated November 21, 1938. Tallahassee, Florida.
- Florida Lakewatch. 2001. Florida Lakewatch data report 2000. Department of Fisheries and Aquatic Sciences, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida.
- Garcia, B. 1998. Letter to Mr. George Boger, dated October 7, 1998. Subject: flooding caused by blockage at Lake Allen, Administrative Referral No. 49352. Hillsborough County Public Works Department, Tampa, Florida.
- Griffith, G., Canfield, D., Jr., Horsburgh, C., Omernik, and J. Azevedo, S. 1997. Lake regions of Florida (map). United States Environmental Protection Agency, University of Florida Institute of Food and Agricultural Sciences, Florida Lakewatch, Florida Department of Environmental Protection, and the Florida Lake Management Society. Gainesville and Tallahassee, Florida.
- Hillsborough County and the Florida Center for Community Design and Research. 1998. Lake assessment document: Lake Allen. Tampa, Florida.
- Hillsborough County and the Florida Center for Community Design and Research. 1998. Lake assessment document: Lake Harvey. Tampa, Florida.

Hillsborough County and the Florida Center for Community Design and Research. 1998. Lake assessment document: Lake Virginia. Tampa, Florida.

Hillsborough County Department of Public Works, Engineering Division. 2004. Plans for proposed Lake Virginia and Lake Allen stormwater improvements, Sections 3 & 10, Township 27 S., Range 18 E. Prepared by PBS&J. Tampa, Florida.

Leeper, D., Kelly, M., Munson, A. and Gant, R. 2001. A multiple-parameter approach for establishing minimum levels for Category 3 Lakes of the Southwest Florida Water Management District, June 14, 2001 draft. Southwest Florida Water Management District. Brooksville, Florida.

Murphy, W. R., Jr., Evans, R. P., and Whalen, J. K. 1984. Flooding in northwestern Hillsborough and southern Pasco Counties, Florida, in 1979. Open-File Report 82-96. U.S. Geological Survey in cooperation with the Southwest Florida Water Management District, Tallahassee, Florida.

Shafer, M. D., Dickinson, R. E., Heaney, J. P., and Huber, W. C. 1986. Gazetteer of Florida lakes. Publication no. 96, Water Resources Research Center, University of Florida. Gainesville, Florida.

Southwest Florida Water Management District. 1981. An evaluation of lake regulatory stage levels on selected lakes in the Northwest Hillsborough Basin. Brooksville, Florida.

Southwest Florida Water Management District. 1989. Northwest Hillsborough Basin, Northwest re-map II, aerial photography with contours. Sheet No. 02-27-18. Brooksville, Florida. Prepared by Kucera International Photogrammetric Consultants, Lakeland, Florida.

Southwest Florida Water Management District. 1989. Northwest Hillsborough Basin, Northwest re-map II, aerial photography with contours. Sheet No. 3-27-18. Brooksville, Florida. Prepared by Kucera International Photogrammetric Consultants, Lakeland, Florida.

Southwest Florida Water Management District. 1989. Northwest Hillsborough Basin, Northwest re-map II, aerial photography with contours. Sheet No. 10-27-18. Brooksville, Florida. Prepared by Kucera International Photogrammetric Consultants, Lakeland, Florida.

Southwest Florida Water Management District. 1996. Lake Levels Program lake data sheets / 1977-1996, NW Hillsborough Basin – 14. Brooksville, Florida.

Southwest Florida Water Management District. 1999. Establishment of minimum levels for Category 1 and Category 2 lakes, *in* Northern Tampa Bay minimum flows and levels white papers: white papers supporting the establishment of minimum flows and levels for isolated cypress wetlands, Category 1 and 2 lakes, seawater intrusion,

environmental aquifer levels, and Tampa Bypass Canal; peer-review final draft, March 19, 1999. Brooksville, Florida.

Southwest Florida Water Management District. 2003. Survey Section Field Book 14/98, pages 1-9 and 11-46. Brooksville, Florida.

Southwest Florida Water Management District. 2005. Surveyor's report. Lake level data for the establishment of minimum flows and levels – Lake Allen – Hillsborough County, Florida. Brooksville, Florida.

Southwest Florida Water Management District. 2005. Surveyor's report. Lake level data for the establishment of minimum flows and levels – Lake Harvey – Hillsborough County, Florida. Brooksville, Florida.

United States Geological Survey. 1943. Lutz quadrangle, Florida, 7.5 minute series (topographic) map; Lutz, Fla., N2807.5-W8222.5/7.5, 1943. Department of Interior. Washington, D.C.

United States Geological Survey. 1974. Lutz quadrangle, Florida, 7.5 minute series (topographic) map; Lutz, Fla., N2807.5-W8222.5/7.5, 1974, AMS 4540 III NW Series, V847. Department of Interior. Washington, D.C.

United States Geological Survey. 1987. Lutz quadrangle, Florida, 7.5 minute series (topographic) map; Lutz, Fla., 28082-B4-TF-024, 1974, photorevised 1987, DMA 4540 III NW-Series V847. Department of Interior. Washington, D.C.

United States Geological Survey (USGS). 1995. 1995 USGS Digital Orthophoto Quarter Quadrangles. United States Department of the Interior Geological Survey. Washington, D.C. Available from the Southwest Florida Water Management District GIS and Mapping Section. Brooksville, Florida.

United States Geological Survey (USGS). 1999. 1999 USGS Digital Orthophoto Quarter Quadrangles. United States Department of the Interior Geological Survey. Washington, D.C. Available from the Southwest Florida Water Management District GIS and Mapping Section. Brooksville, Florida.

United States Geological Survey (USGS). 2004. 2004 Digital Orthophotographs Natural Color – Preliminary. United States Department of the Interior Geological Survey. Reston, Virginia. Prepared by EarthData International. Available from the Southwest Florida Water Management District GIS and Mapping Section. Brooksville, Florida.

White, W. A. 1970. The geomorphology of the Florida peninsula. Geological Bulletin, No. 51. Bureau of Geology, Florida Department of Natural Resources. Tallahassee, Florida.

Wise, G. 2003. Memorandum to Dan Putnam, dated December 12, 2003, regarding SWFWMD Coordination Meeting-Lake Allen/Lake Virginia Project. PBS&J. Tampa, Florida.

Wise, G. 2004. Letter and survey data provided to Doug Leeper, dated February 4, 2004, regarding Lake Allen and Lake Virginia outfall structure improvements, Hillsborough County Stormwater Management Department, CIP Project No. 41091. PBS&J. Tampa, Florida.