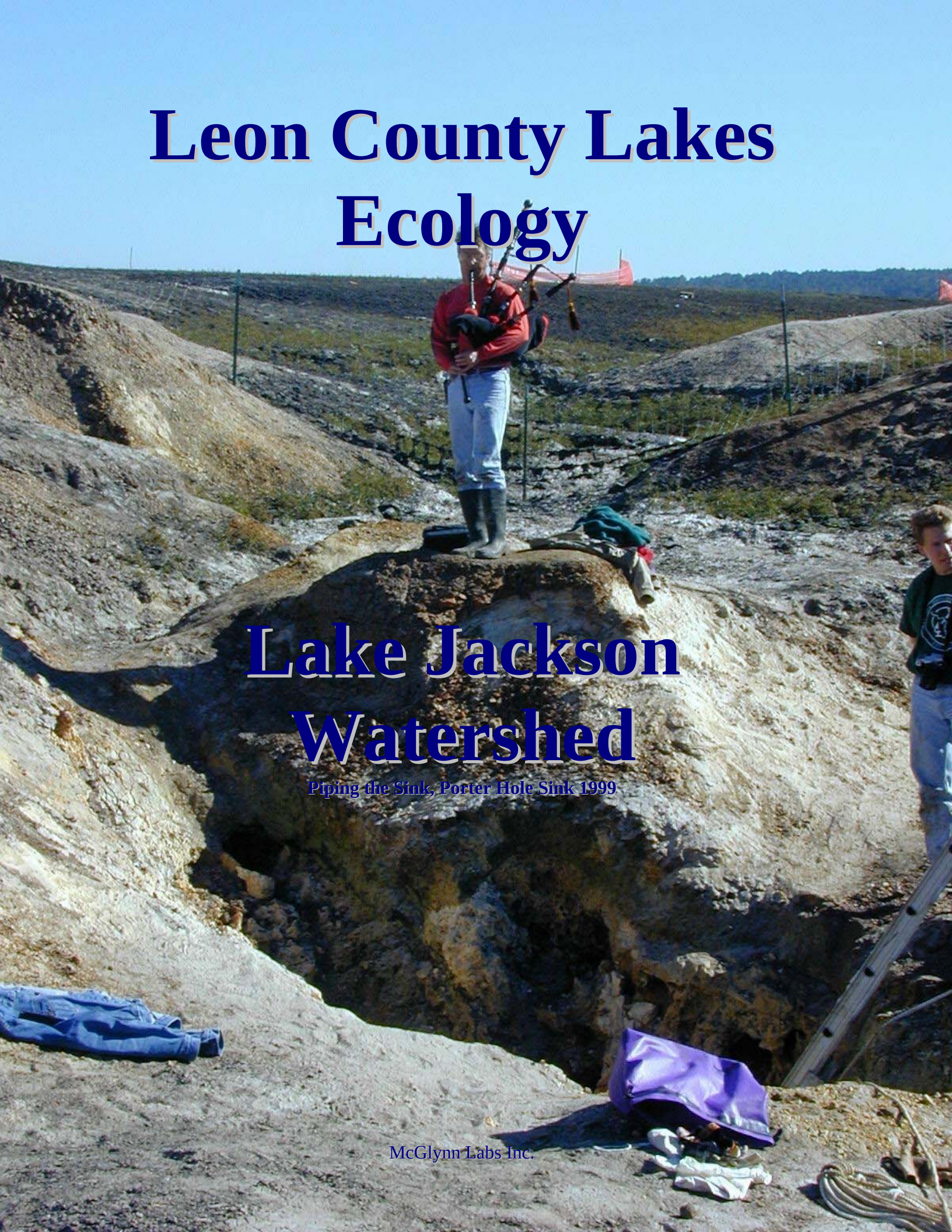
Leon County Lakes Ecology



Lake Jackson Watershed

Piping the Sink, Porter Hole Sink 1999

McGlynn Labs Inc.

4.4.3: Lake Jackson

Surface Area: 4001 Acres
Drainage basin: Jackson
Classification: Mesotrophic/Eutrophic
Location: Tallahassee Hills
Number of Stations: 6
Duration of monitoring: 07/68-09/04

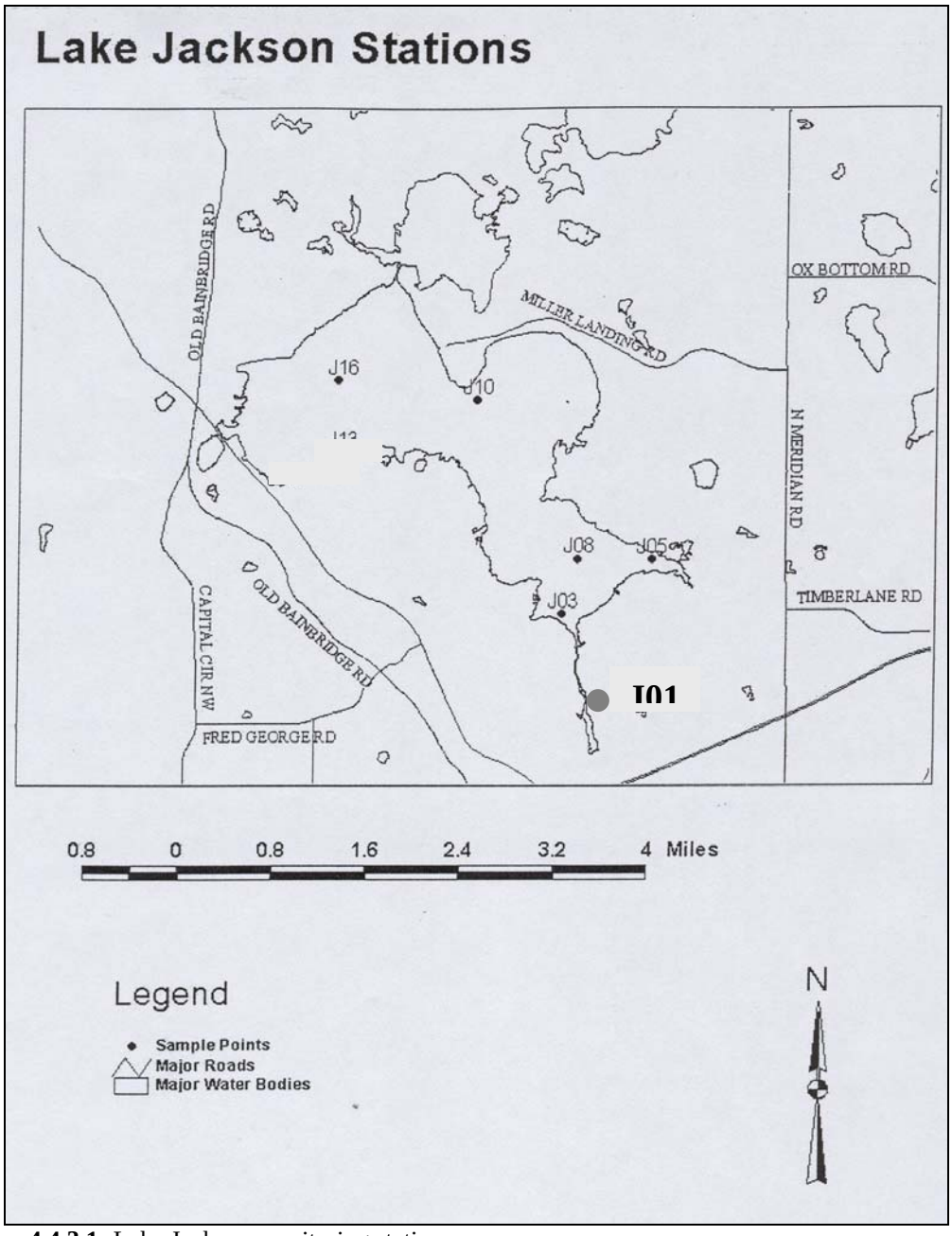


Figure 4.4.3.1: Lake Jackson monitoring stations

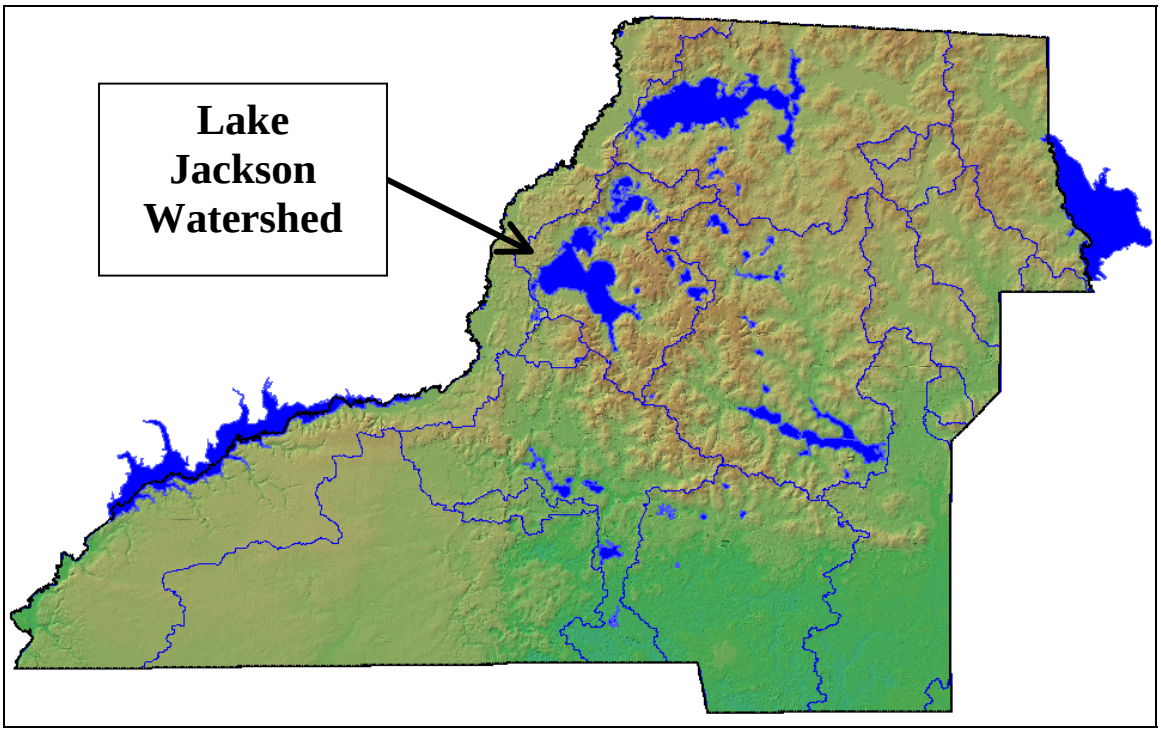


Figure 4.4.3.2: Map by Greg Mauldin, Tallahassee-Leon County GIS

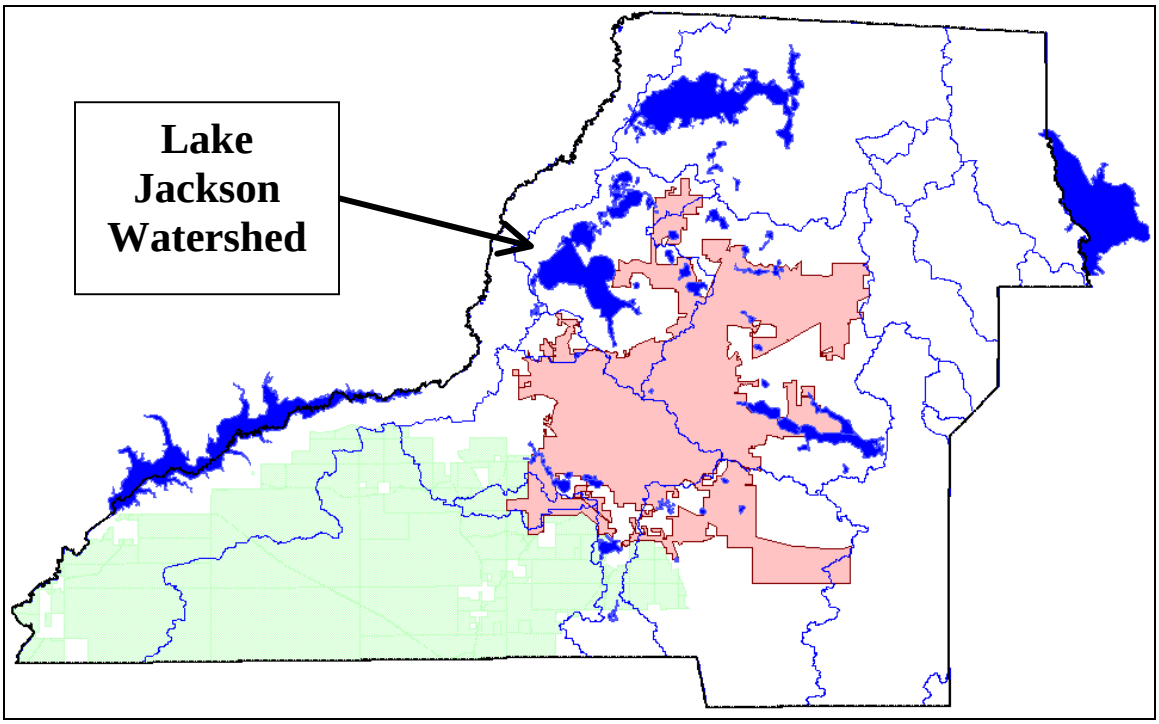


Figure 4.4.3.3: Map by Greg Mauldin, Tallahassee-Leon County GIS

Figure 4.4.3.4: The waters will return and so will the Trophy Bass

Lake Jackson is an example of a disappearing lake, which is a type of karst lake that periodically drains into a permanent sink. There are very few lakes like Lake Jackson in the world which is considered both an Aquatic Preserve and an Outstanding Florida Water body, and is truly a natural wonder. Lake Jackson is located in an upland region and has the capacity to completely drain. In the past it has been dry for years, at times for a decade between refills. It is at an elevation over 100 ft above the aquifer, unlike the other karst lakes in the area. Lake Jackson remains the only lake in our area that has not filled since the drought, and is currently only half full.

Current data shows that the water quality of Lake Jackson is dominated by the drainages to the east of the lake, Megginnis Arm and Fords Arm, which are fed by stormwater from the City of Tallahassee. The data indicate improving conditions within the Megginnis Arm drainage; however, the water quality in Megginnis Arm proper has high chlorophylls, bacteria and nutrients. The isolation of Megginnis Arm from Lake Jackson by a marshy growth of emergent vegetation during the current low water levels allows for some treatment of the stormwater as it exits Megginnis Arm. The improved conditions within Lake Jackson in the vicinity of Megginnis Arm are due to the removal of nutrient rich muck by Leon County during the drought.

At station J01 in Megginnis Arm, the conductivity is always much greater than background, indicating storm water inputs. Chlorophyll a values are in the eutrophic range. TSI's indicate impaired water quality. Fords Arm has a higher TSI than Megginis Arm which would indicate impairment, but since the water is darker, or tannic, this allows higher TSI values according to FDEP's rules. Since this water goes directly into a clear lake, this rule does not seem appropriate for this condition. Chlorophyll values and the frequency of blooms also indicate poor conditions in Fords Arm. When algal blooms

become persistent rather than ephemeral it is an indication of eutrophication. Nutrient concentrations are elevated in Fords Arm as well as in Megginnis Arm, and may be increasing. High levels of nitrates and chlorides in both areas are indicative of possible wastewater inputs.

The data show no statistically significant trends, but chlorophyll values seem to be decreasing in Lake Jackson. Sediment removal and efforts to retrofit the drainage are showing measures of success. Dissolved Oxygen values are improving, with no anoxia occurring since 1997. This is another indicator that water quality is improving. Nitrate and ammonia concentrations show no significant trends; however, they are not increasing. Stabilized conditions also indicate an improvement in water quality.

Figure 4.4.3.5: A map of Lake Jackson taken after the civil war (1868). Lake Jackson surrounded by farms and forests, prior to being surrounded by Tallahassee instead.

In 1907 the Board of Trustees, including Governor N. B. Broward, “drove over the bed of Lake Jackson at several places and found that a large portion of the area, formerly covered by the waters of the lake, was of a sandy character. Water was still standing in some places and there were found a number of places where mud or muck of varying, but not great thickness, was deposited. Owing to the extensive prevalence of sand, the committee considered that the soil in the lakebed was not of a high grade of fertility for the general purpose of cultivation… The history of this place, so far as could be ascertained by the committee, would seem to indicate the probability of its refilling, more or less suddenly, when conditions where favorable… Numerous sinkholes were found in the lakebed… “

Figure 4.4.3.6: Lime Sink, a natural drawdown on Lake Jackson (~1907).

Figure 4.4.3.7: An early picture of Lake Jackson, looking north across the lake from Faulk Drive across Porter Hole sink to Rollins Point (~1907). Note that there was plenty of vegetation, which is very similar to what there is today. Photographed by Elias Howard Sellards.

On March 18, 1941, the Board of Trustees met again on matters concerning another draining of Lake Jackson. Governor Holland presided. The item discussed was that the City of Tallahassee wanted to lease the lake bottom "to build an auxiliary airport in connection with the Tallahassee Airport now being operated by the United States as a training field… the terms of the lease were for the duration of the emergency upon payment of annual rental of $1.00."

Figure 4.4.3.8: Monroe Street (US 27) (1920's) showing the causeway built across part of western Lake Jackson. This created Little Lake Jackson. This is the proposed site of the Lake Jackson Ecopassage today. It would be nice to restore the connection between the lakes for water exchange as well as public access and wildlife crossings. Note that the this area is currently overgrown by scrub trees. The trees should be removed and the shoreline needs to be restored.

After the drought of 1956, Lake Jackson was dry for a number of years. Local residents were frustrated by the empty lake and the major sinkholes in Lake Jackson (Lime, Porter Hole and Megginnis) so all the sinkholes became filled with crushed automobiles and cement. Water levels were stabilized and property values as well as fishing time were maximized. These three sinks have not functioned the same since that time. Flooding followed this dry event, possibly because none of the sinkholes were drawing water. Porter Hole Sink drained Lake Jackson in 1983 for a short time, while Lime Sink remained sealed until 7 May 2000, and then only opened slightly. Meginnis Sink has still not reopened.

In September 16, 1999, the central portion of Lake Jackson vanished into Porter Hole Sink, exposing 750 acres of sediments. Eight months later, May 7, 2000, Lime Sink drained the northern half of the lake. Porter Hole Sink revealed an impressive chimney hole and cavern system, while Lime Sink appeared as only a crack in the muck and

drained slowly. So many fish were trapped in the basin during this event that fishermen came from as far away as Tennessee to fish the 'hole'.

Figure 4.4.3.9: Lake Jackson is an Aquatic Preserve. Aquatic Preserves are created by a legislative act and approved by the Governor. Lake Jackson is the only fresh water lake in the State of Florida designated as an Aquatic Preserve.

This time the bottom of Lake Jackson was not mostly sand. The muck was so deep in places that the lake bottom was called a hazard and public access was limited. This was the fifth time in the last 100 years that the lake's water disappeared beneath the ground. The once sandy lake bottom has obviously changed over the 100 years since Governor Broward's visit.

Figure 4.4.3.10: Porter Hole Sink opens in slightly different places during each natural drainage event. In 1999 Porter Hole was located about 10 meters north of the 1983 site and about another 100 meters to the

north of the 1956 fissure. In the 1983 and 1999 drainage events Porter Hole was the sink drawing the most water, prior to 1956 Lime Sink was the largest.

The periodic draining and refilling of Lake Jackson defines the plant and animal communities. Periodic desiccation causes dramatic changes in the plant communities. For example, the aquatic vegetation dies during drawdowns. The three year long dry period beginning in 1956 primed the lake for the proliferation of game fish. After the drawdown occurred, Lake Jackson became famous for trophy Largemouth Bass, *Micropterus salmoide*. There are several reasons why the drawdown improved fishing. Organic sediments that are exposed to air tend to oxidize and expose the underlying sand. This improves the breeding habitat for Largemouth Bass. Species that compete with the Largemouth Bass like Chain Pickerel *(Esox niger*), Florida Gar (*Lepisosteus platyrhincus)* and Bowfin *(Amia calva),* do not recover as rapidly. Aquatic plant densities also are decreased and Largemouth Bass have less difficulty feeding since the cover for their prey is reduced.

Intentional burns on the dry lake bottom were not a great success. Superficial burns were required by the Department of Forestry; all burns had to be extinguished at the end of the day to avoid hotter fires and the resulting smoke. Muck fires were not allowed and would have been more beneficial since they remove sediment and deepen the lake. After a burn nutrients, particularly phosphorus, is released. The burns also stimulated seed banks. The diverse flora common in unburned parts of the Lake, *Eupatorium caoillifolium* (dog fennel), *Decodon verticillatus* (water willow), *Polgonum densiflorum* (smart weed), *Bidens mitis* (bur marigolds), *Hibiscus spp*., *Salix nigra* (Willow*), Myrica cerifera* (Wax Myrtle), *Acer rubrum* (Red Maple) and Juvenile *Taxodium spp.* (Cypress) were replaced by *Panicum hemitomen*. The dry Lake bottom became a monoculture of *Panicum hemitomen* (Maidencane). The proliferation of Maidencane after a burn has been noted in other habitats as well, such as the Loxahatchee Wildlife Refuge (Pope, 1993).

The hydrological balance for Lake Jackson is typical of karst lakes. More water is lost to evaporation than to seepage. The seepage from the lake bottom accounts for 40% of the annual loss of water. Evaporation losses total 60% (Landing 1993). The lake water lost to seepage recharges the aquifer. Fine organic silts that have built up within the lake may influence this recharging process. The silt or fluid mud, commonly called MUCK, can clog the pore spaces in sandy soils necessary for water to seep out of the lake. Its removal can restore seepage. Thirty two percent of the water in the Floridan Aquifer is of recent origin, mostly seepage and leakage from lakes. This estimate was calculated from the isotopic content of the water in the Floridan Aquifer in wells over 100m deep, 2 km south of Lake Jackson (Katz et al., 1997).

However, evaporation from the lake's surface can account for the loss of 98.5 acre-ft/day, 49.7 cfs or about 0.394 inches/day. Hydrologic models predict that as much as 16 cfs must seep out of the lake (Tyler Macmillian). The acceptance rate of Porter Hole was measured at 12 cfs in 1999, whereas Lime Sink seemed to be draining at a rate of less than 3 cfs. This loss of water can account for 29.4 acre-ft/day or 0.12 inches/day.

Therefore evaporation should account for more than three times the water loss from Lake Jackson than would be flowing into the sinks.

Exploration of the caverns began on the 15th of October after flow into the sink ceased. With Tom Scott from the Florida Geological Survey leading the way, the dry caves to the northwest and the southeast were explored at a depth of about 50 feet below the former surface of the Lake. The passage to the southeast leads to submerged caverns dropping another 40 feet. Since Lake Jackson is about 105 feet above sea level, this submerged passage represents the potentiometric surface of the aquifer, and may be the constriction that limits the rate at which the lake water reaches the aquifer. In all, 36 slots and 4 loops have been mapped in the caverns, which measured 278.8 feet in length.

Long cores taken at several sites through the lake indicate a broad range of Karst activity throughout the basin. Portions of northern Lake Jackson once were canyons 100 feet deep (Tom Scott, pers com). Tree scars have pockmarked sediments uncovered by the water coursing through the ravine leading to Porter Hole Sink, indicating that the lake has been dry for long periods of time in the past.

During the 1999 drawdown water from Lake Jackson entered Porter Hole Sink in two streams, one from the north and one from the south. Water from the northern part of the lake entering the sink was of rather good quality and was clear in appearance. Water entering the sink from the southern portion of the lake was of poor quality, full of suspended sediment and resembled black coffee. Sediment laden water poured into the sink from the south until vegetation began to grow on the lake bottom with the advent of spring. After the plants took hold, mostly dog fennel, water entering the sink from the south cleared and became quite clean. This indicates that the southern portion of Lake Jackson was in worse condition.

The 1983 Dry Event was of too short a duration to mobilize major restoration efforts in Lake Jackson. County officials were ready for the 1999 event. On July 8, 1999, two full months before the Lake went dry, the Leon County Commission approved $2,000,000 dollars in the 1999 Stormwater Capital Improvement Revenue bond issue for Phase I of the restoration of Lake Jackson. The goal was the removal of accumulated muck in Megginnis and Fords Arms. Then, on February 8, 2000, the Leon County Commission reallocated $2,460,250 from the Lexington and Rhoden Cove stormwater retrofit projects to fund Phase II of the massive restoration effort underway on the Lake. The cleanup of the Lake was extended to the middle of the southern portion of Lake Jackson, from Spring Run to the Arms. Phase II rendered Fords and Megginnis Arms navigable, connecting them back to the lake. County Staff also secured $900,000 in grants from the Northwest Florida Water Management District, the Florida Fish and Wildlife Conservation Commission, and the Florida Department of Environmental Protection. A total of $5,360,250 was collected to restore Lake Jackson. By late May 1,046,500 cubic yards of silt had been removed from the Lake Jackson basin and 10,000 cubic yards of muck were being removed daily with over 500 trucks on the lakebottom (Tyler Macmillian, pers. com). The 2000 Florida Legislature approved an additional $2,650,000

to fund Phase III of the restoration. Three areas were targeted for the removal of accumulated Muck: the mouths of Megginnis and Fords Arms; sinks and Karst depressions between Crowder landing and Faulk Drive; and Church Cove (Friends of Lake Jackson, 2000). At end of the project, 50 years of accumulated muck, over 2,000,000 cubic yards of sediment, were removed from the lake bottom. Overall, it was hoped to restore the lake to the former sandy bottom described by Governor Broward.

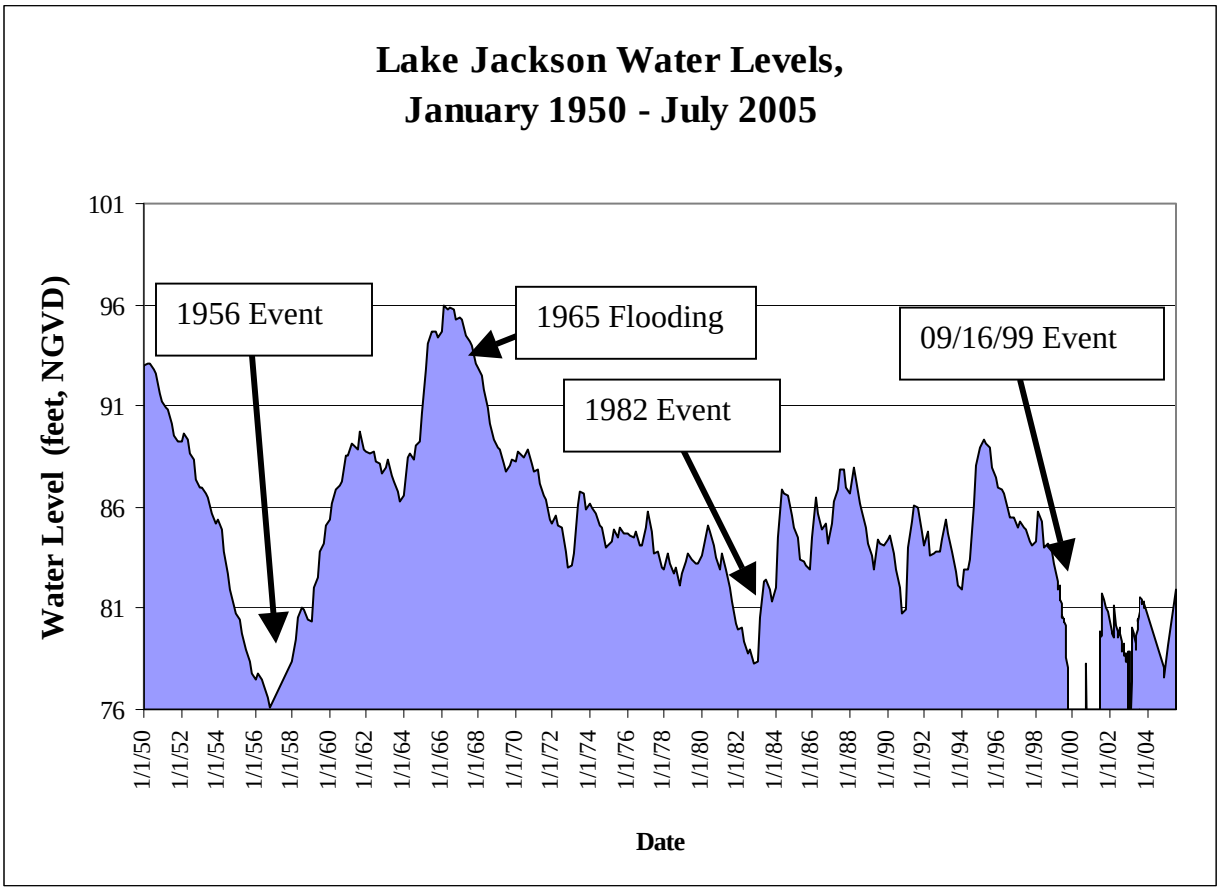


Figure 4.4.3.11: Lake Jackson water levels since 1950. Lake Jackson has emptied three times in the last half century. In 1957 citizens loaded all manner of stuff from wrecked automobiles to hydrolic cement into the Sinkholes. It has been hypothesised that the flooding of the late 60's might be due to this clogging of the sinkholes in 1957. In 1982 Lake Jackson filled without the sinkhole being plugged. Since the 1999 drainage event Lake Jackson has not filled and is currently about half full.

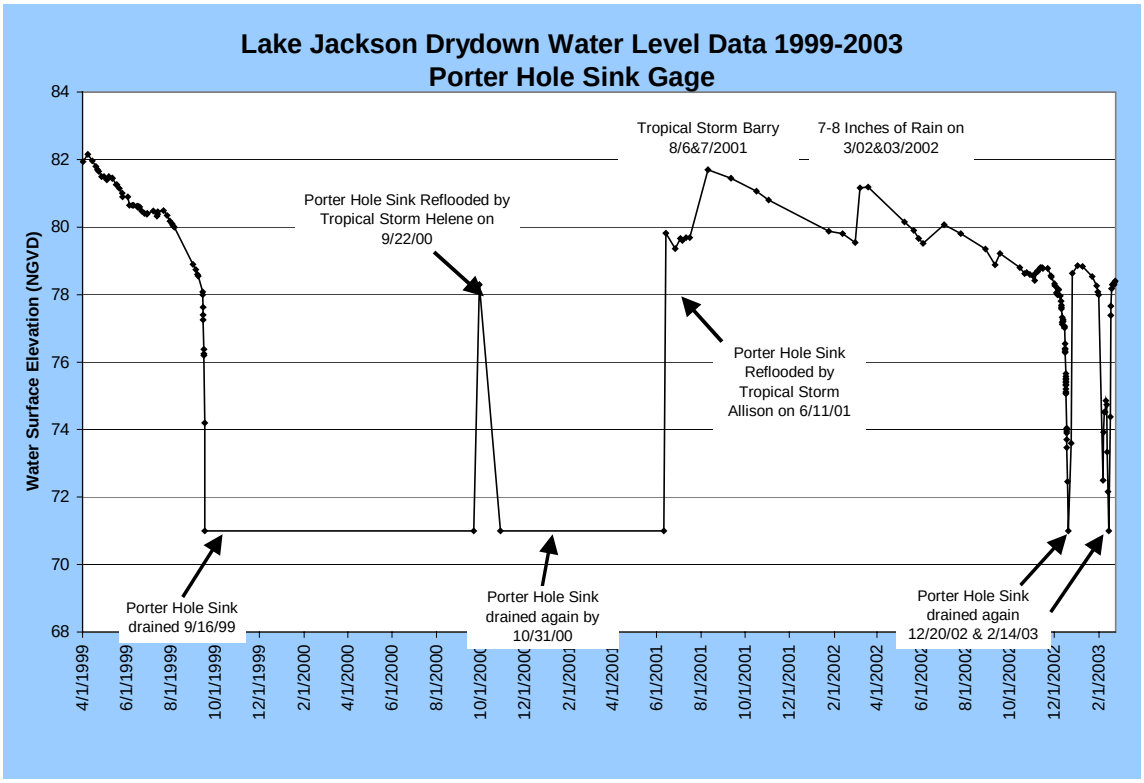


Figure 4.4.3.12: Lake Jackson has still not recovered from the drought. Since the initial drawdown of 9/99 it has refilled somewhat and drained again in 10/00, 12/02 and 2/03. (Graphics from Tyler MacMillian, NWFWMD)

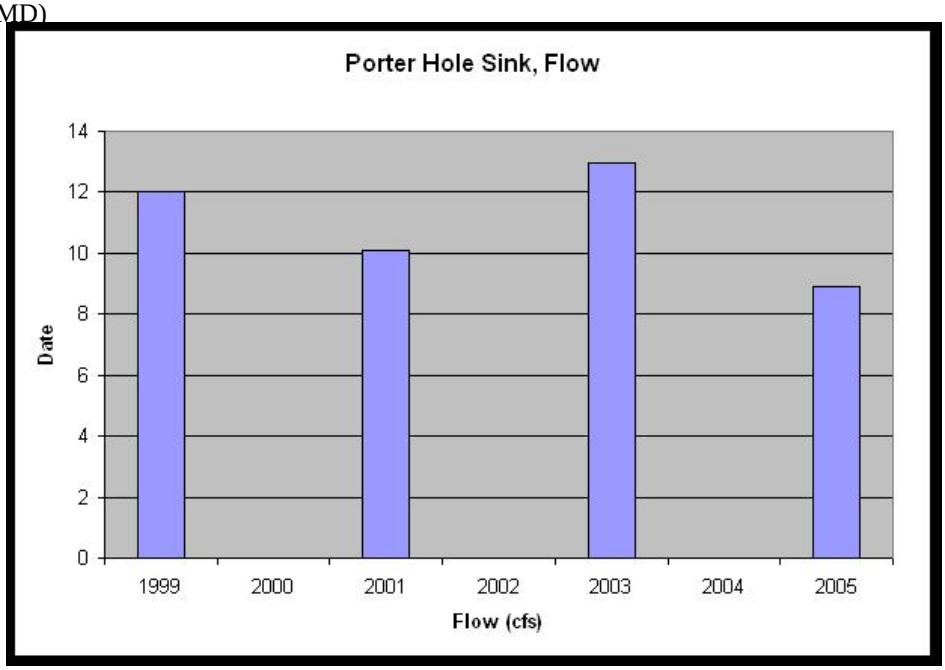


Figure 4.4.3.13: Flow into Porter Hole Sink has been steady since the drought. Flow measurements in Porter Hole Sink, 1999 (by Niedaroda and McGlynn), 2001-3 (FGS, NWFWMD, Blue Water Scuba and MLI), 2005 (MLI).

Figure 4.4.3.14: Tyler MacMillian measuring the flow into Porter Hole Sink assisted by diver Fleet Pride and James Baisillie (first picture, December 2003). The Leon County Commissioners go fishing on Lake Jackson (second picture,).

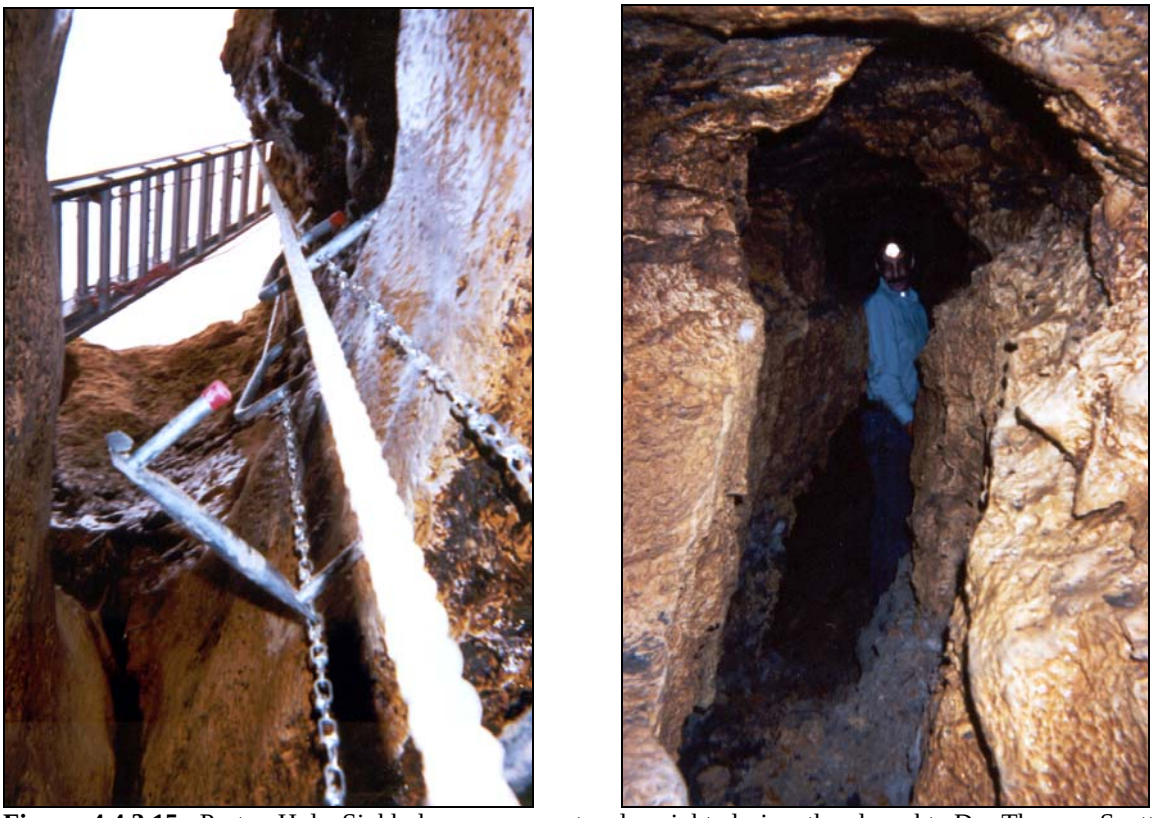


Figure 4.4.3.15: Porter Hole Sinkhole was a spectacular sight during the drought. Dr. Thomas Scott (FSGS) called it the 'Super bowl of Geology.' This dramatic Chimney Sink and the adjoining cavern system was the subject of a special documentary filmed by Japanese PBS.

Algal toxin analysis (Lake Jackson)– The drinking water threshold the cyanobacterial toxin microcystin, as defined by the World Health Organization (WHO), is 1.0 µg/L MCLR. No other Algal toxin standard exists. The bloom in Lake Jackson was just under the standard and found to contain 0.5 ug/L microcystin on 5/1/06 Anabaena and Microcystis algae was found. These bluegreen alage produce an algal toxin called microcystin. The waters of Lake Jackson are connected to the aquifer by sinks and could potentially impact drinking water. There have been problems associated with incidental contact with water containing algal toxins and these blooms are properly termed Harmful Algal Blooms (HAB). The algal toxin analytical results from Green Water Labs and a poster from the Florida Department of Health are included (suggested for use in affected waters).

Figure 4.4.3.16: Lake Jackson Algal Bloom at new boat ramp (photo by Jess VanDyke, 02.06).

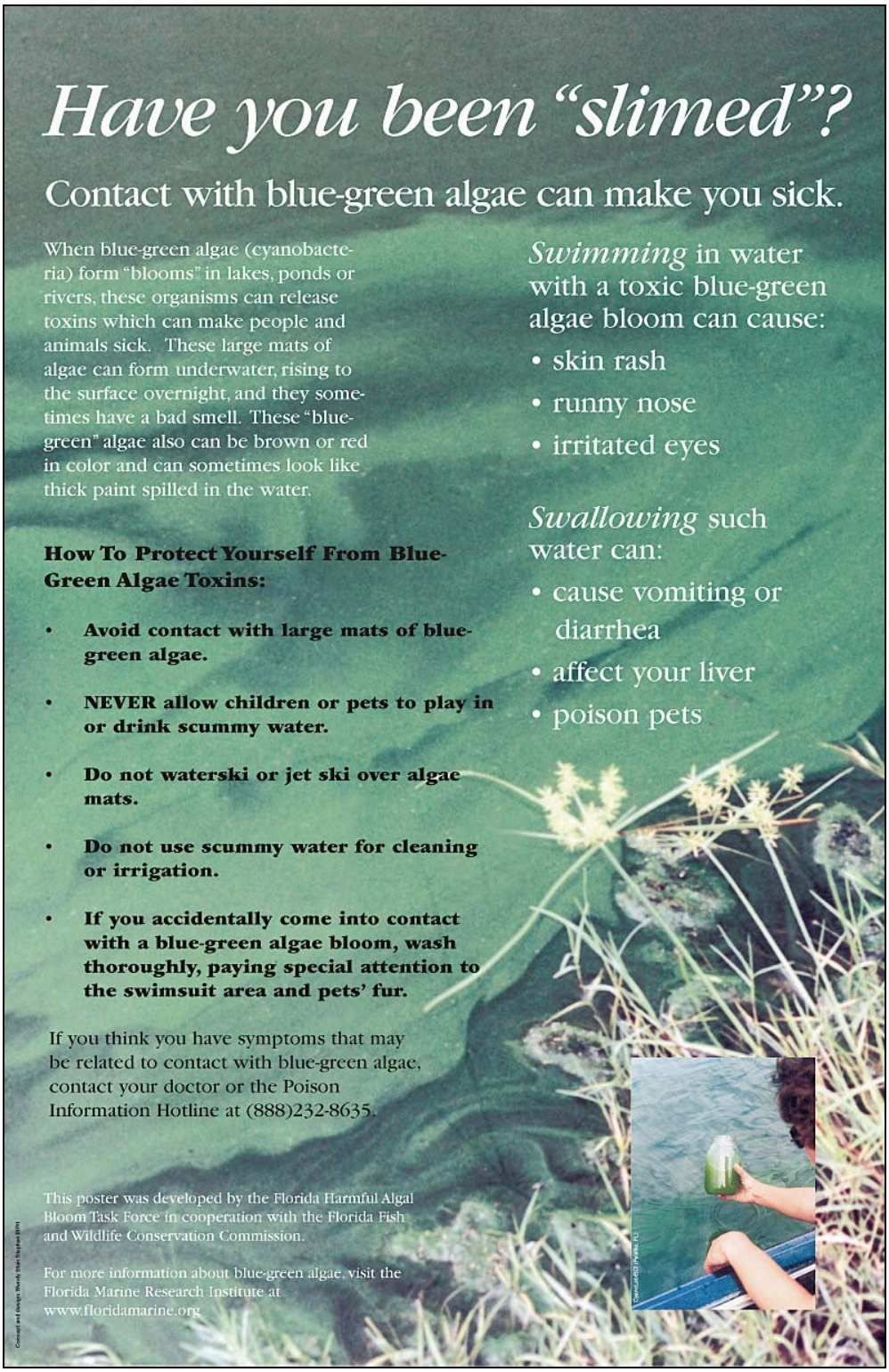
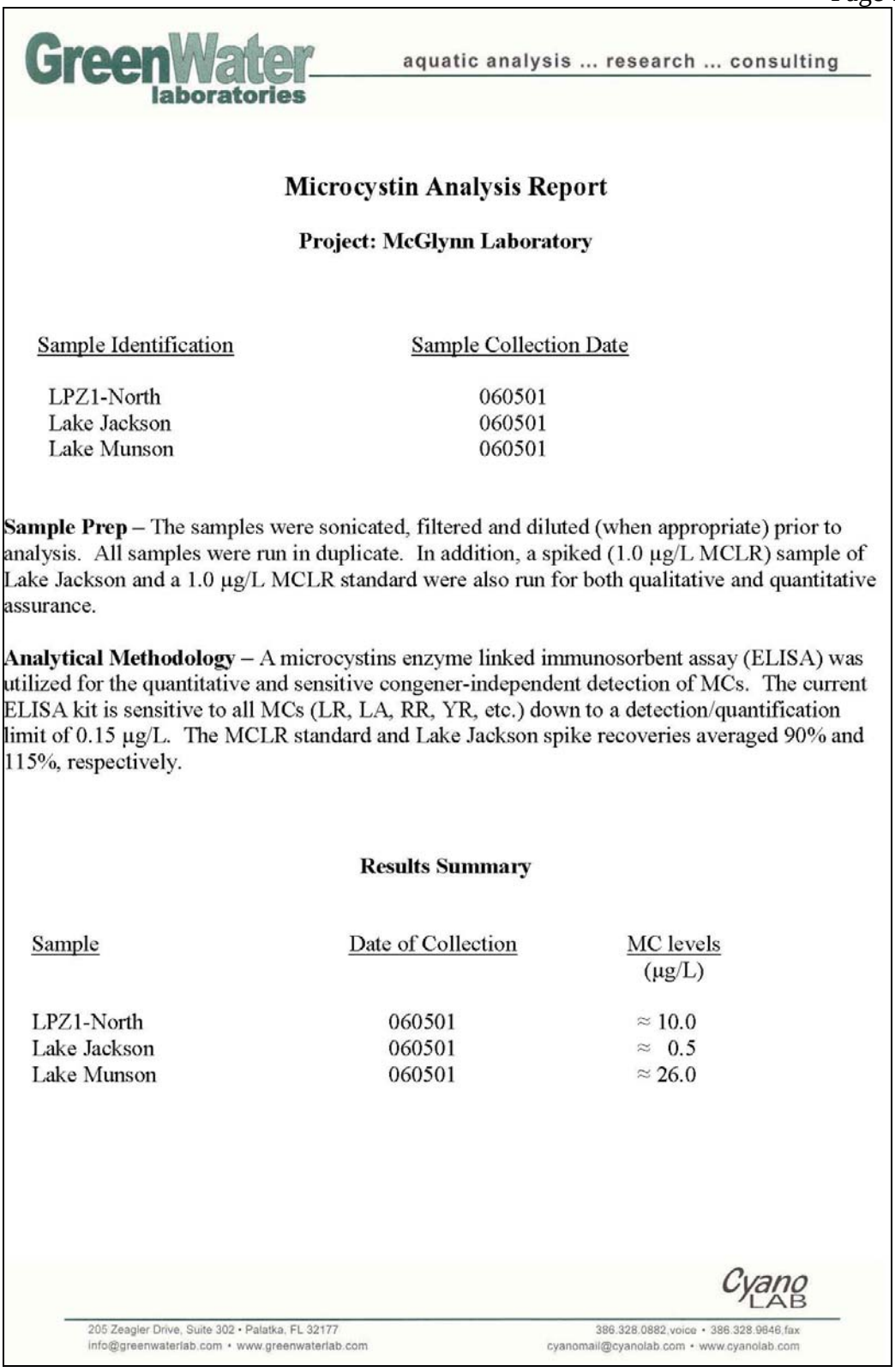


Figure 4.4.3.17: Poster recommended for use in affected waters by FDOH.



GreenWater laboratories — aquatic analysis ... research ... consulting

Microcystin Analysis Report

Project: McGlynn Laboratory

Sample Identification	Sample Collection Date
LPZ1-North	060501
Lake Jackson	060501
Lake Munson	060501

Sample Prep – The samples were sonicated, filtered and diluted (when appropriate) prior to analysis. All samples were run in duplicate. In addition, a spiked (1.0 µg/L MCLR) sample of Lake Jackson and a 1.0 µg/L MCLR standard were also run for both qualitative and quantitative assurance.

Analytical Methodology – A microcystins enzyme linked immunosorbent assay (ELISA) was utilized for the quantitative and sensitive congener-independent detection of MCs. The current ELISA kit is sensitive to all MCs (LR, LA, RR, YR, etc.) down to a detection/quantification limit of 0.15 µg/L. The MCLR standard and Lake Jackson spike recoveries averaged 90% and 115%, respectively.

Results Summary

Sample	Date of Collection	MC levels (µg/L)
LPZ1-North	060501	≈ 10.0
Lake Jackson	060501	≈ 0.5
Lake Munson	060501	≈ 26.0

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Figure 4.4.3.18: Algal toxin analysis results from Greenwater Labs in Palatka.

Lake Jackson drained into the aquifer again in July 2006. There had been insignificant rainfall since March 2006. It appears that someone put 48 cinderblocks into Porter Hole Sink using threaded pipes to guide the blocks into the sink. A week later another sinkhole opened 25 feet to the north of the old Porter Hole Sink. This sinkhole was filled with plastic trays. Nature is persistent and yet another sink opened about 31 feet to the south of old Porter Hole Sink in about the same area as the 1983 sink was presumed to be. Small bands of people carrying shovels persistently chopped off the hard clay near the sink and threw it into the sink. Some shovels with names on them were even found by the sink the next day. This did not work very well and quantities of foot square flooring tiles were found in the sink.

Figure 4.4.3.19: Tiles and tubs clogging the new sink near Porter Hole, July 2006..

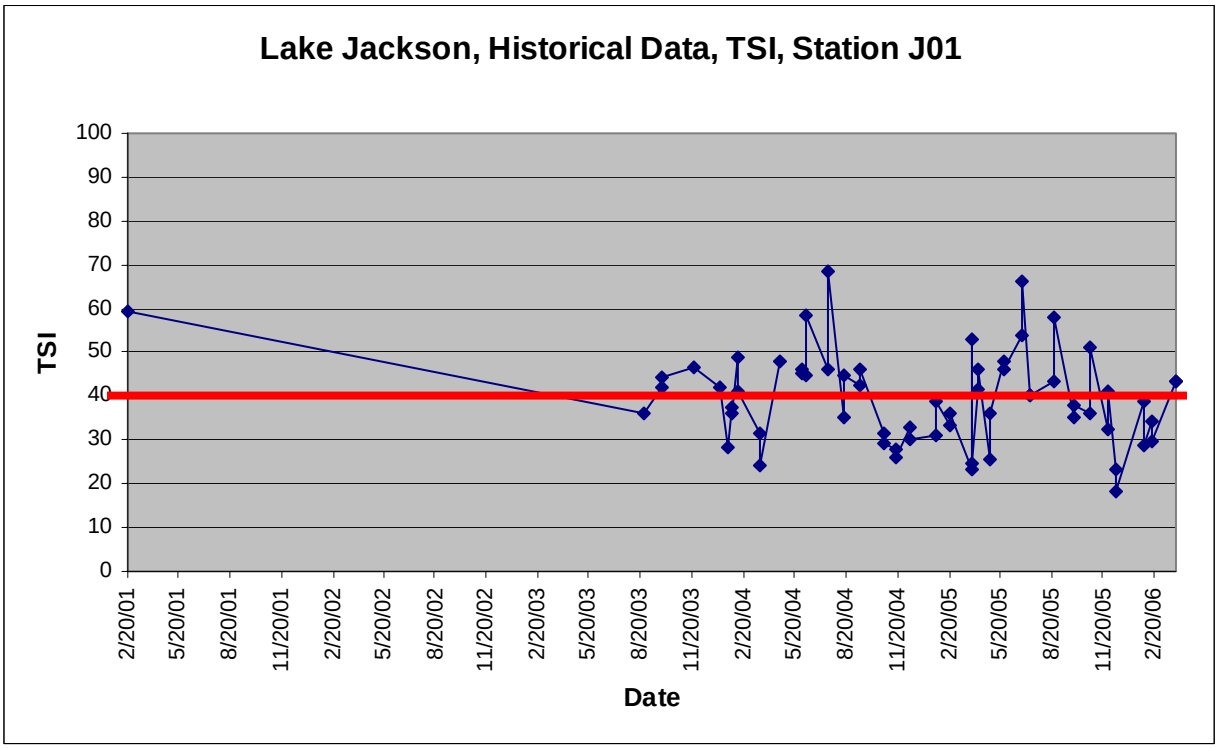

Figure 4.4.3.20: Lake Jackson, Station J01, in Meginnis Arm
Clear lake,
According to FDEP criteria this lake would be impaired at TSIs greater than 40 units,
Data source LCL Data (McGlynn Laboratories Inc).
Data duration: 02/01-09/04

*** Result: potentially impaired and getting worse.**

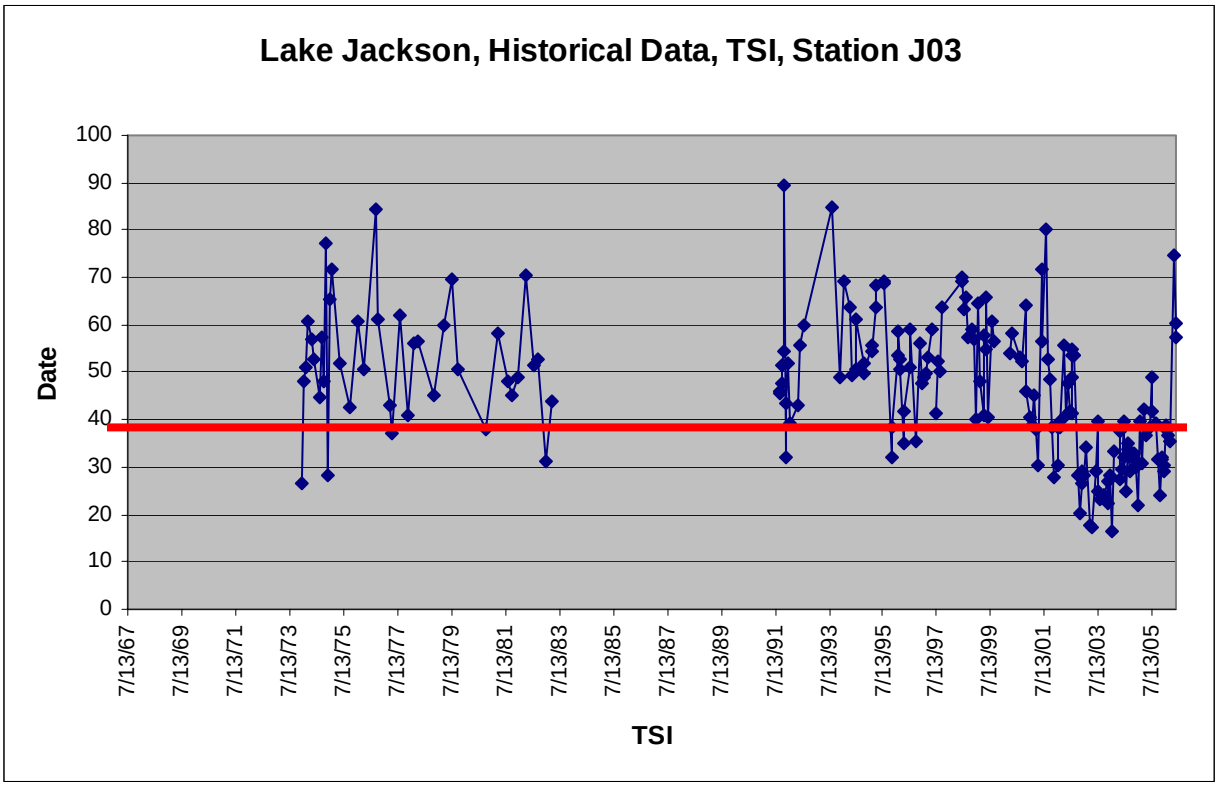

Figure 4.4.3.21: Lake Jackson, Station J03, near Meginnis Arm Clear lake, According to FDEP criteria this lake would be impaired at TSIs greater than 40 units, Data source LCL Data (McGlynn Laboratories Inc), data from 1997-1991 LCL Data (CARRMa) and LaRock/Landing, data from 1973-1883 from Burnett and Donahue. Data duration: 07/67-09/04

*** Result: potentially impaired and getting worse.**

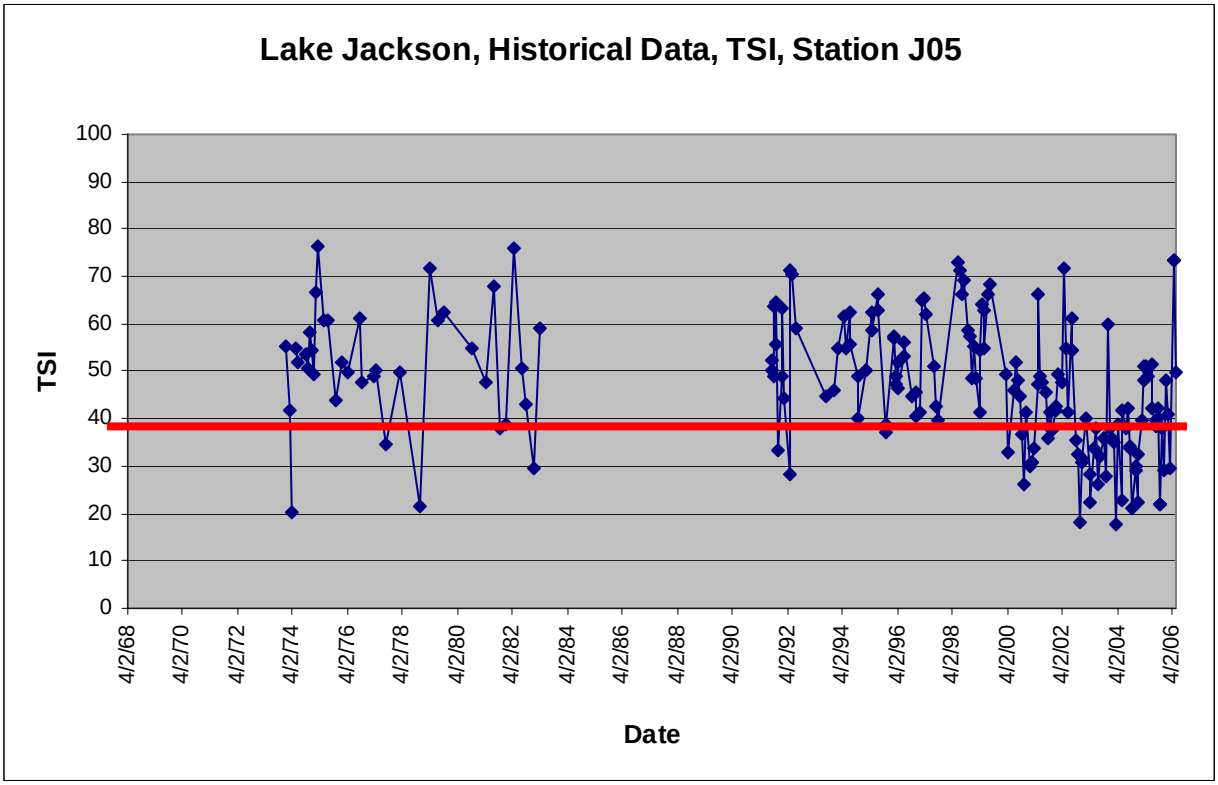

Figure 4.4.3.22: Lake Jackson, Station J05, Rhoden Cov
Clear lake,
According to FDEP criteria this lake would be impaired at TSIs greater than 40 units,
Data source LCL Data (McGlynn Laboratories Inc), data from 1997-1991 LCL Data (CARRMa) and LaRock/Landing, data from 1973-1883 from Burnett and Donahue.
Data duration: 04/68-09/04

*** Result: potentially impaired and getting worse.**

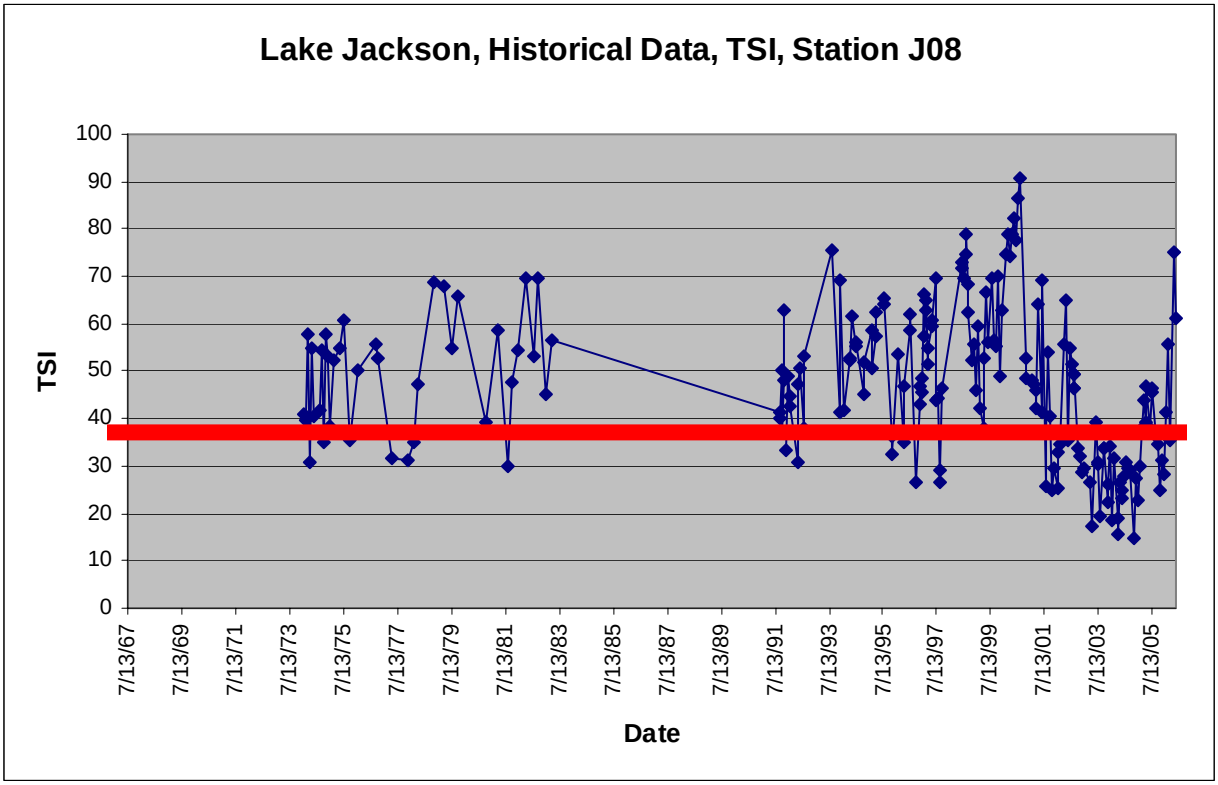

Figure 4.4.3.23: Lake Jackson, Station J08
Clear lake,
According to FDEP criteria this lake would be impaired at TSIs greater than 40 units,
Data source LCL Data (McGlynn Laboratories Inc), data from 1997-1991 LCL Data (CARRMa) and LaRock/Landing, data from 1973-1883 from Burnett and Donahue.
Data duration: 07/68-09/04

*** Result: potentially impaired and getting worse.**

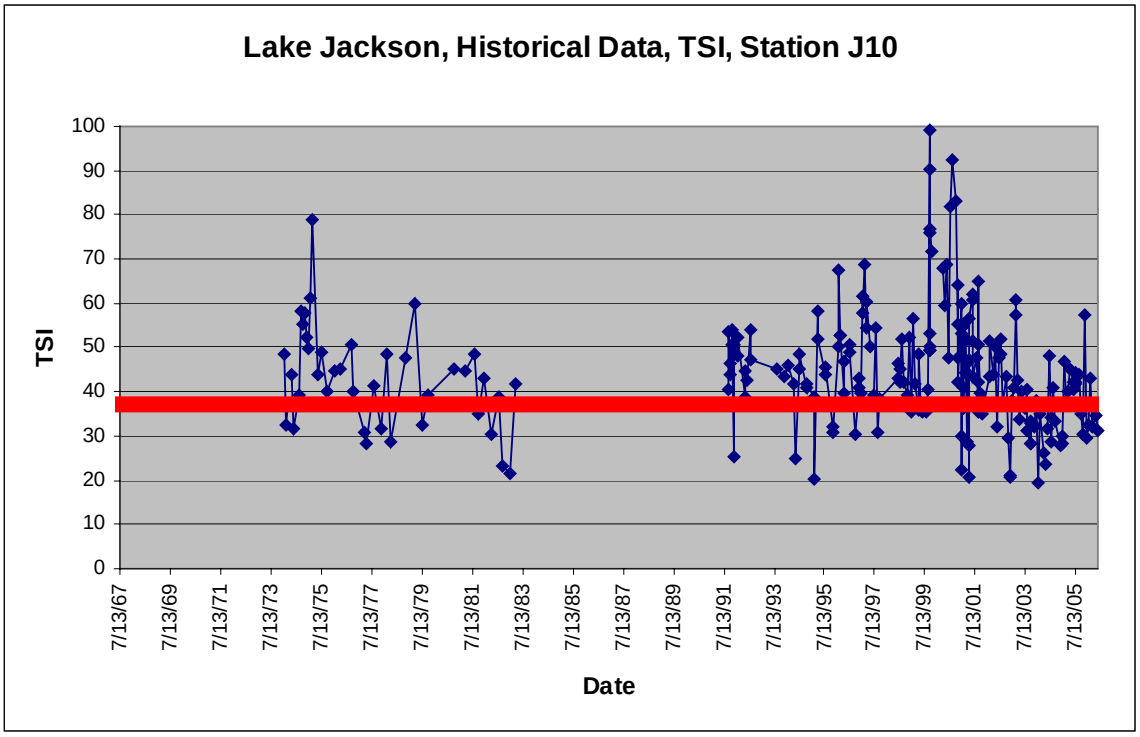

Figure 4.4.3.24: Lake Jackson, Station J10, near Porter Hole
Clear lake,
According to FDEP criteria this lake would be impaired at TSIs greater than 40 units,
Data source LCL Data (McGlynn Laboratories Inc) data from 1997-1991 LCL Data (CARRMa) and LaRock/Landing, data from 1973-1883 from Burnett and Donahue.
Data duration: 07/67-09/04

*** Result: improving, not impaired but may be getting worse.**

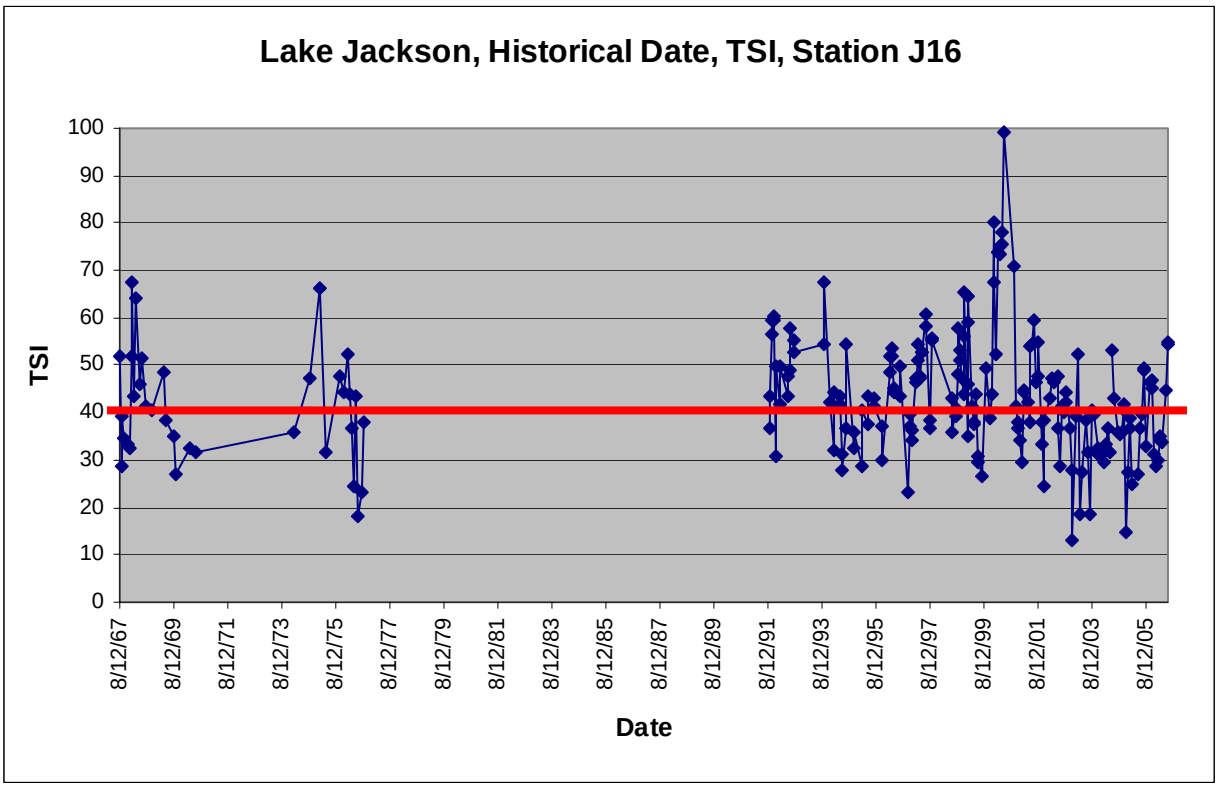

Figure 4.4.3.25: Western Lake Jackson, Station J16
Clear lake,
According to FDEP criteria this lake would be impaired at TSIs greater than 40 units,
Data source LCL Data (McGlynn Laboratories Inc) data from 1997-1991 LCL Data (CARRMa) and LaRock/Landing, data from 1973-1883 from Burnett and Donahue.
Data duration: 08/67-09/04

*** Result: potentially impaired and getting worse.**