**January 8, 2004**

**MEMORANDUM**

**TO:** **File**

**FROM:** **Doug Leeper, Senior Environmental Scientist**
**Resource Conservation and Development Department**
**Southwest Florida Water Management District**

**SUBJECT:** **Proposed minimum and guidance levels for Mountain Lake in Hernando County, Florida**

# Mountain Lake

## *General Description*

Mountain Lake (Figure 1) is located in the Withlacoochee River Basin in Hernando County, Florida (Sections 16 and 21, Township 23S, Range 20E). The area surrounding the lake is categorized as the Dade City Hills subdivision of the Ocala Uplift Physiographic District. The subdivision has been characterized as a "spectacular ridge of high hills dissected from Upper Miocene sand and silty sand" (Brooks 1981). As part of the Florida Department of Environmental Protection's Lake Bioassessment/ Regionalization Initiative, the area has been identified as the Southern Brooksville Ridge lake region, and described as an area of thick sand hills overlying limestone, with slightly colored, mostly neutral to alkaline (some are acidic), mesotrophic or meso-eutrophic lakes (Griffith *et al.* 1997).

The lake basin (Figure 2) has been highly modified, with upland areas used for residential development, citrus production and livestock grazing. Natural vegetation remains intact along much of the lake shoreline. A public boat ramp along the north shore of the lake is maintained by the Hernando County Government.

Mountain Lake receives inflow from an unnamed lake located about 0.5 miles to northeast of the lake. A ditch and culvert system, initiating along the lakes west shore, connects Mountain Lake to Neff Lake when the stage of Mountain Lake exceeds 102.54 ft above the National Geodetic Vertical Datum of 1929 (NGVD). Neff Lake has no outlet, however, so water does not drain from Mountain Lake when Neff Lake is staged at high levels. There are no surface water withdrawals from the lake currently permitted by the District. There are, however, a few permitted groundwater withdrawals in the area.

The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 127 acres and an elevation of 105 ft above NGVD. The 1954 (photorevised 1988) United States Geological Survey 1:24,000 Spring Lake, Fla. quadrangle map does not provide a surface water elevation for the lake. The 105 ft elevation listed in the "Gazetteer of Florida Lakes" corresponds to a lake surface area of 160 acres, based on a topographic map of the basin generated in support of minimum levels development (Figure 3). Data used for production of the topographic map were obtained from field surveys conducted in February 2003 and 1:200 aerial photograph maps containing one-foot contour lines prepared using photogrammetric methods.

**Figure 1. Location of Mountain Lake in Hernando County, Florida.**

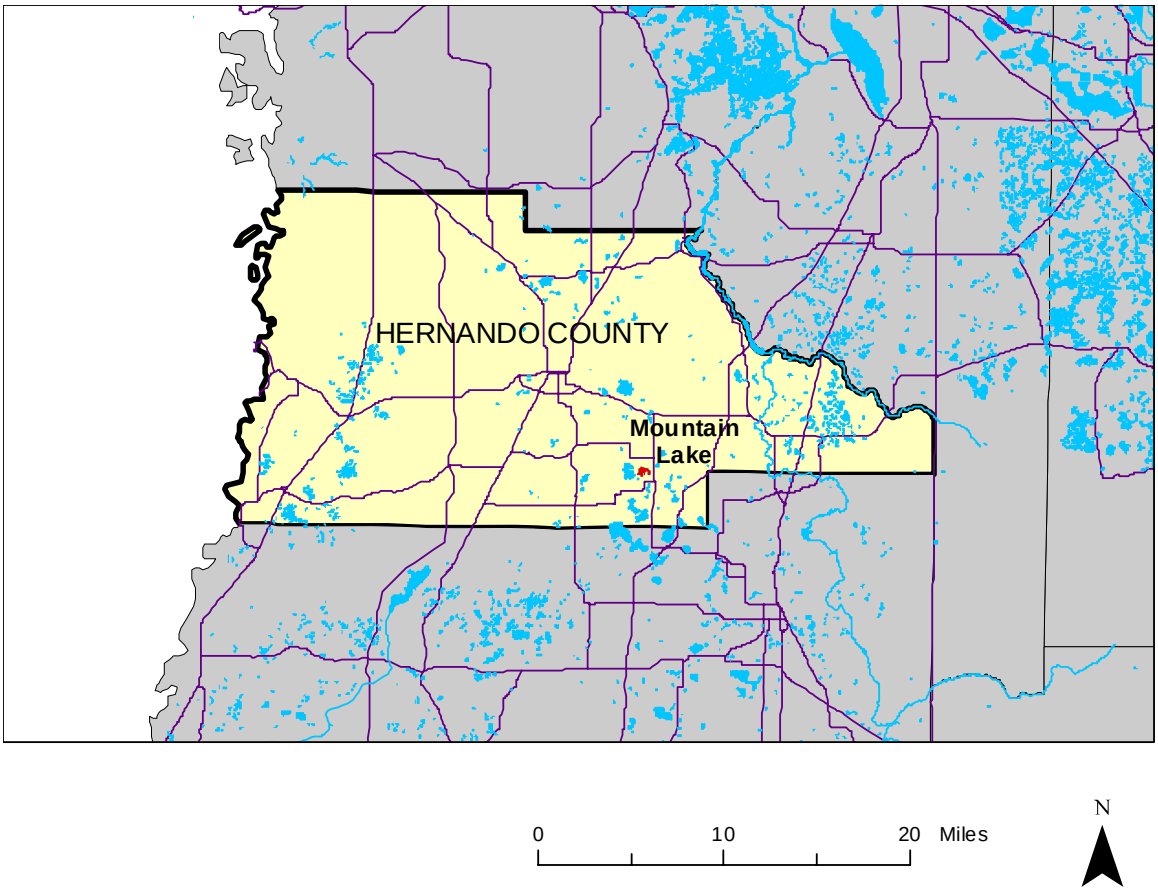
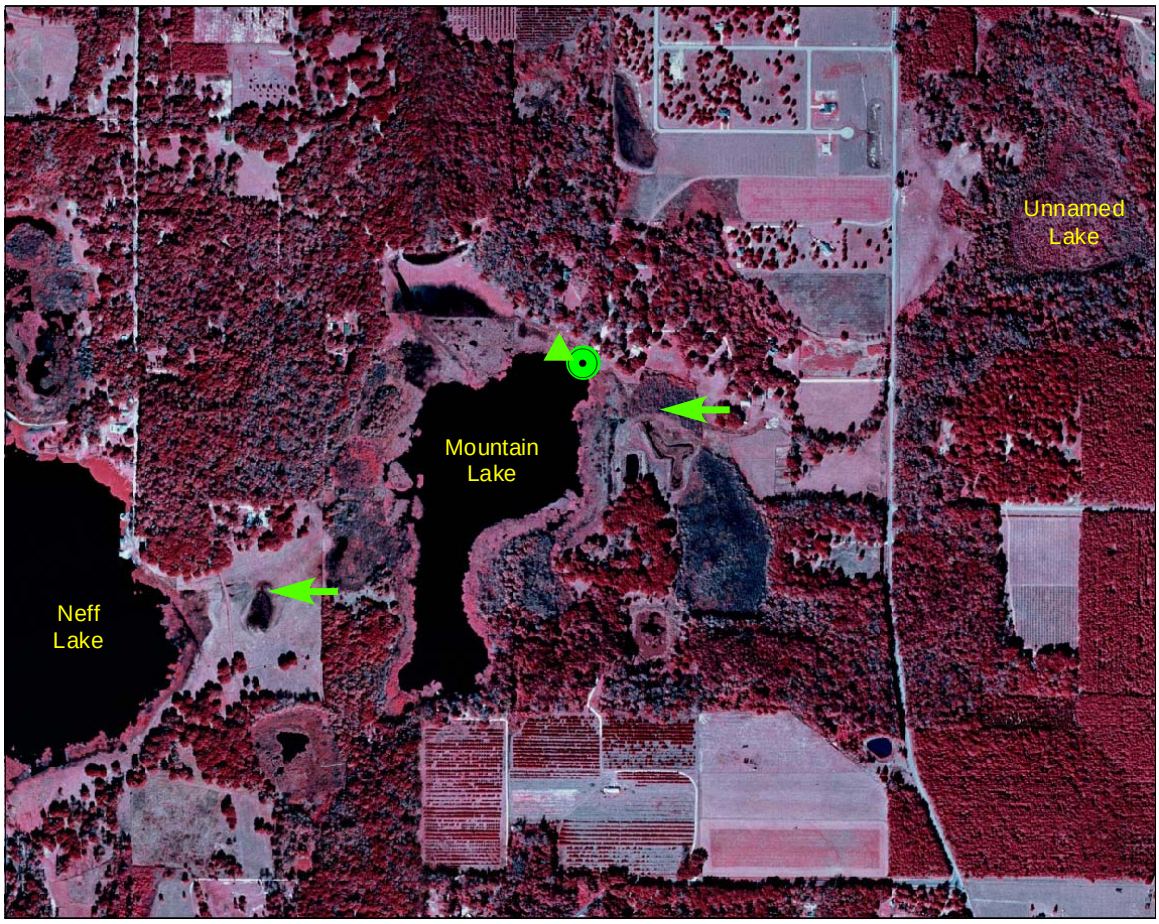


**Figure 2. Location of District lake-level gauge, boat ramp, inlet and outlet at Mountain Lake in Hernando County, Florida.**




Lake gauge

Inlet or outlet

Public boat ramp

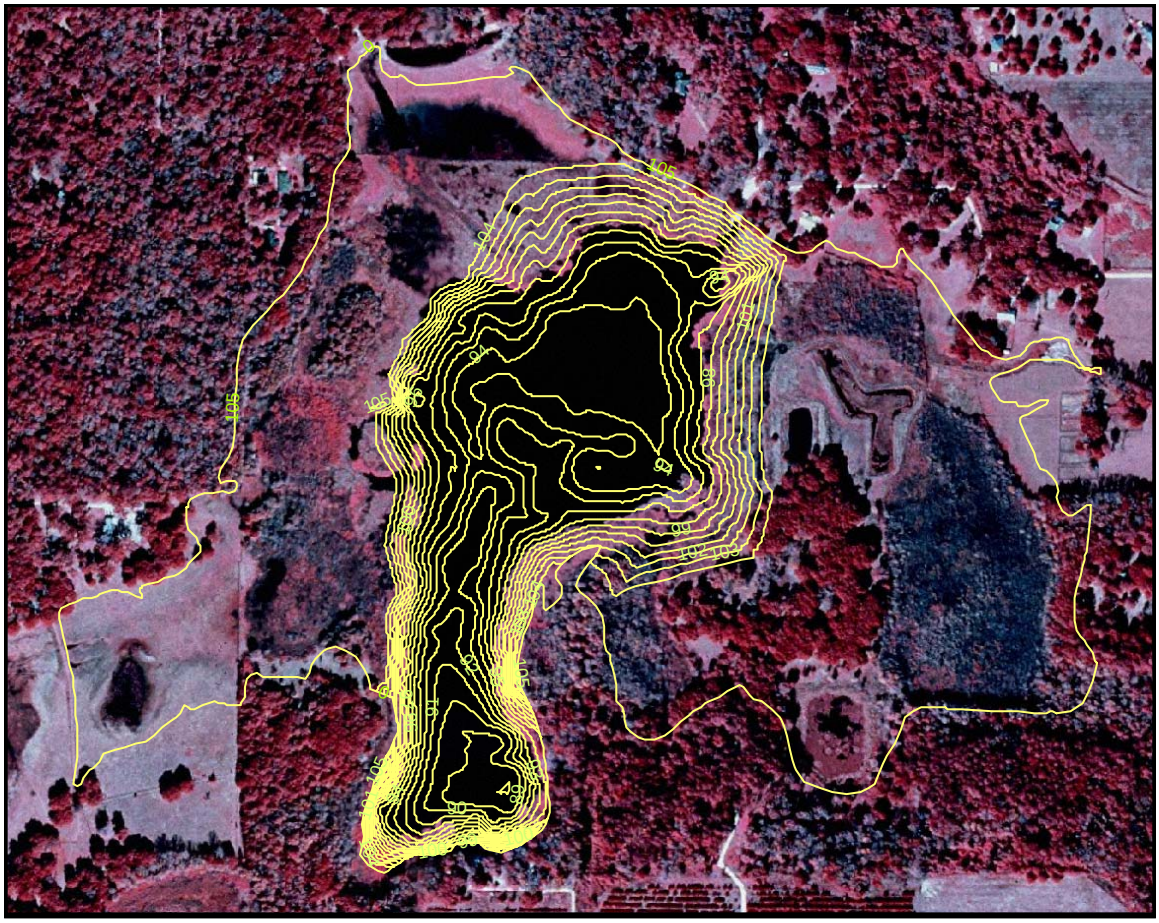
0 1,000 2,000 Feet

N

Aerial photography from 1999 USGS Digital Orhtophotograph.

Map prepared September 23, 2003

**Figure 3. One-foot contours within the Mountain Lake basin in Hernando County, Florida. Values shown are elevations, in feet above the National Geodetic Vertical Datum of 1929.**



Map prepared June 5, 2003 using 1999 USGS digital orthophotography, elevation data from 1987 SWFWMD aerial photography with contours maps (Sheet Nos. 16-23-20 and 21-23-20), and elevation data collected on February 12, 2003 by SWFWMD Staff.

0 250 500 1,000 Feet

N

### *Previously Adopted Lake Management Levels*

Based on work conducted in the 1980s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Mountain Lake in February 1986 (Table 1). A Maximum Desirable Level of 103.50 ft above NGVD was also developed, but was not adopted by the Governing Board.

**Table 1. Adopted guidance levels and associated surface areas for Mountain Lake in Hernando County, Florida.**

| Level | Elevation (feet above NGVD) | Total Lake Area (acres) |
|---|---|---|
| Ten Year Flood Guidance Level | 105.10 | NA |
| High Level | 104.00 | 63 |
| Low Level | 101.00 | 51 |
| Extreme Low Level | 99.00 | 43 |

NA = not available

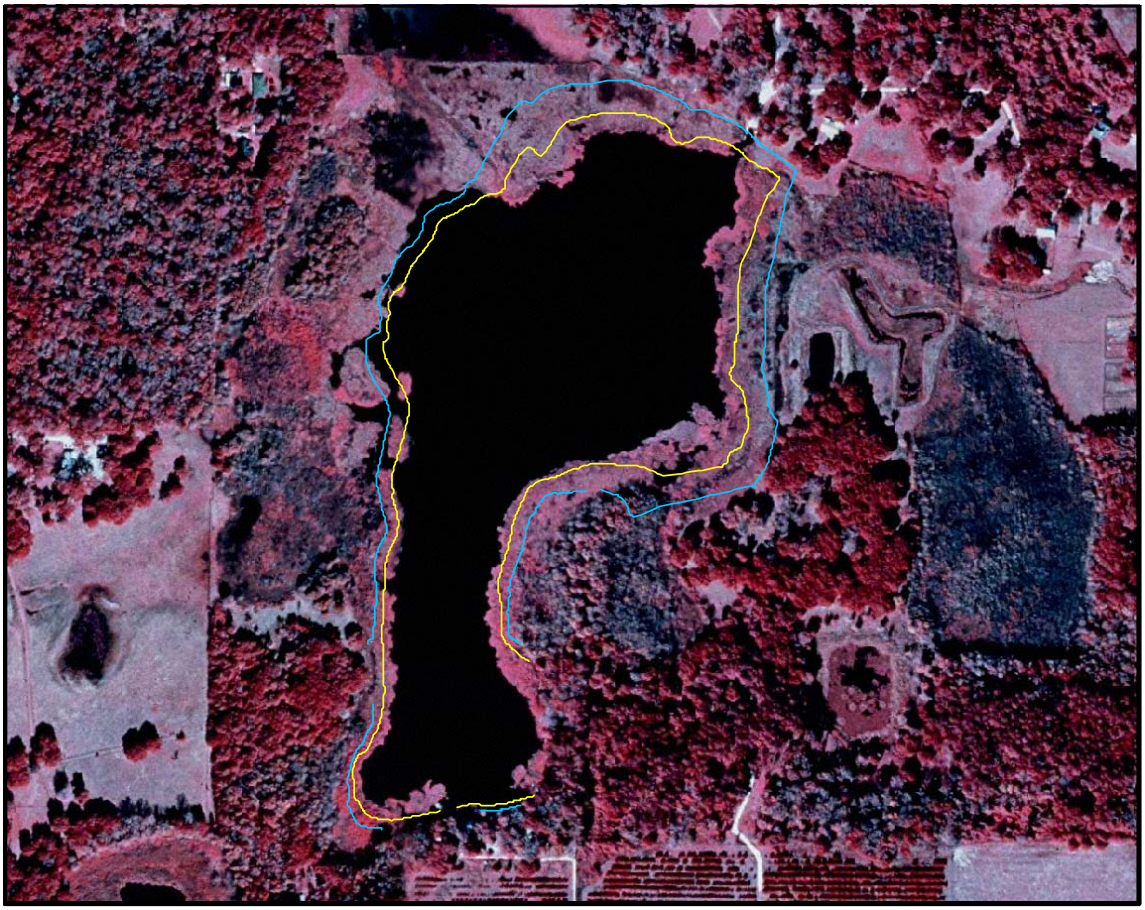
### *Proposed Minimum and Guidance Levels*

Proposed Minimum and Guidance Levels were developed for Mountain Lake using the methodology for Category 3 Lakes described in Leeper *et al.* (2001), in accordance with modifications outlined by Dierberg and Wagner (2001). Proposed levels, along with lake surface area values for each level are listed in Table 2. Locations of the proposed minimum levels within the lake basin are shown in Figure 4.

**Table 2. Proposed minimum levels, guidance levels and associated surface areas for Mountain Lake in Hernando County, Florida.**

| Level | Elevation (feet above NGVD) | Lake Area (acres) |
|---|---|---|
| Ten Year Flood Guidance Level | 105.0 | 160 |
| High Guidance Level | 102.8 | 58 |
| High Minimum Lake Level | 102.8 | 58 |
| Minimum Lake Level | 99.5 | 45 |
| Low Guidance Level | 96.3 | 32 |

**Figure 4. Approximate location of the proposed Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Mountain Lake in Hernando County, Florida. Elevations of contours are in feet above the National Geodetic Vertical Datum of 1929.**



Map prepared June 6, 2003 using 1999 USGS digital orthophotography, elevation data from 1987 SWFWMD aerial photography with contours maps (Sheet Nos. 16-23-20 and 21-23-20), and elevation data collected on February 12, 2003 by SWFWMD Staff.

0 500 1,000 Feet

N

**mountain_min_levels**

**CONTOUR**

99.5 ft

102.8 ft

***Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels***

Hydrologic data are available for Mountain Lake (District Universal ID Number STA 504 506) from July 1984 to the present date (Figure 5, see Figure 2 for current location of the SWFWMD lake-level gauge). Monthly mean water surface elevations, along with proposed guidance and minimum levels are shown in Figure 6. For the entire period of record, the hydrologic data are classified as Historic data. Historic data collected through January 2003 were used to calculate the Historic P10, P50, and P90 (Table 3).

The Category 3 Lake Normal Pool elevation was established at 110 ft above NGVD based on elevations associated with the distribution of saw palmetto (*Serenoa repens*) and live oak (*Quercus virginiana*) in the Neff Lake basin, downstream from Mountain Lake (Table 4). The low floor slab elevation and extent of structural alteration were determined using available one-foot contour interval aerial maps and field survey data (Table 3). The lake may drain to Neff Lake when the water surface exceeds 102.54 ft above NGVD (Figure 7). However, Neff Lake does not have an outlet and when water levels are high (i.e., higher than 102.5 ft above NGVD), the lake surfaces may equilibrate. Mountain Lake is therefore classified as a closed basin lake and a control point elevation was not established.

Based on the availability of Historic hydrologic data for the lake basin, the High Guidance Level (102.8 ft above NGVD) was established at the Historic P10 elevation (Table 3). The Historic P50 (99.5 ft above NGVD) and Low Guidance Level (96.3 ft above NGVD) were also determined using the Historic hydrologic data.

The Ten Year Flood Guidance Level NGVD for Mountain Lake was established at 105.0 ft NGVD using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). In accordance with the closed-basin methodology, the 10-year flood level was based on frequency analysis of available lake stage data and stage values derived from a HSPF (Hydrologic Simulation Program Fortran) continuous simulation model. Inputs to the model included standard watershed parameters (basin size, slope, infiltration rate, ground water recession rate, etc.) and rainfall from the Brooksville National Weather Service site for the period from 1950 through 2003.

The Ten Year Flood Guidance Level has not been exceeded during the period for which lake stage data are available (see Figure 5). The highest surface elevation for Mountain Lake included in the District Water Management Database, 104.67 ft above NGVD, occurred on September 8, 1998. The low of record, 94.80 ft above NGVD, occurred on May 31, 2001.

Mountain Lake is not contiguous with any cypress-dominated wetlands of 0.5 or more acres in size and is therefore classified as a Category 3 Lake for the purpose of minimum levels development. Aquatic macrophytes, including cattail (*Typha* sp.), pickerelweed (*Pontederia cordata*), torpedograss (*Panicum repens*), water fern (*Salvinia*

sp.), water hyacinth (*Eichhornia crassipes*), pennywort (*Hydrocotyle umbellata*), and willow (*Salix* sp.) occur throughout the basin.

Recreation/Ski, Dock-Use, Species Richness, Aesthetics and Mixing Standards were evaluated for minimum levels development (Table 3). The Recreation/Ski Standard was established at 105.2 ft above NGVD, based on the elevation at which the lake could contain a safe skiing area (102 ft above NGVD) and the difference between the Historic P50 and Historic P90 (3.2 ft). The Dock-Use Standard was established at 104.4 ft above NGVD, based on the elevation of sediments at the end of ninety percent of the 5 docks at the lake (99.2 ft above NGVD, Table 4), a clearance value of 2 ft based on use of powerboats in the lake, and the difference between the Historic P50 and Historic P90 elevations (3.2 ft). The Species Richness Standard was established at 97.7 ft above NGVD, based on limiting change in lake surface area to less than a 15% reduction from the area at the Historic P50 elevation. The Aesthetic-Standard for the lake was established at the Low Guidance Level elevation of 96.3 ft above NGVD. Based on potential resuspension of sediments, the Mixing Standard was established at 88.9 ft above NGVD.

Review of changes in potential herbaceous wetland area associated with change in lake stage, and potential change in area available for aquatic macrophyte colonization indicated that use of the Mixing Standard would not be inappropriate for minimum levels development (Figure 7). At the standard elevation, the lake surface area would be less than one acre and the entire inundated area would be subject to colonization by emergent and floating-leaved macrophytes. The Recreation/Ski Standard was also considered inappropriate for minimum levels development, because the standard exceeds the Historic P50 elevation.

The Dock-Use Standard, the most conservative *(i.e*., the highest) of the appropriate standards, is greater than the Historic P50 elevation, so the Historic P50 was used to establish the proposed Minimum Lake Level at 99.5 ft above NGVD. The proposed High Minimum Lake Level was established at 102.8 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and the Historic P50 (3.3 ft). The proposed High Minimum Lake Level is 6.8 ft below the Low Floor Slab elevation on Mountain Lake, 5.5 ft below the Low Floor Slab elevation on Neff Lake, and1.6 ft below the Low Road elevation for Neff Lake. When compared to the elevations of other structures, the proposed High Minimum Lake Level is 3.9 ft below the floor elevation of a restroom/laundry building on Neff Lake and 2.7 ft below the top of a public boat ramp on Mountain Lake, but is 4.4 ft above the floor elevation of a first floor garage under a house on Neff Lake. The garage of this house has been inundated a number of times in the past for extended periods of time.

**Figure 5. Surface water elevation at Mountain Lake in Hernando County, Florida. Data through January 2003 are shown.**

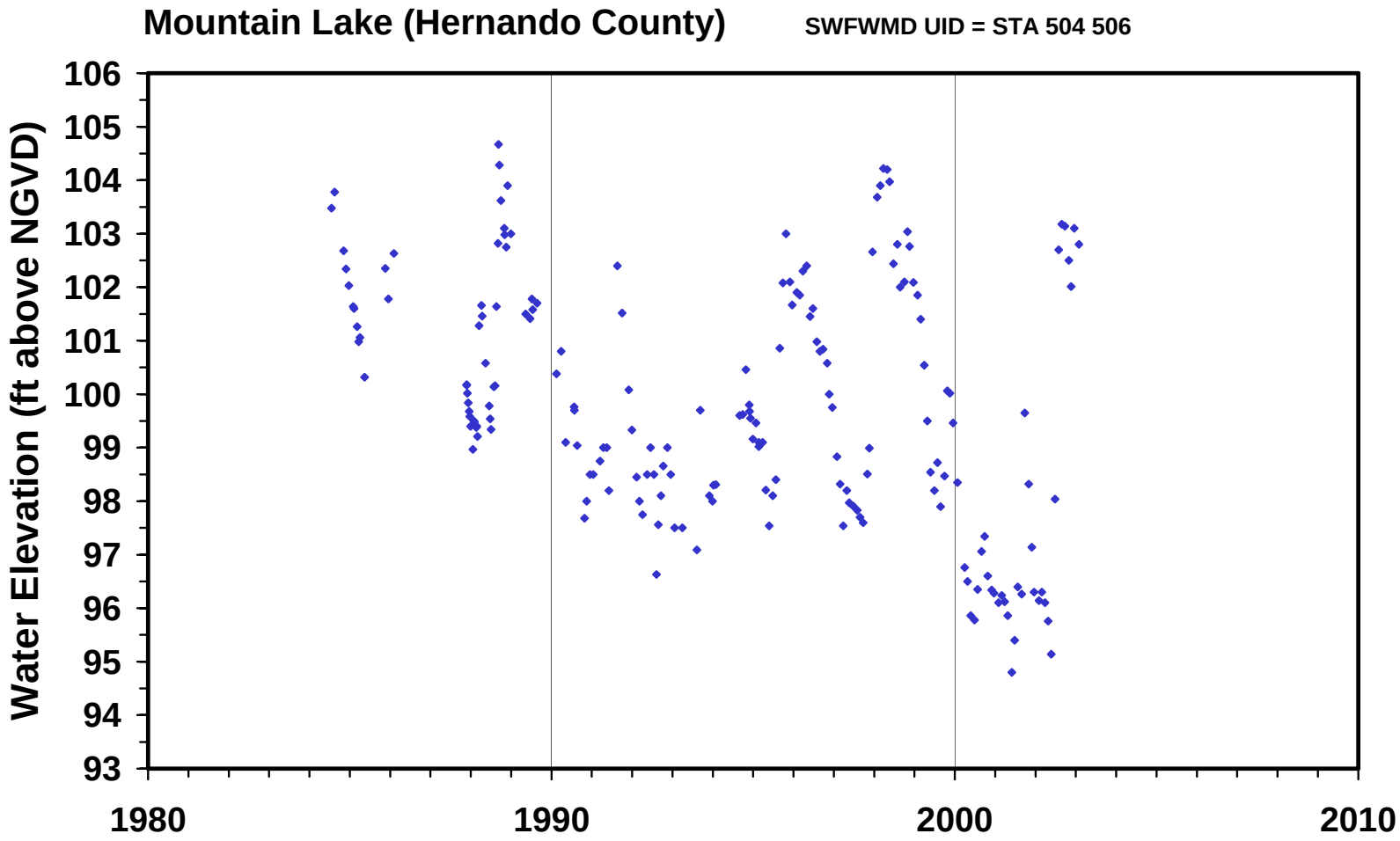


**Figure 6. Mean monthly surface water elevation, and proposed guidance and minimum levels for Mountain Lake in Hernando County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).**

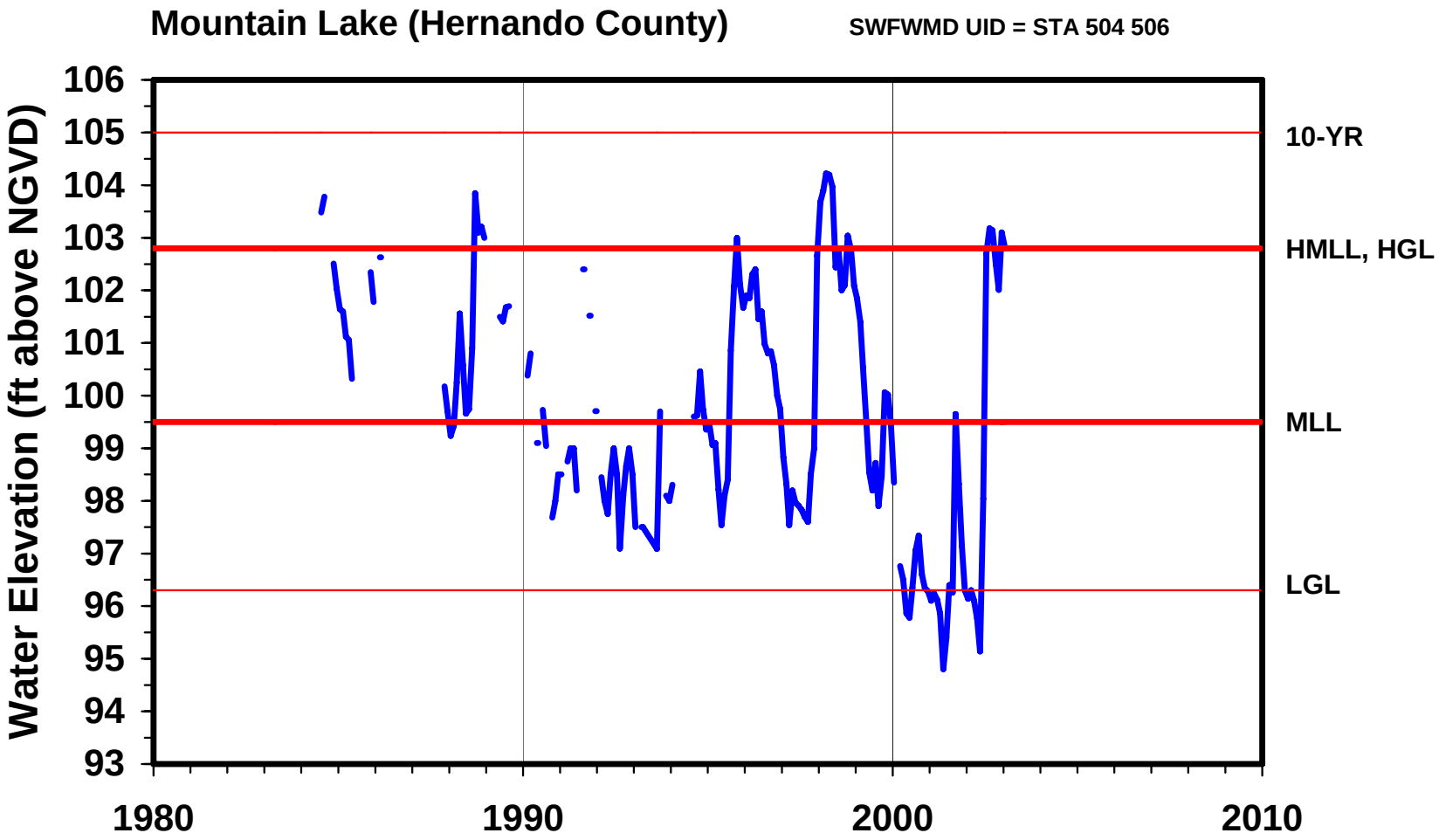


**Table 3. Elevation data and associated area values used for establishing minimum and guidance levels for Mountain Lake in Hernando County, Florida.**

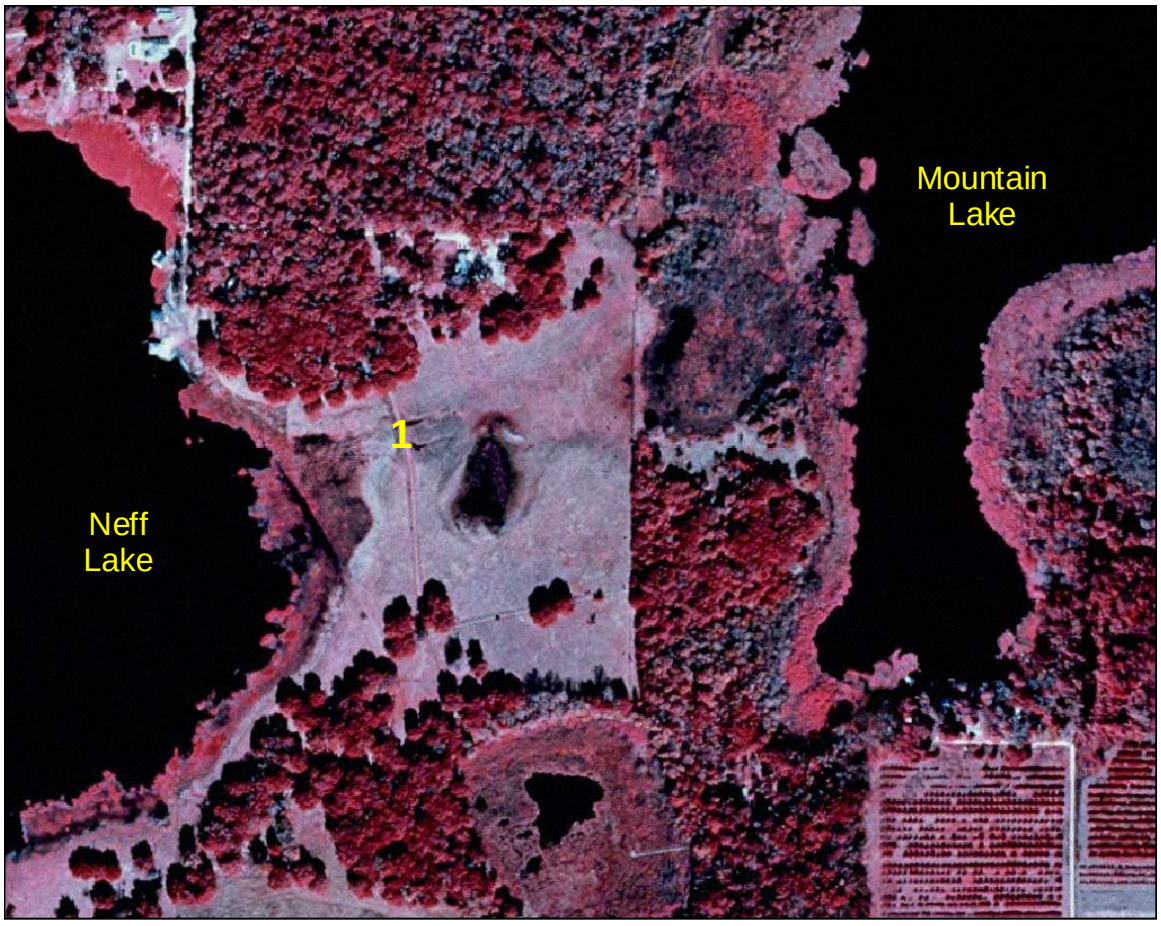
| Level or Feature | Elevation (feet above NGVD) | Lake Area (acres) |
|---|---|---|
| Historic P10 | 102.80 | 58 |
| Historic P50 | 99.50 | 45 |
| Historic P90 | 96.34 | 32 |
| | | |
| Category 3 Lake Normal Pool | 110 | NA |
| Low Floor Slab (Mountain Lake) | 109.6 | NA |
| Low Floor Slab (Neff Lake) | 108.3 | NA |
| Low Road (Neff Lake Road) | 104.4 | 65 |
| Low Other (Neff Lake – floor slab of restroom/laundry building) | 105.7 | NA |
| Low Other (Mountain Lake – top of public boat ramp) | 105.5 | NA |
| Low Other (Neff Lake – floor slab of first floor garage under house) | 98.4 | 41 |
| | | |
| High Guidance Level | 102.8 | 58 |
| Historic P50 | 99.5 | 45 |
| Low Guidance Level | 96.3 | 32 |
| | | |
| Recreation/Ski Standard | 105.2 | NA |
| Dock-Use Standard | 104.4 | 65 |
| Species Richness Standard | 97.7 | 39 |
| Aesthetic Standard | 96.3 | 33 |
| Mixing Standard | 88.9 | <1 |

NA = not available

**Table 4. Elevation data used for establishing the Category 3 Lake Normal Pool Elevation for Mountain Lake in Hernando County, Florida. Data were based on field observations in February 2003 and SWFWMD aerial photography with elevation contours maps.**

| Hydrologic Indicator | Elevation (feet above NGVD) |
|---|---|
| Base of live oak in the Neff Lake basin | ~120 |
| Base of saw palmetto in the Neff Lake basin | ~110-115 |

**Figure 7. Conveyance system between Mountain and Neff Lakes in Hernando County, Florida.**




Aerial photography from 1999 USGS Digital Orhtophotograph.

Map prepared June 5, 2003

0 500 1,000 Feet

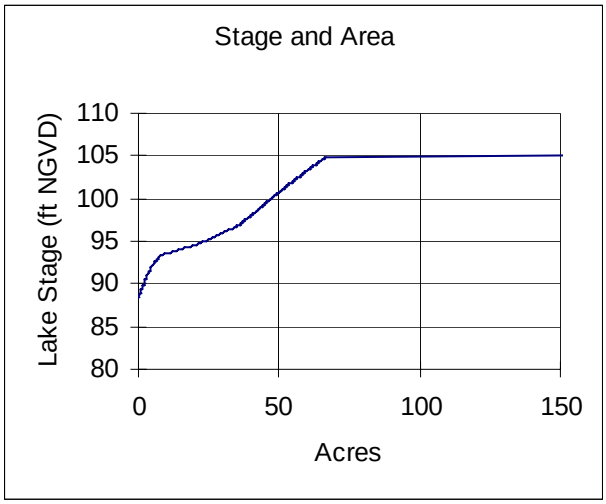
N

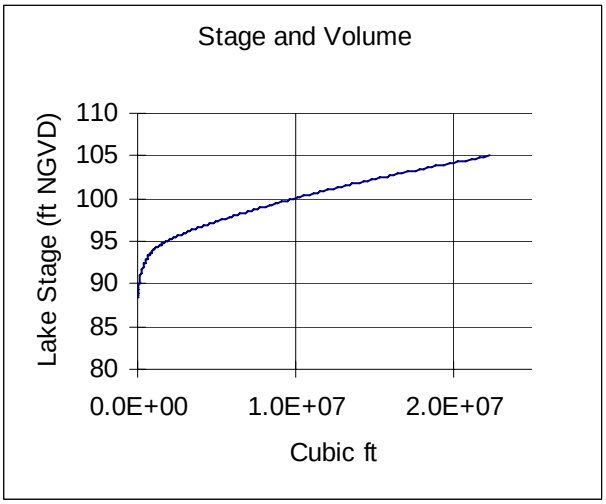
| Site | Description | Elevation (feet above NGVD) |
|---|---|---|
| 1 | Invert at east end of 24 inch diameter, 20 ft long corrugated metal pipe; invert at west end of pipe is 102.40 ft above NGVD | 102.54 |

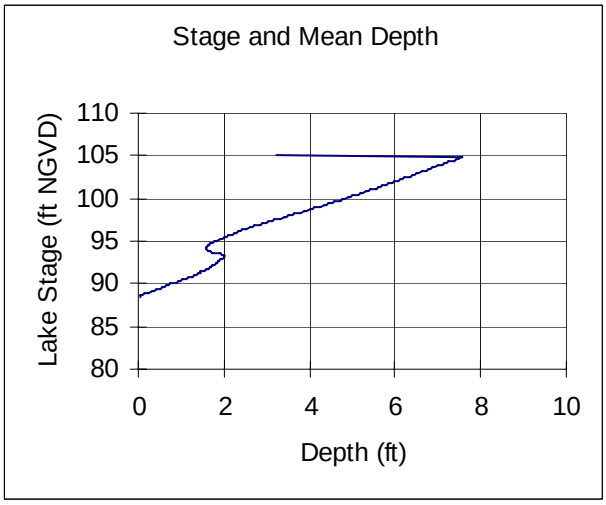
**Table 5. Summary statistics for elevations associated with five docks at Mountain Lake in Hernando County, Florida. Data were on April 9, 2002 by SWFWMD staff. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.**

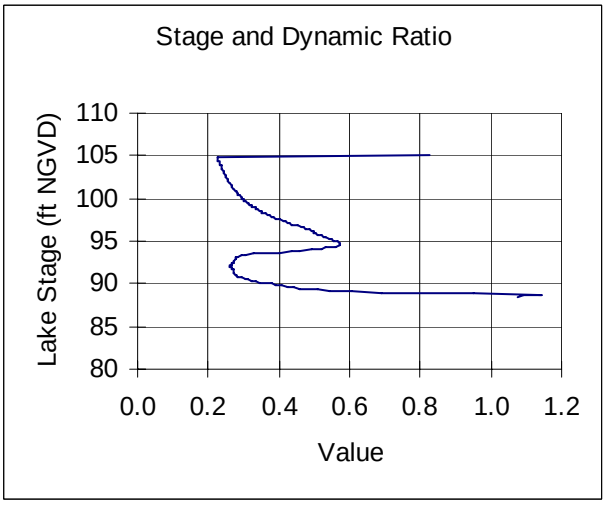
| Statistic | Elevation of Sediments at Five Dock Ends (feet above NGVD) | Elevation of Five Dock Platforms (feet above NGVD) |
|---|---|---|
| Mean (SD) | 97.1 (1.9) | 104.0 (0.9) |
| P10 | 99.2 | 104.8 |
| P50 (Median) | 96.2 | 104.0 |
| P90 | 95.8 | 103.2 |
| Maximum | 100.3 | 105.3 |
| Minimum | 95.8 | 103.0 |

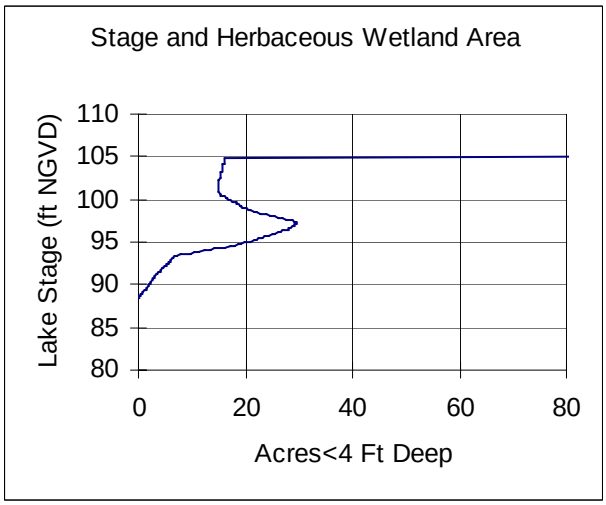
**Figure 8. Surface area, volume, mean depth, dynamic ratio, potential herbaceous wetland area, and area available for colonization by aquatic macrophytes versus lake stage for Mountain Lake in Hernando County, Florida.**

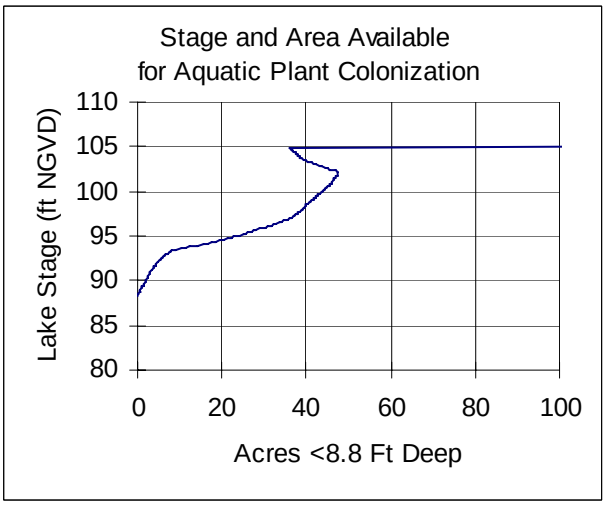


***Documents Cited and Reviewed for Development of Proposed Guidance and Minimum Levels***

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