

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 Starvation Lake in
Hillsborough County, Florida**

Starvation Lake

General Lake Description

Starvation Lake (Figure Starvation-1) is located in the Northwest Hillsborough Basin in Hillsborough County, Florida (Section 21, Township 27S, Range 18E). 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 Land-O-Lakes lake region; an area of numerous neutral to slightly alkaline, low to moderate nutrient, clear-water lakes (Griffith *et al.* 1997). Starvation Lake lies within the Section 21 Wellfield, which is one of the major water supply wellfields operated by Tampa Bay Water. The Hillsborough County Parks and Recreation Department maintains the area surrounding the lake as a county park (Lake Park).

The drainage area for Starvation Lake is 0.7 square miles (Florida Board of Conservation 1969). Inlets to the lake include a culvert connected to a small cypress wetland northwest of the lake, and a canal entering the lake from Lake Jackson to the west (Figure Starvation-2). A series of ditches and culverts connect Starvation Lake to Lakes Crum and Simmons. Water exits the lake system along the south shore of Lake Simmons. There are no surface water withdrawals from Starvation Lake currently permitted by the District. There are, however, several permitted groundwater withdrawals in the area, including major withdrawals associated with operation of the Section 21 Wellfield. Anecdotal reports indicate that Starvation Lake was intermittently augmented with Floridan ground water prior to the 1980s (Hassell 1994).

A lake surface elevation is not provided on the 1956 United States Geological Survey (photorevised 1987) 1:24,000 Citrus Park, Fla. quadrangle map, although the lake is shown separated into two basins, a state expected when the surface water elevation drops below 46-47 ft above NGVD. The 1974 (photorevised 1987) Odessa, Fla. Quadrangle map also does not include a surface elevation for the lake.

The Florida Lake Gazetteer (Florida Board of Conservation 1969, Shafer *et al.* 1986) lists the lake surface area at 52 acres, and a surface elevation of 53 ft above mean sea level. Based on a topographic map of the basin generated in support of minimum levels development (Figure Starvation-3), lake area is 81 acres when the surface elevation is at 53 ft above NGVD. 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 Starvation-1. Location of Starvation Lake in Hillsborough County, Florida.

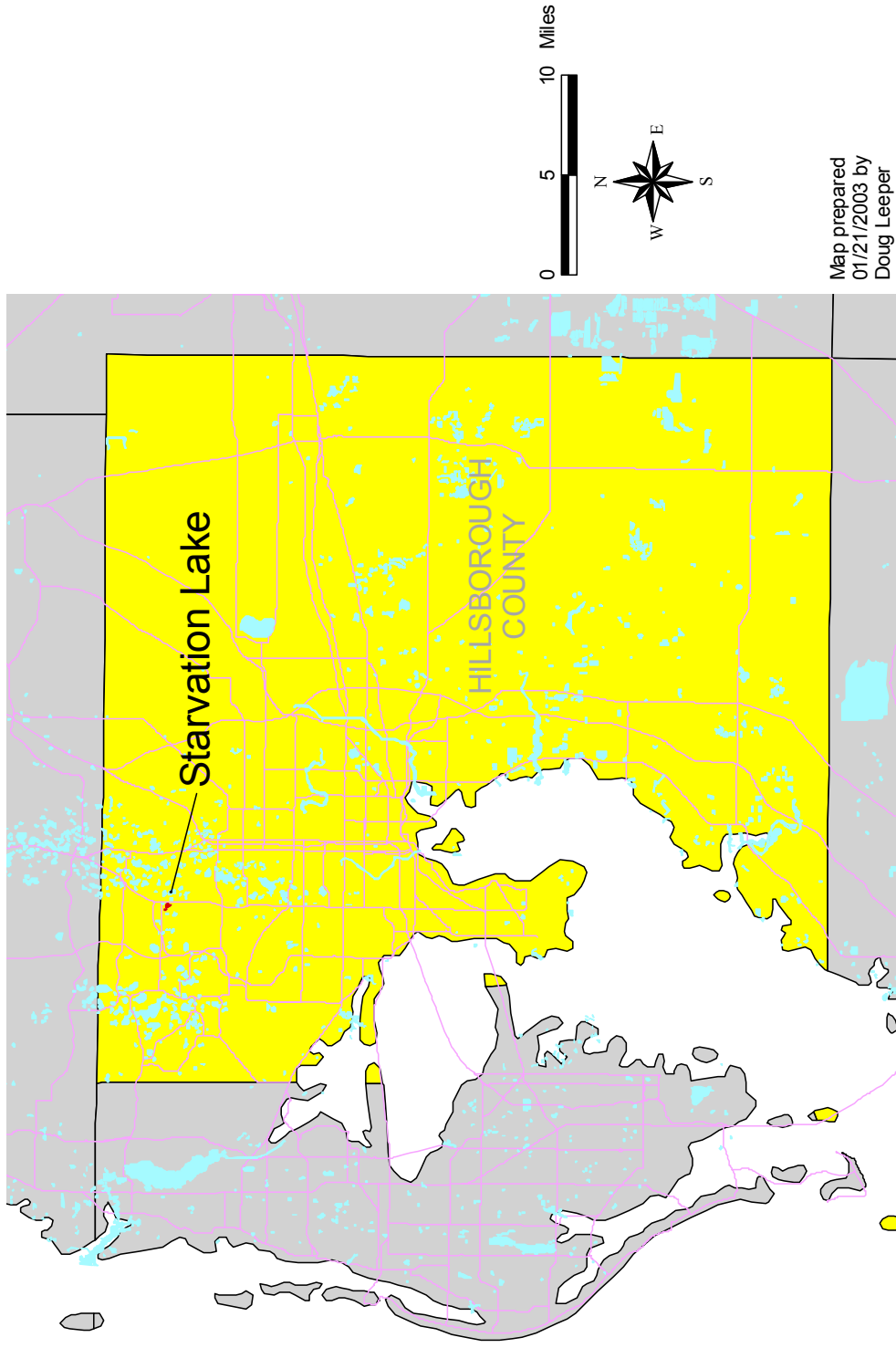


Figure Starvation-2. Location of the District lake level gauge, inlets, outlets and sites where hydrologic indicators were measured for Starvation Lake in Hillsborough County, Florida.

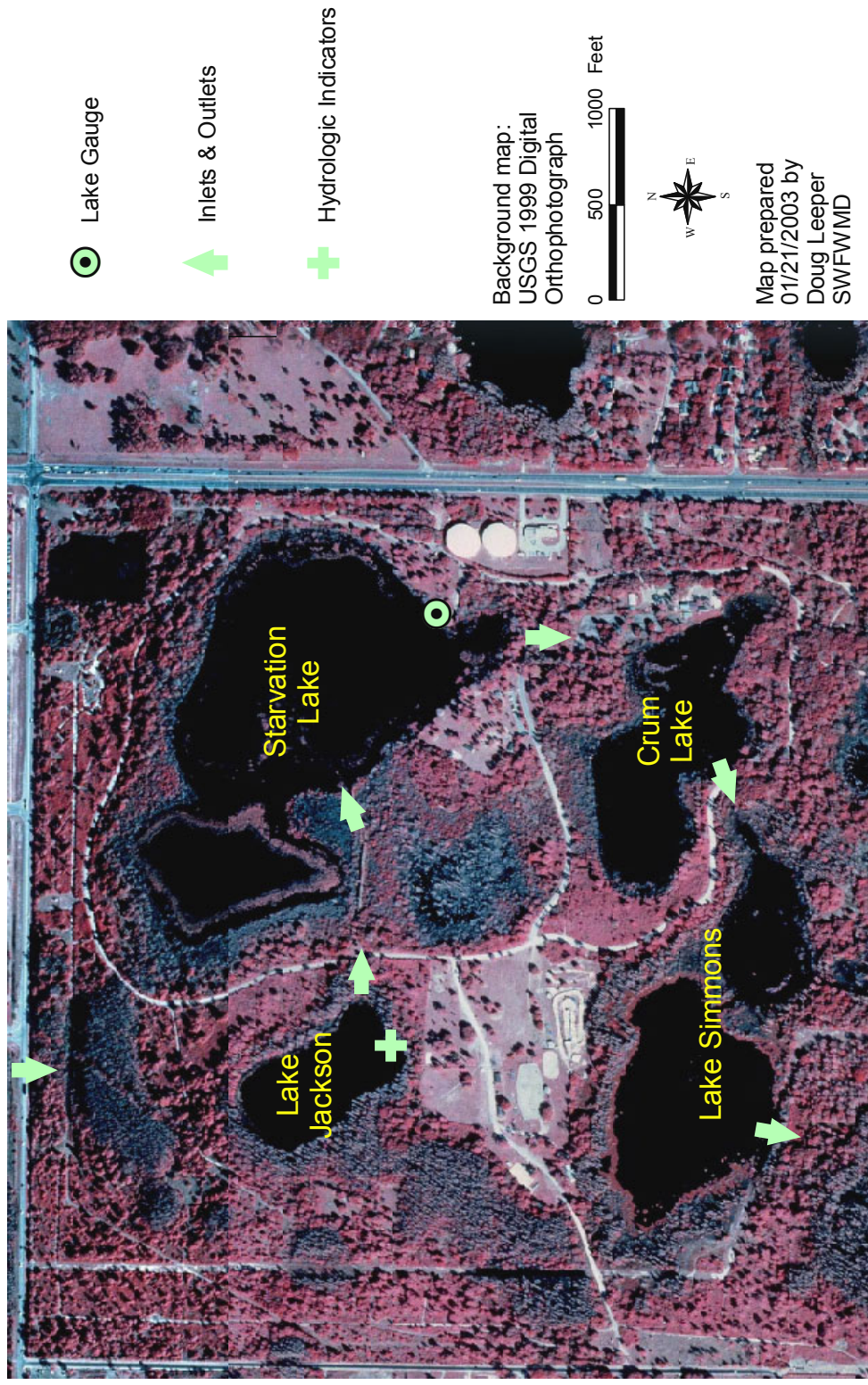
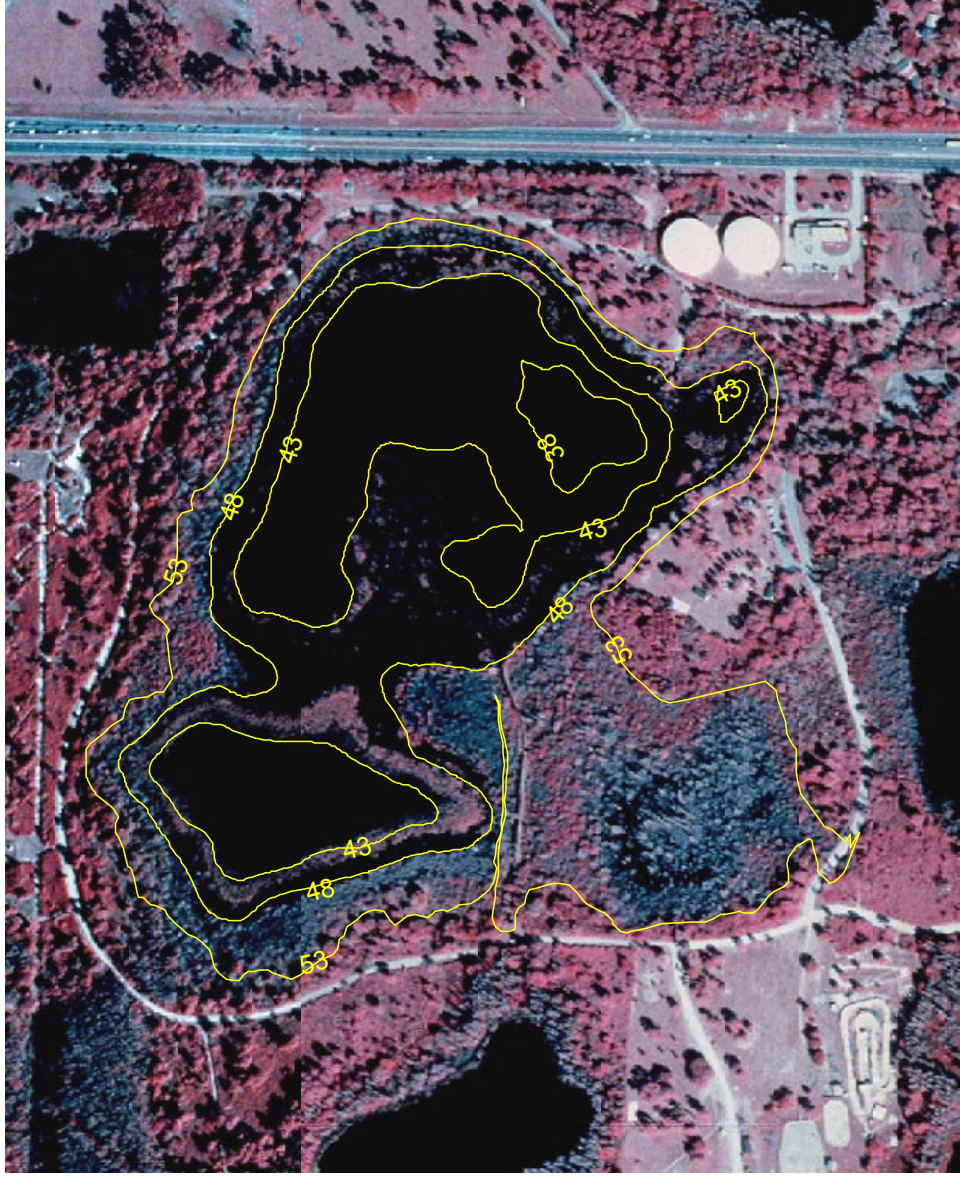


Figure Starvation-3. Five-foot contours within the Starvation Lake basin in Hillsborough County, Florida. Values shown are elevations, in feet, above the National Geodetic Vertical Datum of 1929.



Background map:
USGS 1999 Digital
Orthophotograph

0 200 400 600 Feet



Map prepared
01/21/2003 by
Doug Leeper
SWFWMD

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 Starvation Lake in September 1980 (Table Starvation-1). A Maximum Desirable Level of 52.50 ft above NGVD was also developed, but was not adopted by the Governing Board.

Table Starvation-1. Adopted guidance levels and associated surface areas for Starvation Lake in Hillsborough County, Florida.

| Level | Elevation (feet above NGVD) | Total Lake Area (acres) |
|-------------------------------|--|------------------------------------|
| Ten Year Flood Guidance Level | 55.00 | NA |
| High Level | 53.00 | 81 |
| Low Level | 50.00 | 55 |
| Extreme Low Level | 48.00 | 48 |

NA = not available

Proposed Minimum and Guidance Levels

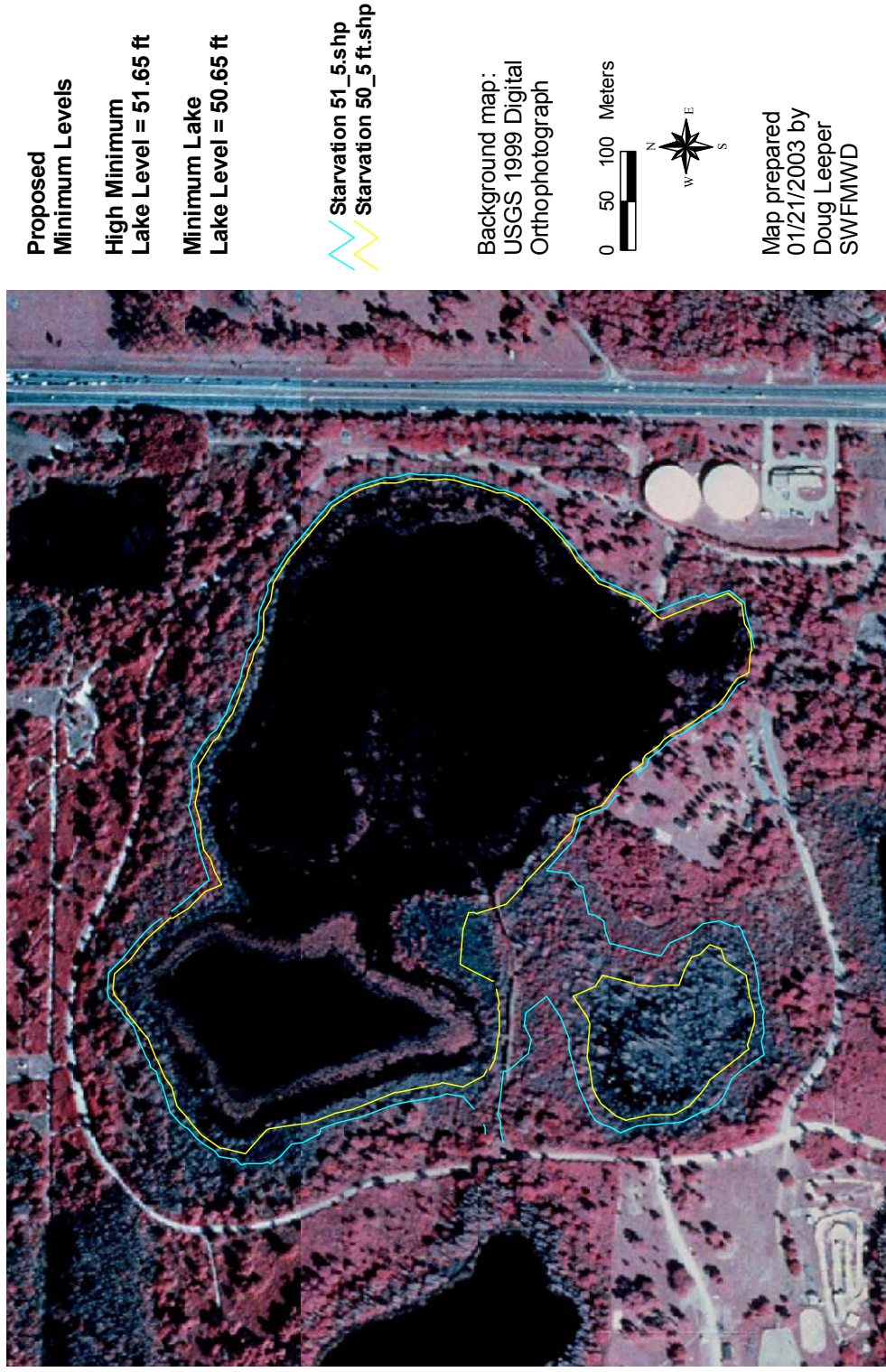
Proposed Minimum and Guidance Levels were developed for Starvation Lake using the methodology for Category 3 Lakes described in Leeper *et al.* (2001), in accordance with modifications outlined by Dierberg and Wagner (2001). Proposed levels, along with lake surface area values for each level are listed in Table Starvation-2. Locations of the proposed minimum levels within the lake basin are shown in Figure Starvation-4.

Table Starvation-2. Proposed minimum levels, guidance levels and associated surface areas for Starvation Lake in Hillsborough County, Florida.

| Level | Elevation (feet above NGVD) | Lake Area (acres) |
|-------------------------------|--|------------------------------|
| Ten Year Flood Guidance Level | 53.77 | NA |
| High Guidance Level | 52.72 | 80 |
| High Minimum Lake Level | 51.65 | 73 |
| Minimum Lake Level | 50.65 | 63 |
| Low Guidance Level | 50.62 | 63 |

NA = not available

Figure Starvation-4. Approximate location of the proposed Minimum Lake Level (yellow) and the proposed High Minimum Lake Level (blue) for Starvation Lake 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 Starvation Lake (District Universal ID Number STA 528 530) from June 1961 through the present date (Figure Starvation-5). For the period of record from January 1974 through the present, the hydrologic data are classified as Current data. Current data collected through January 2002 were used to calculate the Current P10, P50, and P90 (Table Starvation-3).

The Category 3 Lake Normal Pool elevation was established at 53.45 ft above NGVD based on the occurrence of saw palmetto (*Serenoa repens*) and live oak (*Quercus virginiana*) along the lake shore and on elevations associated with the buttressing of large cypress trees along the south shore of Lake Jackson (Table Starvation-4). 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 Starvation-3 and Starvation-5, Figure Starvation-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 control point elevation of 52.72 ft above NGVD (Table Starvation-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 Starvation Lake 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 method, 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 Starvation Lake outlet conveyance system. The initial elevation of Starvation Lake was set at the outlet control point elevation of 52.72 feet 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 (53.77 ft above NGVD) has been exceeded numerous times during the period for which lake stage data are available (see Figure

Starvation-5). The highest surface elevation included in the District water management database, 54.20 ft above NGVD, occurred on September 11, 1964, and September 18 and 25, 1979. The USGS (Murphy *et al.* 1983) report that the lake was staged at 54.55 ft above NGVD on September 21, 1979. The low of record, 40.20 ft above NGVD, occurred on June 25, 2001.

Starvation Lake is not contiguous with any 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. Aquatic macrophytes, including maidencane (*Panicum hemitomum*), cattail (*Typha* sp.), torpedograss (*Panicum repens*), spikerush (*Eleocharis baldwinii*), southern naid (*Najas quadelupensis*) and spatterdock (*Nuphar luteum*) occur throughout the basin.

Species Richness, Aesthetics and Basin Connectivity Standards were evaluated for minimum levels development (Table Starvation-3). A Species Richness Standard was established at 50.65 ft above NGVD, based on a 15% reduction in lake surface area from that at the Historic P50 elevation. An Aesthetic-Standard for the lake was established at the Low Guidance Level elevation of 50.62 ft above NGVD. A Basin Connectivity Standard was established at 49.6 ft above NGVD, based on use of powerboats in the lake, a critical high-spot elevation of 46.5 ft and the RLWR5090 for the northern Tampa Bay area. There are no docks within the basin and water skiing is not permitted, so development of Dock-Use and Recreation/Ski Standards was not appropriate. 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 Starvation-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 Starvation-7).

The Species Richness Standard, the most conservative of the appropriate standards, is less than the Historic P50 elevation and was used to establish the proposed Minimum Lake Level at 50.65 ft above NGVD. The proposed High Minimum Lake Level was established at 51.65 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 4.6 ft below the Low Floor Slab elevation and 1.1 ft below the low spot on the paved park access road that runs along the south shore of the lake.

Figure Starvation-5. Mean monthly surface water elevation, and proposed guidance and minimum levels for Starvation 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 (MLL).

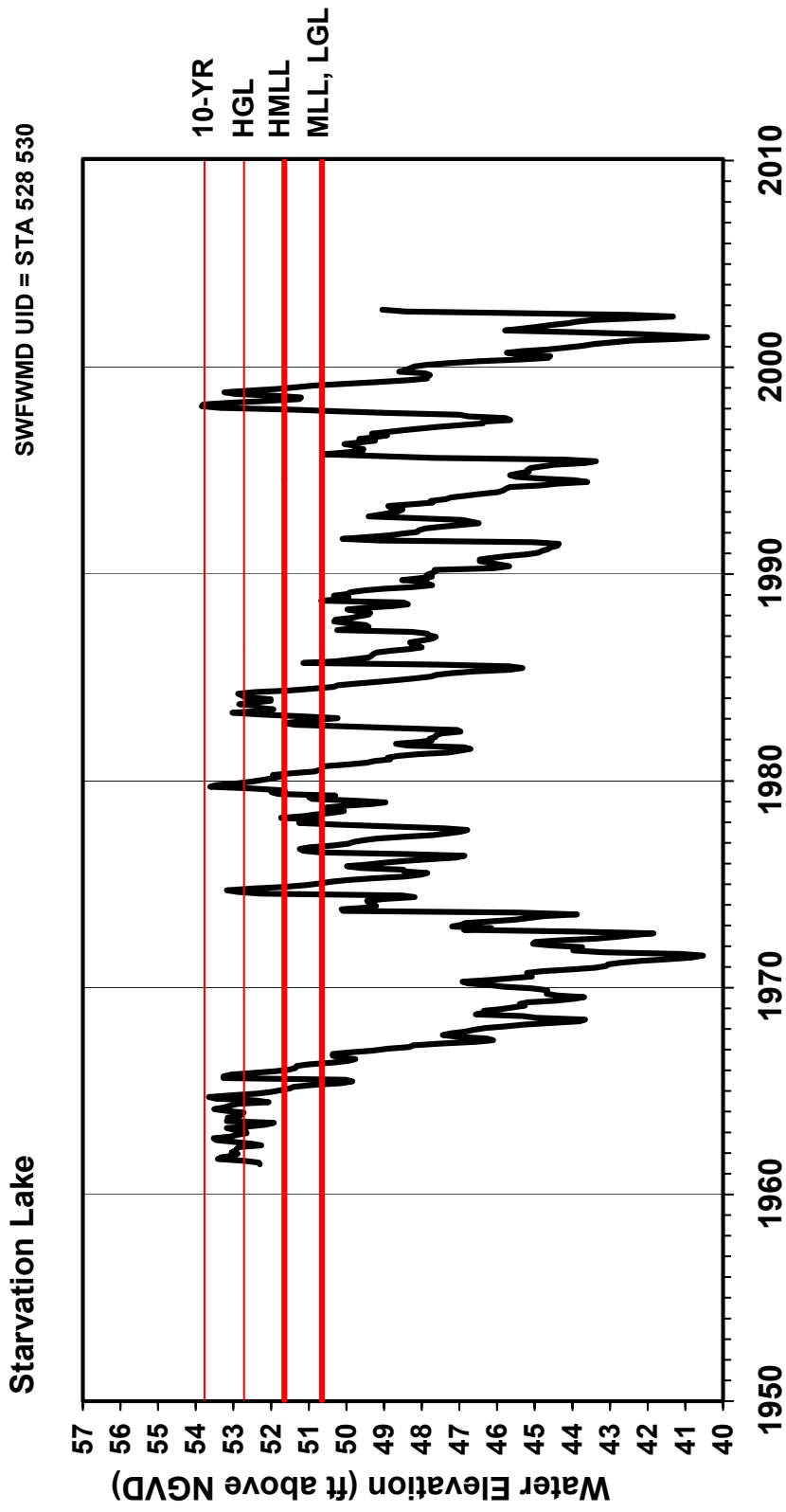


Table Starvation-3. Elevation data and associated area values used for establishing minimum levels for Starvation Lake in Hillsborough County, Florida.

| Level or Feature | Elevation (feet above NGVD) | Lake Area (acres) |
|------------------------------------|--|------------------------------|
| Current P10 | 51.95 | 75 |
| Current P50 | 48.79 | 51 |
| Current P90 | 45.17 | 29 |
| | | |
| Category 3 Lake Normal Pool | 53.45 | NA |
| Low Floor Slab | 56.28 | NA |
| Low Other (boat ramp dirt road) | 53.2 | NA |
| Low Other (top of paved boat ramp) | 52.4 | 78 |
| Low Road | 52.77 | 80 |
| Control Point | 52.72 | 80 |
| | | |
| High Guidance Level | 52.72 | 80 |
| Historic P50 | 51.72 | 74 |
| Low Guidance Level | 50.62 | 63 |
| | | |
| Species Richness Standard | 50.65 | 63 |
| Aesthetic Standard | 50.62 | 63 |
| Connectivity Standard | 49.60 | 54 |

NA = not available

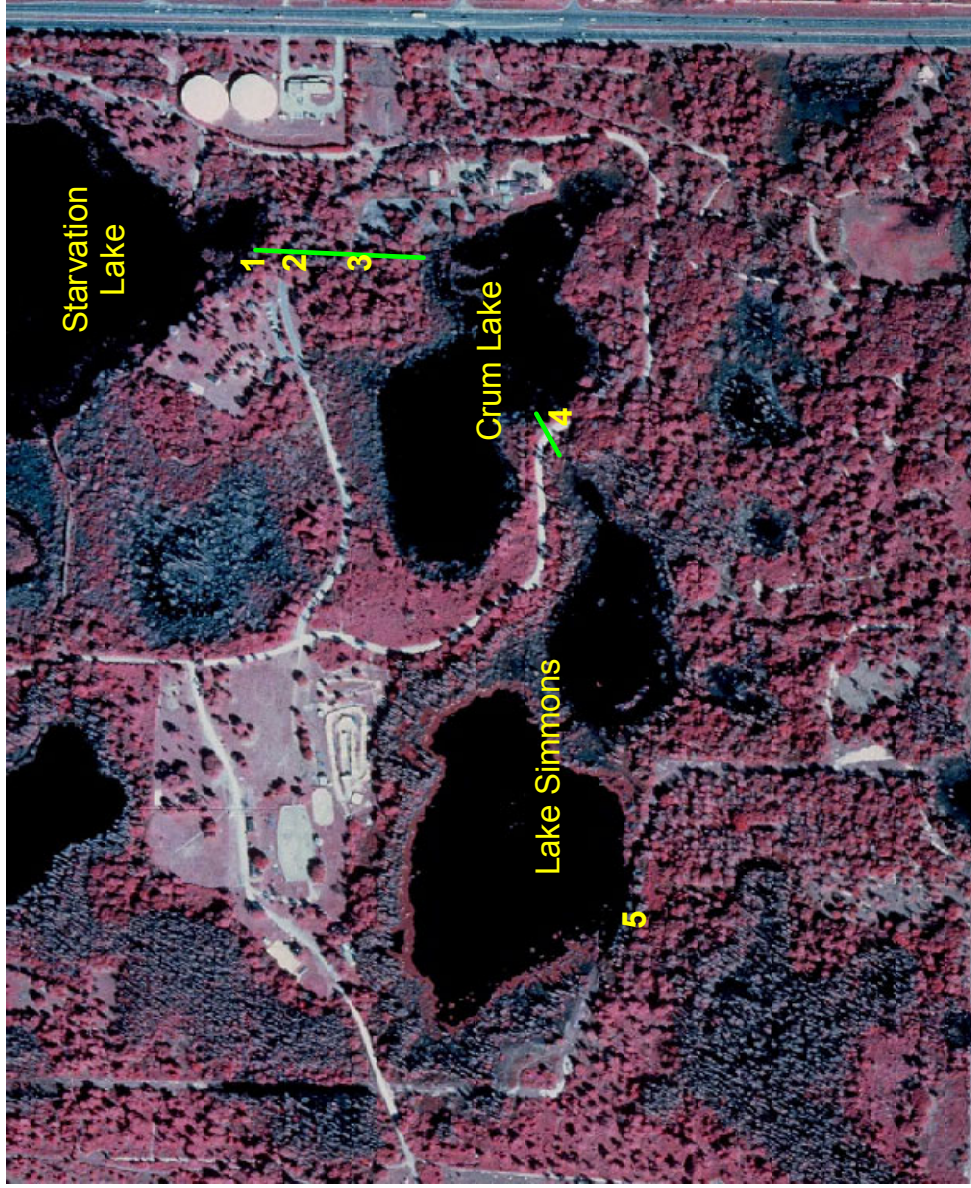
Table Starvation-4. Elevation data used for establishing the Category 3 Lake Normal Pool Elevation for Starvation Lake in Hillsborough County, Florida. Data were collected by Jim Bays of CH2MHill in 1997 at Starvation Lake, and by SWFWMD staff at Lake Jackson on August 12 1999 when the water level elevation was at 47.44 ft above NGVD.

| Hydrologic Indicator | Elevation (feet above NGVD) |
|--|--|
| Base of saw palmetto (Starvation Lake) | 53.50 |
| Base of live oak (Starvation Lake) | 52.24 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.43 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.44 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.46 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.57 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.29 |
| Normal pool based on cypress buttress (Lake Jackson) | 53.70 |
| N | 8 |
| Median | 53.45 |
| Mean | 53.33 |
| Standard Deviation | 0.43 |

Table Starvation-5. Summary of structural alteration and control point elevation information for Starvation Lake in Hillsborough County, Florida. Numbers correspond to those shown in Figure Starvation-6.

| No. | Description | Elevation (feet above NGVD) |
|------------|--|--|
| 1 | Invert at north end of 18" corrugated metal pipe running under paved park access road | 43.04 |
| 2 | Invert at south end of 18" corrugated metal pipe running under paved park access road | 45.51 |
| 3 | High spot in channel between Starvation Lake and Crum Lake | 49.6 |
| 4 | Invert at northeast end of 24" corrugated metal pipe running under unpaved park access road; invert at southwest end is 41.63 ft above NGVD. | 42.02 |
| 5 | Control point; vegetated natural ground | 52.72 |

Figure Starvation-6. Outlet conveyance system for Starvation Lake in Hillsborough County, Florida. Numbered sites are described in Table Starvation-5..



Background map:
USGS 1999 Digital
Orthophotograph

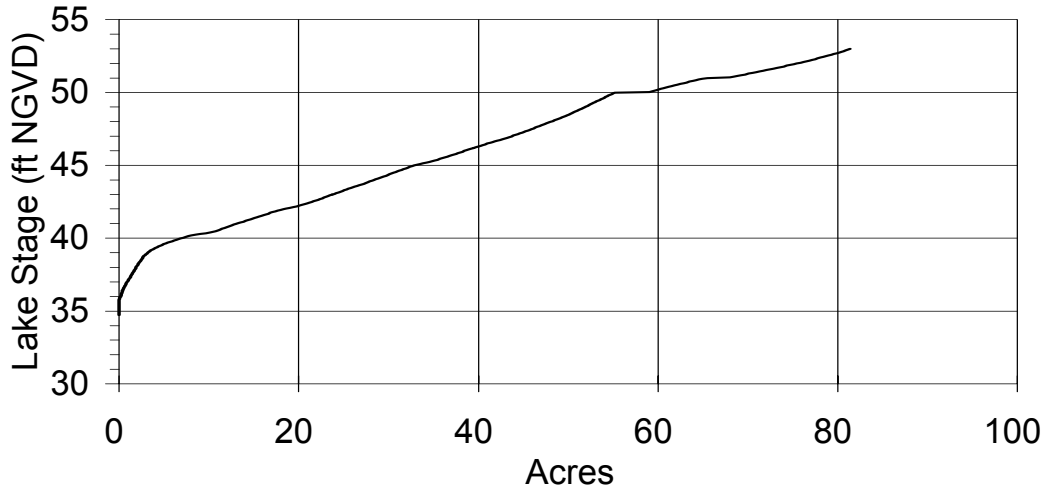
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Map prepared
01/21/2003 by
Doug Leeper
SWFWMD

Figure Starvation-7. Surface area, volume, potential herbaceous wetland area, area available for aquatic macrophyte colonization, and dynamic ratio versus lake stage for Starvation Lake in Hillsborough County, Florida.

Stage and Area



Stage and Volume

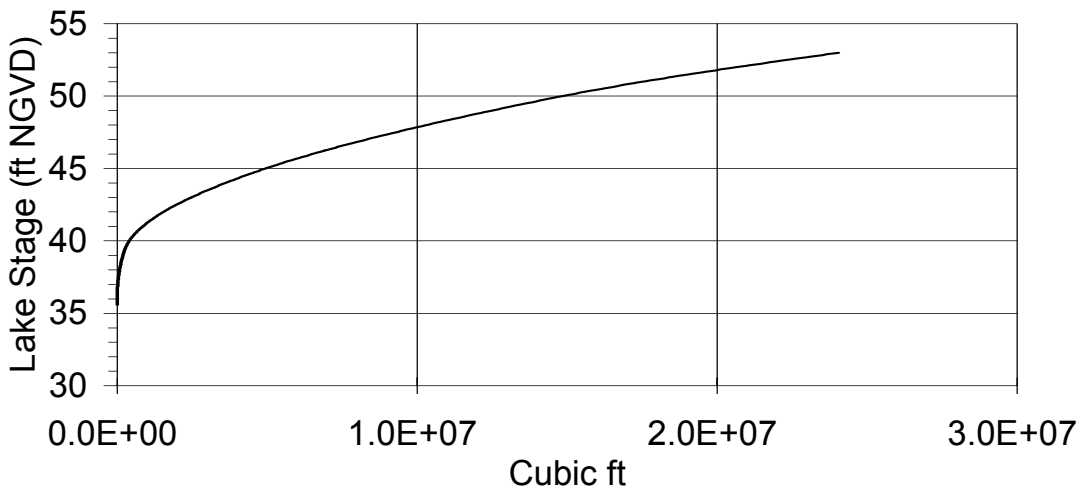
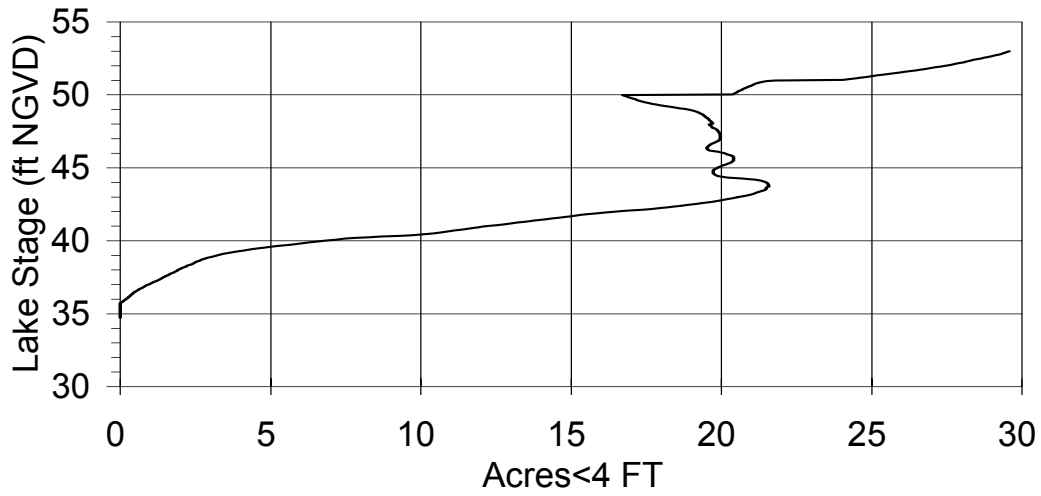


Figure Starvation-7 (continued).

Stage and Herbaceous Wetland Area



Stage and Area Available for Aquatic Plant Colonization

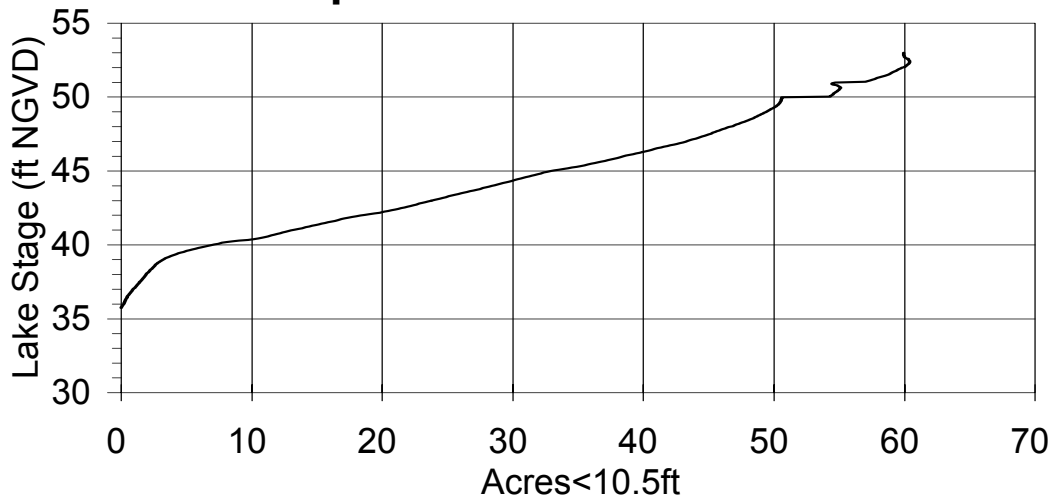
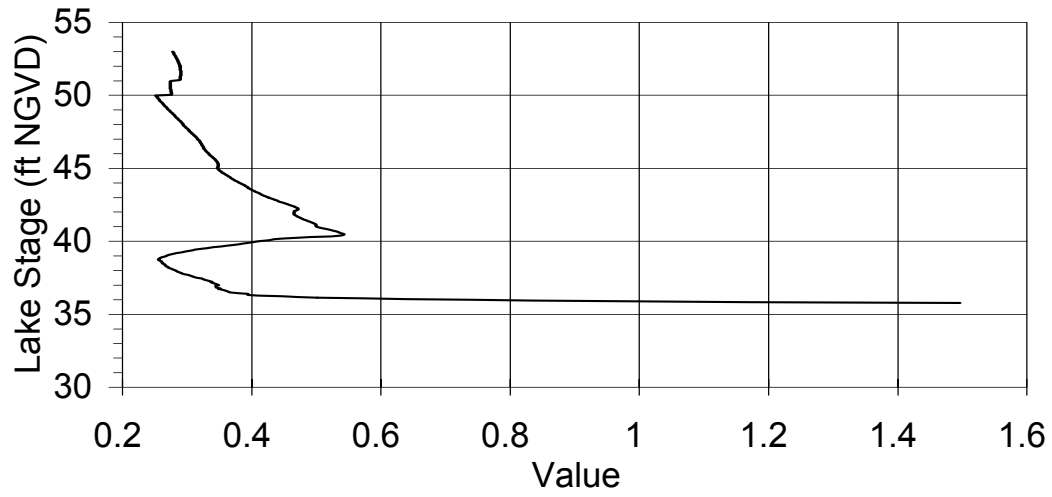


Figure Starvation-7 (continued).

Stage and Dynamic Ratio



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