April 23, 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 Strawberry (North Crystal) Lake in Hillsborough County, Florida**

Strawberry (North Crystal) Lake

General Description

Strawberry (North Crystal) Lake (Figure 1) is located in the Northwest Hillsborough Basin of the Southwest Florida Water Management District (SWFWMD or District) in Hillsborough County, Florida (Sections 11 and 14, Township 27S, Range 18E). White (1970) classified the area of west-central Florida containing Strawberry Lake 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. The subdivision is 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).

Most of the lake shoreline has been cleared and is currently covered with residential development (Figure 2). Public access to the shoreline is not available. The lake is located in the Rocky/Brushy Creek watershed. The drainage area for Strawberry (North Crystal) Lake is 2.0 square miles (SWFWMD 1996). An inlet along the north shore of the north basin of the lake conveys water from Lake Cooper. Pumped groundwater represents another source of water for the basin. In 1977, the District issued a consumptive use permit (No 7601898) to the North Crystal Lake Improvement Association for augmentation of the lake with groundwater from the Floridan aquifer. Augmentation of the lake was discontinued following expiration of the permit in 1983, but was reinitiated following issuance of a new Water Use Permit (No. 2012294.000) to the Association in 2002.

An outlet along the south shore of the lake drains Strawberry Lake under Crystal Lake Road to Crystal Lake. A dredged canal along the west shore of Crystal Lake drains the lakes to the north, back under Crystal Lake Road to a wetland adjacent to an unnamed lake. This lake/wetland system drains to the south, under Crystal Lake Road to a series of wetlands that discharge into Reinheimer Lake. There are no surface water withdrawals from Strawberry Lake currently permitted by the District. There are, however, several permitted groundwater withdrawals in the area, including major withdrawals associated with Tampa Bay Water's operation of the Section 21 Wellfield.

The 1974 and 1987 (photorevised) United States Geological Survey 1:24,000 Lutz quadrangle maps do not include an elevation for the lake surface. The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake's area at 41 acres at 60 ft above the National Geodetic Vertical Datum of 1929 (NGVD). A topographic map of the basin generated in support of minimum levels development (Figure 3) indicates that the lake extends over 42 acres at an elevation of 60 ft above NGVD. Data used for production of the topographic map were obtained from field surveys and aerial photography maps containing one-foot contour lines prepared using photogrammetric methods.

Figure 1. Location of Strawberry (North Crystal) Lake in Hillsborough County, Florida.

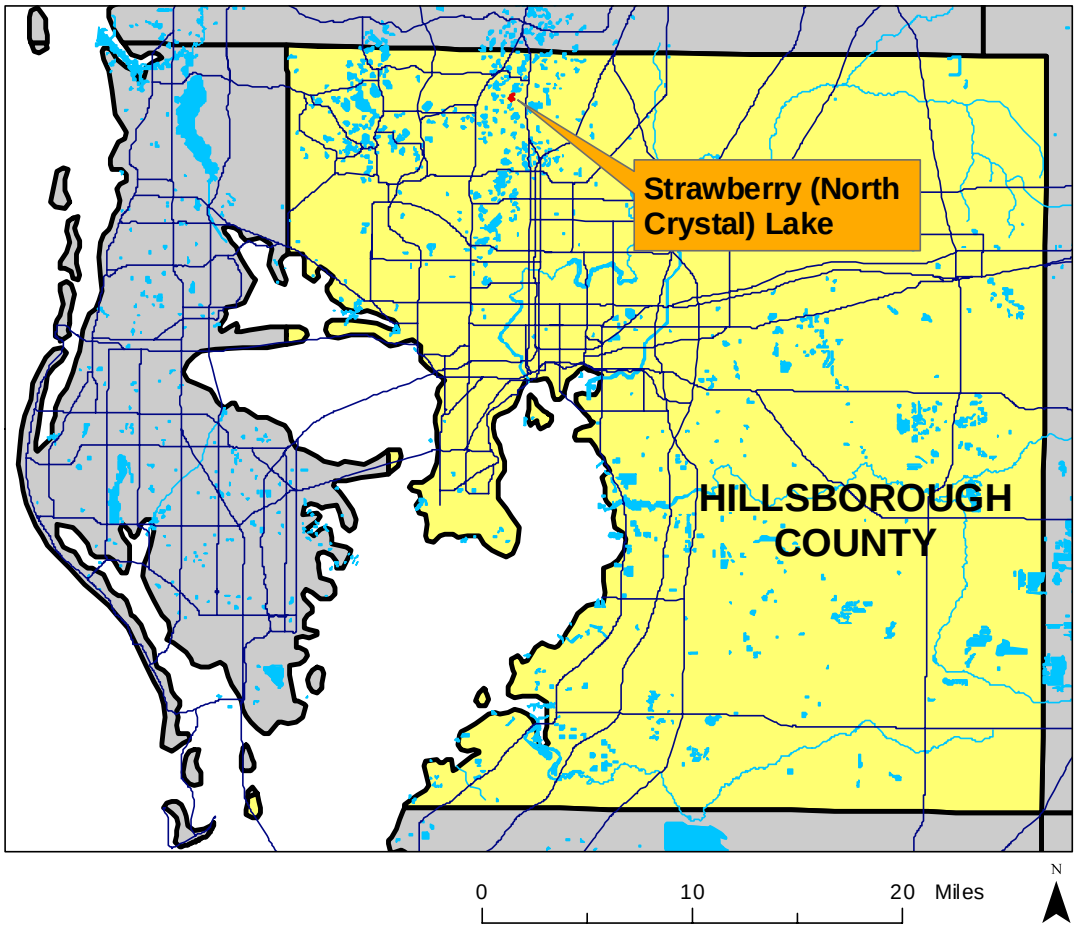
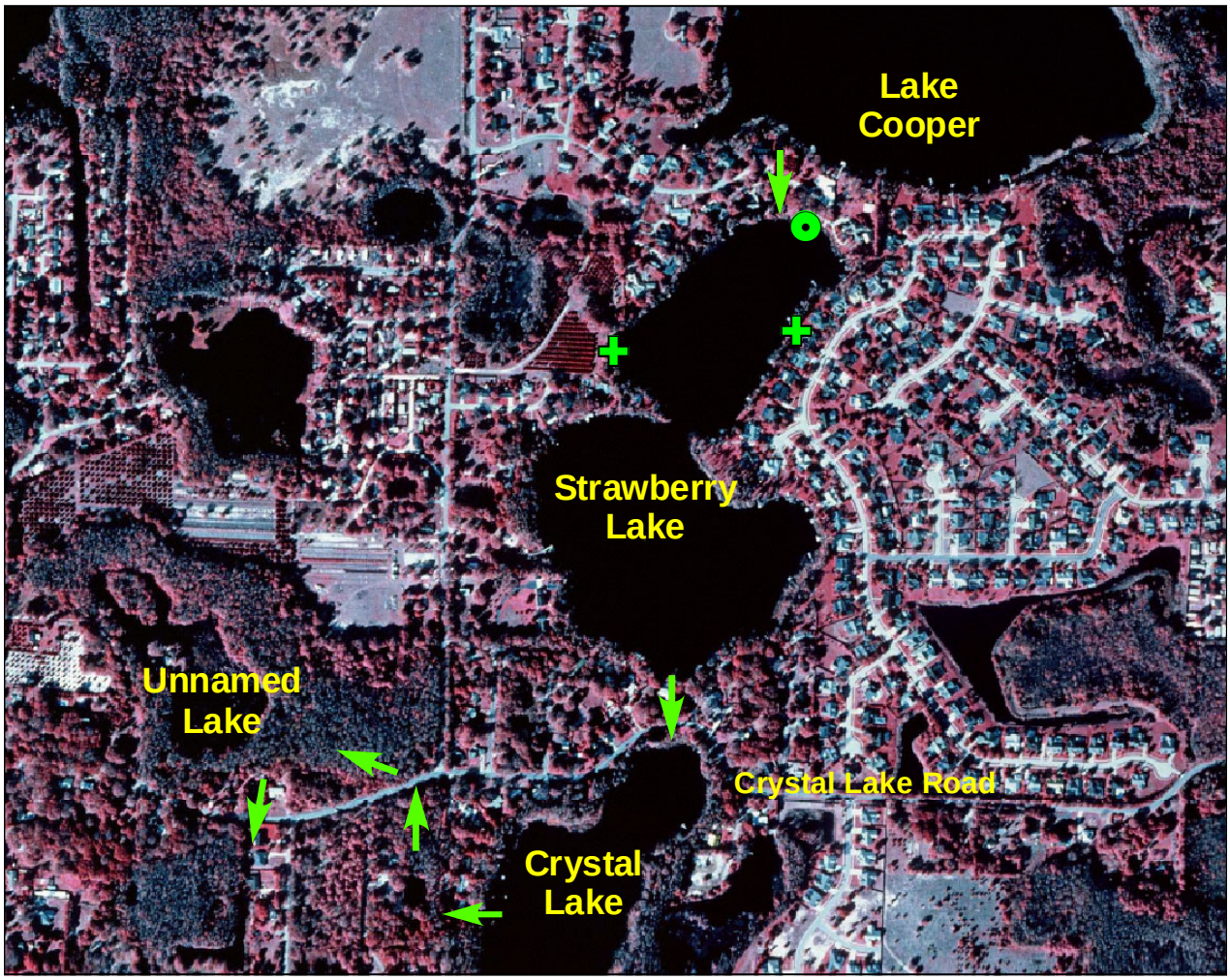


Figure 2. Location of District lake-level gauge, inlet, outlet and sites where hydrologic indicators were measured at Strawberry (North Crystal) Lake in Hillsborough County, Florida.



Lake gauge

Inlets/Outlet

Hydrologic Indicators

0 500 1,000 Feet

Aerial photography from 1999 USGS Digital Orhtophotograph.

Map prepared September 3, 2003

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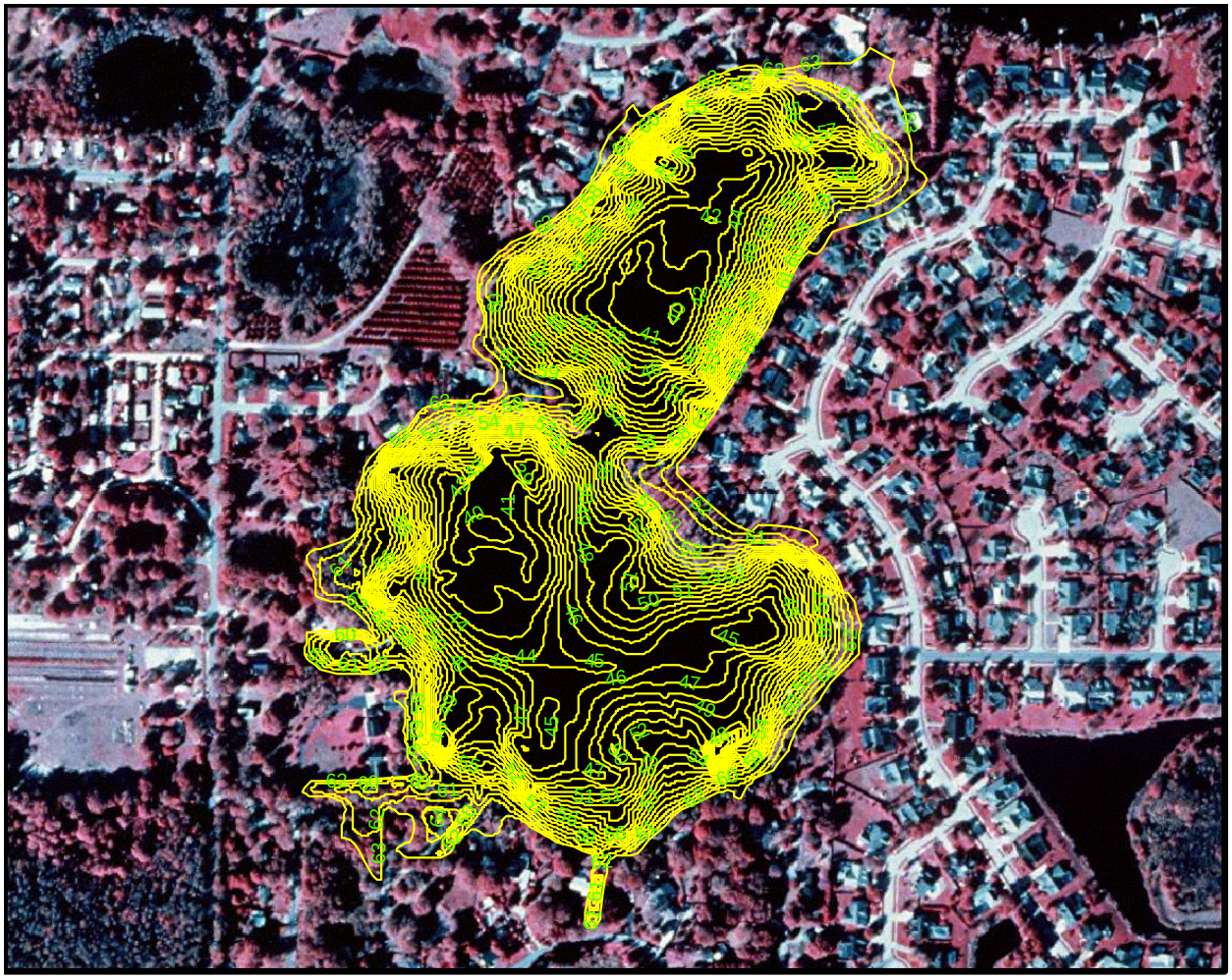
Figure 3. One-foot contours within the Strawberry (North Crystal) Lake basin in Hillsborough County, Florida. Values shown are elevations, in feet above the National Geodetic Vertical Datum of 1929.



Map prepared September 3, 2003 using 1999 USGS digital orthophotography, one-foot contour data from 1981 SWFWMD aerial photography maps (Sheet Nos. 11-27-18 and 14-27-18), and elevation data collected by Hillsborough County Stormwater Section staff on July 22, 1998.

0 500 1,000 Feet

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Previously Adopted Lake Management Levels

Based on work conducted in the 1970s (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Strawberry (North Crystal) Lake in September 1980 (Table 1). A Maximum Desirable Level of 61.75 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table 1. Adopted guidance levels and associated surface areas for Strawberry (North Crystal) Lake in Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	62.80	52
High Level	62.00	49
Low Level	59.75	42
Extreme Low Level	57.00	37

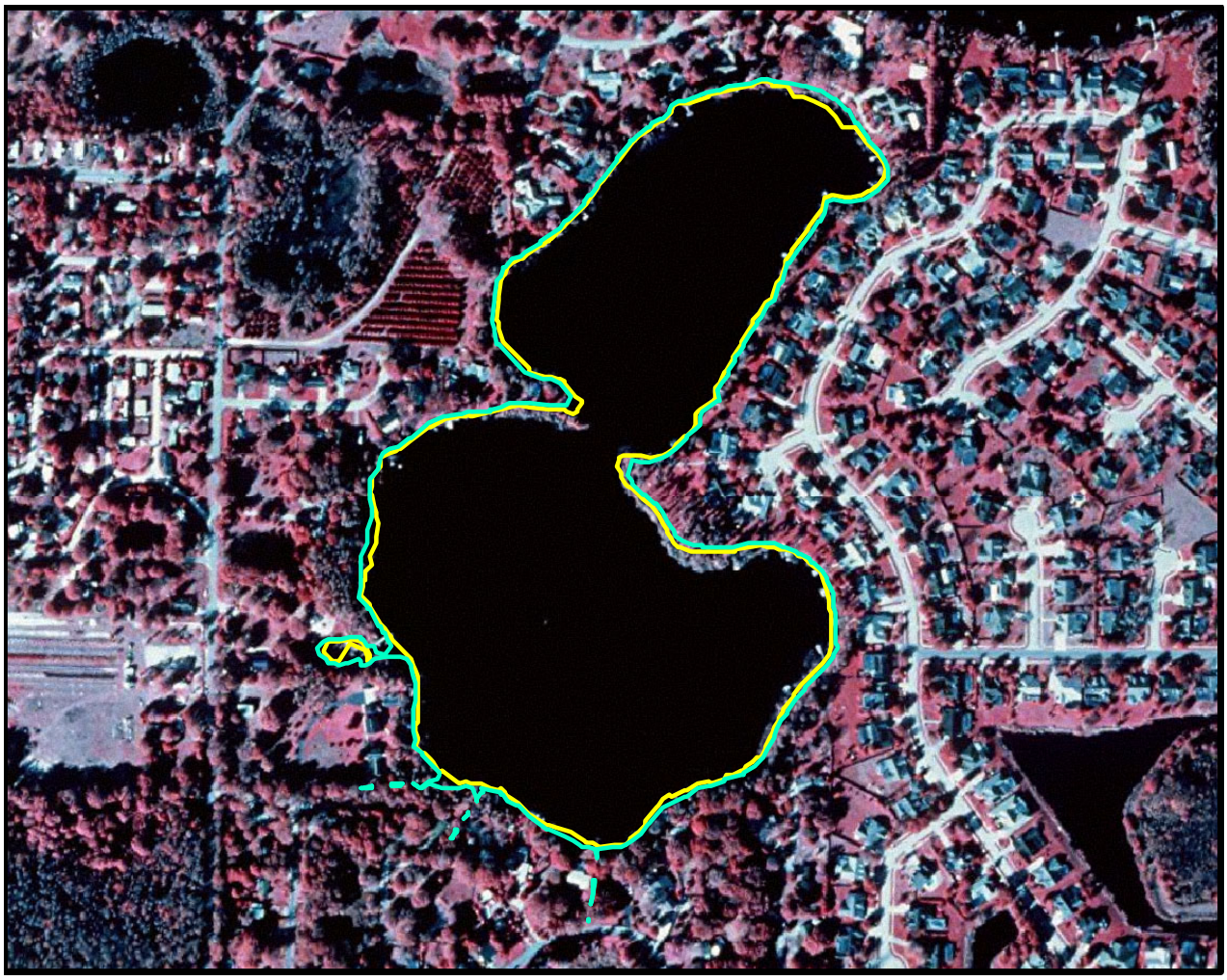
Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for Strawberry (North Crystal) Lake using the methodology for Category 3 Lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). 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 Strawberry (North Crystal) Lake in Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Lake Area (acres)
Ten Year Flood Guidance Level	62.0	49
High Guidance Level	60.1	43
High Minimum Lake Level	60.1	43
Minimum Lake Level	59.1	41
Low Guidance Level	58.0	39

Figure 4. Approximate location of the proposed Minimum Lake Level (yellow) and proposed High Minimum Lake Level (blue) for Strawberry (North Crystal) Lake in Hillsborough County, Florida. Elevations listed are in feet above the National Geodetic Vertical Datum of 1929.



Map prepared September 3, 2003 using 1999 USGS digital orthophotography, one-foot contour data from 1981 SWFWMD aerial photography maps (Sheet Nos. 11-27-18 and 14-27-18), and elevation data collected by Hillsborough County Stormwater Section staff on July 22, 1998.

0 500 1,000 Feet

N

Strawberry_minimum_levels

Contour

59.1 ft above NGVD

60.1 ft above NGVD

Summary of Data and Analyses Supporting Recommended Minimum and Guidance Levels

Hydrologic data are available for Strawberry (North Crystal) Lake (District Universal ID Number STA 416 417) from June 1971 through the present date (Figure 5, see Figure 2 for current location of the SWFWMD lake-level gauge). Note that hydrologic date record is not continuous*; i.e.*, there are some months during the period of record when water level data were not recorded. Monthly mean water surface elevations, along with proposed guidance and minimum levels are graphed in Figure 6. Historic data are not available. For the period of record from January 1985 through the present, the hydrologic data are classified as Current data. This period of record was selected based on regional wellfield pumpage and structural modifications to the Strawberry Lake and Crystal Lake outlet conveyance system in the 1980s. Current data collected through January 2003 were used to calculate the Current P10, P50, and P90 (Table 3).

The Normal Pool elevation was established at 62.3 ft above NGVD based on elevations associated with the buttressing of large cypress (*Taxodium* sp.) trees along the west and east shores of the north basin (Table 4, Figure 2). 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 collected in June, July and August 2003 (Table 3). The control point elevation was established at 59.3 ft above NGVD, based on the ground elevation at the north end of a reinforced concrete pipe running under Crystal Lake Road at the outlet from Crystal Lake (Figure 7). The Normal Pool elevation is higher than the control point elevation so the lake is considered to be Structurally Altered.

Based on the relationship between the control point elevation, the Normal Pool elevation and the Current P10, the High Guidance Level was established at the Current P10 elevation of 60.1 ft above NGVD (Table 3). The Historic P50 and Low Guidance Level were established at 59.1 and 58.0 ft above NGVD, respectively, 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 for Strawberry Lake was established at 62.0 ft above NGVD using the methodology for open basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). For the analysis, Hillsborough County's modified version of the Environmental Protection Agency's Stormwater Management Model (SWMM), version 4.31C (Hillsborough County 2000) 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 was exceeded 12 times in 1979, but has not been exceeded since that time (Figures 5 and 6). The highest surface elevation for Strawberry Lake included in the District water management database, 63.0 ft above NGVD, occurred on September 25,

1979. The low of record, 53.69 ft above NGVD, occurred on May 23, 2002. Strawberry Lake contains diverse stands of aquatic macrophytes and other hydrophytes, including cattail (*Typha* sp.), road-grass (*Eleocharis* sp.), spatterdock (*Nuphar luteum*), lemon bacopa (*Bacopa* sp.), pickerelweed (*Pontedaria cordata*), torpedograss (*Panicum repens*), pennywort (*Hydrocotyle umbellata*), and primrose willow (*Ludwigia* sp.). Cypress (*Taxodium* sp.) is also abundant, but the lake is not contiguous with a cypress-dominated wetland greater than 0.5 acre in size. The lake is, therefore, classified as a Category 3 Lake for the purpose of minimum levels development.

Dock-Use, Basin Connectivity, Aesthetics, and Species Richness Standards were evaluated for minimum levels development (Table 3). The Dock-Use Standard was established at 59.3 ft above NGVD, based on the elevation of sediments at the end of 90% of the 10 docks at the lake (56.2 ft above NGVD, Table 5), a clearance value of 2 ft based on use of powerboats in the lake, and the difference between the Reference Lake Water Regime 5090 for the northern Tampa Bay area (1.1 ft). The Connectivity Standard was established at 58.1 ft above NGVD, based on the elevation that ensures connectivity among the two major sub-basins of the lake (55 ft), a two-foot clearance value for use of powerboats on the lake, and the Reference Lake Water Regime 5090 for the northern Tampa Bay area (1.1 ft). The Aesthetic-Standard for the lake was established at the Low Guidance Level elevation of 58.0 ft above NGVD. The Species Richness Standard was established at 55.6 ft above NGVD, based on limiting reduction in lake surface area to less than a 15% decrease in the area at the Historic P50 elevation. Mixing and Recreation/Ski Standards were not developed, based on the small size and morphology of the lake basin. 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 8).

The Dock-Use Standard, the most conservative *(i.e.,* the highest) of the standards is higher than the Historic P50 elevation. The Minimum Lake Level was therefore established at the Historic P50 elevation of 59.1 ft above NGVD. The proposed High Minimum Lake Level was established at 60.1 ft above NGVD, an elevation corresponding to the Minimum Lake Level plus the Reference Lake Water Regime 50 for the northern Tampa Bay areas (1.0 ft). The proposed High Minimum Lake Level is 4.2 ft below the Low Floor Slab elevation, 3.2 ft below the lowest spot in the roads located in the immediate lake basin, and 1.5 ft below a swimming pool located on a lakeshore residential lot.

Figure 5. Surface water elevation at Strawberry (North Crystal) Lake in Hillsborough County, Florida. Data through January 2003 are shown.

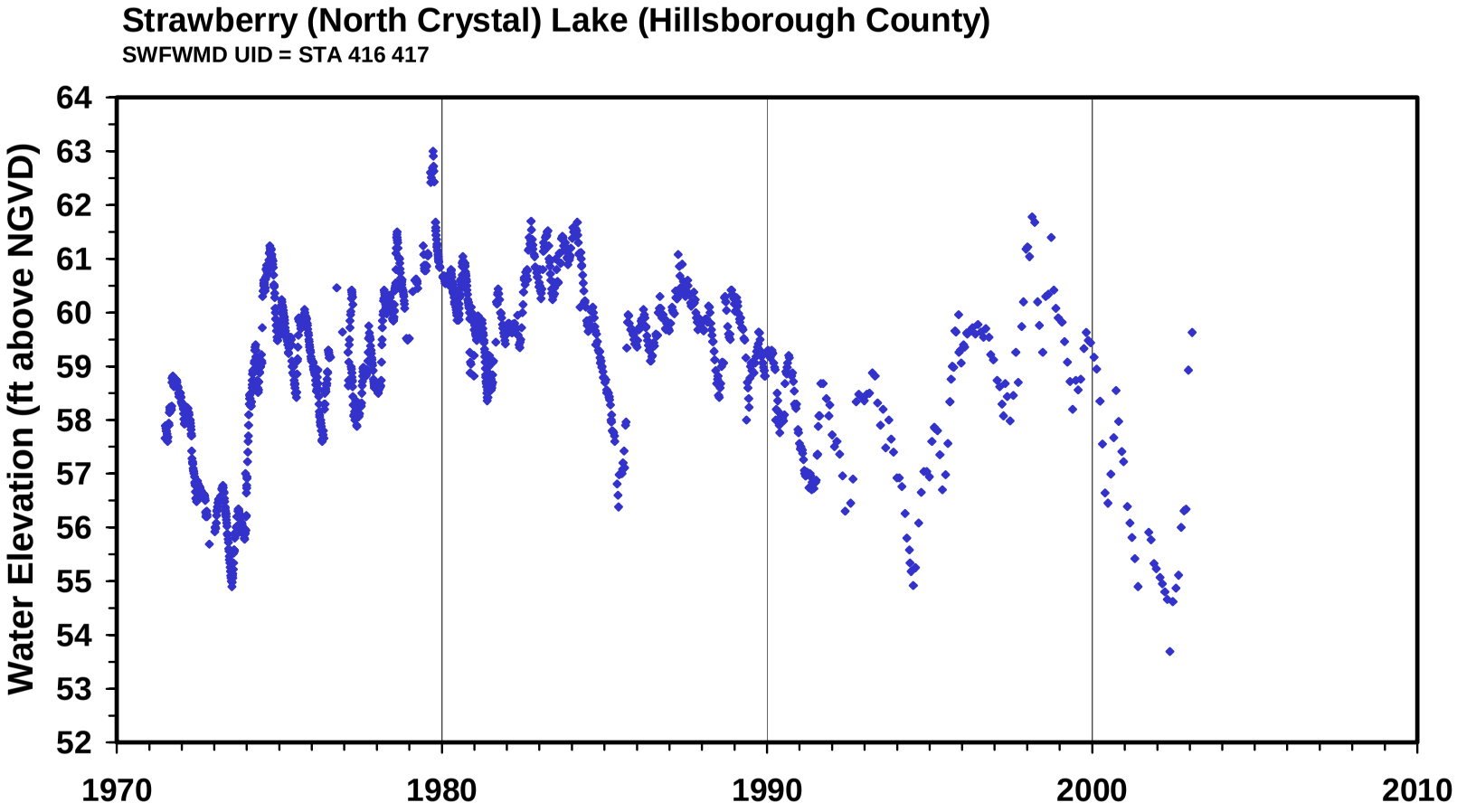


Figure 6. Mean monthly surface water elevation through January 2003, and proposed guidance and minimum levels for Strawberry (North Crystal) Lake in Hillsborough County, Florida. Proposed levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High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

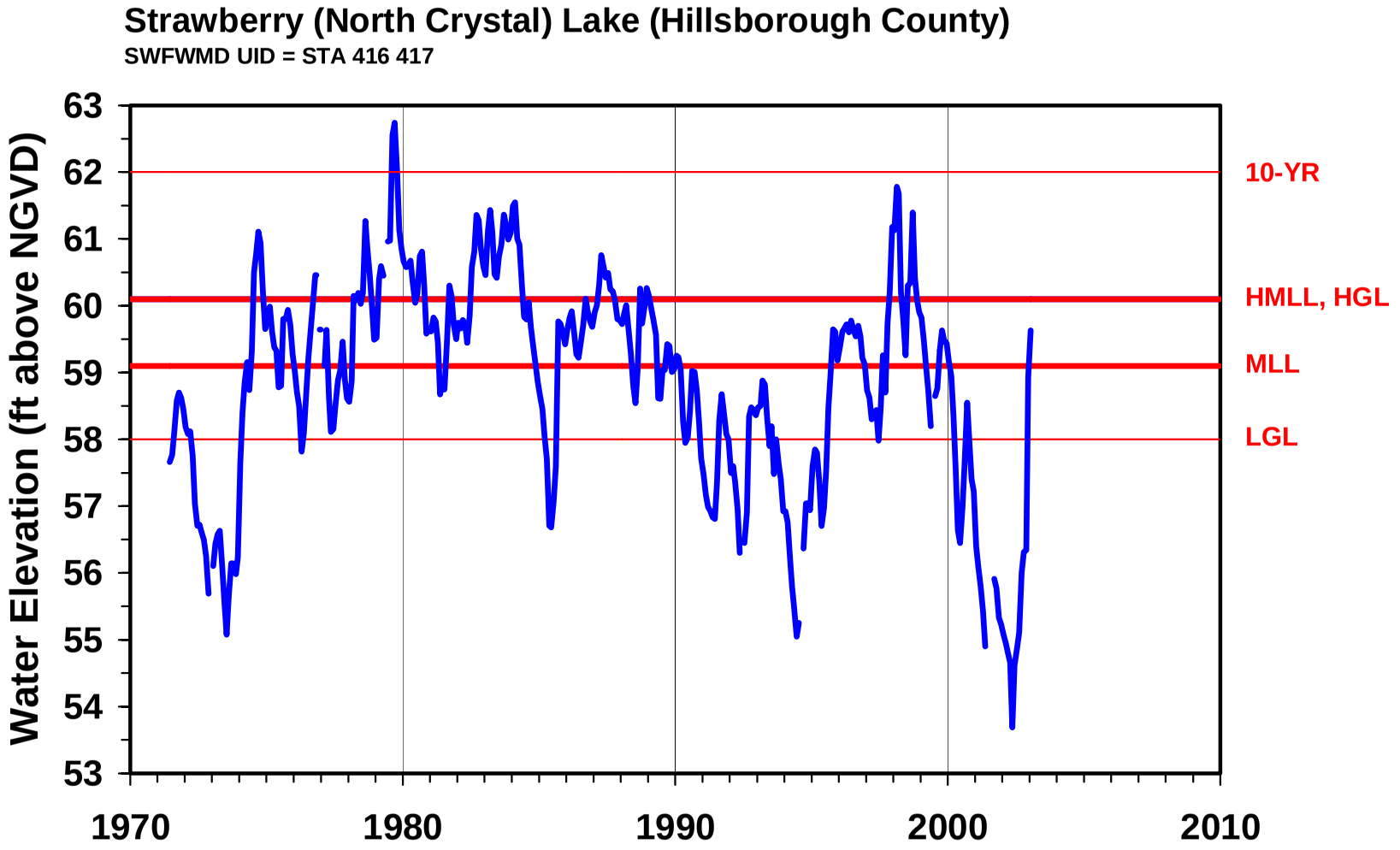


Table 3. Elevation data and associated area values used for establishing minimum levels for Strawberry (North Crystal) Lake in Hillsborough County, Florida.

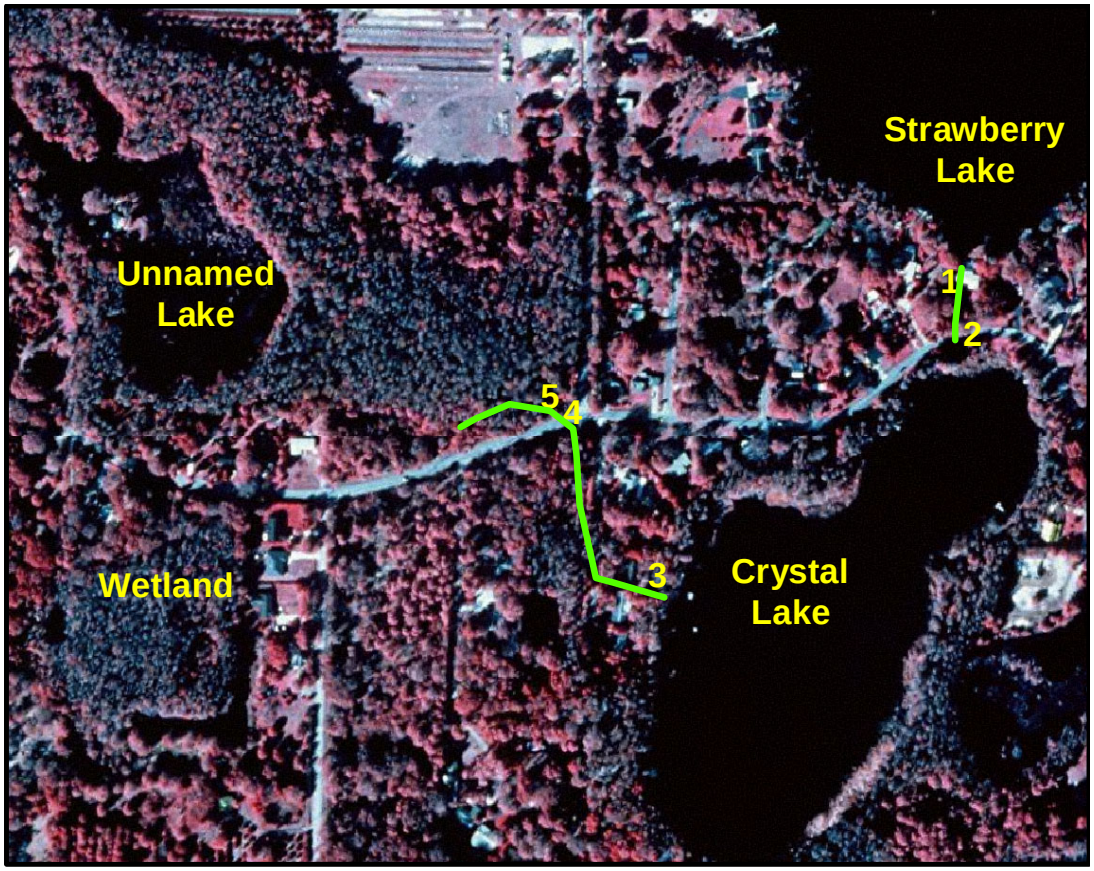
Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Current P10	60.08	43
Current P50	58.65	40
Current P90	56.26	37
Normal Pool	62.3	50
Low Floor Slab	64.3	NA
Low Other (pool)	61.6	47
Low Road	63.29	53
Control Point	59.3	41
High Guidance Level	60.1	43
Historic P50	59.1	41
Low Guidance Level	58.0	39
Dock-Use Standard	59.3	41
Connectivity Standard	58.1	39
Aesthetic Standard	58.0	39
Species Richness Standard	55.6	34
Mixing Standard	NA	NA
Recreation/Ski Standard	NA	NA

NA = not available/applicable

Table 4. Elevation data used for establishing the Normal Pool Elevation for Strawberry (North Crystal) Lake in Hillsborough County, Florida. Data were collected at two sites by SWFWMD staff on September 9, 2002.

Hydrologic Indicator	Tree Diameter at Breast Height (ft)	Elevation (feet above NGVD)
Normal pool based on cypress buttress	1.6	61.5
Normal pool based on cypress buttress	2	61.74
Normal pool based on cypress buttress	2.3	61.74
Normal pool based on cypress buttress	2.3	62.11
Normal pool based on cypress buttress	2.7	62.22
Normal pool based on cypress buttress	1.7	62.32
Normal pool based on cypress buttress	2	62.32
Normal pool based on cypress buttress	1.7	62.36
Normal pool based on cypress buttress	2.8	62.37
Normal pool based on cypress buttress	1.5	62.64
Normal pool based on cypress buttress	1.5	62.67
Normal pool based on cypress buttress	2	62.76
Normal pool based on cypress buttress	2.5	62.88
N		**13**
Median		**62.3**
Mean		**62.3**
Standard Deviation		**0.4**

Figure 7. Outlet conveyance system for Strawberry (North Crystal) Lake in Hillsborough County, Florida. Ditched flow paths are indicated by the green line.



Map prepared September 3, 2003 using 1999 USGS digital orthophotography.

0 500 1,000 Feet

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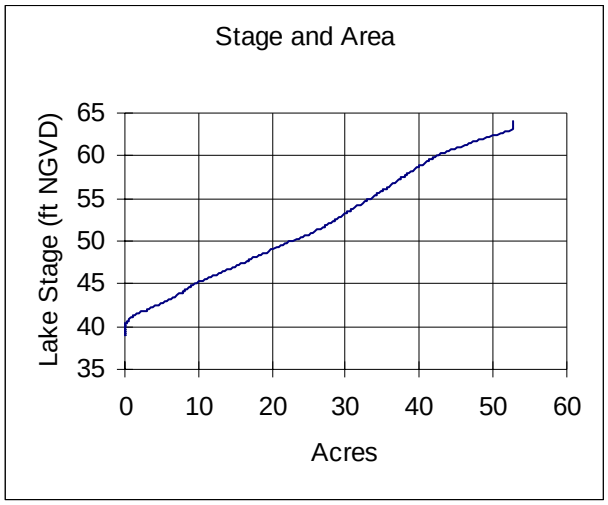
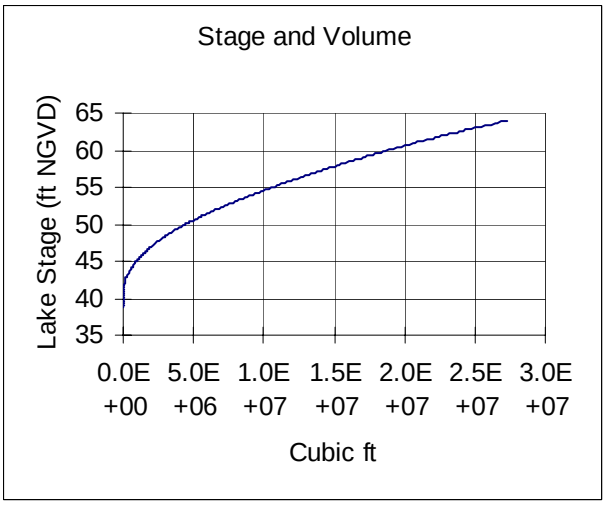
Site	Description	Elevation (feet above NGVD)
1	Ground elevation in center of ditch, approximately 85-ft north of Crystal Lake Road	59.2
2	North and south inverts of 38-inch X 60-inch oval reinforced concrete pipe running under Crystal Lake Road	57.61, 57.64
3	East and west inverts of 8-inch diameter PVC pipe imbedded in concrete wier. Top of wier is at 60.1 ft above NGVD; soil is eroded around wier.	58.96, 59.50
4	Southeast and northwest inverts of 38-inch X 60-inch oval reinforced concrete pipe running under Crystal Lake Road. Ground elevations in ditches south and north of the pipe are 58.6 and 58.4 ft above NGVD, resepectively.	58.20, 58.22
5	Control point; ground elevation in center of ditch northwest of pipe identified as Site No. 4. Ditch drains through a wetland to an unnamed lake that drains under Crystal Lake Road to Reinheimer Lake through a series of wetlands.	59.3

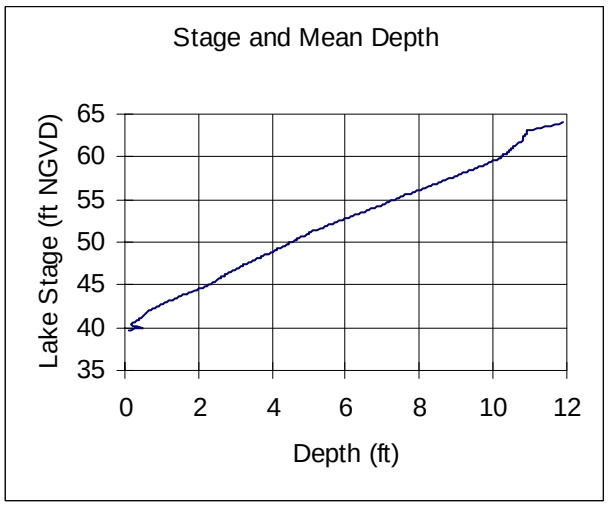
Table 5. Summary statistics for elevations associated with docks (n=32) at Strawberry (North Crystal) Lake in Hillsborough County, Florida, based on data collected by SWFWMD staff on September 9, 2002. Percentiles (P10, P50, P90) represent elevations exceeded by 10, 50 and 90 percent of the docks.

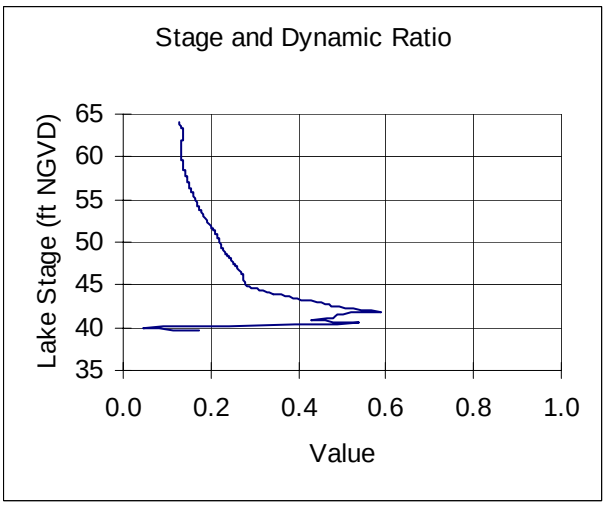
Statistic	Elevation of Sediments at Waterward End of Docks (feet above NGVD)	Elevation of Dock Platform (feet above NGVD)
Mean (SD)	55.2 (1.0)	61.6 (0.8)
P10	56.2	62.4
P50	55.3	61.7
P90	54.1	60.6
Maximum	56.9	63.1
Minimum	53.0	59.4

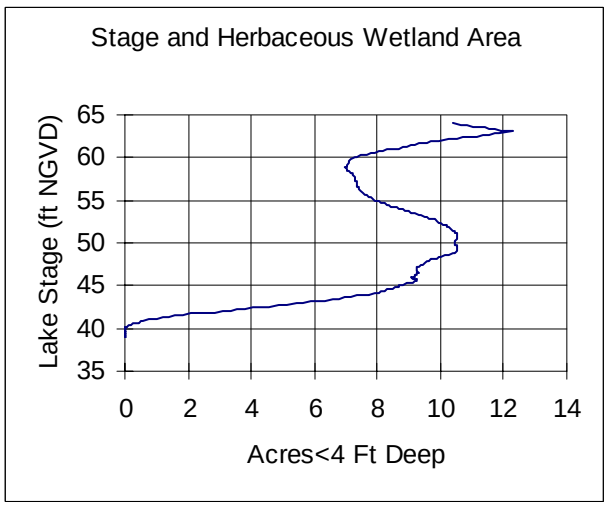
Figure 8. Surface area, volume, mean depth, dynamic ratio (basin slope), potential herbaceous wetland area, and area available for colonization by aquatic macrophytes versus lake stage for Strawberry (North Crystal) Lake in Hillsborough County, Florida.

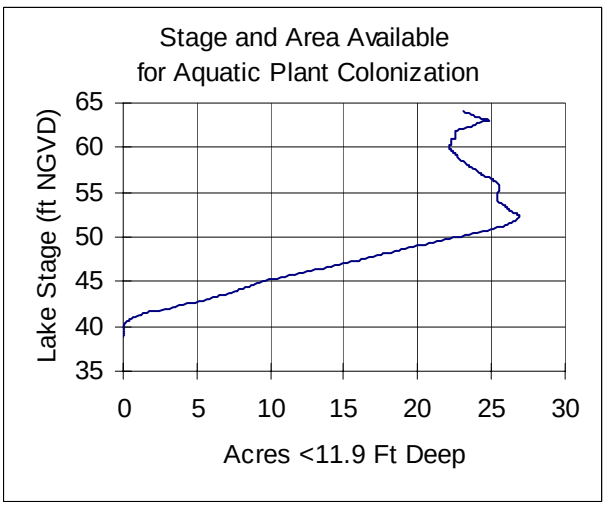












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