

November 13, 2003

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 Hancock Lake in
Pasco and Hernando Counties, Florida**

Hancock Lake

General Description

Hancock Lake (Figure 1) is located in the Hillsborough River Basin of the Southwest Florida Water Management District (SWFWMD or District) in Pasco and Hernando Counties, Florida (Sections 5 and 6, Township 24 S, Range 20 E; Sections 31 and 32, Township 23 S, Range 20 E). 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 has been highly modified, with upland areas primarily used for livestock grazing, citrus production and residential development (Figure 2). Despite these modifications, natural vegetation remains intact along much of the lake shoreline. Public access to the Hancock Lake is not available.

Hancock Lake is located in the Crews Lake Outlet drainage basin, and has a drainage area of 3.3 square miles (SWFWMD 1996). An inlet along the southeastern lakeshore conveys water from Middle Lake to Hancock Lake when Middle Lake is staged above 99.5 ft above the National Geodetic Vertical Datum of 1929 (NGVD). Hancock Lake does not have a surface water outlet, but may drain to underlying aquifers through active sinkholes located along the southwestern lakeshore. To curtail this internal drainage, a dyke was constructed across a portion of the lake basin in the 1970s. Based on observations by District staff, the dyke does not completely limit drainage to

the sinkholes or the sub-basin where the sinkholes are located (Gant 1986, personal observation). There are no surface water withdrawals from the lake currently permitted by the District. There is, however, one permitted surface withdrawal located at a site northeast of the lake, and there are several permitted groundwater withdrawals in the vicinity of the lake.

The 1954 (photorevised 1988) United States Geological Survey 1:24,000 Spring Lake, Fla. quadrangle map shows a surface elevation of 106 ft above NGVD for Lake Hancock. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 519 acres at a surface elevation of 106 ft above NGVD. Based on a topographic map of the basin generated in support of minimum levels development (Figure 3), the lake covers an area of 601 acres when the surface level is at 106 ft above NGVD. Data used for production of the topographic map were obtained from field surveys conducted in March 2003 and 1:200 aerial photography maps containing one-foot contour lines prepared using photogrammetric methods.

Figure 1. Location of Hancock Lake in Pasco and Hernando Counties, Florida.

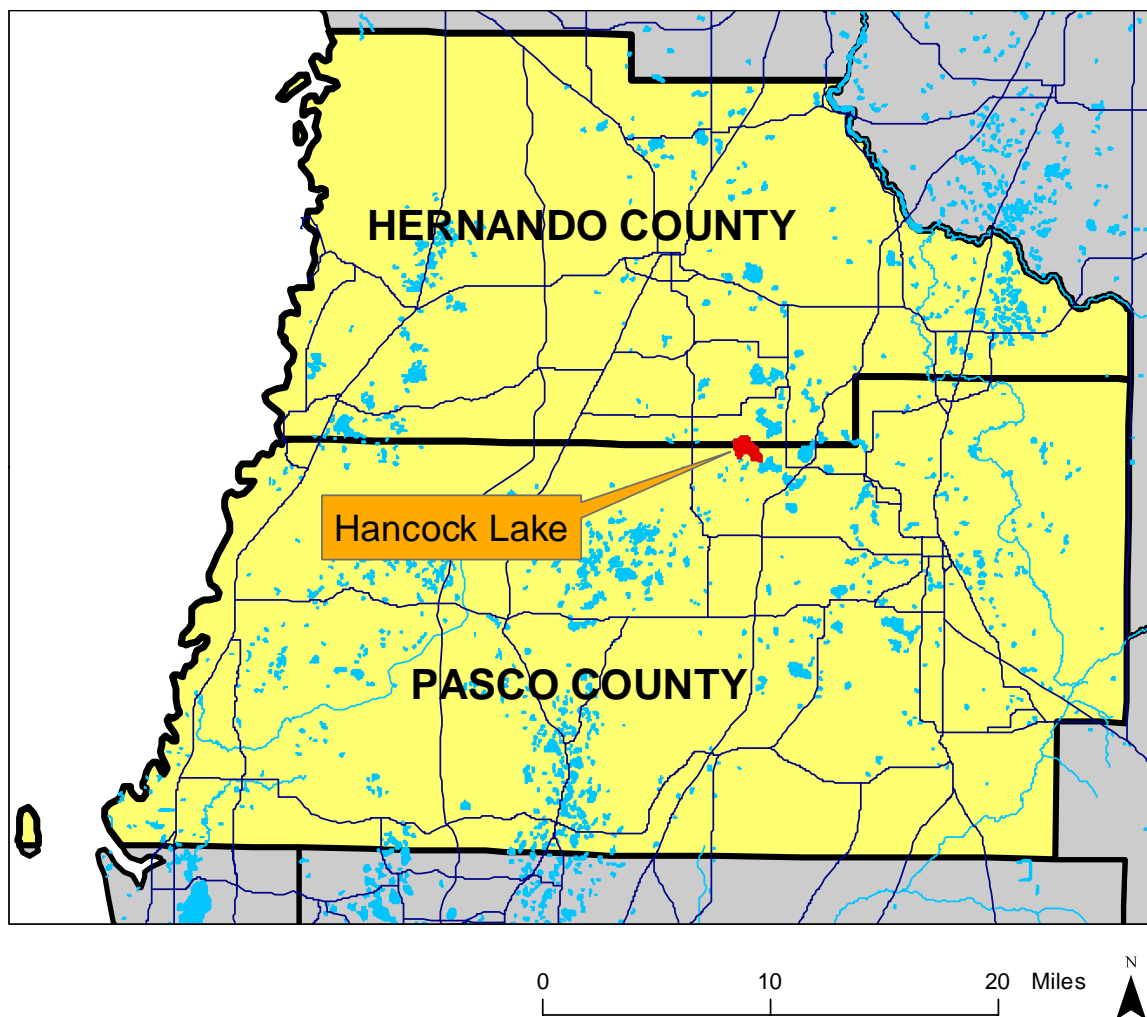


Figure 2. Location of District lake-level gauge, inlet and area of active sinkhole activity at Hancock Lake in Pasco and Hernando Counties, Florida.

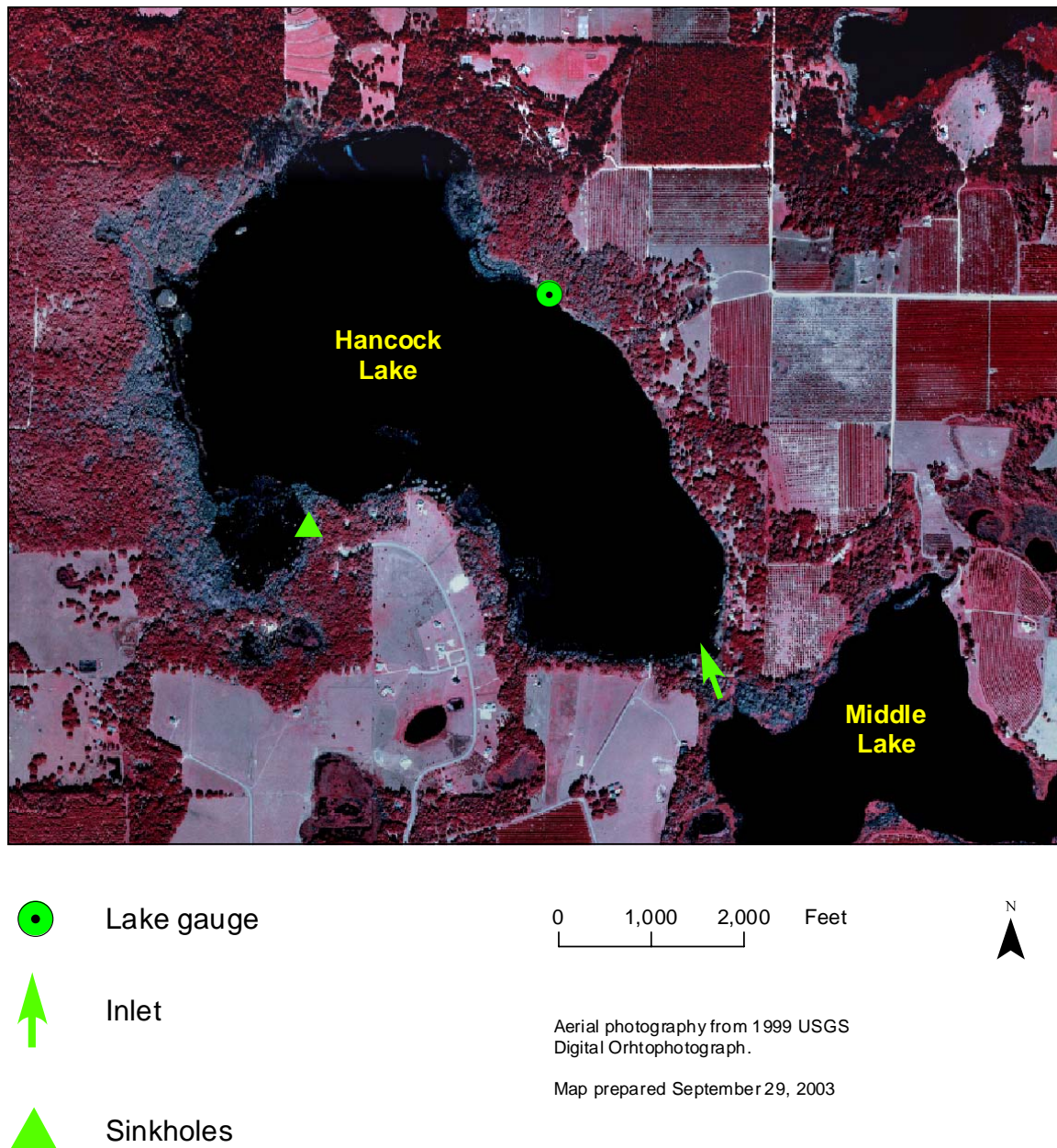
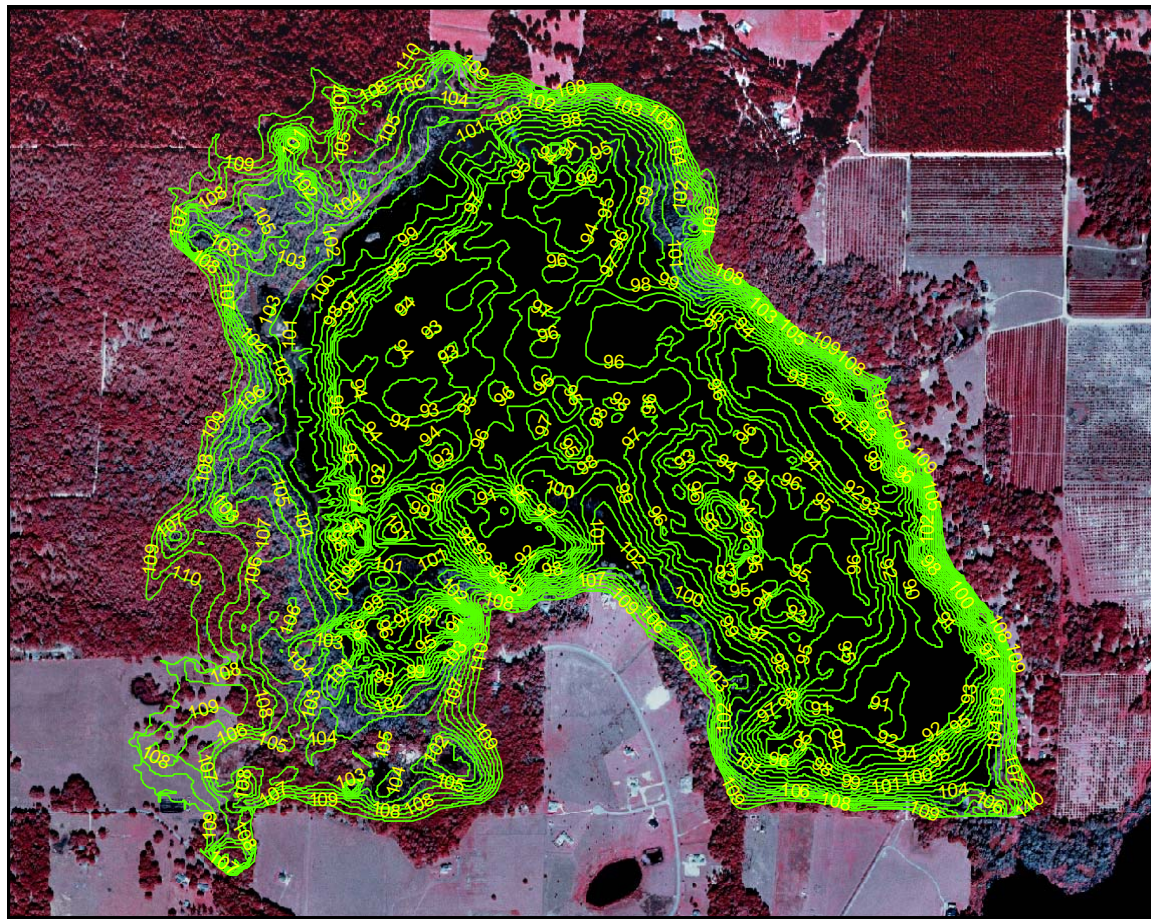
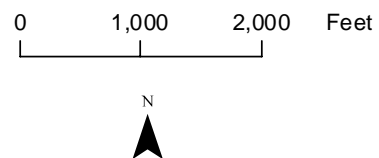


Figure 3. One-foot contours within the Hancock Lake basin in Pasco and Hernando Counties, Florida. Values shown are elevations, in feet above the National Geodetic Vertical Datum of 1929.



Map prepared July 17, 2003 using 1999 USGS digital orthophotography, elevation data from 1987 SWFWMD aerial photography with contours maps (Sheet Nos 05-24-20, 06-24-20, 31-23-20 and 32-23-20), and elevation data collected on March 13 and 18, 2003 by SWFWMD Staff.



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 Hancock Lake in May 1986 (Table 1). A Maximum Desirable Level of 106.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table 1. Adopted guidance levels and associated surface areas for Hancock Lake in Pasco and Hernando Counties, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	107.48	640
High Level	106.50	615
Low Level	104.00	520
Extreme Low Level	102.00	452

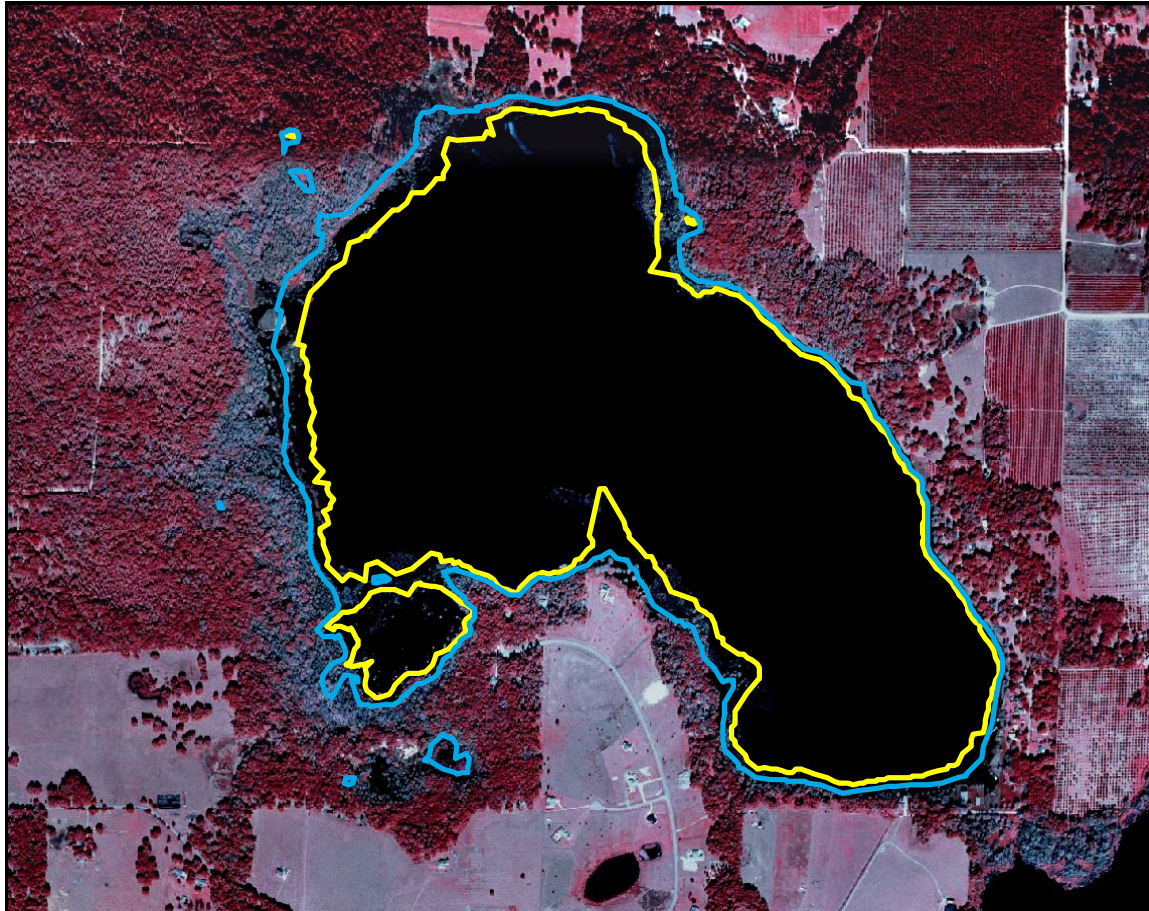
Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for Hancock 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. Contour lines corresponding the proposed minimum level elevations are shown within the basin in Figure 4.

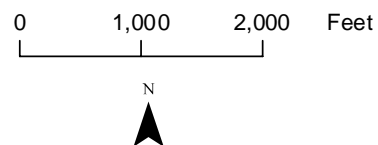
Table 2. Proposed minimum levels, guidance levels and associated surface areas for Hancock Lake in Pasco and Hernando Counties, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	106.9	625
High Guidance Level	102.5	467
High Minimum Lake Level	102.5	467
Minimum Lake Level	100.2	400
Low Guidance Level	97.7	325

Figure 4. Approximate location of the proposed Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Hancock Lake in Pasco and Hernando Counties, Florida. Contour elevations are expressed as feet above the National Geodetic Vertical Datum of 1929.



Map prepared September 30, 2003 using 1999 USGS digital orthophotography, elevation data from 1987 SWFWMD aerial photography with contours maps (Sheet Nos 05-24-20, 06-24-20, 31-23-20 and 32-23-20), and elevation data collected on March 13 and 18, 2003 by SWFWMD Staff.



hancock_minimum_levels

Contour

- 100.2 ft above NGVD
- 102.5 ft above NGVD

Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Hancock Lake (District Universal ID Number STA 121 121) from May 1978, from April 1980 through August 1982, and from January 1983 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).

Based on the availability of Historic hydrologic data for the lake basin, the High Guidance Level was established at the Historic P10 elevation (102.5 ft above NGVD). Historic hydrologic data were also used to establish the Historic P50 elevation (100.2 ft above NGVD) and the Low Guidance Level (97.7 ft above NGVD).

A Category 3 Lake Normal Pool elevation was not established for Hancock Lake. The elevation would be expected to occur in the range of 103 to 110 ft above NGVD, based on elevations associated with the distribution of live oak (*Quercus virginiana*) and other canopy species (Table 4). Establishment of the Category 3 Lake normal pool elevation was not critical for development of lake levels, as Historic data were available for determination of the High Guidance Level. 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). Because Hancock Lake does not have a surface water outlet, a control point was not established and the lake was classified as a closed basin lake.

The Ten Year Flood Guidance Level for Lake Hancock was established at 106.9 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 the lake stage values derived from a HSPF (Hydrologic Simulation Program Fortran) continuous simulation model and the available gauging record. Inputs to the model included standard watershed parameters (basin size, slope, infiltration rate, ground water recession rate, etc.) and rainfall records from the Brooksville National Weather Service site for the period from 1950 through 2003.

Based on available stage data, the Ten Year Flood Guidance Level was last exceeded during the late 1990s (see Figure 5). The highest surface elevation for Hancock Lake included in the District Water Management Database, 108.9 ft above NGVD, occurred on March 26, 1998. The low of record, 95.64 ft above NGVD, occurred on March 31, 2001.

Aquatic macrophytes, including cattail (*Typha* sp.), pickerelweed (*Pontederia cordata*), fragrant water lily (*Nymphaea odorata*), banana lily (*Nymphoides aquatica*), milfoil (*Myriophyllum* sp.), burhead sedge (*Scirpus cubensis*), water hyacinth (*Eichhornia crassipes*), pennywort (*Hydrocotyle umbellata*), hydrilla (*Hydrilla verticillata*), and willow

(*Salix* sp.) occur throughout the basin. The lake is not, however, contiguous with 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.

Dock-Use, Basin Connectivity, Recreation/Ski, Species Richness, Aesthetics and Mixing Standards were evaluated for minimum levels development (Table 3). The Dock-Use Standard was established at 102.3 ft above NGVD, based on the elevation of sediments at the end of ninety percent of the 10 docks at the lake (97.9 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 (2.4 ft). The Basin Connectivity Standard was established at 100.9 ft above NGVD, based on the elevation that ensures connectivity among the major lake sub-basins (96.5 ft above NGVD), a clearance value of 2 ft for use of power boats on the lake and the difference between the Historic P50 and Historic P90 elevations (2.4 ft). The Basin Connectivity Standard was developed to ensure connectivity among the major lake sub-basins, but not between the major lake sub-basins and the southwestern sub-basin, which is the site of active sinkhole activity. The Recreation/Ski Standard was established at 100.4 ft above NGVD, based on the elevation at which the lake could contain a safe skiing area with a depth of five-feet (98 ft above NGVD) and the difference between the Historic P50 and Historic P90 (2.4 ft). The Species Richness Standard was established at 98.2 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 97.7 ft above NGVD. Based on review of dynamic ratio values for lake stages up to the Historic P50 elevation (see Figure 7), a Mixing Standard was not established for the lake. Review of changes in potential herbaceous wetland area associated with change in lake stage, and potential change in area available for aquatic macrophyte colonization did not indicate that use of any of the identified standards would be inappropriate for minimum levels development (Figure 7).

Because the Recreation/Ski Standard exceeds the Historic P50 elevation, the standard is not considered appropriate for minimum levels development. 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 100.2 ft above NGVD. The proposed High Minimum Lake Level was established at 102.5 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and the Historic P50 (2.3 ft). The proposed High Minimum Lake Level is 2.7 ft below the Low Floor Slab elevation and 3.5 ft below the lowest paved road in the immediate lake basin.

Figure 5. Surface water elevation at Hancock Lake in Pasco and Hernando Counties, Florida. Data through January 2003 are shown.

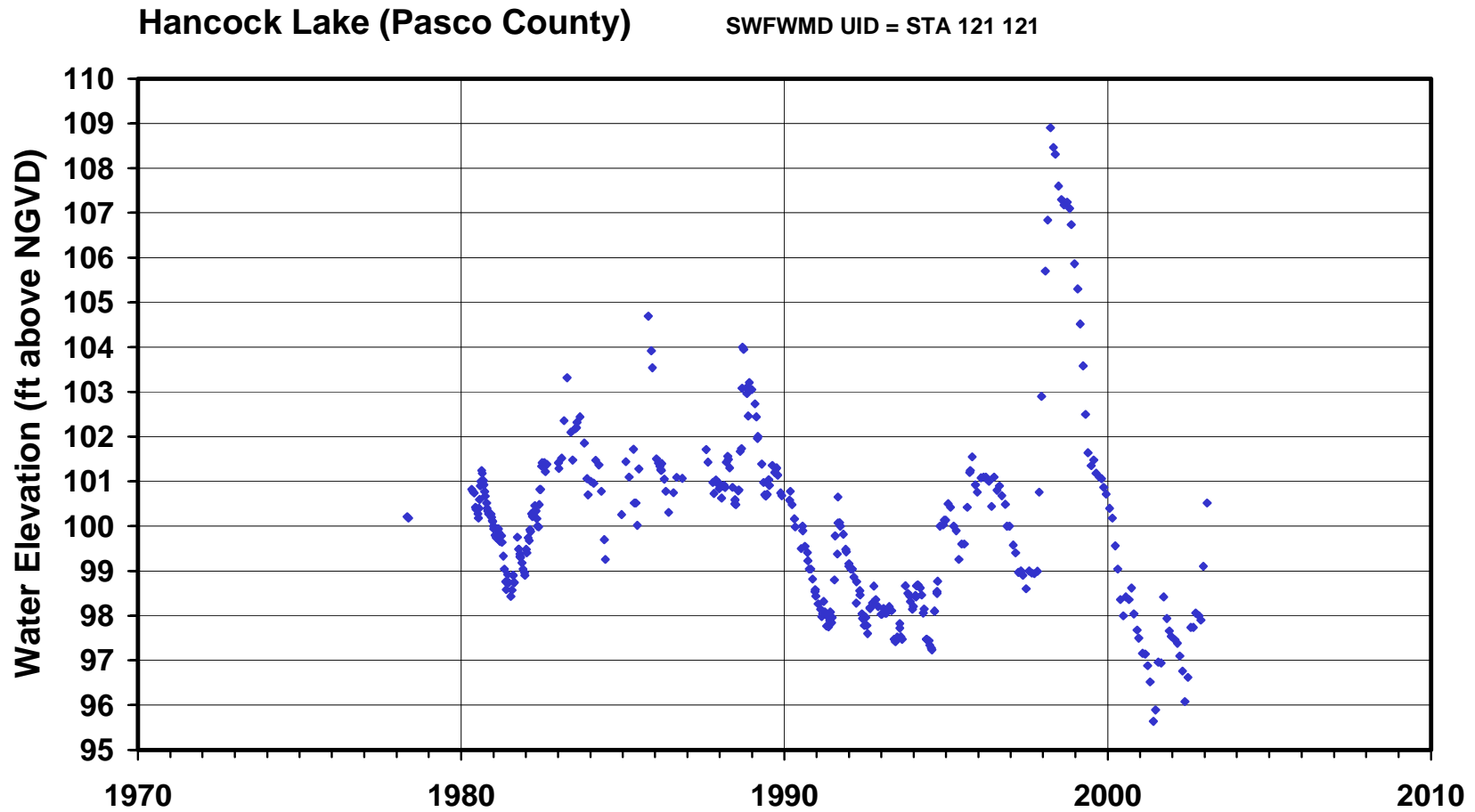


Figure 6. Mean monthly surface water elevation through January 2003, and proposed guidance and minimum levels for Hancock Lake in Pasco and Hernando Counties, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL), and Minimum Lake Level (MLL).

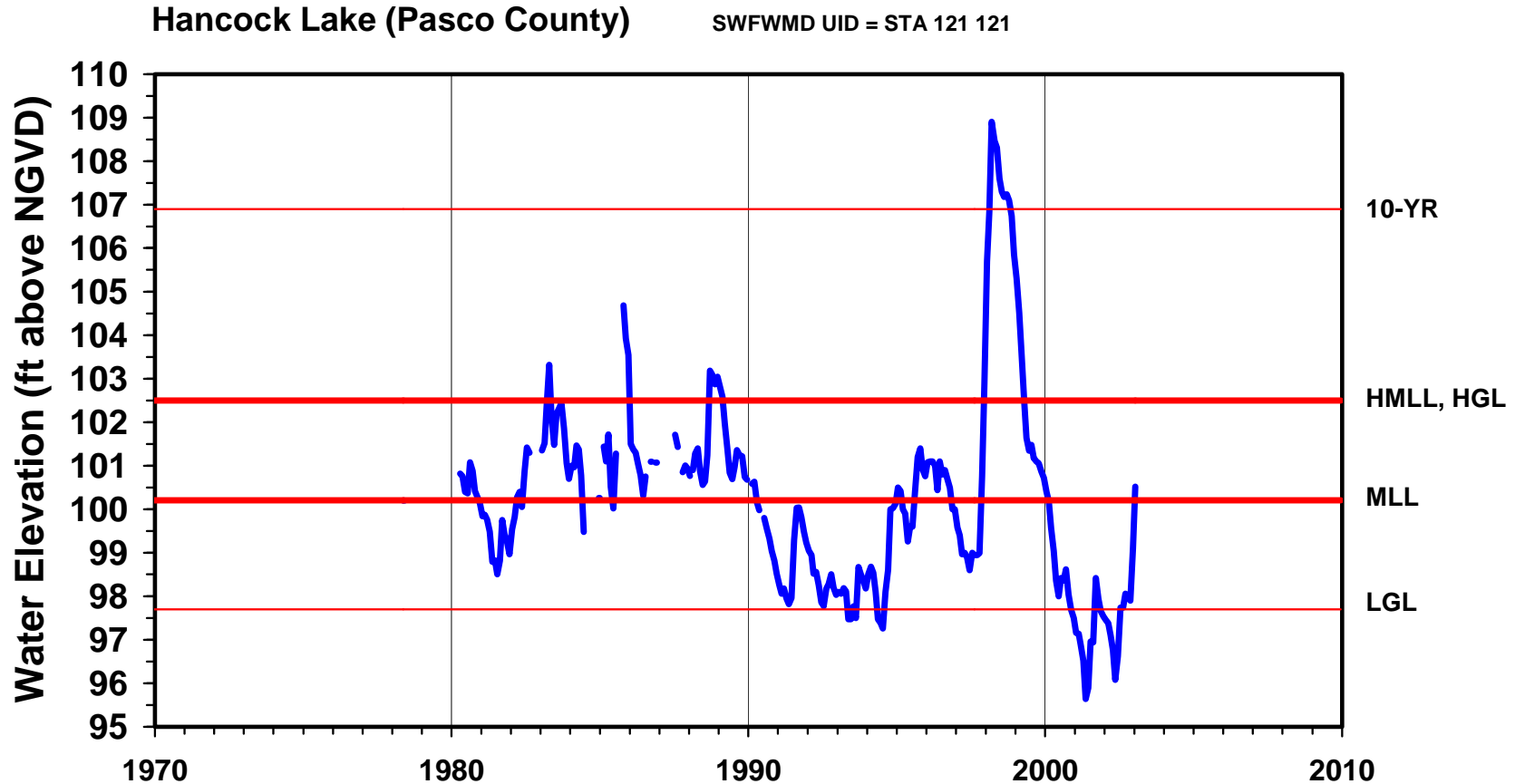


Table 3. Elevation data and associated area values used for establishing minimum and guidance levels for Hancock Lake in Pasco and Hernando Counties, Florida.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Historic P10	102.51	467
Historic P50	100.17	400
Historic P90	97.74	325
Category 3 Lake Normal Pool	NA	NA
Low Road	106.0	601
Low Floor Slab	105.2	573
High Guidance Level	102.5	467
Historic P50	100.2	400
Low Guidance Level	97.7	386
Dock-Use Standard	102.3	461
Connectivity Standard	100.9	419
Recreation/Ski Standard	100.4	405
Species Richness Standard	98.2	343
Aesthetic Standard	97.7	325
Mixing Standard	NA	NA

NA = not available/not applicable

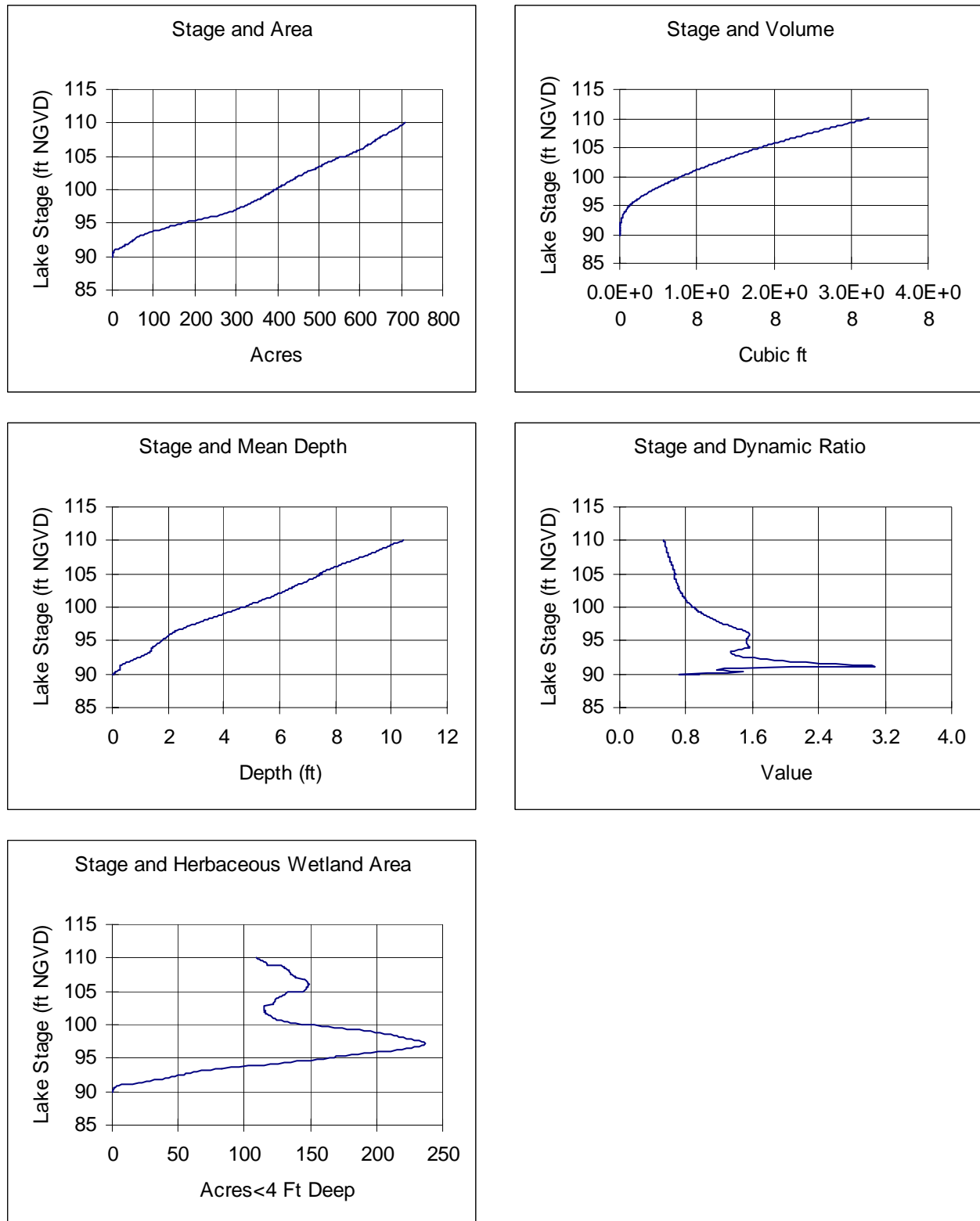
Table 4. Elevation data used for establishing the Category 3 Lake Normal Pool Elevation for Hancock Lake in Pasco and Hernando Counties, Florida. Data were based on field observations from January 1996 and SWFWMD aerial photography with elevation contours maps.

Hydrologic Indicator	Elevation (feet above NGVD)
Base of live oak along north shore of the lake	110.7
Pine hummock at transition between water oak and live oak	104.3
Tree line, based on aerial photography maps	~103 – 105

Table 5. Summary statistics for elevations associated with docks (n=10) at Hancock Lake in Pasco and Hernando Counties, Florida. Data were collected on October 3, 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 Dock Ends (feet aboveNGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	96.1 (1.6)	103.3 (0.7)
P10	97.9	104.0
P50 (Median)	96.1	103.5
P90	93.9	102.5
Maximum	98.1	104.2
Minimum	93.2	101.8

Figure 7. Surface area, volume, mean depth, dynamic ratio, and potential herbaceous wetland area versus lake stage for Hancock Lake in Pasco and Hernando Counties, Florida.



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