February 4, 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 Lakes Helen, Ellen and Barbara in Hillsborough County, Florida**

Lakes Helen, Ellen and Barbara

General Lake Description

Lakes Helen, Ellen and Barbara are located in the Northwest Hillsborough Basin in Hillsborough County, Florida (Section 19, Township 27S, Range 18E) (Figure HEB-1). 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); 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 Keystone Lakes region; an area of numerous slightly acidic, low nutrient, and mostly clear-water lakes (Griffith *et al.* 1997).

Lakes Helen, Ellen and Barbara are connected via navigable canals (Figure HEB-2). For the purpose of establishing minimum levels, the three basins, their interconnections (canals) and the large canal contiguous with the southern shore of Lake Helen are grouped together as the Lake Helen, Ellen and Barbara system. No major inlets from other surface water features exist. The system drains to the west through an outlet on the northwest shore of Lake Helen, ultimately connecting through wetland systems to Rock Lake in the Rocky Creek drainage. There are no surface water withdrawals from the lakes currently permitted by the District. There are, however, several permitted groundwater withdrawals in the vicinity of the lakes

The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists surface areas of 16, 5 and 2 acres for Lakes Helen, Ellen and Barbara, respectively. The 1956 United States Geological Survey (photorevised 1987) 1:24,000

Citrus Park, Fla. quadrangle map indicates a water level elevation of 53 ft above mean sea level in the Helen and Ellen basins. This elevation corresponds to a surface area of 28 acres for the system, based on a topographic map generated in support of minimum levels development (Figure HEB-3). Data used for production of the topographic map were obtained from field surveys and 1:200 aerial photograph maps containing one-foot contour lines prepared using photogrammetric methods.

Figure HEB-1. Location of Lakes Helen, Ellen and Barbara in Hillsborough County, Florida.

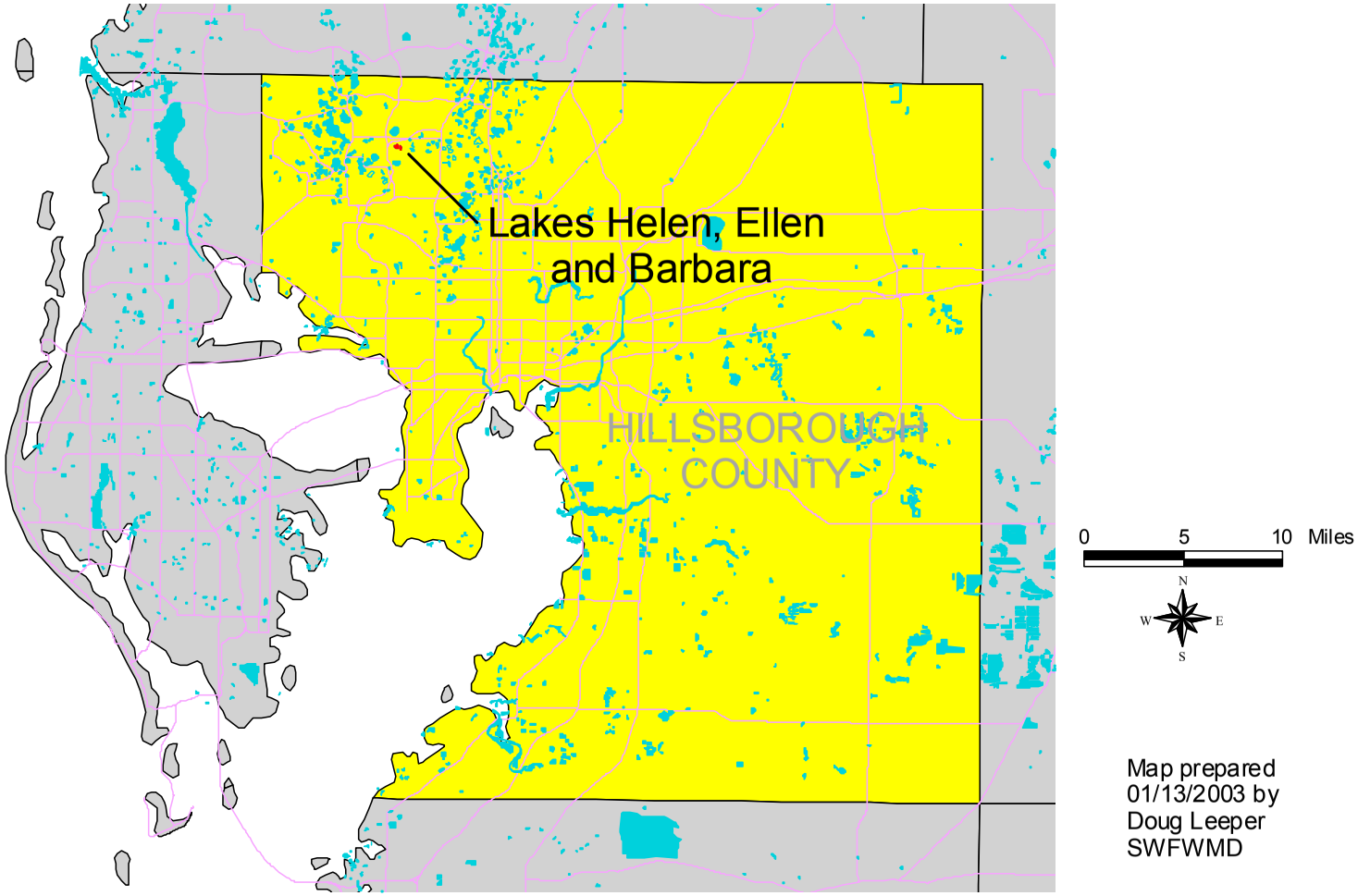


Figure HEB-2. Location of the District water level gauge and outlets for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida.

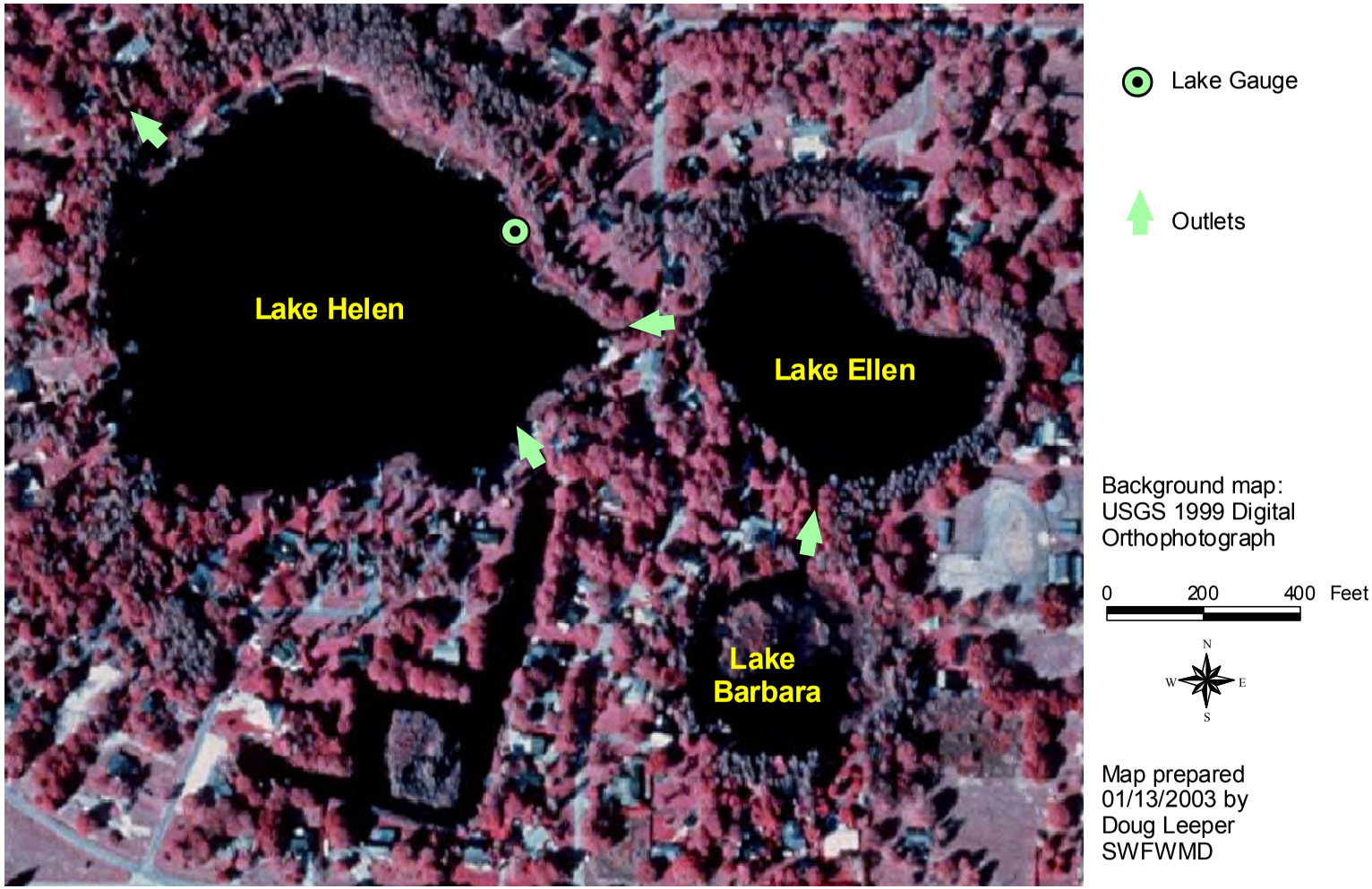
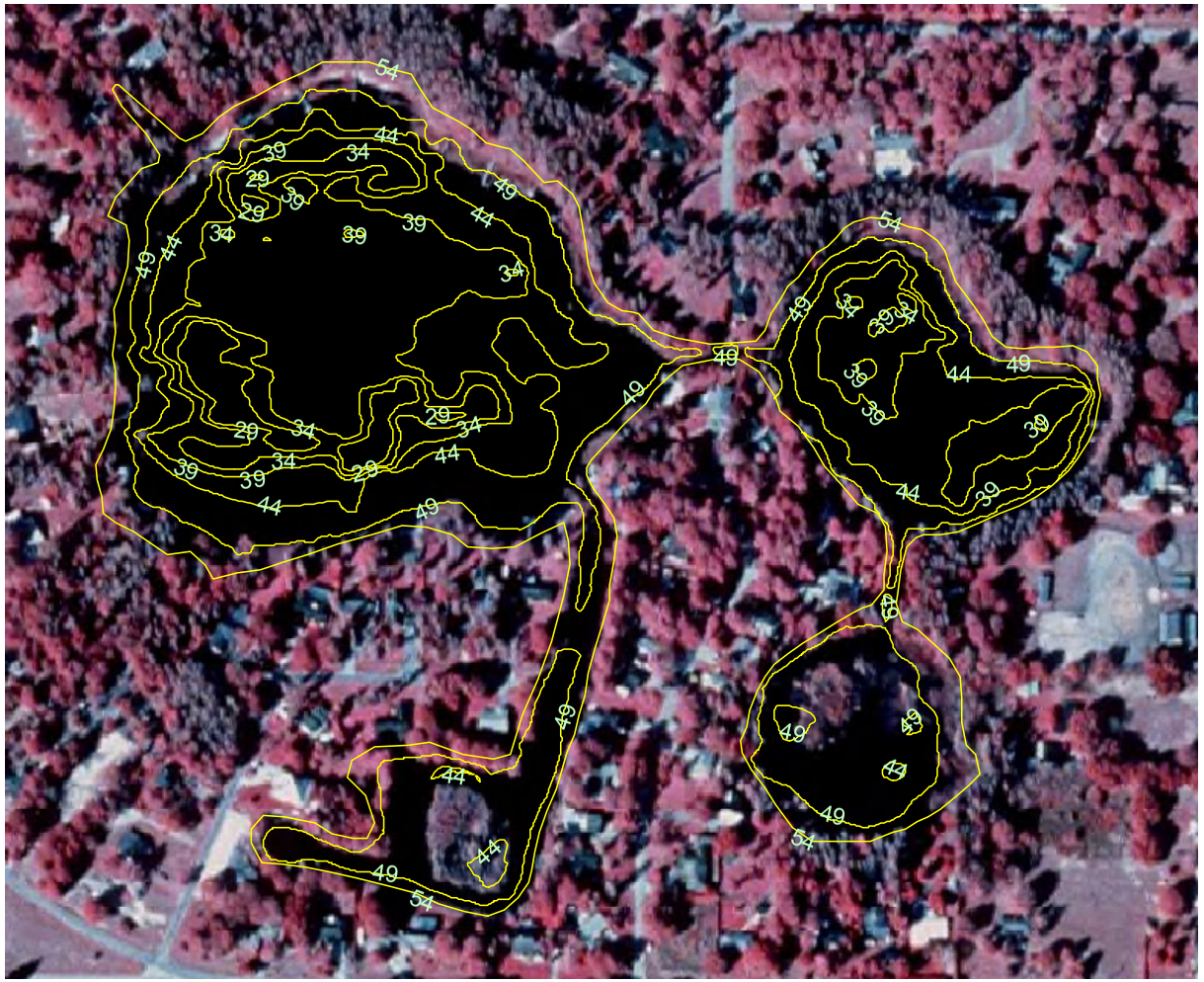


Figure HEB-3 Five-foot contours within the Lake Helen, Ellen and Barbara system basin in Hillsborough County, Florida. Values shown are elevation, in feet above the National Geodetic Vertical Datum of 1929.



Previously Adopted Lake Management Levels

The District has not previously adopted management levels for Lakes Helen, Ellen or Barbara.

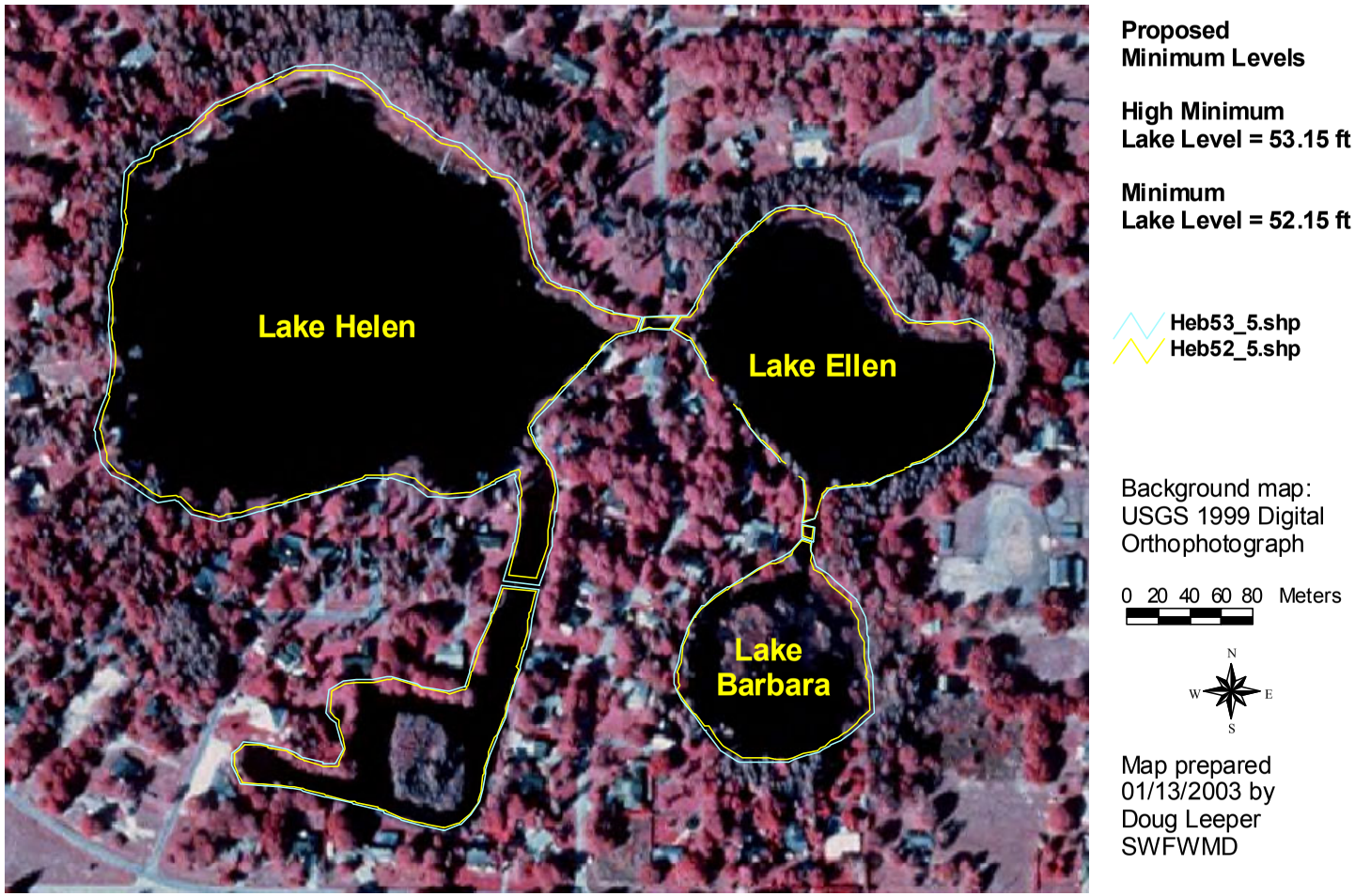
Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for the Lake Helen, Ellen and Barbara system 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 system-surface areas for each level are listed in Table HEB-1. The locations of the proposed minimum levels within the lake basin are shown in Figure HEB-4.

Table HEB-1. Proposed minimum levels, guidance levels and associated surface areas for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	54.96	31
High Guidance Level	53.15	28
High Minimum Lake Level	53.15	28
Minimum Lake Level	52.15	27
Low Guidance Level	51.05	26

Figure HEB-4. Approximate location of the proposed Minimum Lake Level (yellow) and the proposed High Minimum Lake Level (blue) for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida. Elevations listed are in feet, relative to the National Geodetic Vertical Datum of 1929.



Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Lake Helen (District Universal ID Number STA 710 573) from February 1993 through the present date (Figure HEB-5). For the entire period of record, the hydrologic data are classified as Current data. Data collected through December 2001 were used to calculate the Current P10, P50, and P90 (Table HEB-2).

The Category 3 Lake Normal Pool elevation was established at 55.09 ft above NGVD, based on buttressing of large cypress trees along the west shore of the lake (Tables HEB-2 and HEB-3. The low floor slab elevation, extent of structural alteration and the control point elevation were determined using available one-foot contour interval aerial maps and field survey data (Tables HEB-2 and HEB-4, Figure HEB-6). The Category 3 Lake Normal Pool elevation is above the control point, so the lake is considered to be Structurally Altered.

Based on the relationship between the control point elevation, the Category 3 Lake Normal Pool elevation and the Current P10, the High Guidance Level was established at the Current P10 elevation of 53.15 ft above NGVD (Table HEB-2). The Historic P50 and Low Guidance Level were determined using the High Guidance Level and the Northern Tampa Bay Region RLWR50 (1.0 ft) and RLWR90 (2.1 ft) statistics (see SWFWMD 1999 for a discussion of the reference lake water regime statistics).

The Ten Year Flood Guidance Level was established for Lakes Helen, Ellen and Barbara using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). The District used an existing hydrologic and hydraulic computer model of the Rocky Creek Watershed developed by Hillsborough County (Hillsborough County 1998). The Rocky Creek runoff hydrographs were computed using the NRCS Dimensionless Unit Hydrograph, a 256-shape factor, a 10.0-inch rainfall depth, and a 72-hour rainfall distribution developed by the South Florida Water Management District. The Rocky Creek conveyance system was simulated with the Hillsborough County modified version of EXTRAN, and the hydrodynamic routing component of the Environmental Protection Agency's Stormwater Management Model (SWMM) v.4.31. District staff modified the EXTRAN input data developed by Hillsborough County to include additional surveyed elements of the Lake Helen outlet conveyance system. The initial elevation of Lakes Helen, Ellen and Barbara were set at the outlet control point elevation of 52.95 feet above NGVD. The modified data set was then used to determine the 10-year flood level based on runoff hydrographs from the 10-year storm event. The Ten Year Flood Guidance Level (54.96 ft above NGVD) has not been exceeded during the period for which lake stage data are available (see Figure HEB-5). The highest recorded surface elevation for the system occurred on December 30, 1997, when Lake Helen was at 54.90 ft above NGVD.

Lakes Helen, Ellen and Barbara area not contiguous with any cypress-dominated wetlands of 0.5 or more acres in size and are therefore classified as a Category 3 Lakes for the purpose of minimum levels development. Aquatic macrophytes, including cattail

(*Typha* sp.), panic grass (*Panicum sp.*), spikerush (*Eleocharis* sp.), pickerelweek (*Pontederia cordata*) and spatterdock (*Nuphar luteum*) occur throughout the basin.

Dock-Use, Basin Connectivity, Aesthetics, and Species Richness Standards were evaluated for minimum levels development. A Dock-Use Standard for the lake system was established at 52.95 ft above NGVD, based on the Northern Tampa Bay area RLWR5090 (1.1 ft) and a Dock-End Sediment elevation of 49.85 ft, developed from measurement of 48 docks. A Basin Connectivity Standard was established at 52.1 ft above NGVD, based on use of powerboats in the lake, a critical high-spot elevation of 49 ft and the RLWR5090 for the northern Tampa Bay area. An Aesthetic-Standard for the system was established at the Low Guidance Level elevation of 51.05 ft above NGVD. A Species Richness Standard was established at 49.05 ft above NGVD, based on a 15% reduction in lake surface area from that at the Historic P50 elevation. Development of a Recreation/Ski Standard was not appropriate, based on the size of the lake basins. Review of the dynamic ratio for lake stages bounded by the Current P10 and Current P90 elevations and the High and Low Guidance Levels did not indicate that potential changes in basin susceptibility to wind-induced sediment resuspension would be of concern for minimum levels development (Figure HEB-7). 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 HEB-7).

The Dock-Use Standard, the most conservative of the appropriate standards, exceeded the Historic P50 elevation, so the Historic P50 elevation was substituted for this standard and used to establish the proposed Minimum Lake Level at 52.15 ft above NGVD. The proposed High Minimum Lake Level was established at 53.15 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the RLWR50 (1.0 ft) for the northern Tampa Bay area. The proposed High Minimum Lake Level is equivalent to the High Guidance Level and is 2.5 ft below the Low Floor Slab elevation and 2.1 ft below a garage slab sited lower than the low floor slab

Figure HEB-5. Mean monthly surface water elevation, and proposed guidance and minimum levels for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida. Data are shown for a gauge site in Lake Helen. 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).

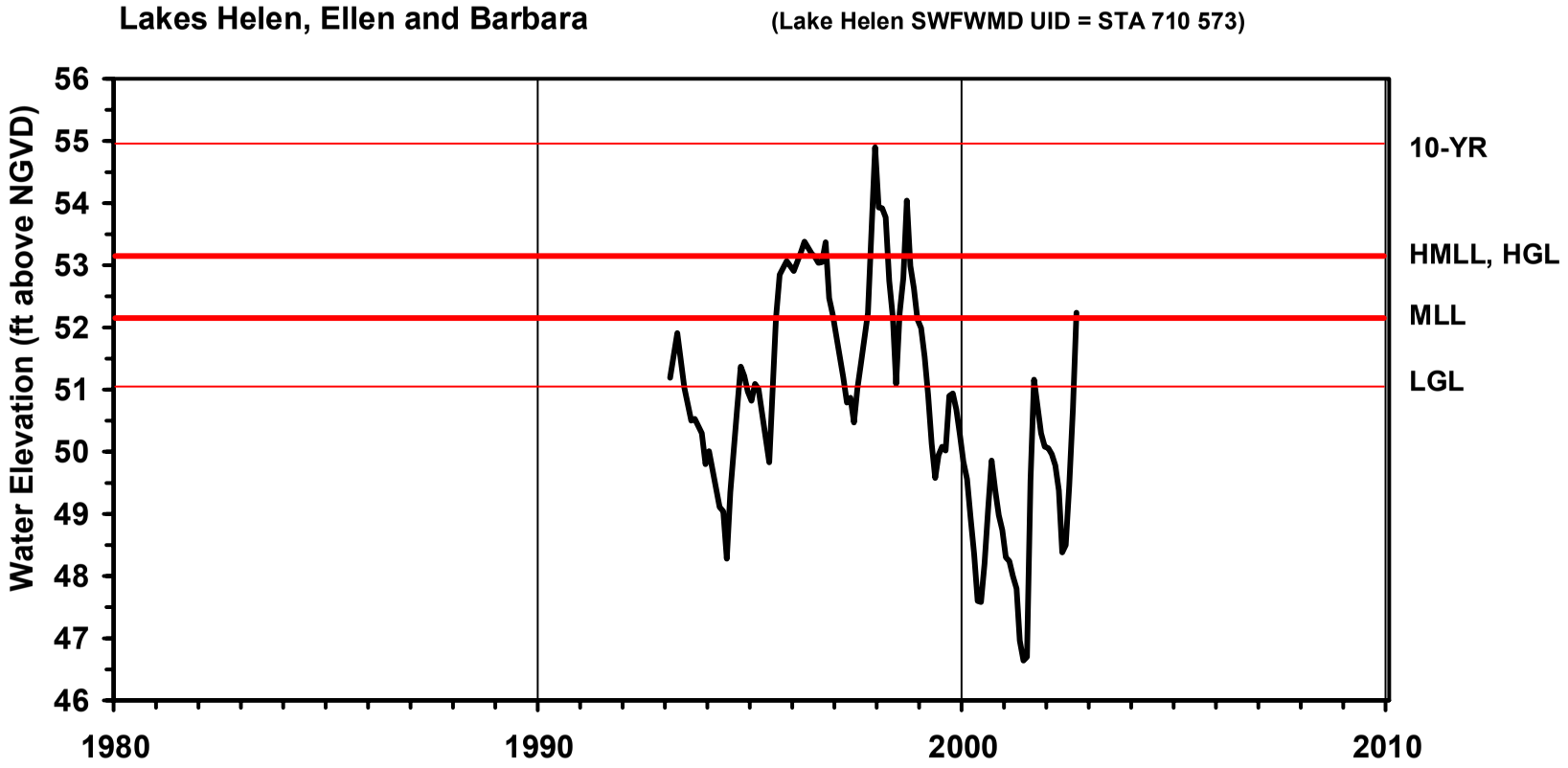


Table HEB-2. Elevation data and associated area values used for establishing minimum levels for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida.

Level or Feature	Elevation (feet above NGVD)	Total Lake Area (acres)
Current P10	53.15	28
Current P50	50.89	25
Current P90	48.27	22
Category 3 Lake Normal Pool	55.09	31
Low Floor Slab	55.62	NA
Low Garage Slab	55.28	NA
Low Road	55.49	NA
Control Point	52.95	28
High Guidance Level	53.15	28
Historic P50	52.15	27
Low Guidance Level	51.05	26
Dock-Use Standard	52.95	28
Basin Connectivity Standard	52.1	27
Aesthetic Standard	51.05	26
Species Richness Standard	49.05	23

NA = not applicable

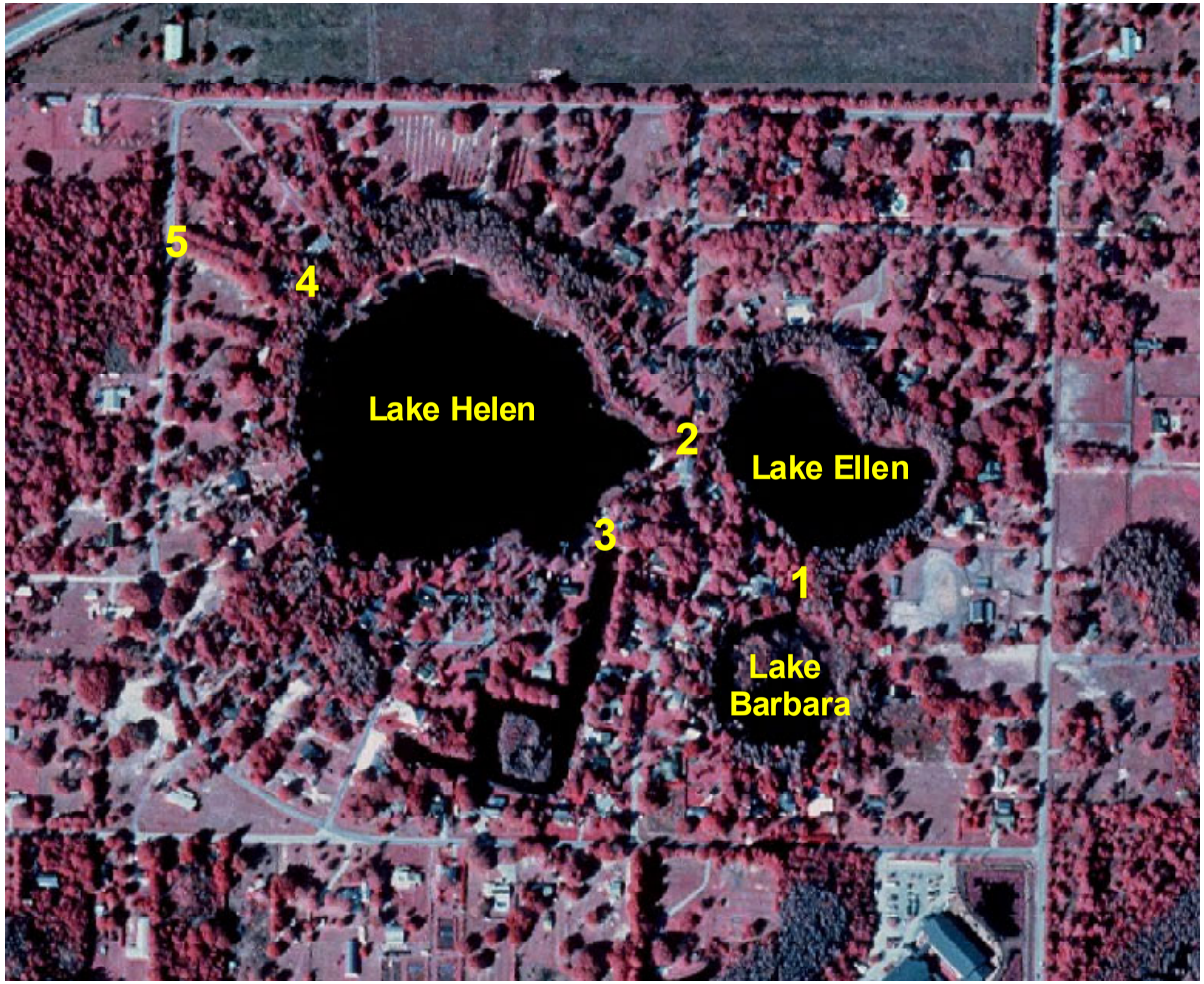
Table HEB-3. Elevation data used for establishing the Category 3 Lake Normal Pool Elevation for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida. Data were collected on March 11, 1998; water level elevation was 53.67 ft above NGVD.

Hydrologic Indicator	Elevation (ft above NGVD)
Normal pool based on cypress buttress	55.09
Normal pool based on cypress buttress	55.50
Normal pool based on cypress buttress	55.09
N	**3**
Median	**55.09**
Mean	**55.23**
Standard Deviation	**0.24**

Table HEB-4. Summary of structural alteration and control point elevation information for the Lake Helen, Ellen, and Barbara system in Hillsborough County, Florida. Numbers correspond to those shown in Figures HEB-6.

No.	Description	Elevation (feet above NGVD)
1	High point in canal between Lakes Barbara and Ellen	48.0
2	High point in canal between Lakes Ellen and Helen	48.9
3	High point in channel between canal and Lake Helen	49.1
4	Control point; vegetated high point in channel	52.95
5	Invert at east end of 24" corrugated metal pipe under Lakeside Drive	51.95

Figure HEB-6. Outlet conveyance system for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida. Numbered sites are described in Table HEB-4.



Background map:
USGS 1999 Digital
Orthophotograph

0 200 400 Feet

N
W E
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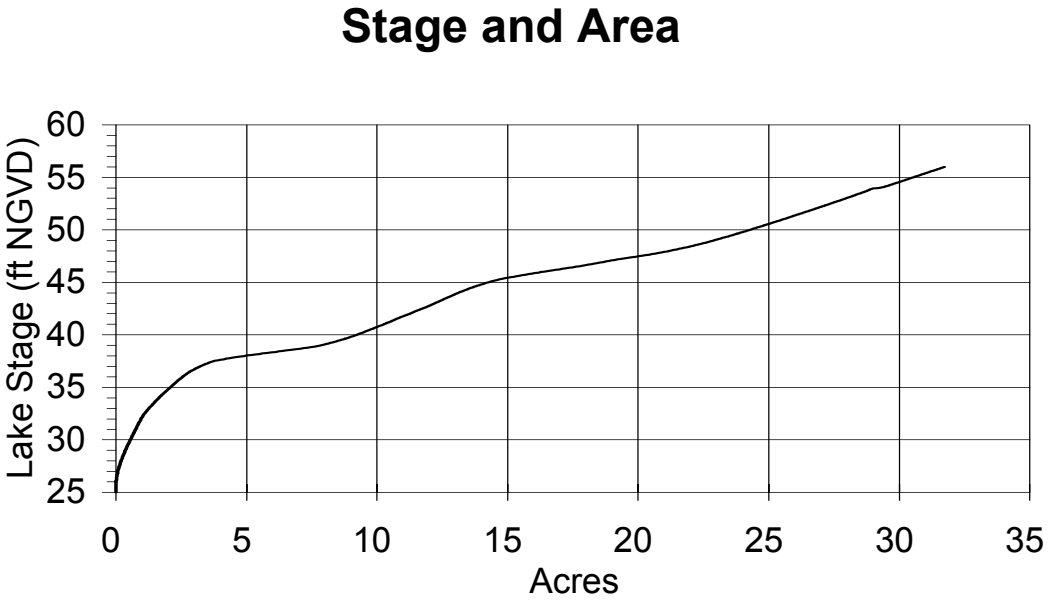
Map prepared
01/13/2003 by
Doug Leeper
SWFWMD

Figure HEB-7. Surface area, volume, potential herbaceous wetland area, area available for colonization by aquatic macrophytes, and dynamic ratio versus lake stage for the Lake Helen, Ellen and Barbara system in Hillsborough County, Florida.



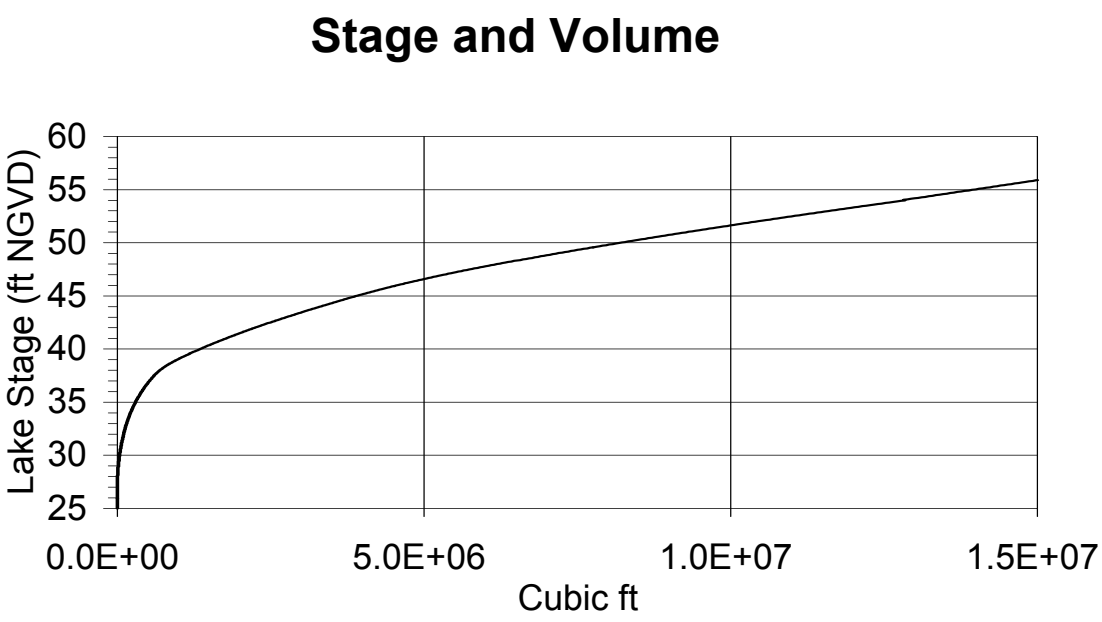
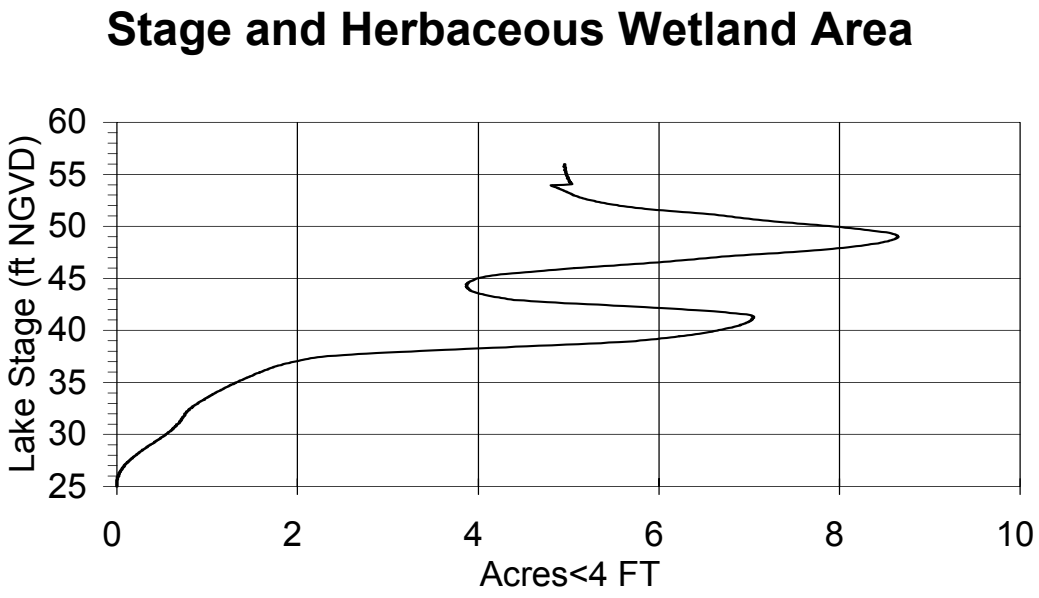


Figure HEB-7 (continued).



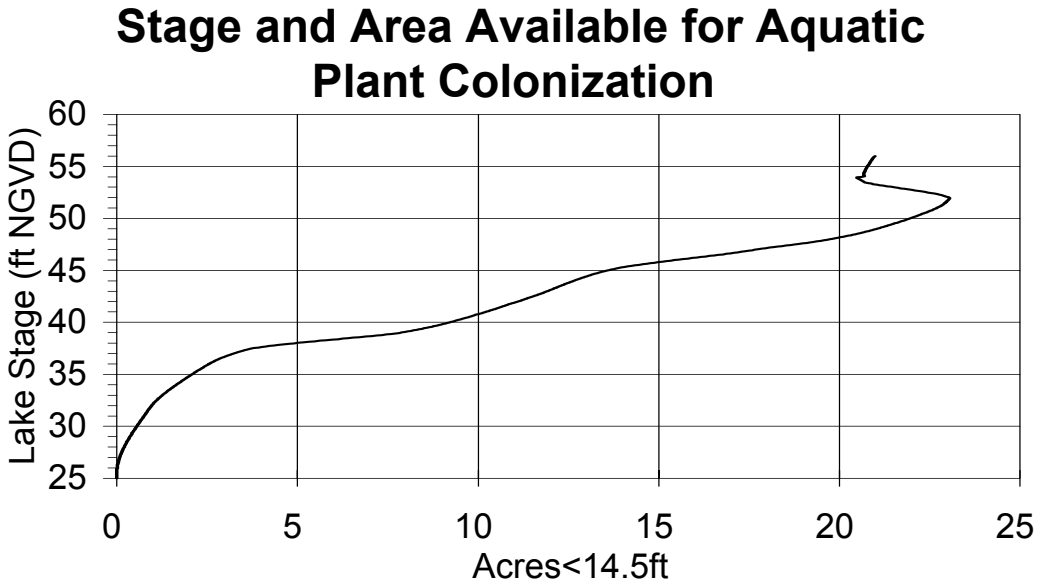
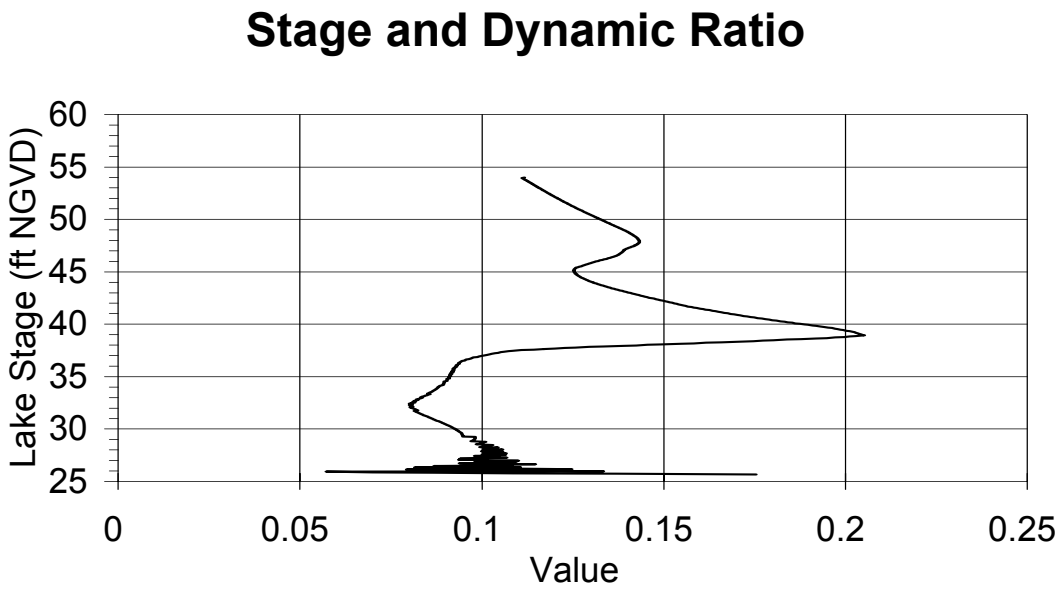


Figure HEB-7 (continued).



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