

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 Church Lake and Echo Lake in Hillsborough County, Florida

Church Lake and Echo Lake

General Lake Description

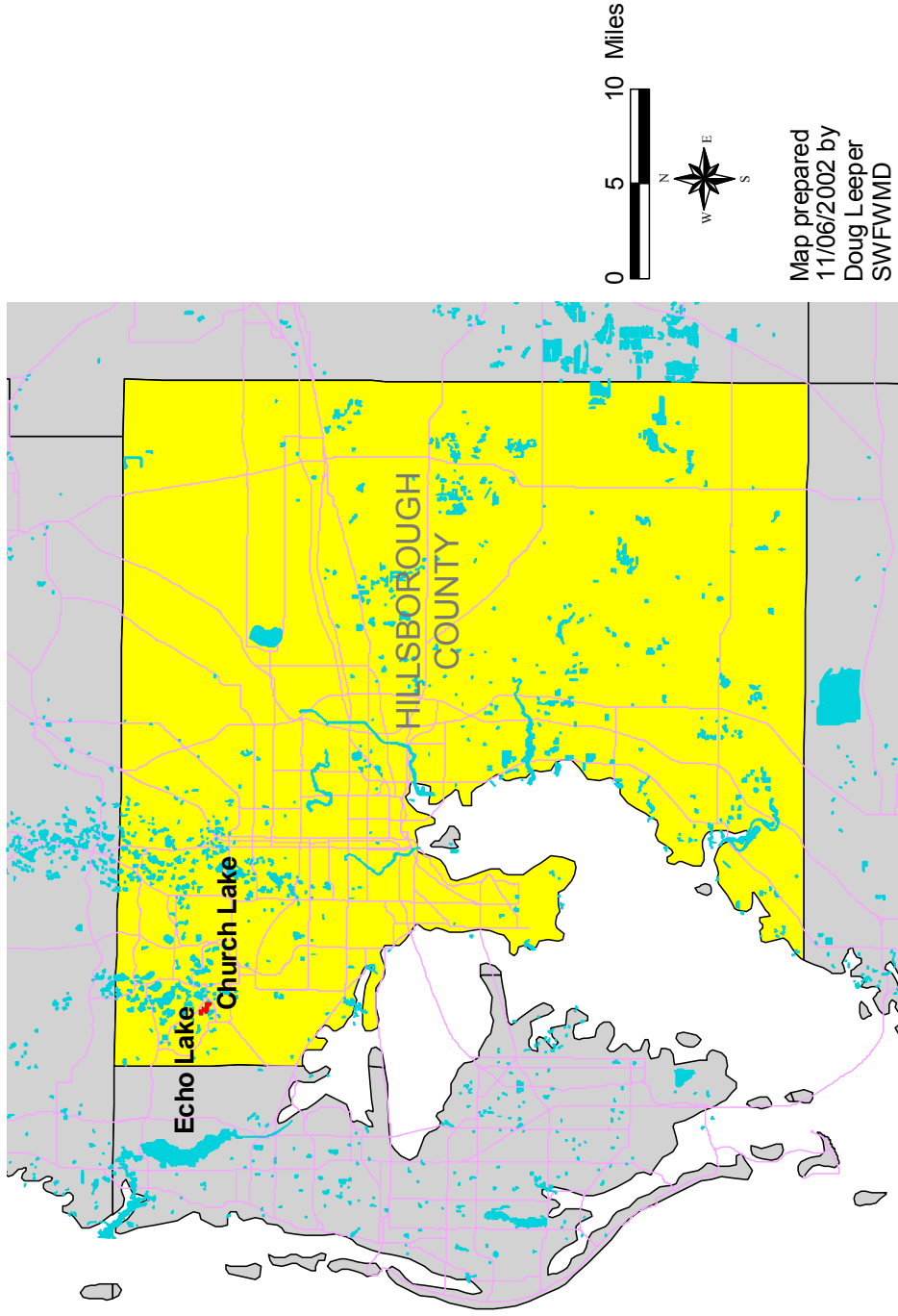
Church Lake and Echo Lake are located in the Northwest Hillsborough Basin in Hillsborough County, Florida (Figure Church/Echo-1). Church Lake is found in Sections 27 and 28, Township 27S, Range 17E; Echo Lake occurs in Section 28, Township 27S, Range 17E. The lakes are located along the border of the Land-O-Lakes and Lake Tarpon basin subdivisions of the Tampa Plain in the Ocala Uplift Physiographic District (Brooks 1981). The Land-O-Lakes subdivision is an area of many lakes on a moderately thick plain of silty sand. The Lake Tarpon Basin is an erosional basin partially filled with Late Pleistocene sediments. Underlying both areas is the Tampa Limestone formation. 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).

Church Lake has a drainage area of 0.51 square miles and Echo Lake has a drainage area of 0.89 square miles (Florida Board of Conservation 1969). Church Lake receives inflow from a small, unnamed lake to the east, and is connected via a navigable canal to Echo Lake at elevations exceeding approximately 32 ft above NGVD. Because the lakes are connected through a navigable canal, and typically fluctuate in concert, the lakes are treated as a single system – the Church and Echo Lakes system – for the purpose of establishing minimum levels. An outlet along the northwestern shore of Echo Lake connects the lakes to the Brooker Creek drainage system (Figure Church/Echo-2). A series of culverts along the south shore of Church Lake connects the lake system to Williams Lake, which is in the Double Branch Creek system. There

are currently no surface water withdrawals from the lakes permitted by the District. There are, however, several permitted groundwater withdrawals in the vicinity of the lakes, including those associated with the Cosme-Odesa Wellfield.

The "Gazetteer of Florida Lakes" (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the area of Church Lake at 68 acres, and that of Echo Lake as 27 acres at an elevation of 33 ft above mean sea level. The United States Geological Survey 1956 (photorevised 1987) 1:24,000 Citrus Park, Fla. quadrangle map indicates a water level elevation of 33 ft above mean sea level for Church Lake. This elevation corresponds to a surface area of approximately 92 acres for both lakes combined, based on a topographic map of the Lake Church and Echo system basin generated in support of minimum levels development. Data used for production of the topographic map were obtained from field surveys and 1:200 aerial photograph maps of the basin containing one-foot contour lines prepared using photogrammetric methods.

Figure Church/Echo-1. Location of Church Lake and Echo Lake in Hillsborough County, Florida.



Map prepared
11/06/2002 by
Doug Leeper
SWFWMD

Figure Church/Echo-2. Location of District lake gauge, inlet, outlets and sites where hydrologic indicators were measured at Church Lake and Echo Lake, Hillsborough County, Florida.

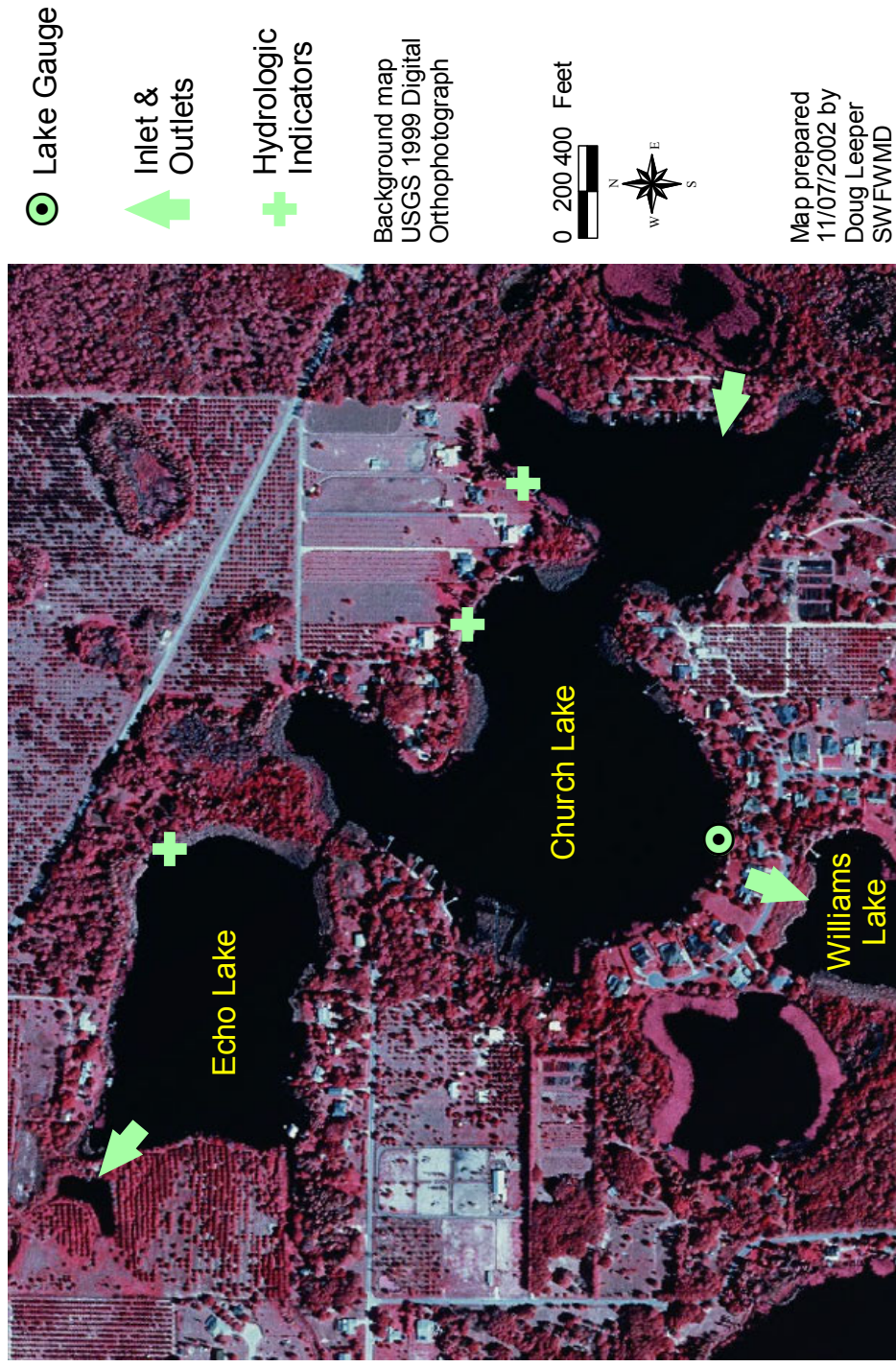
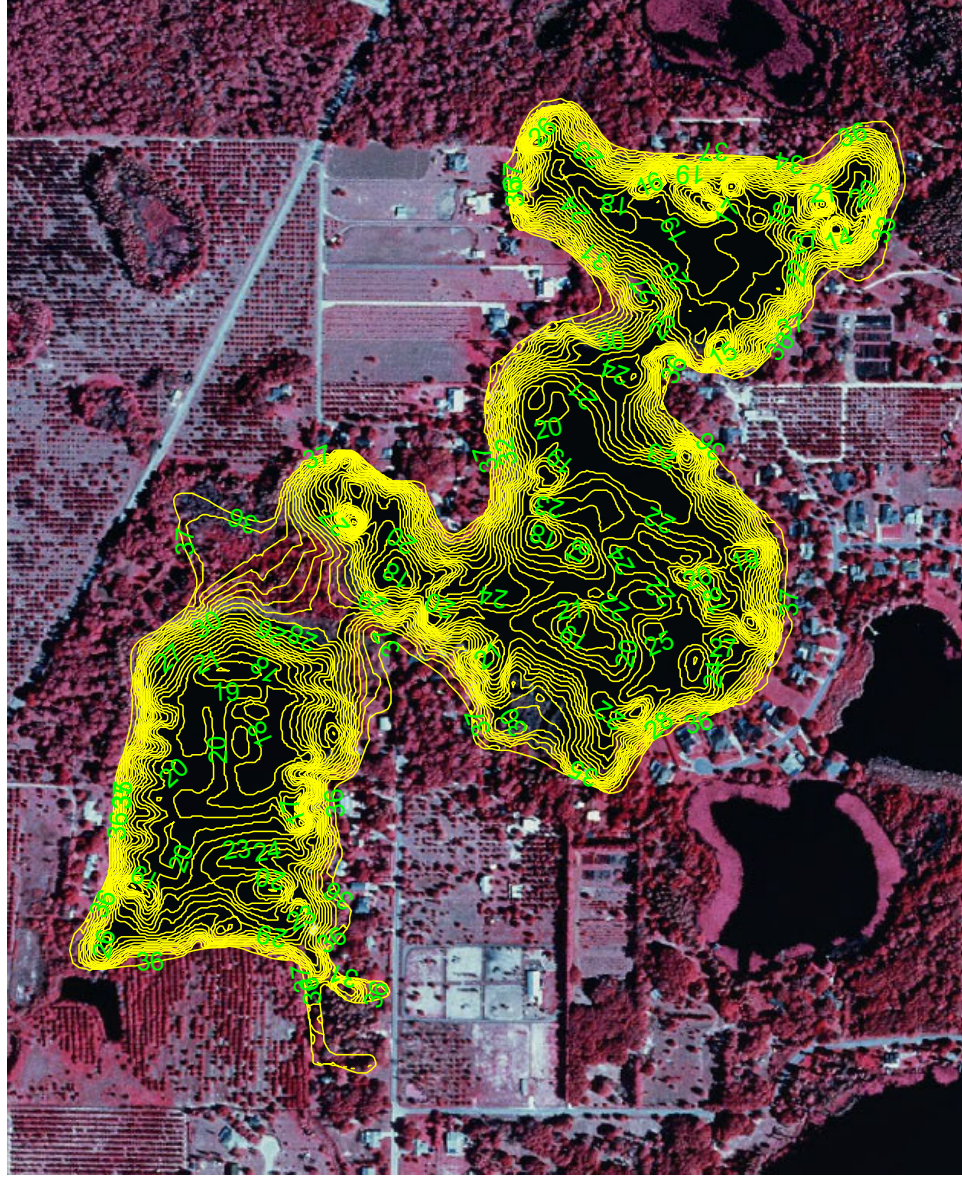


Figure Church/Echo-3. One-foot contour lines within the Church Lake and Echo Lake basins, Hillsborough County, Florida. Values shown are elevations, in feet, relative to the National Geodetic Vertical Datum.



Previously Adopted Lake Management Levels

Based on work conducted in 1977 (see SWFWMD 1996), the District Governing Board adopted management levels (currently referred to as Guidance Levels) for Church Lake and Echo Lake in September 1980 (Table Church/Echo-1). A Maximum Desirable Level of 35.75 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table Church/Echo-1. Adopted guidance levels and associated lake surface areas for Church and Echo Lakes, Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten Year Flood Guidance Level	36.40	112
High Level	36.25	111
Low Level	34.00	97
Extreme Low Level	31.50	86

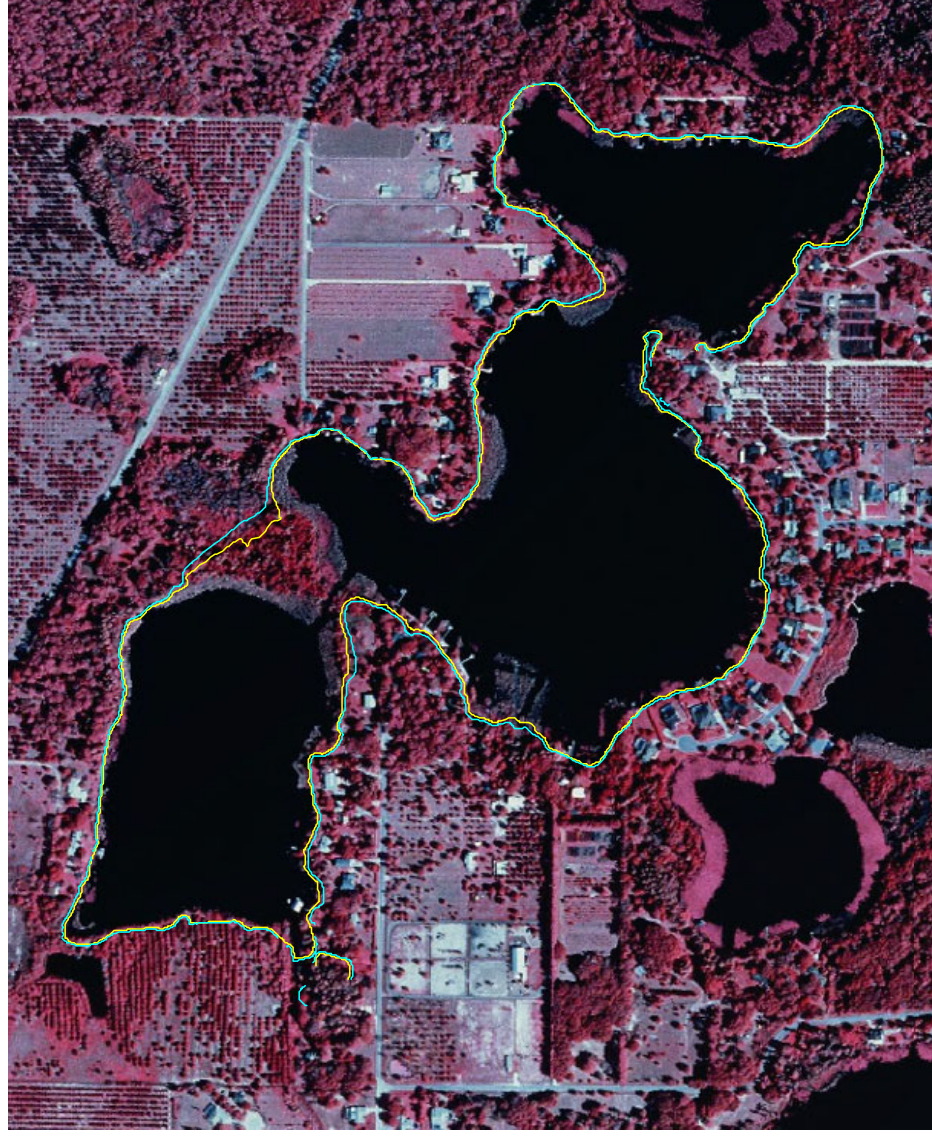
Proposed Minimum and Guidance Levels

Proposed Minimum and Guidance Levels were developed for Church and Echo Lakes 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 Church/Echo-2. The locations of the proposed minimum levels within the lake basins are shown in Figure Church/Echo-4.

Table Church/Echo-2. Proposed Minimum Levels and Guidance Levels with associated lake surface areas for Lakes Church and Echo, Hillsborough County, Florida.

Level	Elevation (feet above NGVD)	Total Lake Area (acres)
Ten-Year Flood Guidance Level	36.74	113
High Guidance Level	35.64	105
High Minimum Lake Level	35.64	105
Minimum Lake Level	34.64	100
Low Guidance Level	33.54	95

Figure Church and Echo-4. Approximate location of the proposed Minimum Lake Level (yellow) and the proposed High Minimum Lake Level (blue) for Church and Echo Lakes, Hillsborough County, Florida. Elevations listed are in feet, relative to the National Geodetic Vertical Datum



**Proposed
Minimum Levels**
**High Minimum
Lake Level = 35.64 ft**
**Minimum Lake
Level = 34.64 ft**

Checho35_5.shp
Checho34_5.shp

Background map:
USGS 1999 Digital
Orthophotograph

0 300 600 Feet



Map prepared
11/07/2002 by
Doug Leeper
SWFWMD

Summary of Data and Analyses Supporting Development of the Proposed Minimum and Guidance Levels

Hydrologic data are available for Church Lake (Southwest Florida Water Management District Universal Identification Number = STA 475 477) for the period from June 1931 through September 1937 and from September 1957 to the present date (Figure Church/Echo-5; see Figure Church/Echo-2 for location of the District water level gauge). For the period from January 1964 to the present, the hydrologic data are classified as Current data. Data collected from January 1964 through December 2001 were used to calculate the Current P10, P50, and P90 for the Church and Echo Lakes system (Table Church/Echo-3).

The Category 3 Lake Normal Pool elevation was established based on trunk morphology of large cypress trees along the northern shore of Lake Church and the northeastern shore of Lake Echo (Tables Church/Echo-3 and Church/Echo-4, Figure Church/Echo-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 (Tables Church/Echo-3 and Church/Echo-5, Figure Church/Echo-6). The Category 3 Lake Normal Pool elevation is above the control point, so the lake system 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 (Table Church/Echo-3). 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 the Church and Echo Lake system using the methodology for closed basin lakes described in current District Rules (Chapter 40D-8, Florida Administrative Code). Although the lake system has outlets, this approach was considered appropriate, as the water surface level with the two basins has been below the control point elevation (34.92 ft above NGVD) for extended periods during the past four decades (see Figure Church/Echo-5). For the analysis, the long-term gauging record for Church Lake was used to assess flooding potential. Flood frequency elevation estimates were based on probability analysis of annual peak stages recorded between 1957 and 2000 (44 years of record). Various theoretical frequency distributions and the probability plots were compared to establish the best estimate of flood frequency elevations. For Church Lake, the Ten Year Flood Guidance Level of 36.74 feet above NGVD was based on the Normal probability distribution. The Ten Year Flood Guidance was exceeded numerous times prior to 1960 (see Figure Church/Echo-5). The highest recorded surface elevation for Church Lake, 38.6 ft above NGVD, occurred on February 22, 1936.

The Church and Echo Lakes system does not contain any cypress-dominated wetland of 0.5 or more acres in size and is therefore classified as a Category 3 Lake system for the purpose of minimum levels development. The lakes do contain abundant stands of

cattail (*Typha* sp.), fragrant water lily (*Nymphaea odorata*), and other wetland vegetation.

Basin Connectivity, Aesthetic, Dock-Use, Species Richness and Recreation/Ski Standard for the lake were evaluated for minimum levels development. The Basin Connectivity Standard was established at 35.1 ft, based on use of powerboats in the lake, a critical high-spot elevation of 32 ft and the RLWR5090 (1.1 ft) for the northern Tampa Bay area. The Dock-Use Standard was established at 33.33 ft above NGVD, based on the Northern Tampa Bay area RLWR5090 and a Dock-End Sediment elevation of 30.23 ft that was developed from measurement of 42 docks. The Aesthetic Standard was established at the Low Guidance Level elevation of 33.54 ft above NGVD. The Species Richness Standard was established at 31.46 ft above NGVD, based on a 15% reduction in lake surface area from that at the Historic P50 elevation. The Recreation/Ski Standard was established at 31.1 ft above NGVD, based on a critical ski elevation of 30.0 ft and the RLWR5090 for the northern Tampa Bay area.

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 Church/Echo-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 Church/Echo-7).

The Basin Connectivity Standard, the most conservative of the appropriate standards, exceeds the Historic P50 elevation, so the Historic P50 elevation was substituted for this standard and used to establish the proposed Minimum Lake Level at 34.64 ft above NGVD. The proposed High Minimum Lake Level was established at 35.64 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 2.5 ft below the Low Floor Slab elevation.

Figure Church/Echo-5. Mean monthly surface water elevation, and proposed guidance and minimum levels for the Church and Echo Lakes system, 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 (MLL).

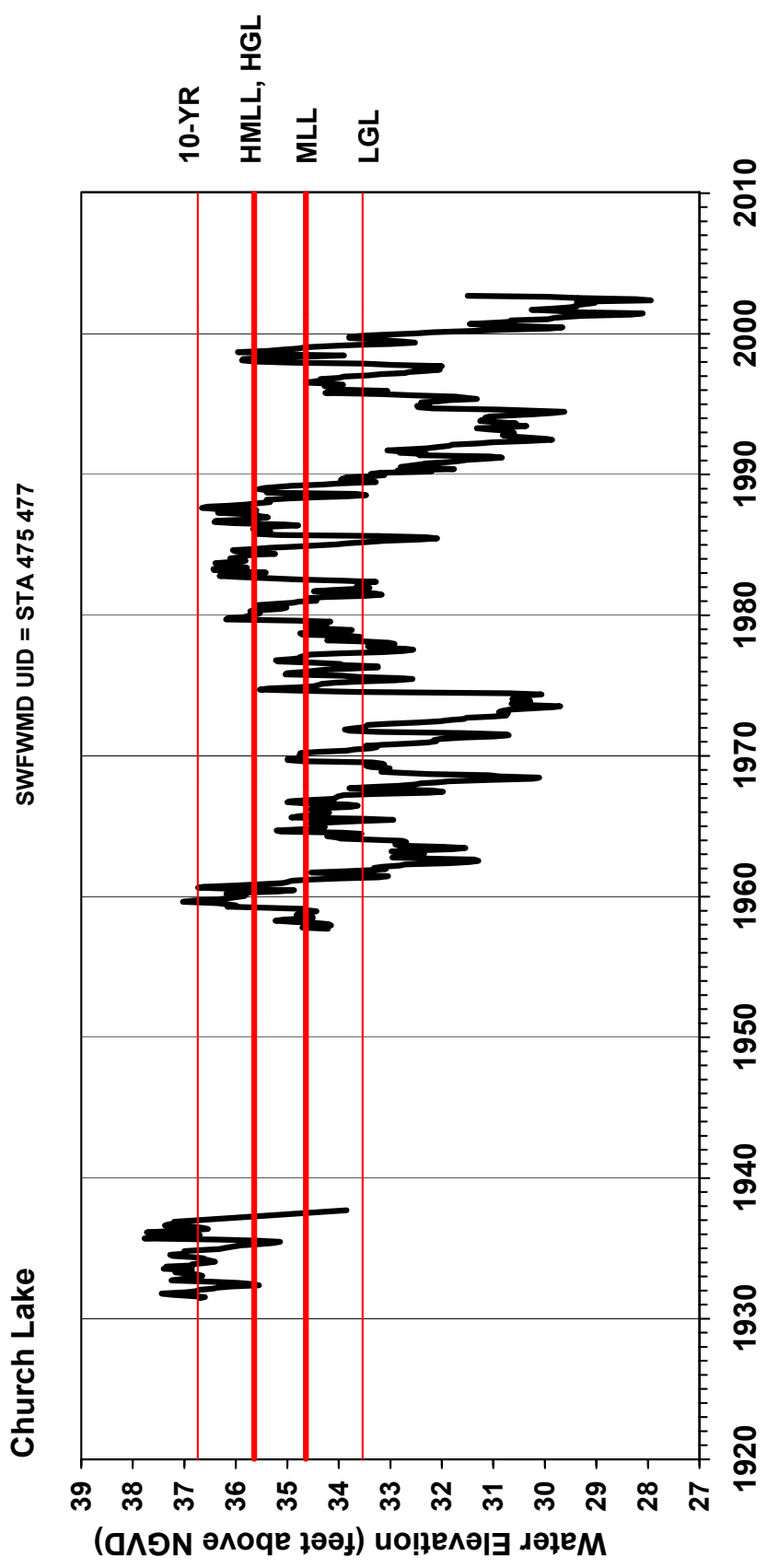


Table Church/Echo-3. Summary of elevation data and associated lake surface areas used for establishing minimum levels for Church and Echo Lakes in Hillsborough County, Florida.

Level or Feature	Elevation (feet above NGVD)	Total Lake Area (acres)
Current P10	35.64	105
Current P50	33.65	95
Current P90	30.67	82
Category 3 Lake Normal Pool	37.97	NA
Low Floor Slab	38.18 (Church Lake)	NA
Low Other (patio slab)	37.77 (Church Lake)	NA
Low Road	39.18	NA
Control Point	34.92	102
High Guidance Level	35.64	105
Historic P50	34.64	100
Low Guidance Level	33.54	95
Basin Connectivity Standard	35.1	102
Aesthetic Standard	33.54	95
Dock-Use Standard	33.33	94
Species Richness Standard	31.46	85
Recreation/Ski Standard	31.1	84

NA = not available / not applicable

Table Church/Echo-4. Elevation data used for establishing the Category 3 Lake Normal Pool elevation for the Church and Echo Lakes system. Data were collected on August 11, 1999; water level = 33.07 ft above NGVD.

Hydrologic Indicator	Elevation (feet above NGVD)
Cypress buttress (normal pool) Church Lake	37.17
Cypress buttress (normal pool) Church Lake	37.17
Cypress buttress (normal pool) Church Lake	37.47
Cypress buttress (normal pool) Echo Lake	38.11
Cypress buttress (normal pool) Echo Lake	37.97
Cypress buttress (normal pool) Echo Lake	38.3
Cypress buttress (normal pool) Echo Lake	38.32
N	7
Mean	37.79
Standard Deviation	0.47
Median	37.97

Table Church/Echo-5. Summary of structural alteration and control point elevation information for the Church and Echo Lakes system. Numbers correspond to those shown in Figure Church/Echo-6.

No.	Description	Elevation (feet above NGVD)
1	Invert at east end of 42" corrugated metal pipe	32.98
2	Invert at southeast end of 36" corrugated metal pipe	32.10
3	Control point; high point in stable, maintained ditch	34.92
4	Invert at southeast end of 18" reinforced concrete pipe	33.75
5	Invert at north end of 18" corrugated metal pipe running under Lake Williams Drive	34.67
6	Inverts at north end of 18" reinforce concrete pipes running under Racetrack Road. Ground elevation of sediments at pipe inverts are 35.2 and 35.3 ft above NGVD.	34.72, 34.81

Figure Church/Echo-6. Outlet conveyance system for Church and Echo Lakes, Hillsborough County, Florida. Numbered sites are described in Table Church/Echo-5.

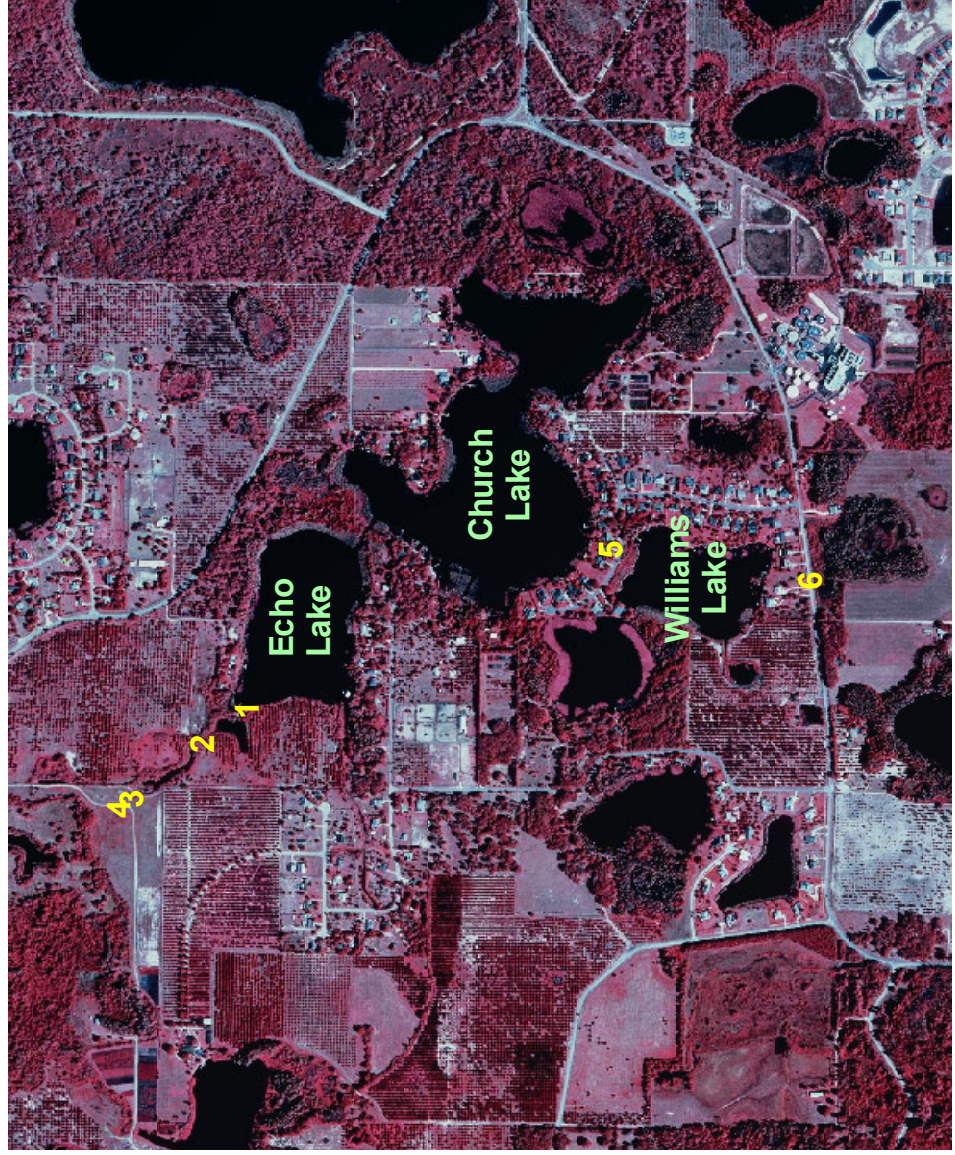
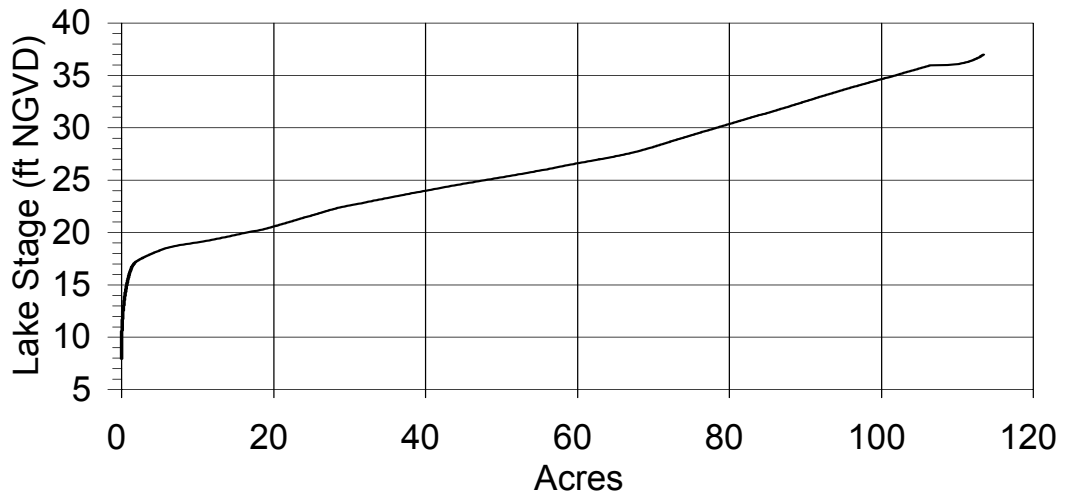


Figure Church/Echo-7. Surface area, volume, potential herbaceous wetland area, area potentially colonized by aquatic macrophytes, and dynamic ratio versus lake stage for the Church and Echo Lake system, Hillsborough County, Florida.

Stage and Area



Stage and Volume

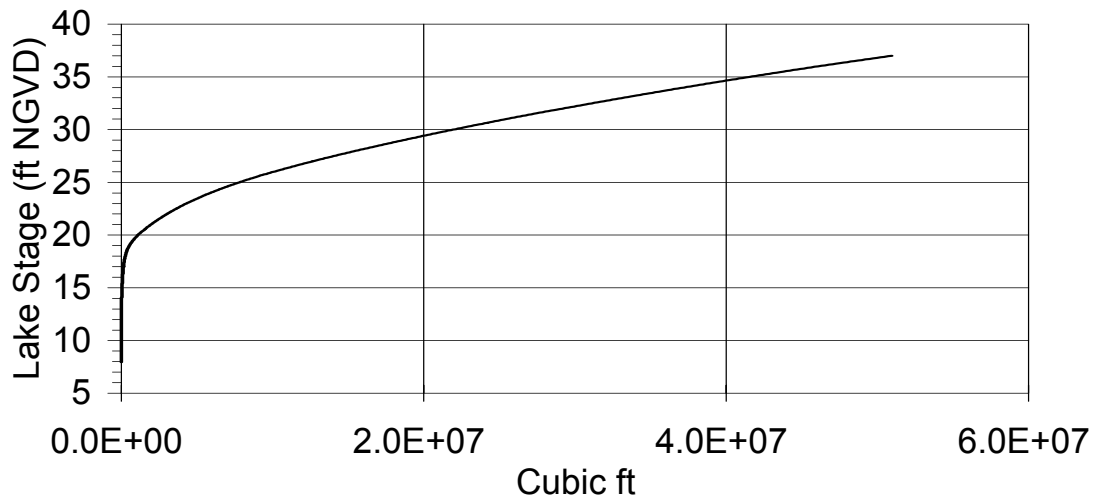
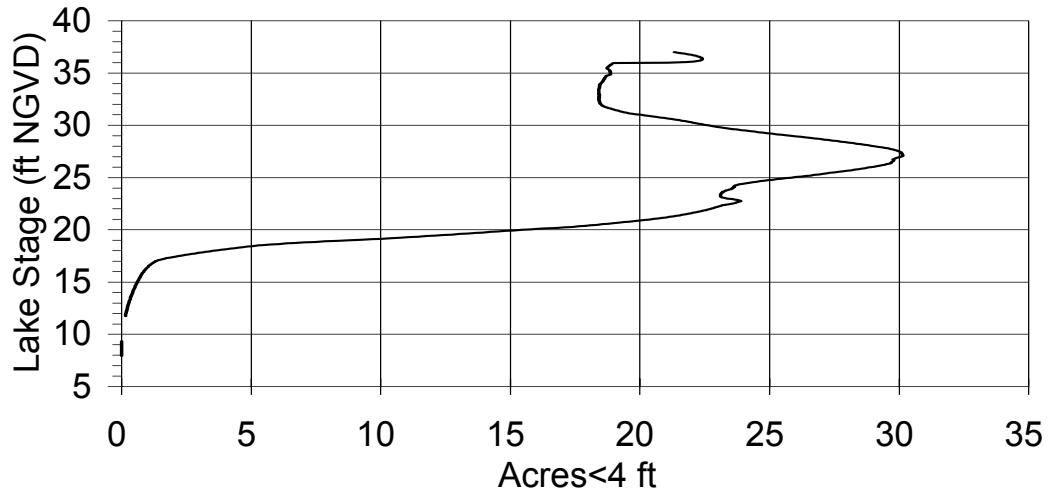


Figure Church/Echo-7. (continued)

Stage and Herbaceous Wetland Area



Stage and Area Available for Aquatic Plant Colonization

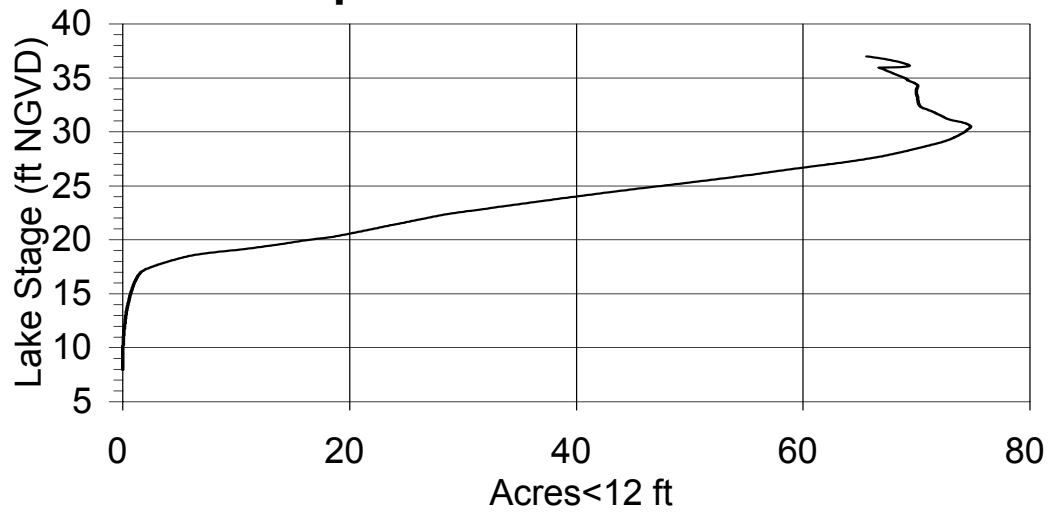
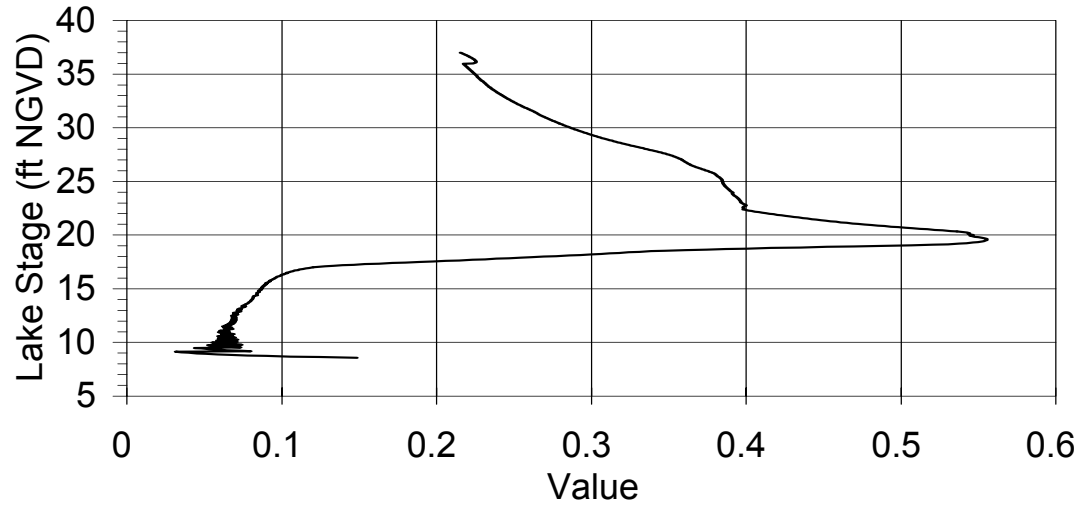


Figure Church/Echo-7. (continued)

Stage and Dynamic Ratio



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