

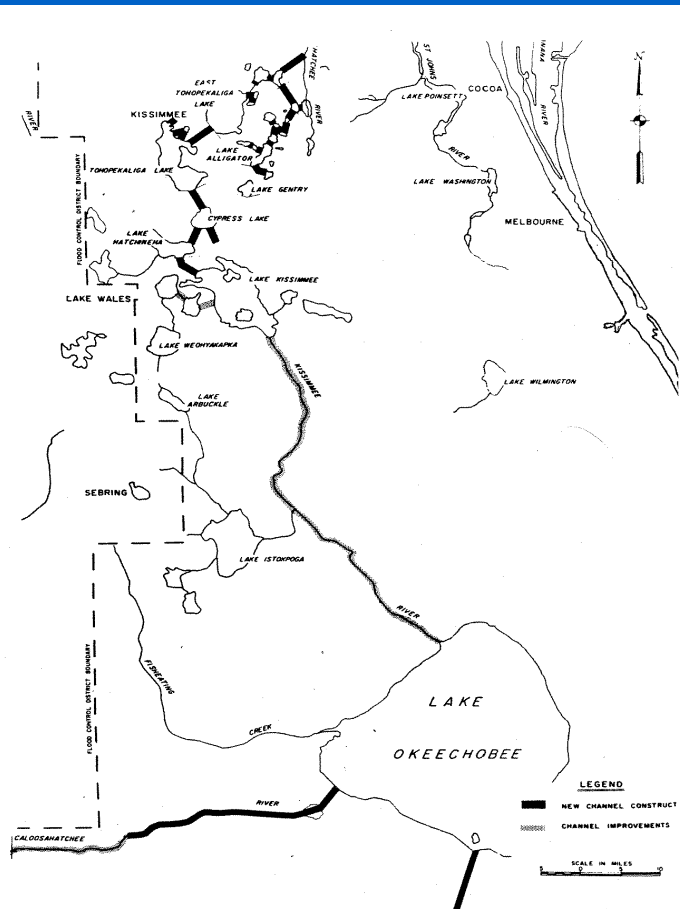
History of Lake Okeechobee Operating Criteria

James Vearil
GEER 2008

Introduction – Why History?

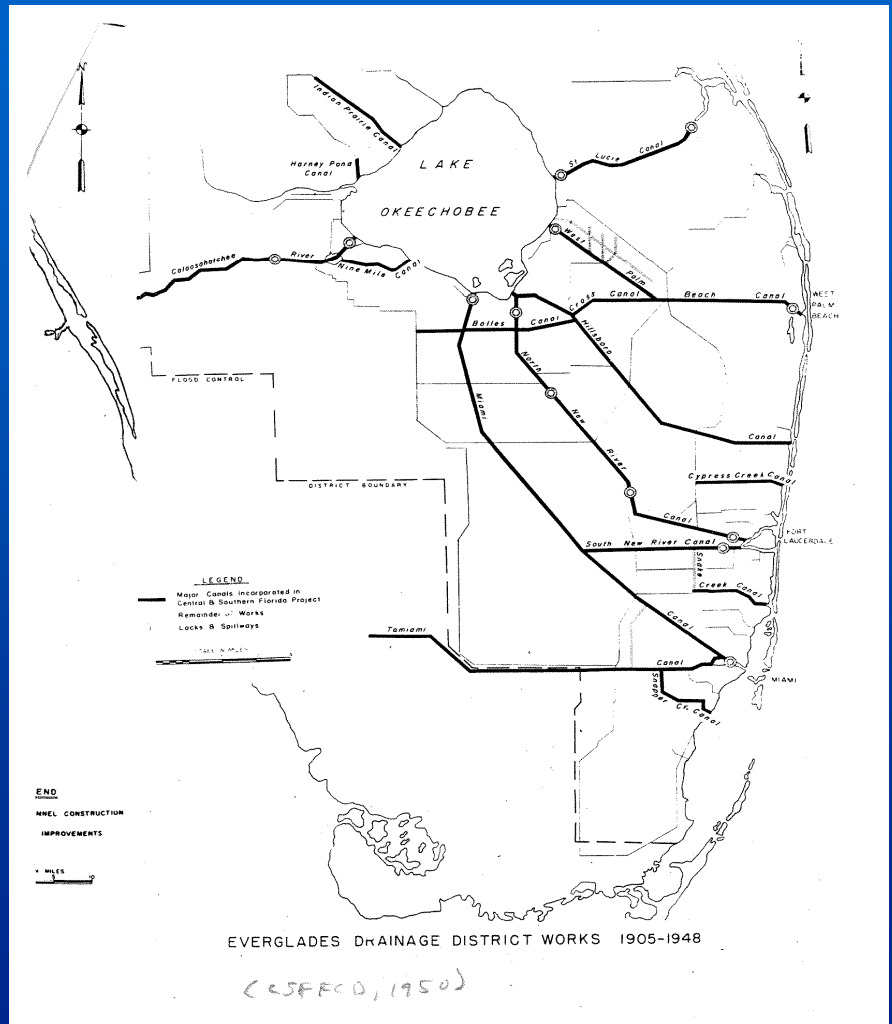
- Anthropologist Eric Higgs (2005) - scientific and technological skill is necessary, but insufficient for ecological restoration, need broader approach that also includes social sciences and humanities
- Environmental Historian William Cronon (2000) – both ecosystems and human societies are dynamic with complex histories where change is an essential feature, ecosystem management needs inter- and trans-disciplinary approach
- Civil Engineer Henry Petroski (1994) - history is relevant for teaching and refinement of engineering thinking and judgment

Early Drainage Efforts



DISSTON CONSTRUCTION PROGRAM 1881—1894

(CSFFCD, 1950)



EVERGLADES DRAINAGE DISTRICT WORKS 1905-1948

(CSFFCD, 1950)

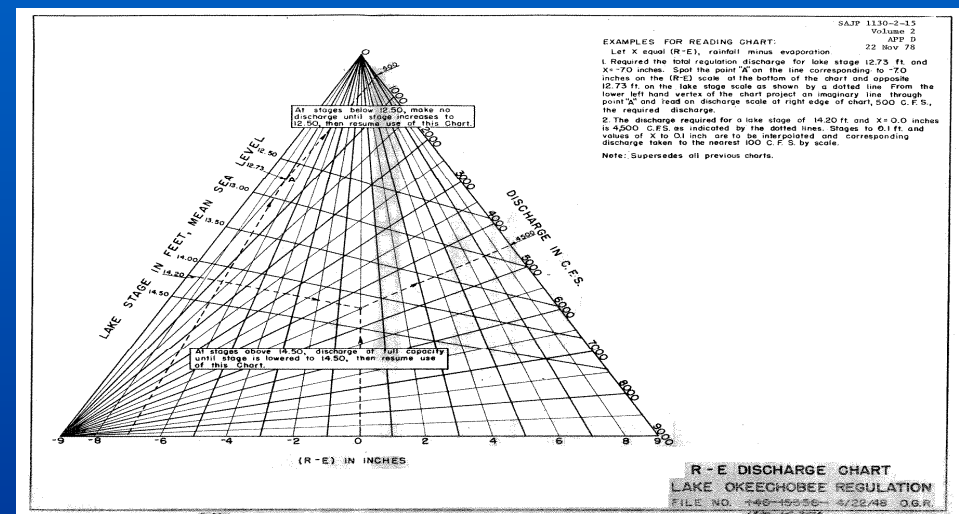
(CSFFCD, 1950)

Everglades Drainage District

- Early 1900's Everglades Drainage District (EDD) construction
- EDD for many years used regulation range 14-17 feet, Lake Okeechobee Datum (or 12.56 - 15.56 feet, NGVD)
- War Department Permit to EDD for St. Lucie Canal required standard low stage of 15 feet, Lake Okeechobee Datum

Caloosahatchee River and Lake Okeechobee Drainage Areas (CR&LODA) Project

- After Hurricanes of 1926 and 1928 Congress in 1930 Rivers and Harbors Act authorized Corps of Engineers to construct protective works for Lake Okeechobee as part of a navigation project
- In 1930's Herbert Hoover Dike constructed along Lake's south shore and on the north shore around town of Okeechobee
- Army Corps of Engineers continued to use Lake Okeechobee Regulation range of 12.56 -15.56 feet, NGVD



- In 1940 plan of operation implemented used R-E formula developed from study of hydrologic records

(Corps of Engineers, 1978)

Lake Okeechobee and Vertical Datum Planes

- ***National Tidal Datum Convention of 1980*** - Mean Sea Level (MSL) Datum, Adjustment of 1929 was renamed National Geodetic Vertical Datum (NGVD), Adjustment of 1929
- NGVD 1929 (or MSL 1929) is a fixed datum adopted as a standard geodetic reference for heights, does not account for changing sea levels
- MSL is the local mean sea level determined over a specific Tidal Epoch and should not be confused with the fixed datums such MSL 1929, NGVD 1929 or NAVD 88.

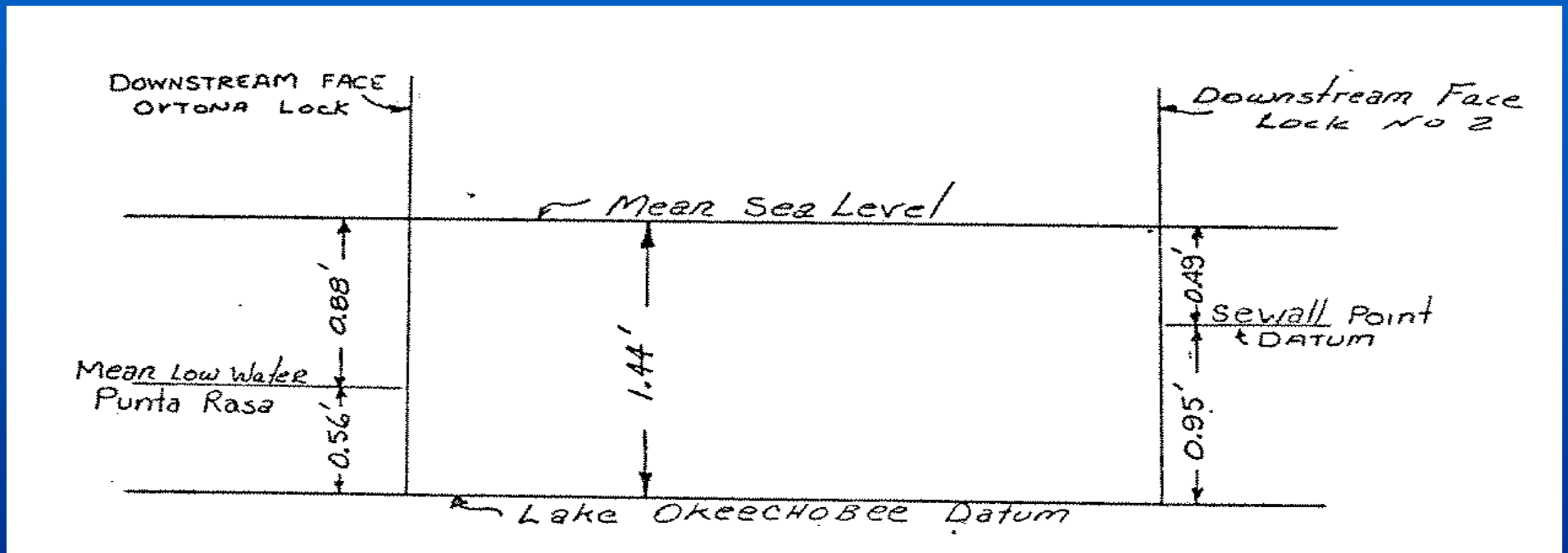
Datum Planes in the Caloosahatchee River- Lake Okeechobee Drainage Areas

- U.S. Coast and Geodetic Survey in 1884-1885 determined Mean Low Water, Punta Rasa
- In 1887 and 1901 levels run by Army Engineers from Punta Rasa benchmarks
- Caloosahatchee River- Lake Okeechobee Drainage Areas Project elevations were referenced to Mean Low Water, Punta Rasa
- U.S. Coast and Geodetic Survey and Army Engineers surveys in 1930's found error in Lake Hicpochee benchmark
- To minimize work and confusion the datum plane from Ortona Lock across the Lake to St. Lucie Lock was renamed Lake Okeechobee Datum

(Corps of Engineers, 1978)

Relationships of Historic Lake Okeechobee Datum Planes

(Corps of Engineers, 1978)



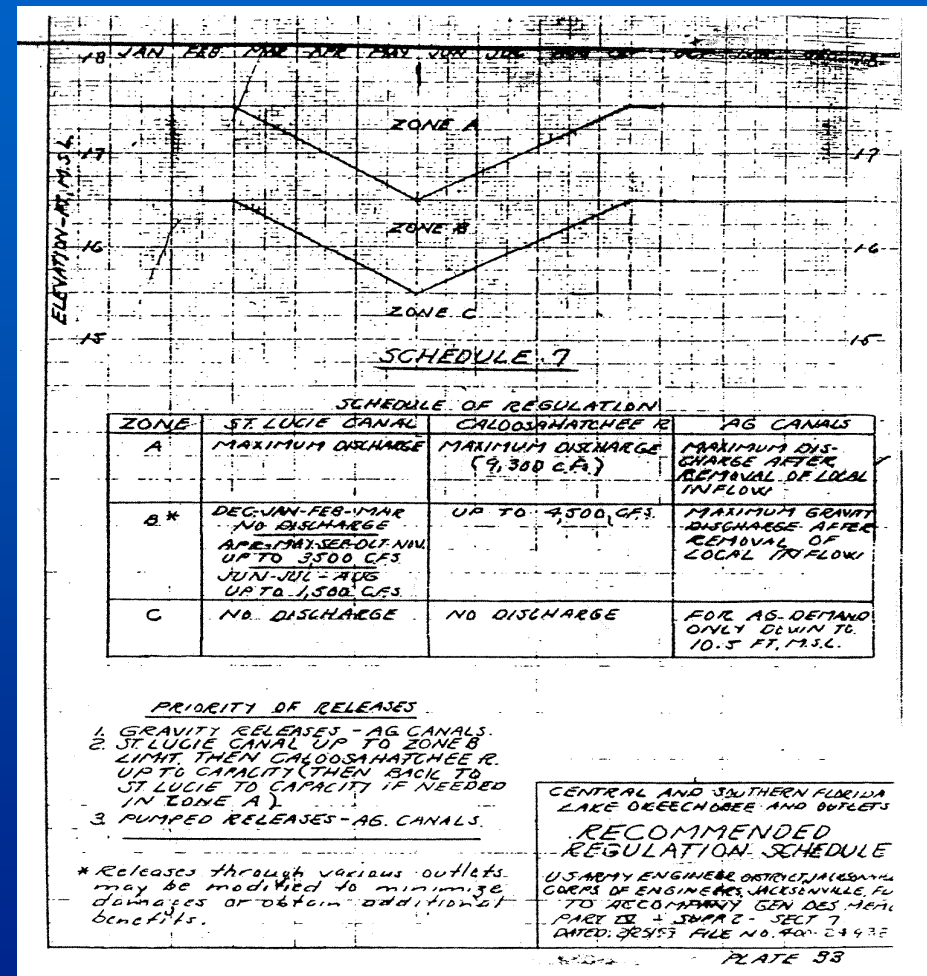
- Note: Mean Sea Level shown on this figure is MSL, 1929 or NGVD, 1929

C&SF Project

- After 1947 flood Congress authorized the Central and Southern Florida (C&SF) Project in Flood Control Act of 1948
- Flood control features of CR&LODA Project incorporated into C&SF Project, navigation features became Okeechobee Waterway Project
- May 1951 interim plan of operation Lake regulation range was 13.0-15.5 feet, NGVD
- Lake regulation schedule revised in May 1954 and October 1958

Corps Lake Okeechobee Regulation Schedule Studies in 1950's

- In 1951 Report Corps analyzed minimum levee grade to provide flood protection with no water supply storage provided
- The 1951 Corps Report recommended flat regulation schedule of 16.4 feet, NGVD to provide water supply storage
- 15.5-16.5 feet, NGVD Lake Regulation Schedule developed and recommended in 1959 Corps Report

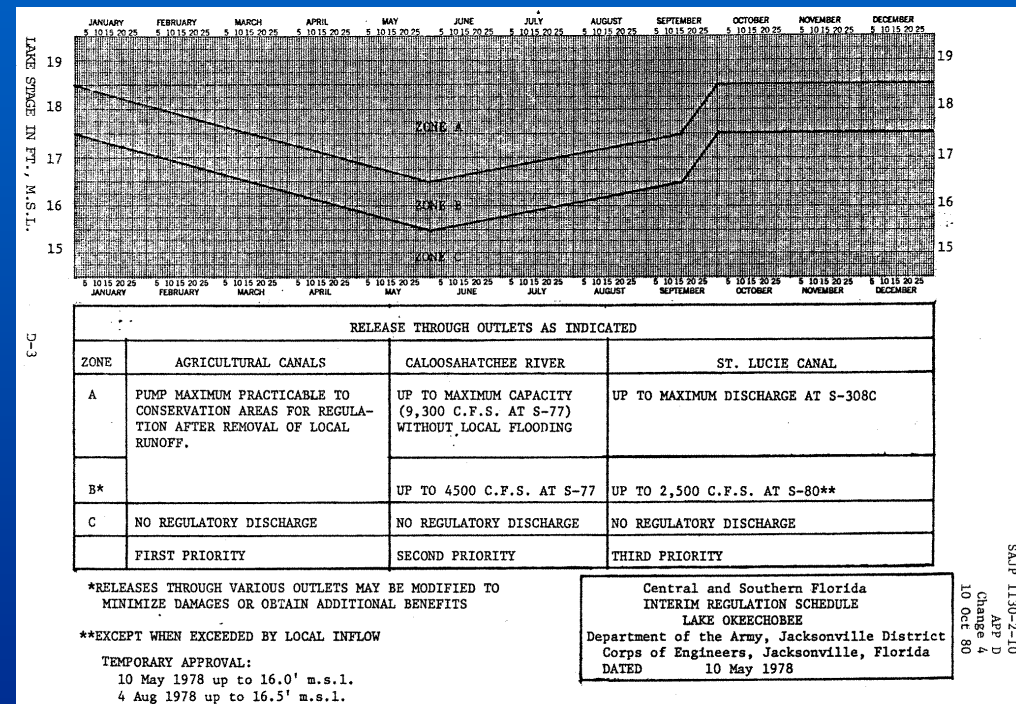


Lake Okeechobee Design Hurricanes - 1950's Studies

- Factors that determined required levee grades
 - Lake level prior to hurricane
 - Storm surge and wave run-up
- Conditions Analyzed
 - Maximum Probable Hurricane with Lake at top of conservation pool
 - Standard Project Hurricane with Lake at highest avg 30-day 100-year lake level of 21.2 feet, NGVD
 - Moderate hurricane with Lake at highest avg 30-day Standard Project Flood level of 23.5 feet, NGVD

C&SF Project 1948 Authorization – Lake Okeechobee

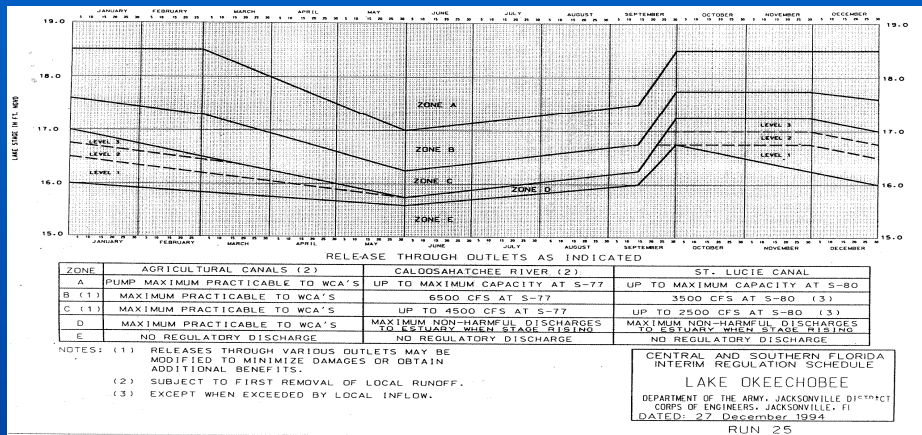
- Regulation schedule modified several times during the droughts of the 1960's, then revised Lake schedule implemented in 1970
- Project construction occurred in 1960's and 1970's as part of a plan to store more water in Lake Okeechobee under 1948 authorization
- 14.5-16 feet, NGVD regulation schedule implemented in August 1974
- 15.5 -17.5 feet, NGVD Lake Regulation Schedule implemented in 1978



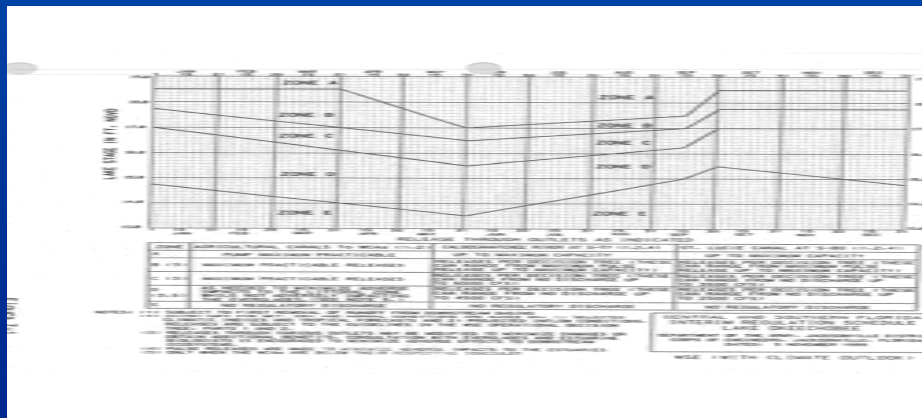
1968 Authorization – Water Resources for C&SF Report Recommended

- Raise Lake Okeechobee Regulation Schedule 4 feet above what was authorized by 1948 Flood Control Act
- Pump First – discharge flood releases from Lake Okeechobee through agricultural canals to Water Conservation Areas as first priority
- Hump Removal – remove constrictions in middle part of North New River and Miami Canals
- Deepen Okeechobee Waterway 2 feet

Lake Okeechobee Regulation Schedules

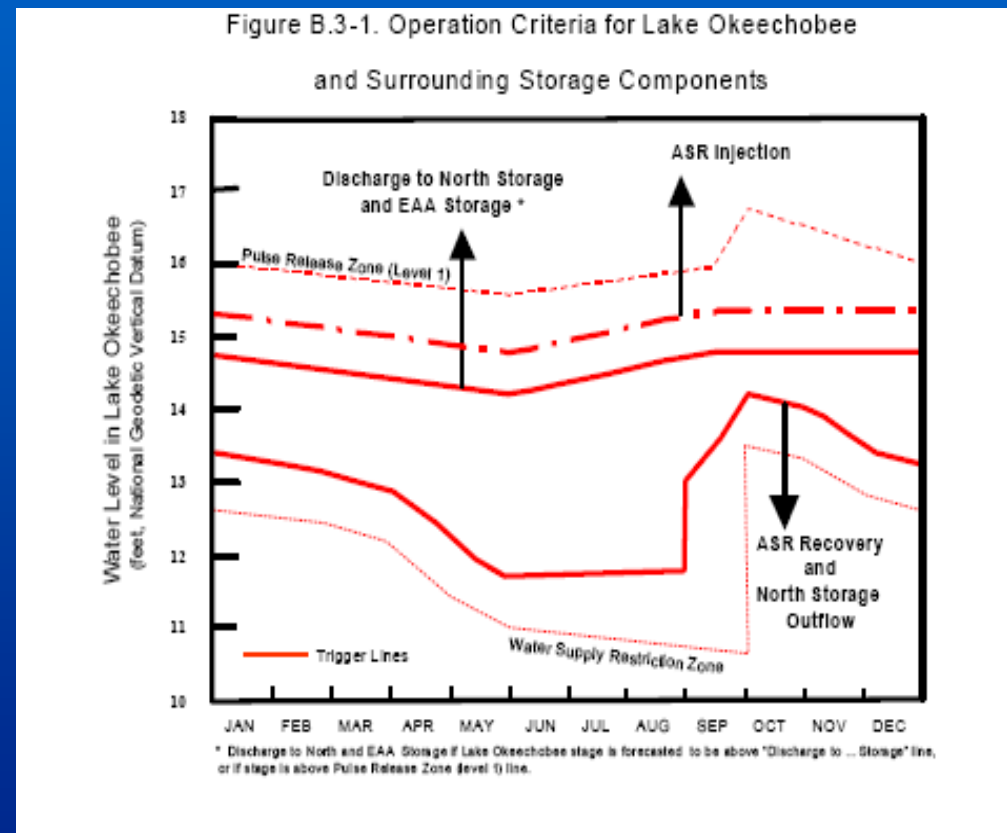


- Run 25 implemented in 1994
- WSE implemented in 2000
- LORSS implemented in 2008



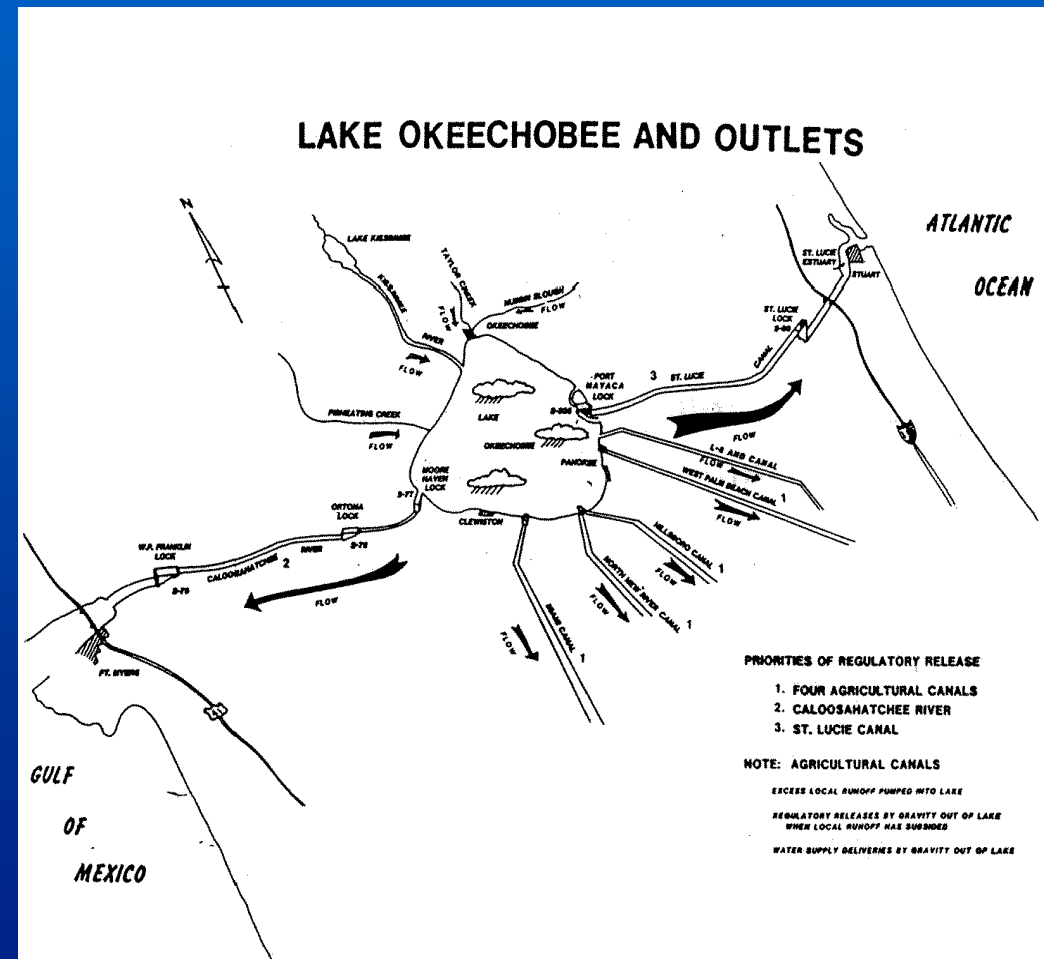
CERP – C&SF Comprehensive Review Study Report (Restudy)

- Recommended Lake Okeechobee Regulation Schedule be modified to take advantage of additional storage facilities
- It was anticipated with CERP Lake Okeechobee would function more as a lake, with reduced high lake stages, reduced frequency and duration of flood control discharges to the estuaries, reduced dependence of urban and agricultural water supply users on Lake Okeechobee



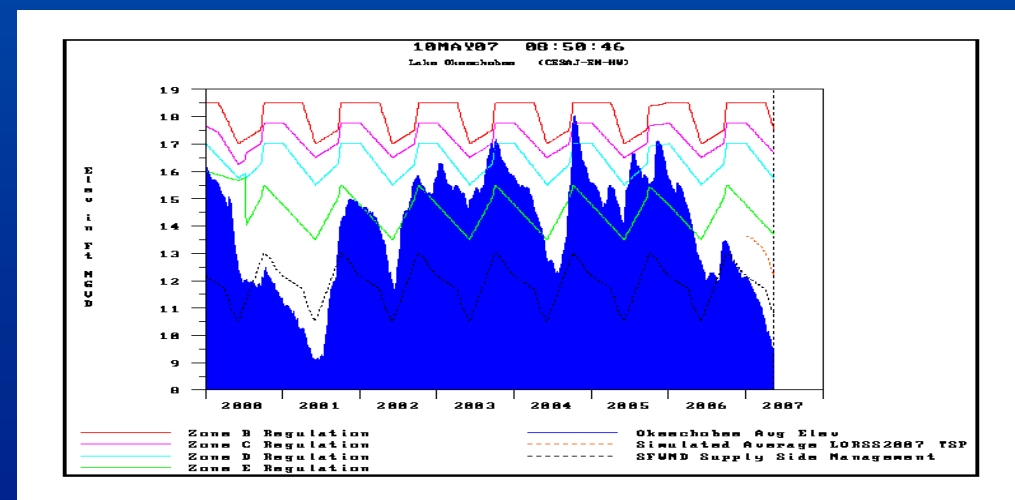
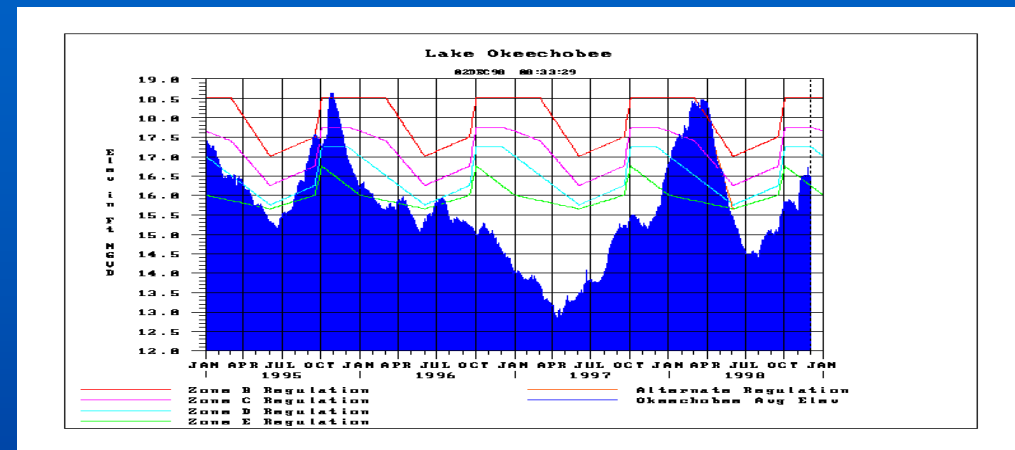
Lake Okeechobee – Flood Control

- Outlet capacity from the Lake is small compared to the immense storage capacity of the Lake
- Top of flood control pool was considered the maximum lake level reached during the Standard Project Flood (SPF)
- Regulatory releases made on secondary basis, after removal of local runoff
- Structures through levee are closed in advance of hurricanes or tropical storms to maintain levee integrity during storm surge



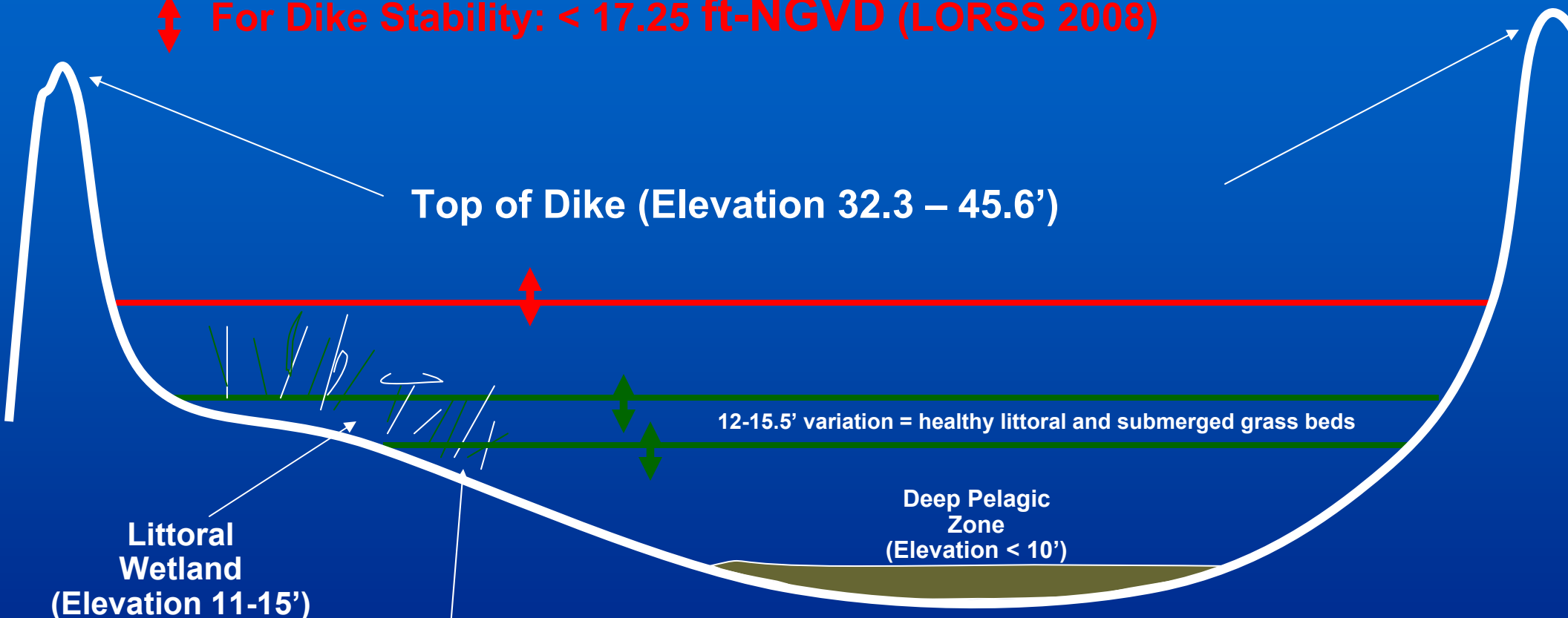
Some Lake Okeechobee Regulation Schedule Issues

- High lake level can adversely affect the lake ecosystem and flood protection
- Low lake level can adversely affect water supply, irrigation, navigation, recreation, lake ecosystem, prevention of saltwater intrusion
- Flood control releases from Lake Okeechobee can adversely impact St. Lucie and Caloosahatchee Estuaries, Stormwater Treatment Areas, Water Conservation Areas



Ranges of water levels (adapted from S. Sylvester, SFWMD Water Summit 2008)

- ↕ For Ecological Sustainability: 12 to 15.5 ft-NGVD
- ↕ For Dike Stability: < 17.25 ft-NGVD (LORSS 2008)



Littoral Wetland (Elevation 11-15')

Submerged Grass Beds (Elevation 10-12')

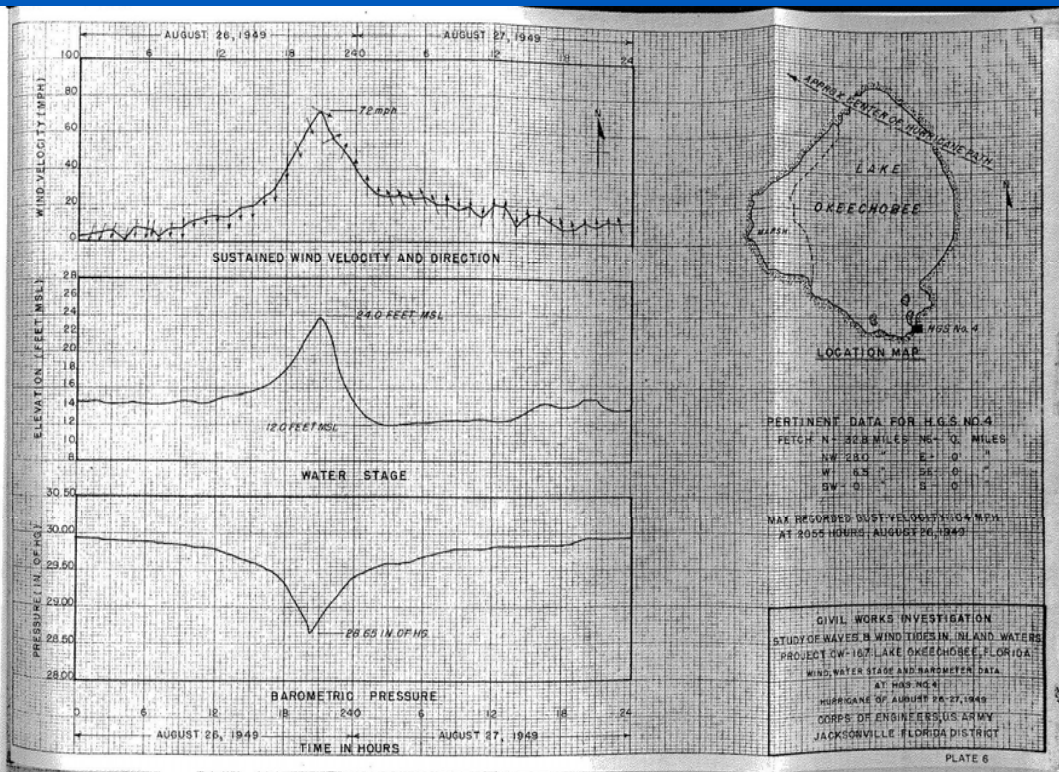
Deep Pelagic Zone (Elevation < 10')

12-15.5' variation = healthy littoral and submerged grass beds

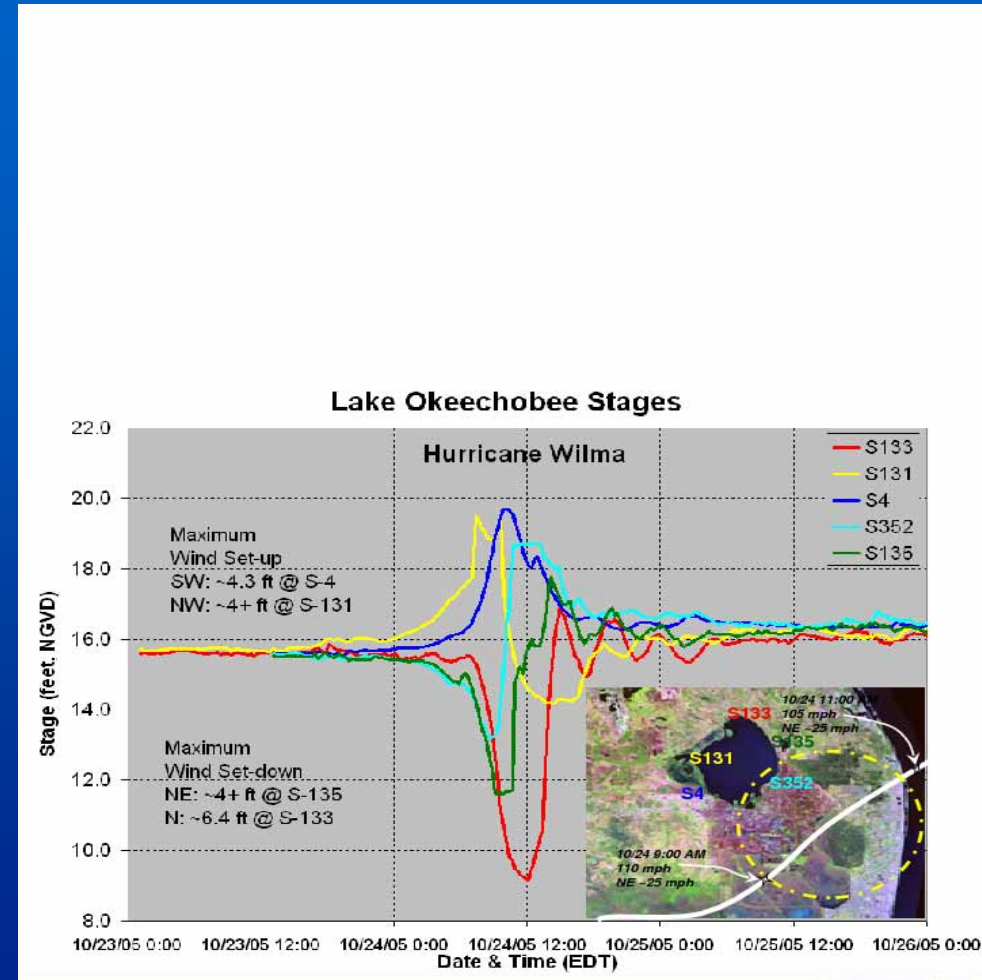
OWW Project depth based on 12.56' lake stage

Not to Scale
18

Lake Okeechobee Storm Surge – Hurricane of 1949 and Hurricane Wilma 2005



(Corps of Engineers, 1950)



(SFWMD)

(SFWMD SFER, 2008)

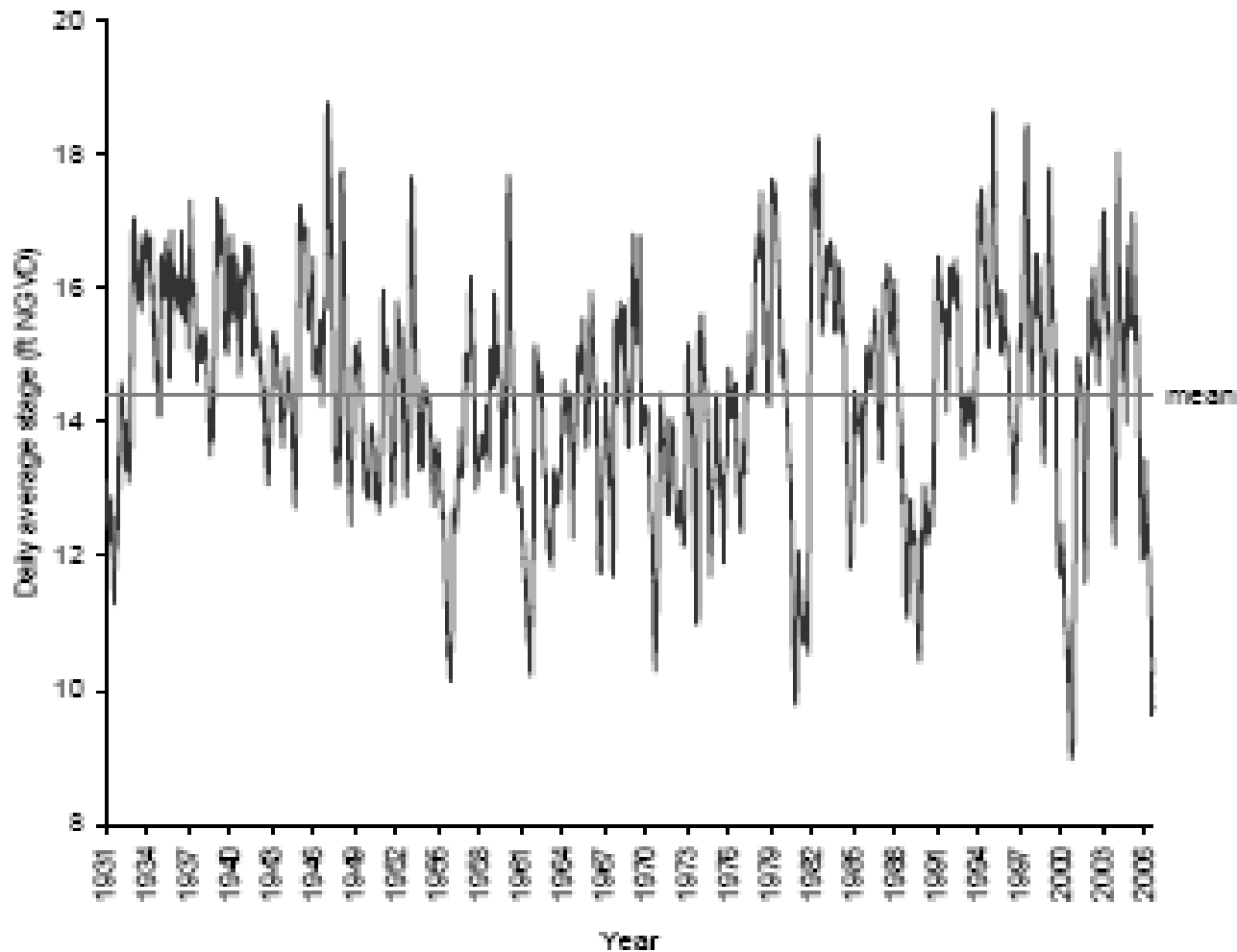


Figure 2-6. Historical daily water level variation of Lake Okeechobee.

Summary

- Disston Construction 1881-1894
- Everglades Drainage District 1905 -1931
- Caloosahatchee and Lake Okeechobee Drainage Areas Project 1931-1948
- Central and Southern Florida Project 1949 -1978
- Central and Southern Florida Project 1979 - 2000
- Comprehensive Everglades Restoration Plan 2000 -