

February 07, 2005

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 Bell Lake in
Pasco County, Florida

Bell Lake

General Description

Bell Lake (Figure 1) is located in the Hillsborough River Basin of the Southwest Florida Water Management District in Pasco County, Florida (Section 13, Township 26S, Range 18E and Section 18, Township 26S, Range 19E). The area surrounding the lake is categorized as the Land-O-Lakes subdivision of the Tampa Plain in the Ocala Uplift Physiographic District (Brooks 1981). The region is characterized as a plain with many small lakes overlying moderately thick limestone with karst features. 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 neutral to slightly alkaline, low to moderate nutrient, clear-water lakes interspersed in sandy uplands (Griffith *et al.* 1997).

The drainage areas for Bell Lake has been reported as 6.3 square miles (Florida Board of Conservation 1969) and ~5.4 square miles (Henderson 1983). The lake receives inflow from King Lake to the north and drains to Lake Padgett to the south through a system of canals, culverts and wetlands (Figure 2). Residential development encircles most of the lake, and extensive canals have been dug in the northern portion of the basin. Forested wetlands occur along the west shore of the lakeshore. A small, approximately 5-ft diameter, sinkhole was reported along the west shore of the north basin of the lake in May 1985. There are no surface water withdrawals from the lake currently permitted by the District. There are, however, numerous permitted groundwater withdrawals in the area.

The 1974 (photorevised 1987) United States Geological Survey 1:24,000 Lutz, Fla. quadrangle map shows a surface water elevation of 71 ft above the National Geodetic Vertical Datum of 1929 (NGVD) for Bell Lake. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake area as 80 acres at a

surface elevation at 75 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 84 acres when the water surface is at 71 ft above NGVD. Data used for production of the topographic map were obtained from field surveys conducted in April 2002 and aerial photography maps of the basin containing one-foot contour lines prepared using photogrammetric methods.

Figure 1. Location of Bell Lake in Pasco County, Florida.

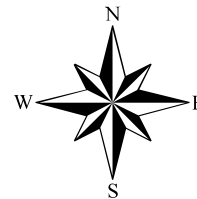
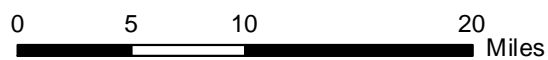
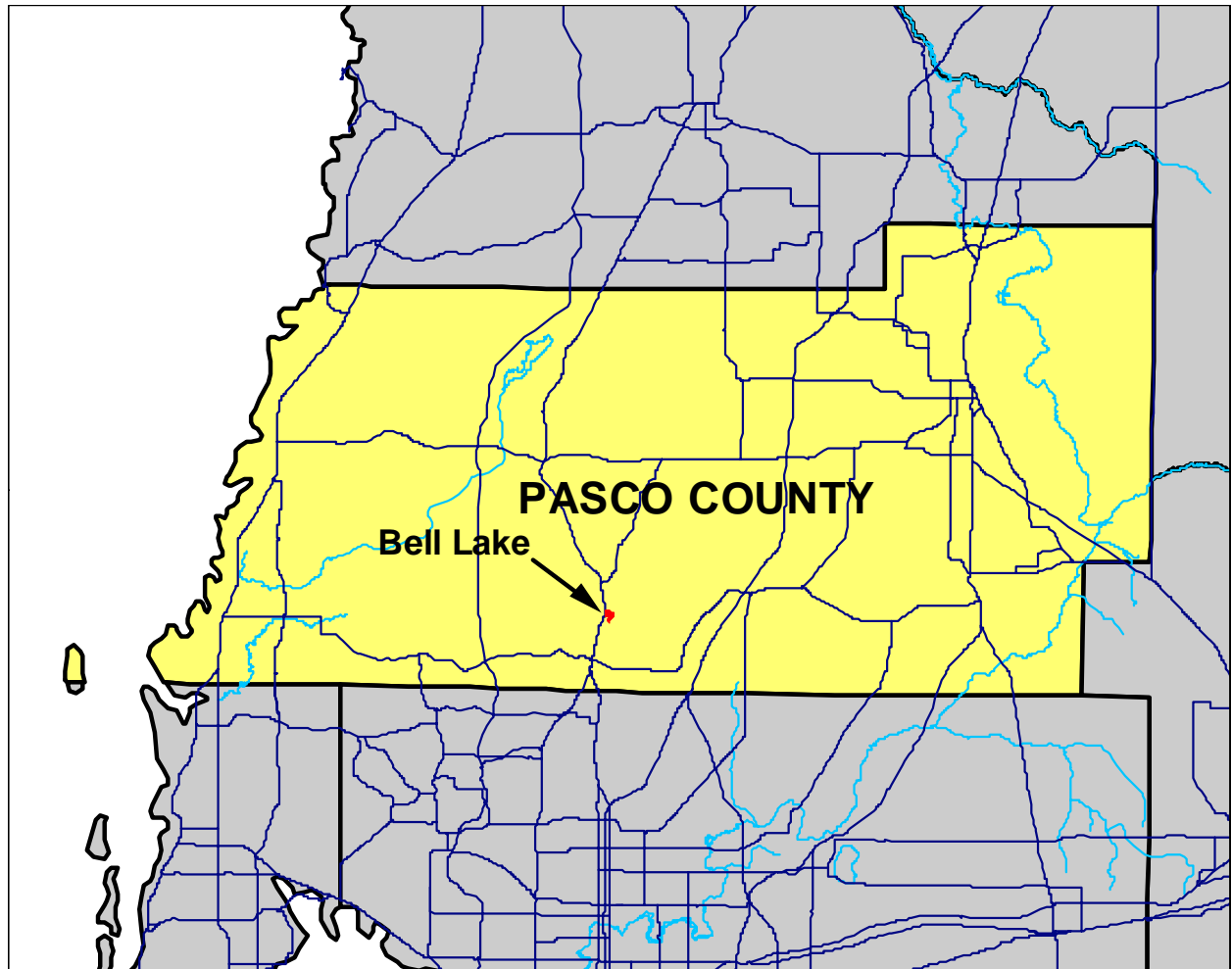
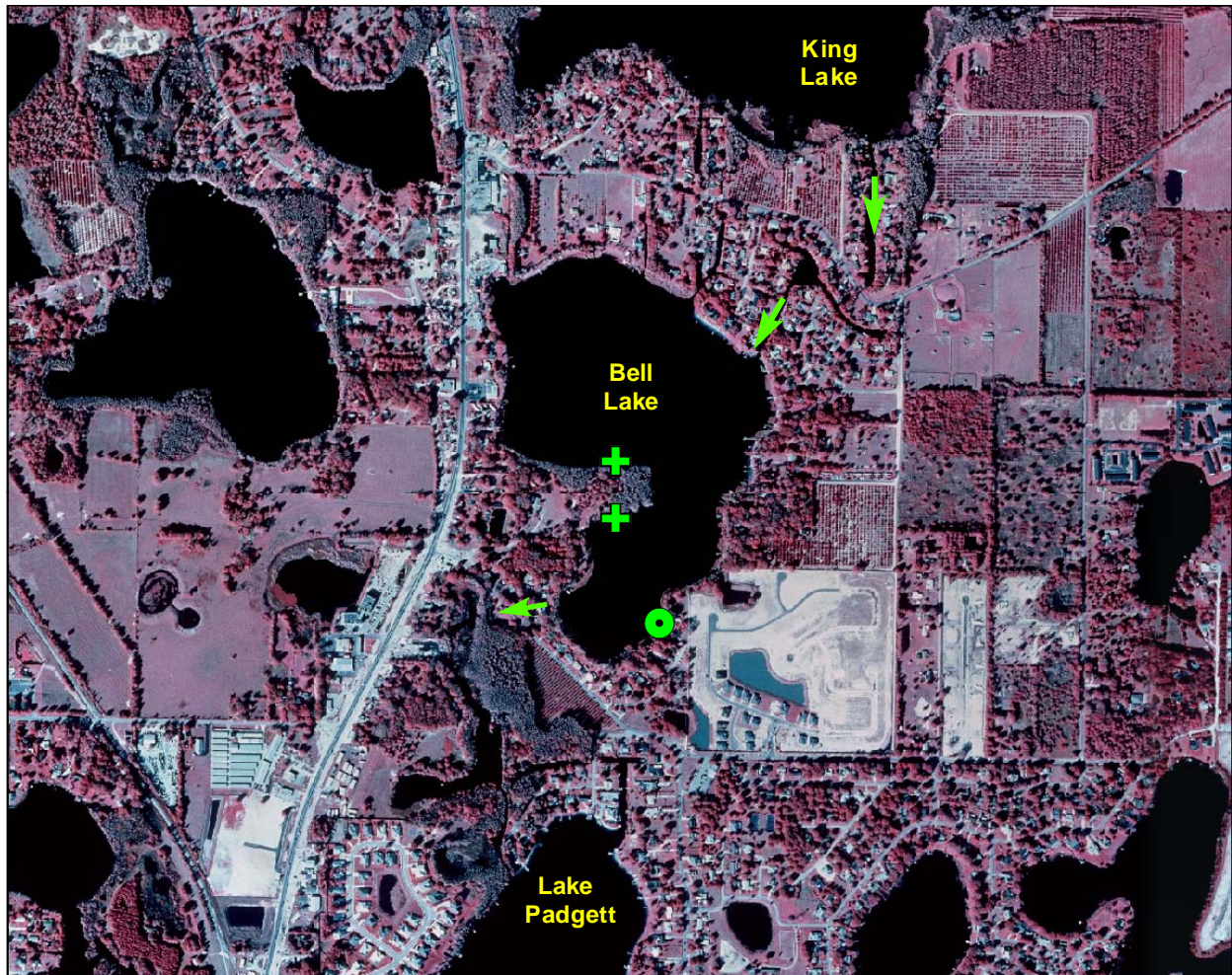


Figure 2. Location of District lake-level gauge, inlet, outlet, and sites where hydrologic indicators were measured at Bell Lake in Pasco County, Florida.

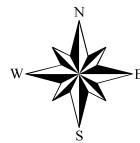


 Lake gauge

 Inlet/Outlet

 Hydrologic Indicators

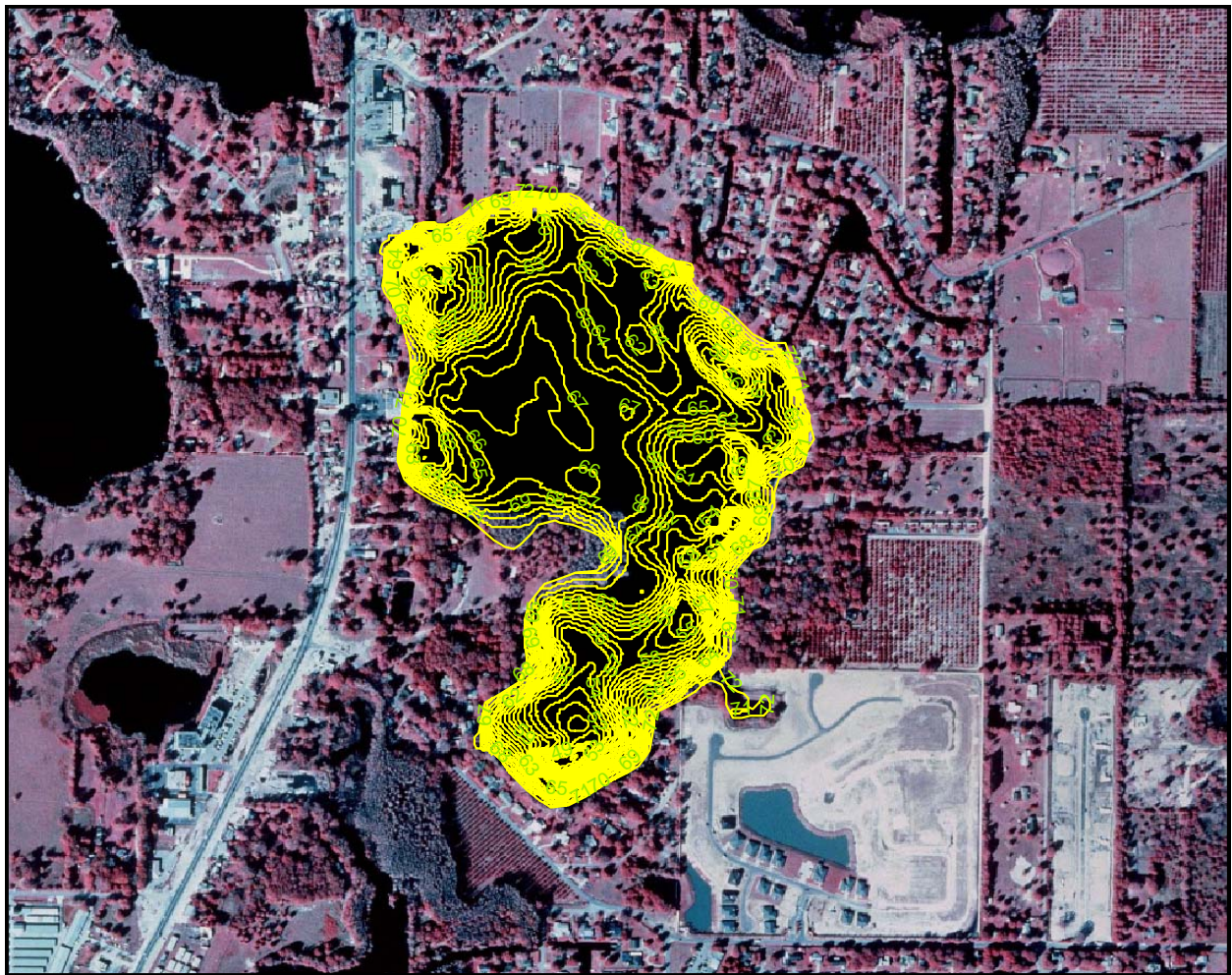
0 1,000 2,000 4,000 Feet



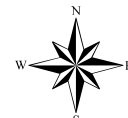
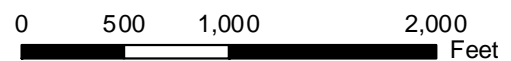
Aerial photography from 1999 USGS Digital Orthophotograph.

Map prepared September 3, 2003

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



Map prepared June 16, 2003 using 1999 USGS digital orthophotography, one-foot contours based on 1971 and 1972 SWFWMD aerial photography with contours maps (Sheet Nos. 18-26-19 and J-7), and elevation data collected by SWFWMD Staff on April 2, 2002.



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 Bell Lake in April 1985 (Table 1). A Maximum Desirable Level of 72.00 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table 1. Adopted guidance levels and associated surface areas for Bell Lake in Pasco County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	72.53	NA
High Level	72.50	NA
Low Level	70.00	82
Extreme Low Level	69.00	80

NA = not applicable/not available

Proposed Minimum and Guidance Levels

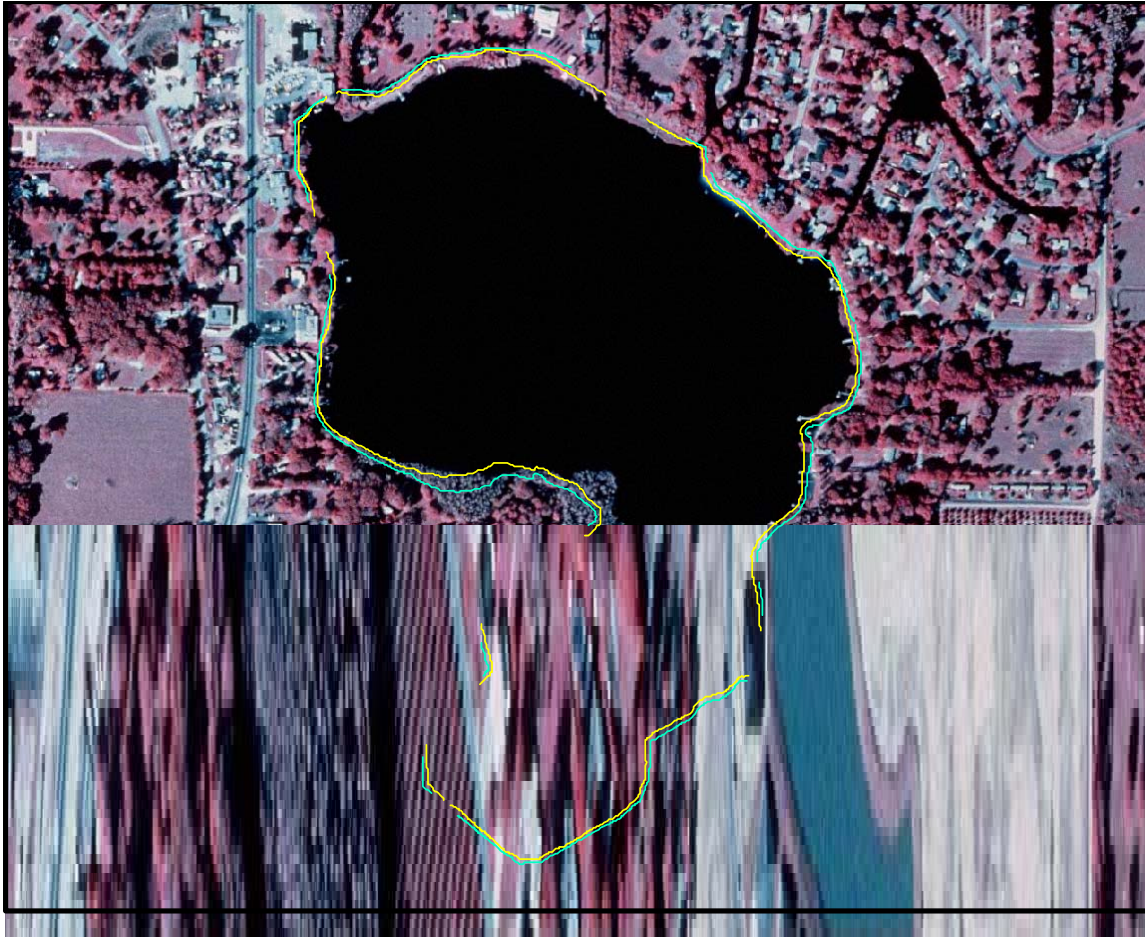
Proposed Minimum and Guidance Levels were developed for Bell Lake using the methodology for Category 1 and 2 Lakes described in SWFWMD (1999) and current District Rules (Chapter 40-D8, Florida Administrative Code). Additional lake-level information was developed using methods outlined in Leeper *et al.* (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 Bell Lake in Pasco County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	73.3	NA
High Guidance Level	71.6	85
High Minimum Lake Level	70.8	84
Minimum Lake Level	69.4	81
Low Guidance Level	69.2	80

NA = not applicable/not available

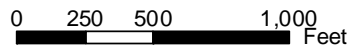
Figure 4. Approximate location of the proposed Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Bell Lake in Pasco County, Florida.



Legend

- 69.4 ft above NGVD
- 70.8 ft above NGVD

Map prepared December 12, 2003 using 1999 USGS digital orthophotography, one-foot contours based on 1971 and 1972 SWFWMD aerial photography with contours maps (Sheet Nos. 18-26-19 and J-7), and elevation data collected by SWFWMD Staff on April 2, 2002.



Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Bell Lake (District Universal ID Numbers STA 177 177) from July and August 1977, and December 1979 through 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 Normal Pool elevation was established at 71.2 ft above NGVD based on the elevation of cypress buttresses in a wetland along the western lakeshore (Table 4, Figure 2). The low floor slab elevation, extent of structural alteration and control point elevation were determined using available one-foot contour interval aerial maps and field survey data (Tables 3 and 5, Figure 7). The Normal Pool elevation is above the control point elevation (70.5 ft above NGVD), so the lake is considered to be Structurally Altered.

Based on the availability of Historic hydrologic data for the lake basin, the High Guidance Level was established at the Historic P10 elevation of 71.6 ft above NGVD (Table 3). The Historic P50 and Low Guidance Levels (70.4 and 69.2 ft above NGVD, respectively) were determined using the Historic P50 and Historic P90 elevations.

The Ten Year Flood Guidance Level for Bell Lake was established at 73.3 ft NGVD using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). For the analysis, the NETWORK flood routing model was used. Model input was based on a ten-year storm event with a 120-hour duration and an 11.3-inch rainfall depth. Based on available lake stage data, the Ten Year Flood Guidance Level has been exceeded only once during the past 26 years (Figures 5 and 6). The highest elevation for Bell Lake recorded in the District Water Management Data Base, 73.89 ft above NGVD, occurred on September 22, 1988. The low of record, 66.87 ft above NGVD, occurred on June 12, 2001.

Bell Lake contains diverse stands of aquatic macrophytes and other hydrophytes, including cattail (*Typha* sp.), maidencaine (*Panicum hemitomon*), pennywort (*Hydrocotyle umbellata*), primrose willow (*Ludwigia* sp.), red maple (*Acer rubrum*), and wax myrtle (*Myrica cerifera*). The western shore of the lake is contiguous with cypress-dominated wetlands of 0.5 or more acres in size, so the lake is classified as a Category 1 or 2 Lake for the purpose of minimum levels development. Because the Historic P50 elevation is less than 1.8 feet below the Normal Pool elevation, the lake is classified as a Category 1 Lake. Note that herein, for discussion purposes, the elevation 1.8 ft below the Normal Pool elevation is identified as the Cypress Standard. For Bell Lake, this standard is established at 69.4 ft above NGVD. Based on the relationship between the Cypress Standard and the Historic P50 elevation, the proposed Minimum Lake Level was established at the Cypress Standard elevation (69.4 ft above NGVD). The proposed

High Minimum Lake Level was established at 70.8 ft above NGVD, an elevation 0.4 ft below the Normal Pool elevation. The proposed High Minimum Lake Level is 3.8 ft below the Low Floor Slab elevation of a one story cottage and 2.3 ft below the low spot on Bell Lake Road.

For comparative purposes, minimum level standards used for establishing Minimum Lake Levels for lakes without fringing cypress wetlands (see Leeper *et al.* 2001) were developed for Bell Lake (Table 3). The Dock-Use Standard would be established at 70.7 ft above NGVD, based on the sum of the P10 elevation of sediments at the end of the 54 docks at the lake (67.5 ft above NGVD), a 2 ft clearance for movement of biota and use of powerboats in the lake, and the difference between the Historic P50 and Historic P90 (1.2 ft). The Recreation/Ski Standard would be established at 70.2 ft above NGVD, based on the sum of the elevation at which the lake could contain a safe skiing area (69 ft above NGVD), and the difference between the Historic P50 and Historic P90 (1.2 ft). The Aesthetic-Standard for the lake would be established at the Low Guidance Level elevation of 69.2 ft above NGVD. The Basin Connectivity Standard would be established at 68.7 ft above NGVD, based on the sum of the elevation that ensures connectivity among lake sub-basins (65.5 ft above NGVD), a 2 ft clearance for movement of biota and use of powerboats in the lake, and the difference between the Historic P50 and Historic P90 (1.2 ft). The Species Richness Standard would be established at 67.1 ft above NGVD, based on limiting reduction in lake surface area to less than a 15% decrease from the lake area at the Historic P50 elevation. Based on basin morphology, a Mixing Standard for preventing potential resuspension of sediments was not established. Review of changes in potential herbaceous wetland area associated with change in lake stage did not indicate that use of any of the standards would be inappropriate for minimum levels development (Figure 8).

Figure 5. Surface water elevation at Bell Lake in Pasco County, Florida. Data through January 2003 are shown.

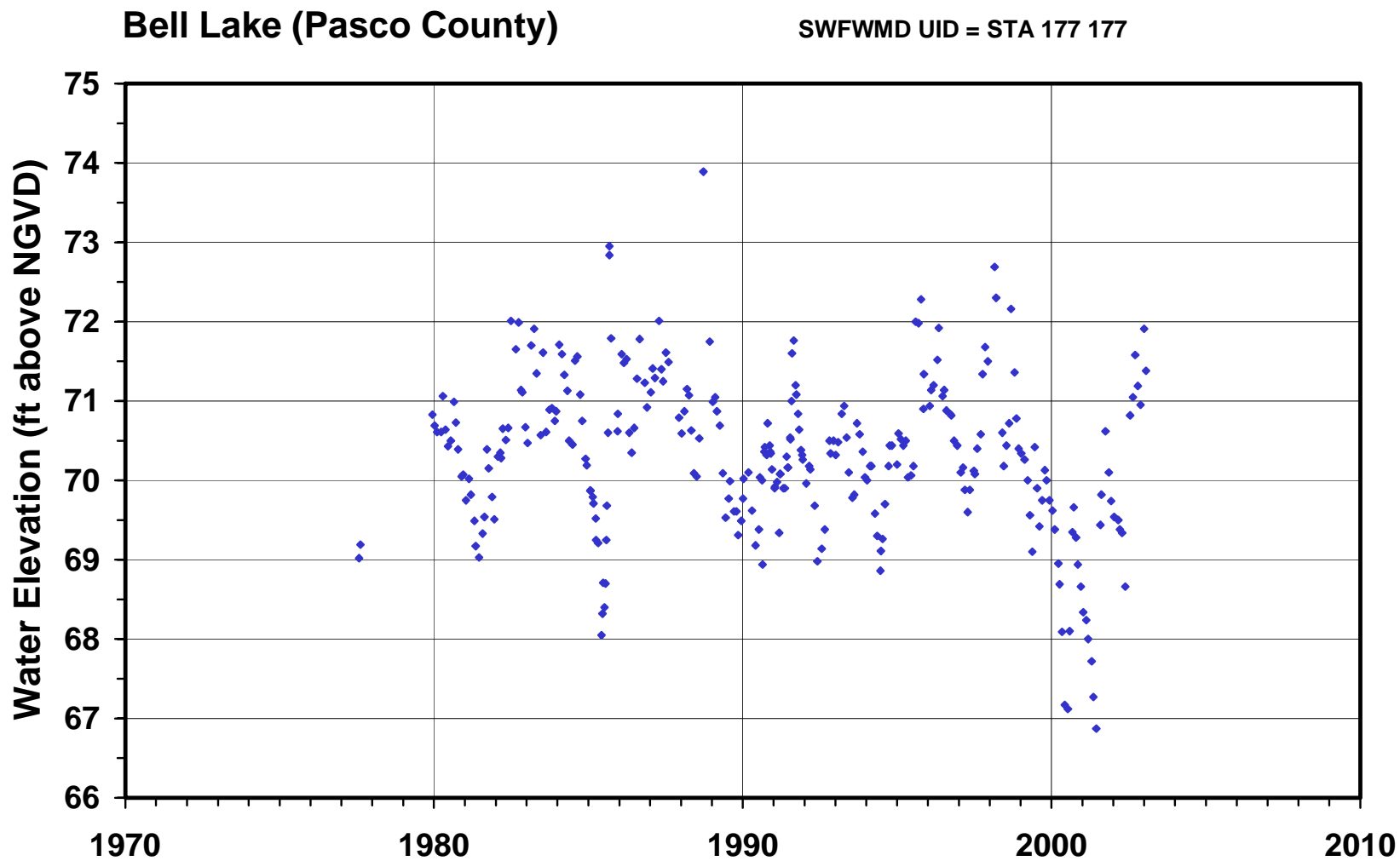


Figure 6. Mean monthly surface water elevations through January 2003, and proposed guidance and minimum levels for Bell Lake in Pasco County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level (HMLL),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

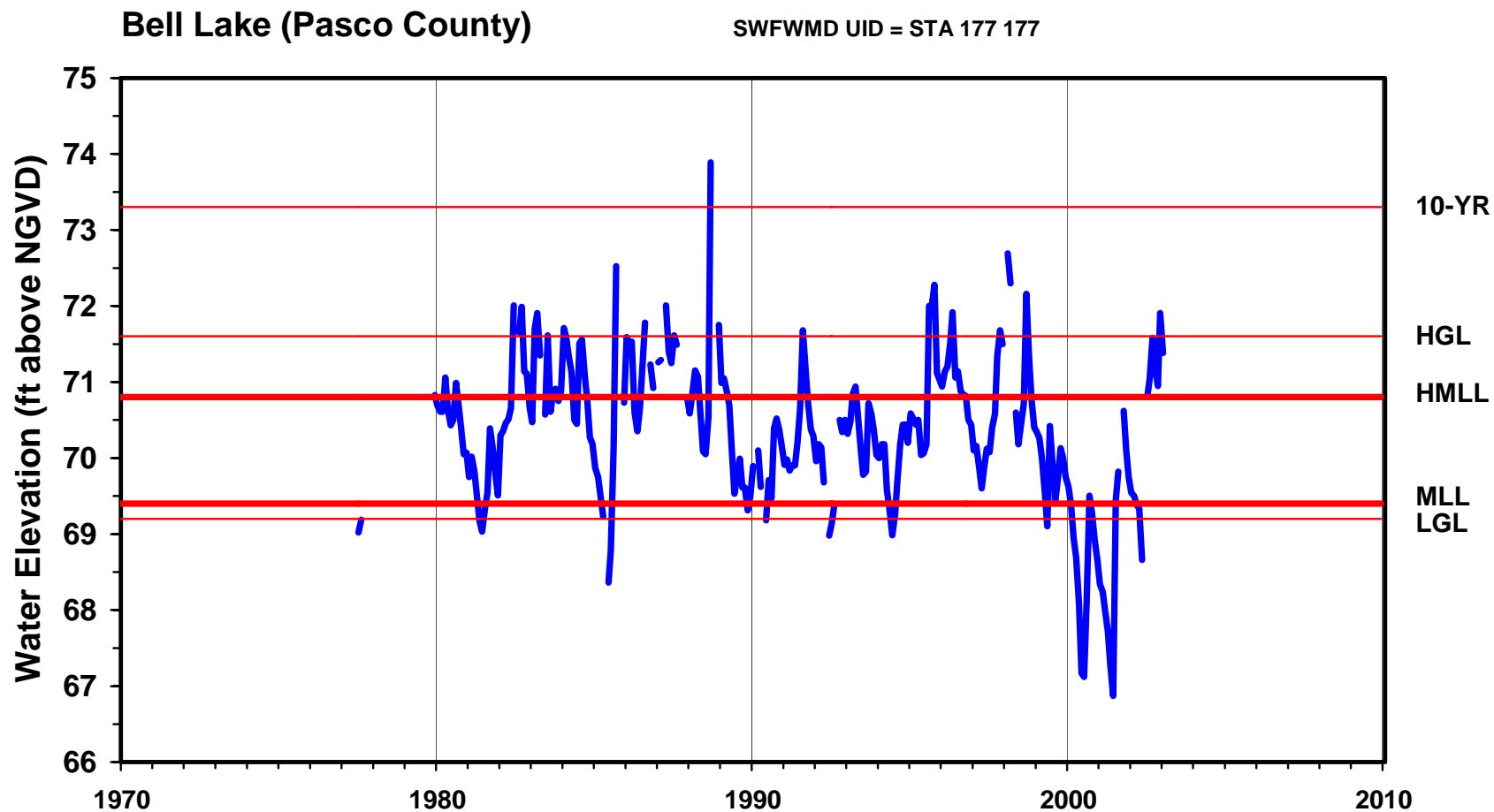


Table 3. Elevation data and associated area values used for establishing minimum levels for Bell Lake in Pasco County, Florida.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Historic P10	71.57	85
Historic P50	70.40	83
Historic P90	69.22	80
Normal Pool	71.2	84
Low Floor Slab (one story cottage)	74.6	NA
Low Road (Bell Lake Rd.)	73.1	NA
Low Other (BBQ pit)	73.6	NA
Control Point	70.5	83
High Guidance Level	71.6	85
Historic P50	70.4	83
Low Guidance Level	69.2	80
Cypress Standard	69.4	81
*Dock-Use Standard	70.7	83
*Recreation/Ski Standard	70.2	82
*Aesthetic Standard	69.2	80
*Connectivity Standard	68.7	79
*Species Richness Standard	67.1	72

NA = not applicable/not available

*Category 3 Lake Standards developed for comparative purposes only.

Table 4. Elevation data used for establishing the Normal Pool Elevation for Bell Lake in Pasco County, Florida. Data were collected by SWFWMD staff in April 2002.

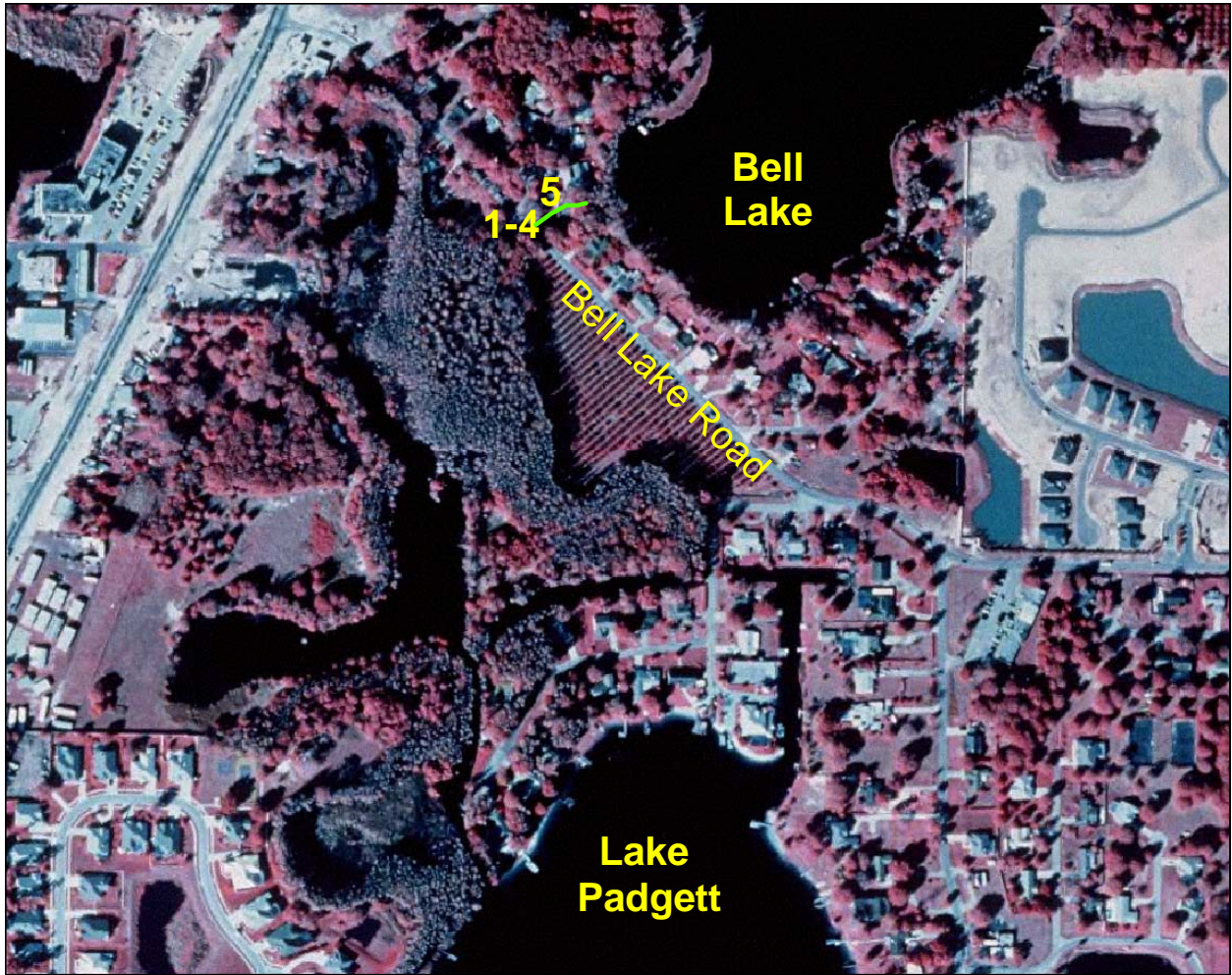
Hydrologic Indicator	Elevation (feet above NGVD)
Cypress buttress inflection point	70.86
Cypress buttress inflection point	70.86
Cypress buttress inflection point	70.96
Cypress buttress inflection point	70.96
Cypress buttress inflection point	71.01
Cypress buttress inflection point	71.06
Cypress buttress inflection point	71.06
Cypress buttress inflection point	71.06
Cypress buttress inflection point	71.16
Cypress buttress inflection point	71.16
Cypress buttress inflection point	71.16
Cypress buttress inflection point	71.16
Cypress buttress inflection point	71.26
Cypress buttress inflection point	71.36
Cypress buttress inflection point	71.36
Cypress buttress inflection point	71.36
Cypress buttress inflection point	71.46
Cypress buttress inflection point	71.46
N	18
Median	71.2
Mean	71.2
Standard Deviation	0.2

Table 5. Outlet conveyance system and control point summary information for Bell Lake in Pasco County, Florida. Numbered sites correspond to those shown in Figure 7.

Site	Description	Elevation (feet above NGVD)
1	Invert at north end of 2 ft X 3.2 ft oval concrete culvert that extends under Bell Road	71.09
2	Invert at south end of 2 ft X 3.2 ft oval concrete culvert described at Site Number 1	71.05
3	Invert at north end of 2 ft X 3.2 ft oval concrete culvert that extends under Bell Road; culvert is located to the west of the culvert described at site number 1	70.16
4	Control point; invert at south end of 2 ft X 3.2 ft oval concrete culvert described at Site Number 3	70.45
5	Ditch with concrete seawall	NA

NA = not applicable/not available

Figure 7. Outlet conveyance system for Bell Lake in Pasco County, Florida. Numbered sites are described in Table 5.



Aerial photography from 1999 USGS
Digital Orthophotograph.

Map prepared June 13, 2003

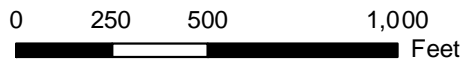
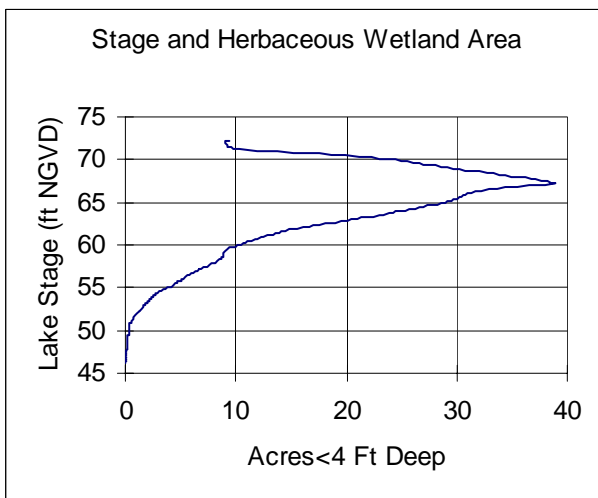
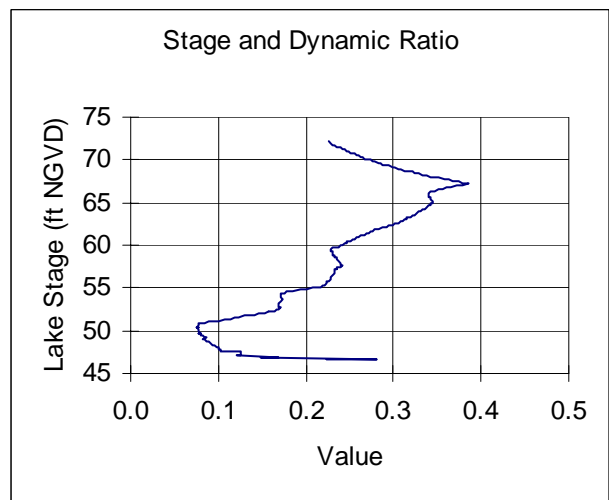
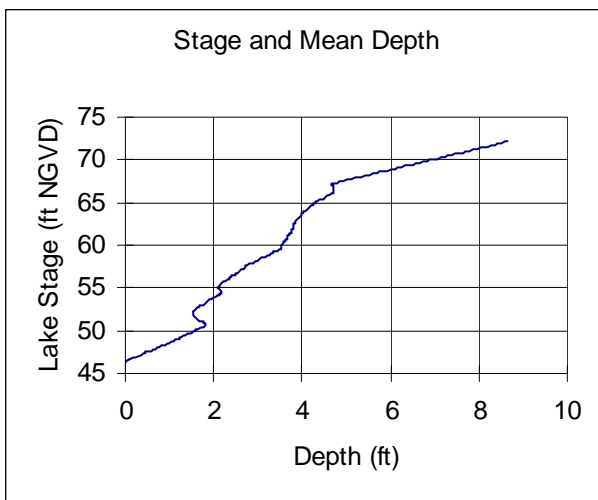
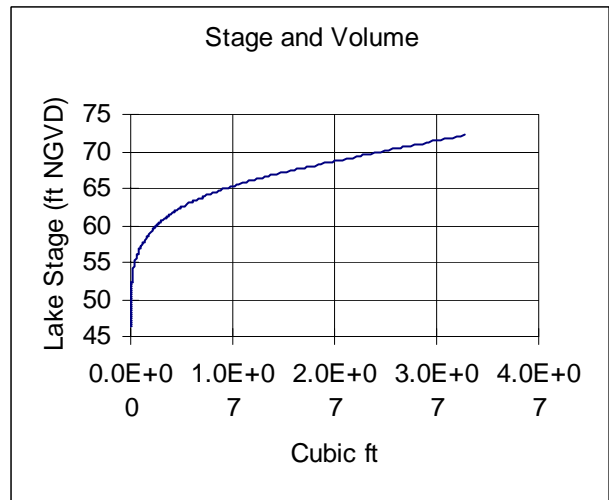
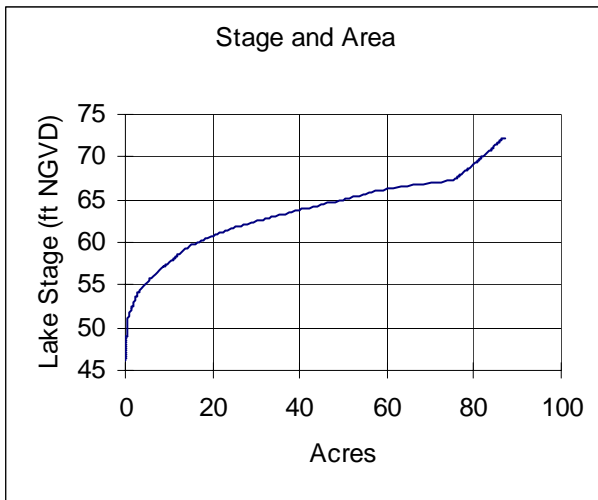


Table 6. Summary statistics for elevations associated with docks (n = 54) at Bell Lake in Pasco County, Florida, based on data collected by SWFWMD staff on April 2, 2002. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

Statistic	Elevation of Sediments at Waterward Ends of Docks (feet above NGVD)	Elevation of Dock Platforms (feet above NGVD)
Mean (SD)	66.3 (1.3)	73.0 (0.6)
P10	67.5	73.9
P50	66.5	73.0
P90	64.9	72.3
Maximum	69.1	74.2
Minimum	62.4	71.4

Figure 8. Surface area, volume, mean depth, dynamic ratio (basin slope), and potential herbaceous wetland area versus lake stage for Bell Lake in Pasco County, Florida.



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