



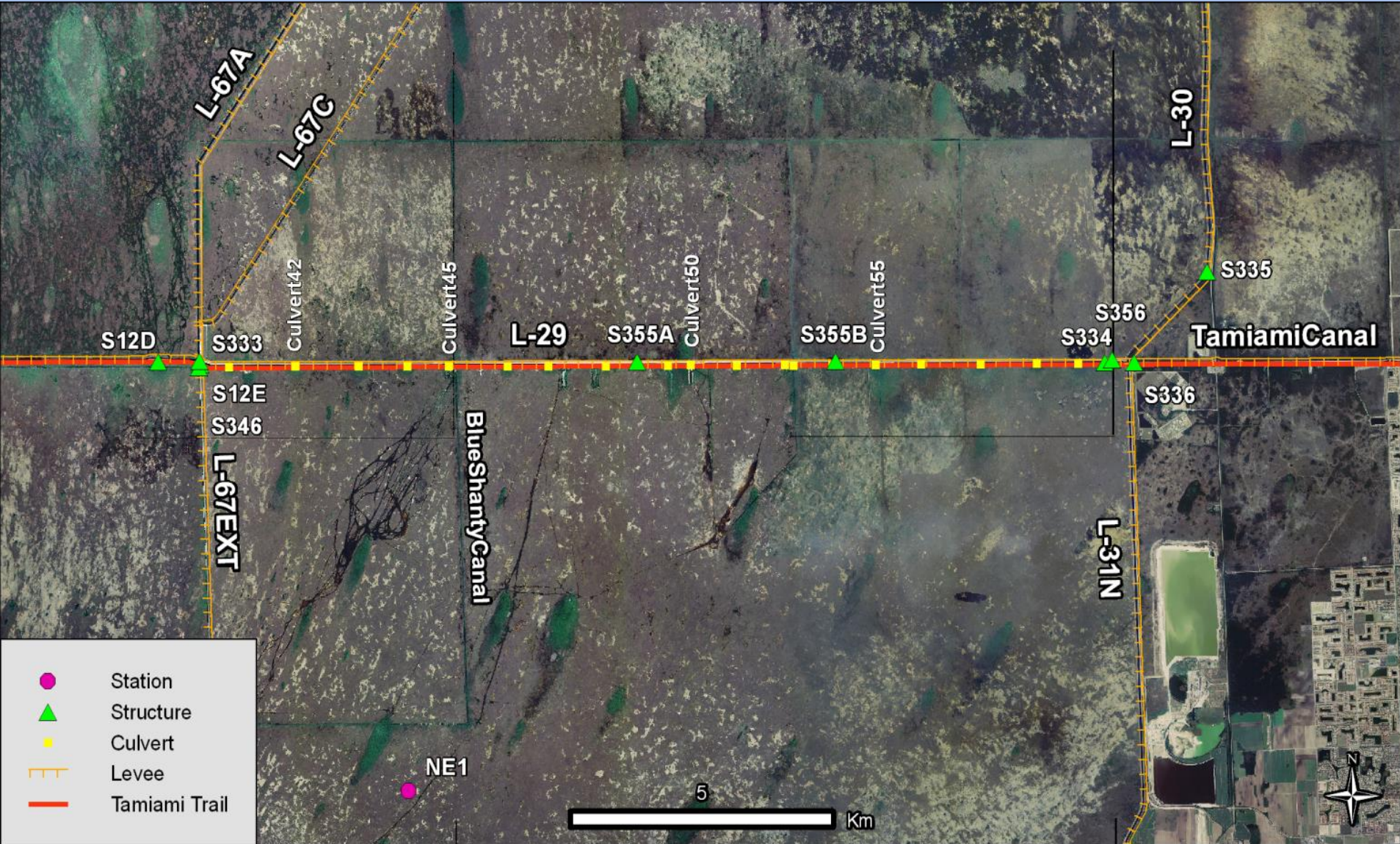
# Water Management and Hydrology of Northeast Shark River Slough from 1940 to 2015

Greater Everglades Ecosystem Restoration Conference  
April 2015

Kevin Kotun, Hydrologist  
Physical Resources Branch  
South Florida Natural Resources Center  
Everglades National Park

# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



26-50





# National Park Service

## South Florida Natural Resources Center

### Structurally:

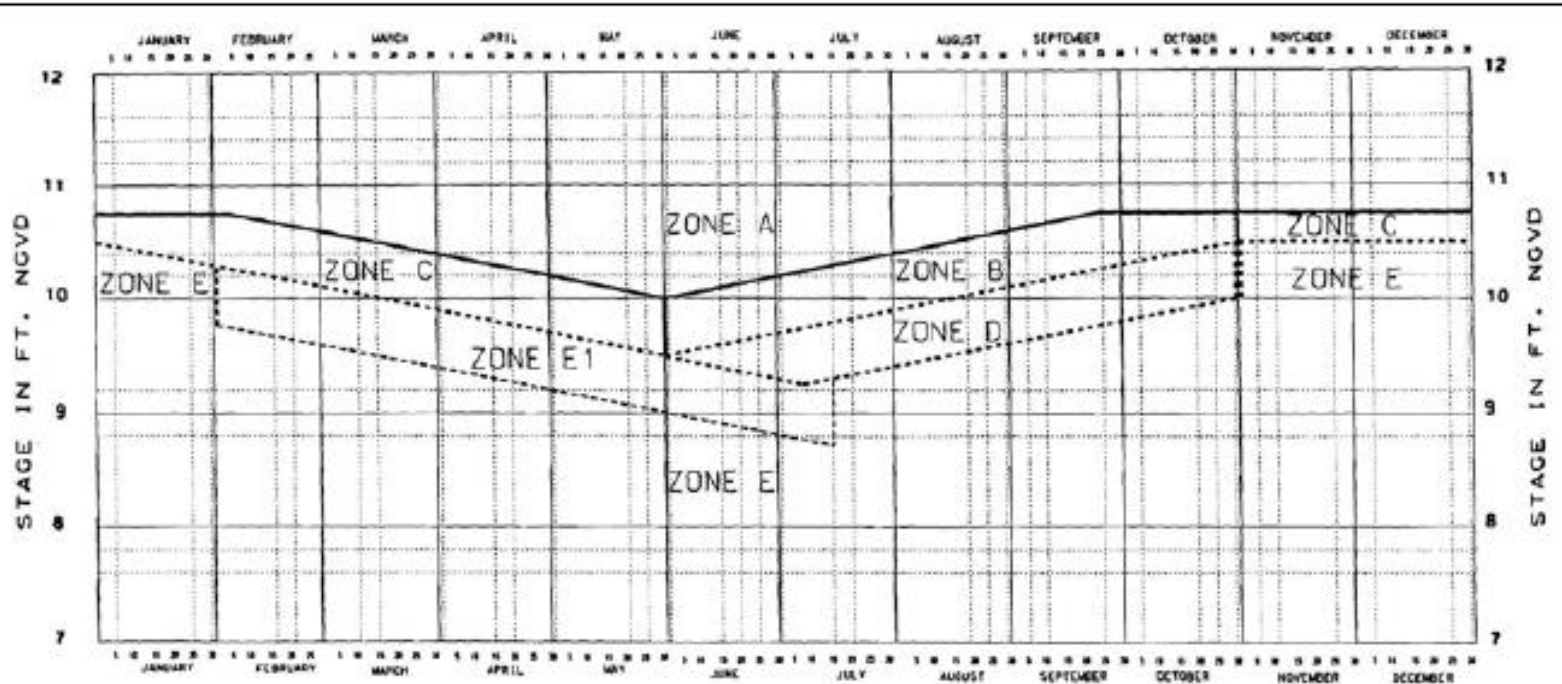
- Over-drained by early canal work - But Still Rain Driven System Until 1962
- 1952 Eastern Protective Levee
- 1962 Water Conservation Areas Impounded
- 1983 Outlet from WCA3A to NESS
- 2003 Lower 4 Miles of L67 removed and filled
- 2013 One-Mile Bridge Opened

### Operationally

- 1962 -1972 Discharge from WCA3A governed by the Regulation Schedule  
No Discharge to NESRS
- 1972 – 1983 Regulation Schedule for WCA3A complimented by the  
Minimum Delivery Schedule  
No Discharge to NESRS
- 1983 – 1999 Experimental Program  
Regulation Schedule for WCA3 complimented by the Rainfall Plan  
Flow to NESRS Constrained by max canal stage of 7.5 ft-ngvd and max stage of 6.8 ft ngvd at  
G3273.
- 2000-2011 Interim Operational Plan. For NESRS basically the same as the Experimental  
Program with WCA3A excess routed into South Dade  
Stage constraint of 7.5 maintained
- 2012 – 2015 Everglades Restoration Transition Plan. Lower Regulation Schedule for WCA3A.  
Stage constraint of 7.5 maintained

# National Park Service

South Florida Natural Resources Center



ZONE	DESCRIPTION
A	FLOOD RELEASES
B	UPPER TRANSITION, WET SEASON
C	UPPER TRANSITION, DRY SEASON
D	LOWER TRANSITION
E	RAINFALL FORMULA

ZONE	DESCRIPTION
E1	MAKE MAXIMUM PRACTICABLE RELEASES AT S-142, S-151, S-31, S-337, S-335, S-333, S-355 & B, AND S-334 WHEN PERMITTED BY DOWNSTREAM CONDITIONS. IF THE HEADWATER AT S-333 FALL BELOW 8.25 FT-NGVD, USE ZONE E RULES.

- NOTES: 1. ZONE INFORMATION IS DETAILED ON ATTACHED SHEET.  
 2. THE L-67A BORROW CANAL STAGE SHOULD NOT BE DRANN DOWN BELOW 7.5 FT-NGVD UNLESS WATER IS SUPPLIED FROM ANOTHER SOURCE.

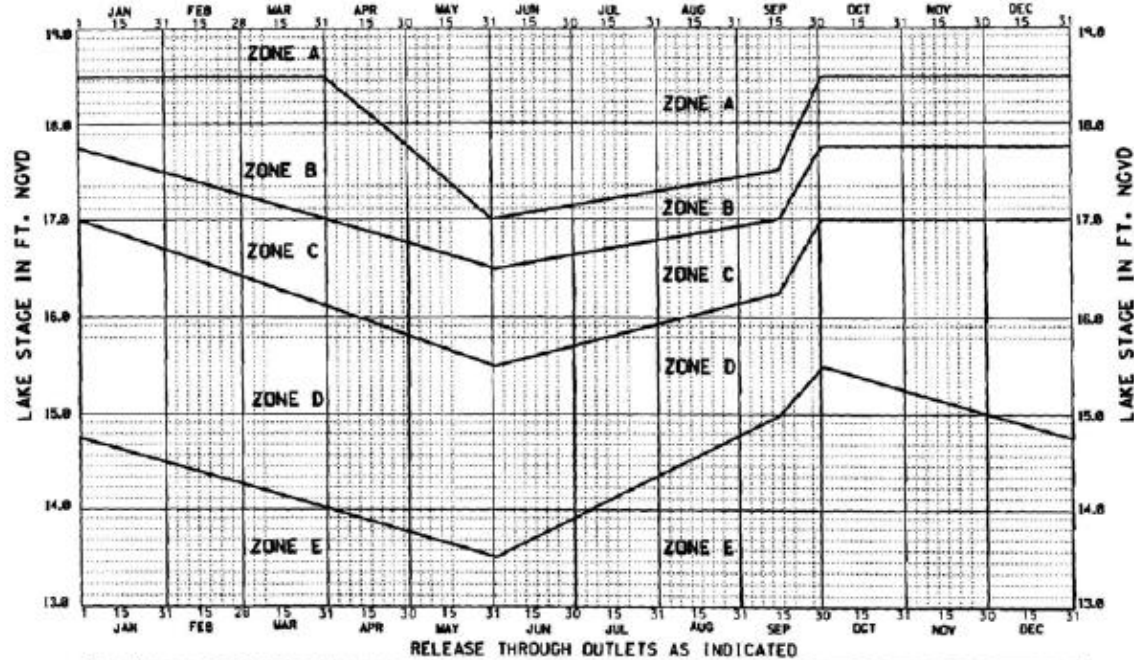
CENTRAL AND SOUTHERN FLORIDA  
 INTERIM REGULATION SCHEDULE  
 INTERIM STRUCTURAL AND OPERATIONAL  
 PLAN 2001

**WATER CONSERVATION AREA NO. 3A**  
 DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT  
 CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA  
 Date revised: November 2000



# National Park Service

South Florida Natural Resources Center



RELEASE THROUGH OUTLETS AS INDICATED

ZONE	AGRICULTURAL CANALS TO WCAs (1,2)	CALOOSAHATCHEE RIVER AT S-TT (1,2,4)	ST. LUCIE CANAL AT S-8D (1,2,4)
A	PUMP MAXIMUM PRACTICABLE	UP TO MAXIMUM CAPACITY	UP TO MAXIMUM CAPACITY
B (3)	MAXIMUM PRACTICABLE RELEASES	NORMAL TO WET: UP TO 6500 CFS DRY: UP TO MAXIMUM PULSE RELEASE	NORMAL TO WET: UP TO 3500 CFS DRY: UP TO MAXIMUM PULSE RELEASE
C (3)	MAXIMUM PRACTICABLE RELEASES	WET: UP TO 4500 CFS NORMAL: UP TO MAXIMUM PULSE RELEASE DRY: NONE	WET: UP TO 2500 CFS NORMAL: UP TO MAXIMUM PULSE RELEASE DRY: NONE
D (3,5)	AS NEEDED TO MINIMIZE ADVERSE IMPACTS TO THE LITTORAL ZONE WHILE NOT ADVERSELY IMPACTING THE EVERGLADES. (SEE NOTE 5.)	VERY WET: UP TO MAXIMUM PULSE RELEASE OTHERWISE: NONE	VERY WET: UP TO MAXIMUM PULSE RELEASE OTHERWISE: NONE
E	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE

- NOTES: (1) SUBJECT TO FIRST REMOVAL OF RUNOFF FROM DOWNSTREAM BASINS  
 (2) GUIDELINES FOR WET, DRY AND NORMAL CONDITIONS ARE BASED ON: 1) SELECTED CLIMATIC INDICES AND TROPICAL FORECASTS AND 2) PROJECTED INFLOW CONDITIONS. RELEASES ARE SUBJECT TO THE GUIDELINES IN THE WSE OPERATIONAL DECISION TREE, PARTS 1 AND 2.  
 (3) RELEASES THROUGH VARIOUS OUTLETS MAY BE MODIFIED TO MINIMIZE DAMAGES OR OBTAIN ADDITIONAL BENEFITS. CONSULTATION WITH EVERGLADES AND ESTUARINE BIOLOGISTS IS ENCOURAGED TO MINIMIZE ADVERSE EFFECTS TO DOWNSTREAM ECOSYSTEMS.  
 (4) PULSE RELEASES ARE MADE TO MINIMIZE ADVERSE IMPACTS TO THE ESTUARIES  
 (5) ONLY WHEN THE WCAs ARE BELOW THEIR RESPECTIVE SCHEDULES

**CENTRAL AND SOUTHERN FLORIDA  
 INTERIM REGULATION SCHEDULE  
 LAKE OKEECHOBEE**

DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT  
 CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA  
 DATED: 5 NOVEMBER 1990

WSE (WITH CLIMATE OUTLOOK)

# National Park Service

South Florida Natural Resources Center

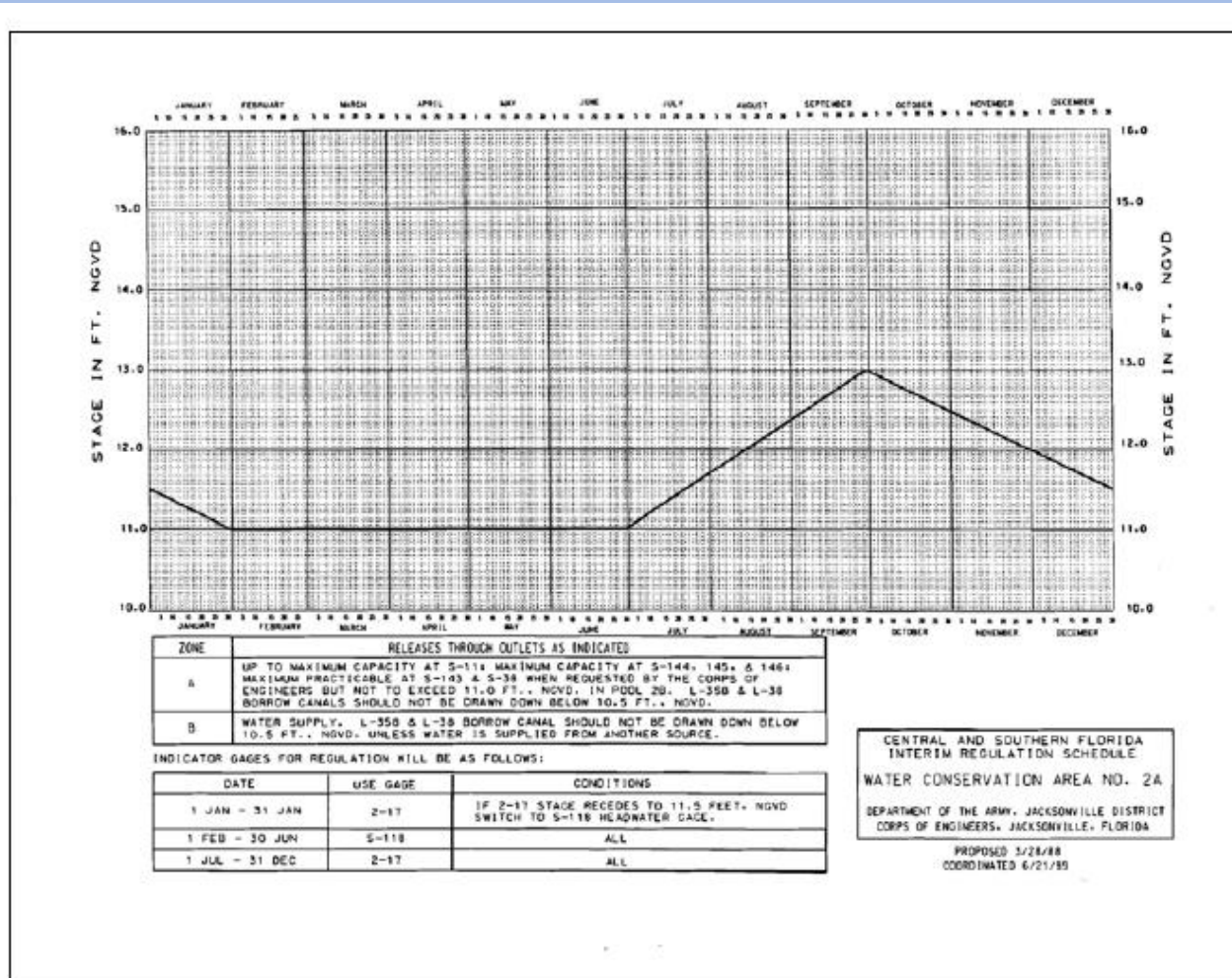
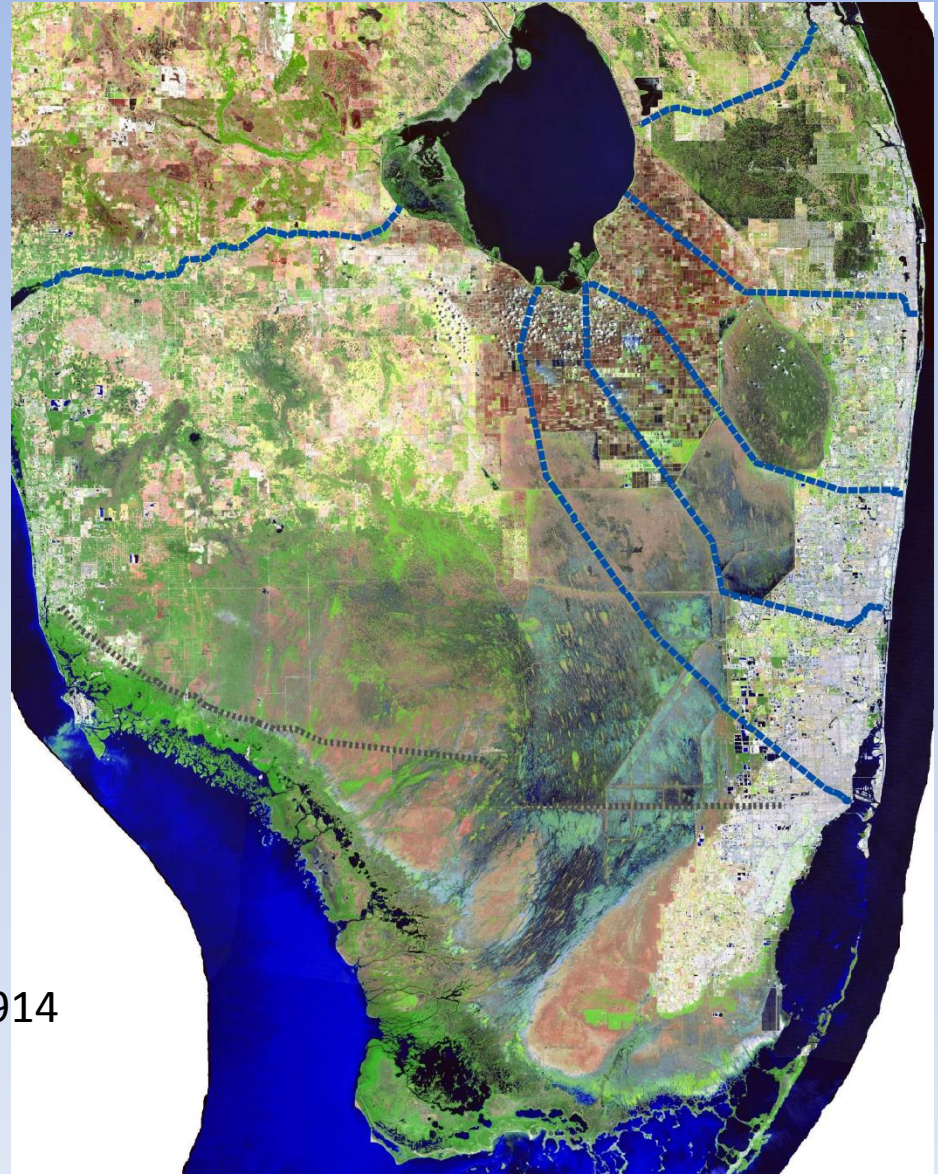
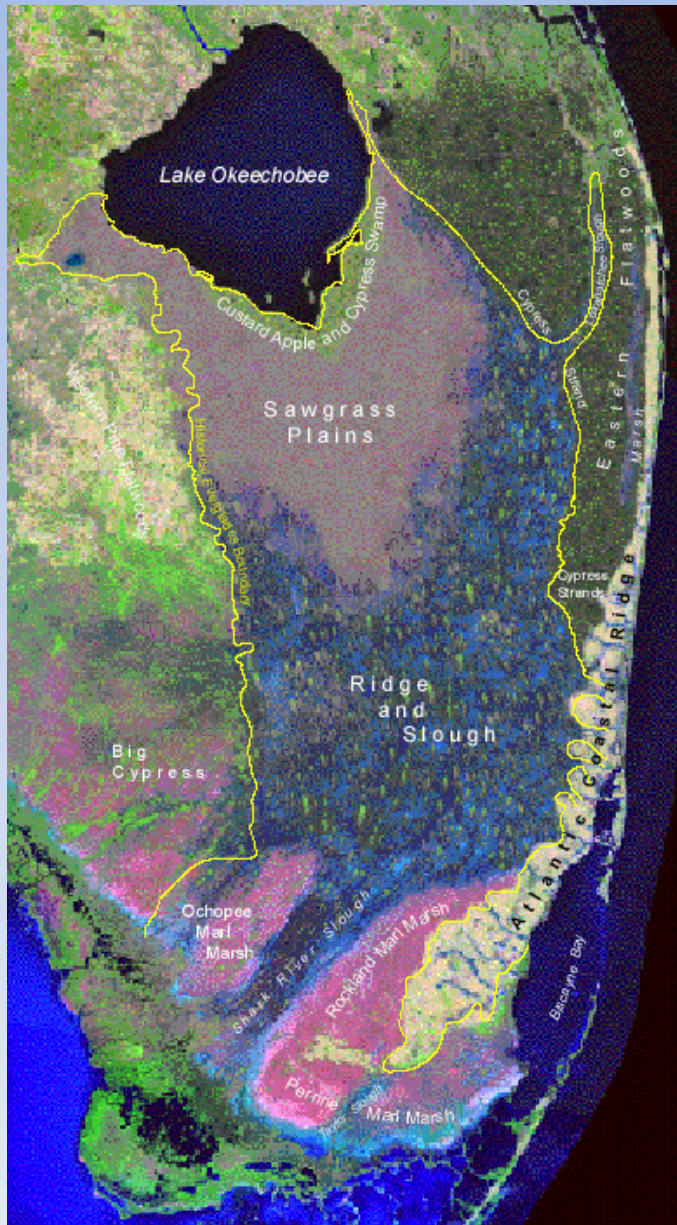


Figure 11. Regulation schedule for Water Conservation Area 2A.

# National Park Service



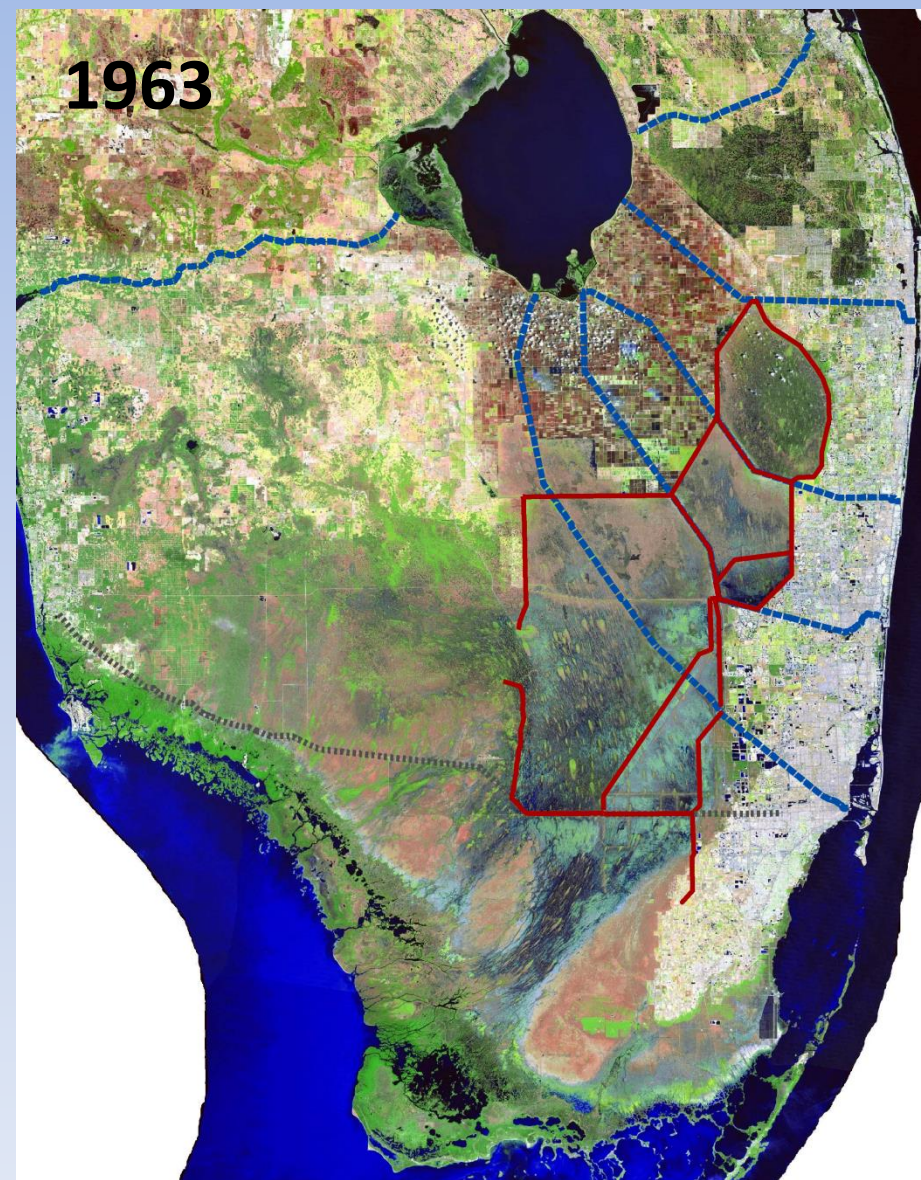
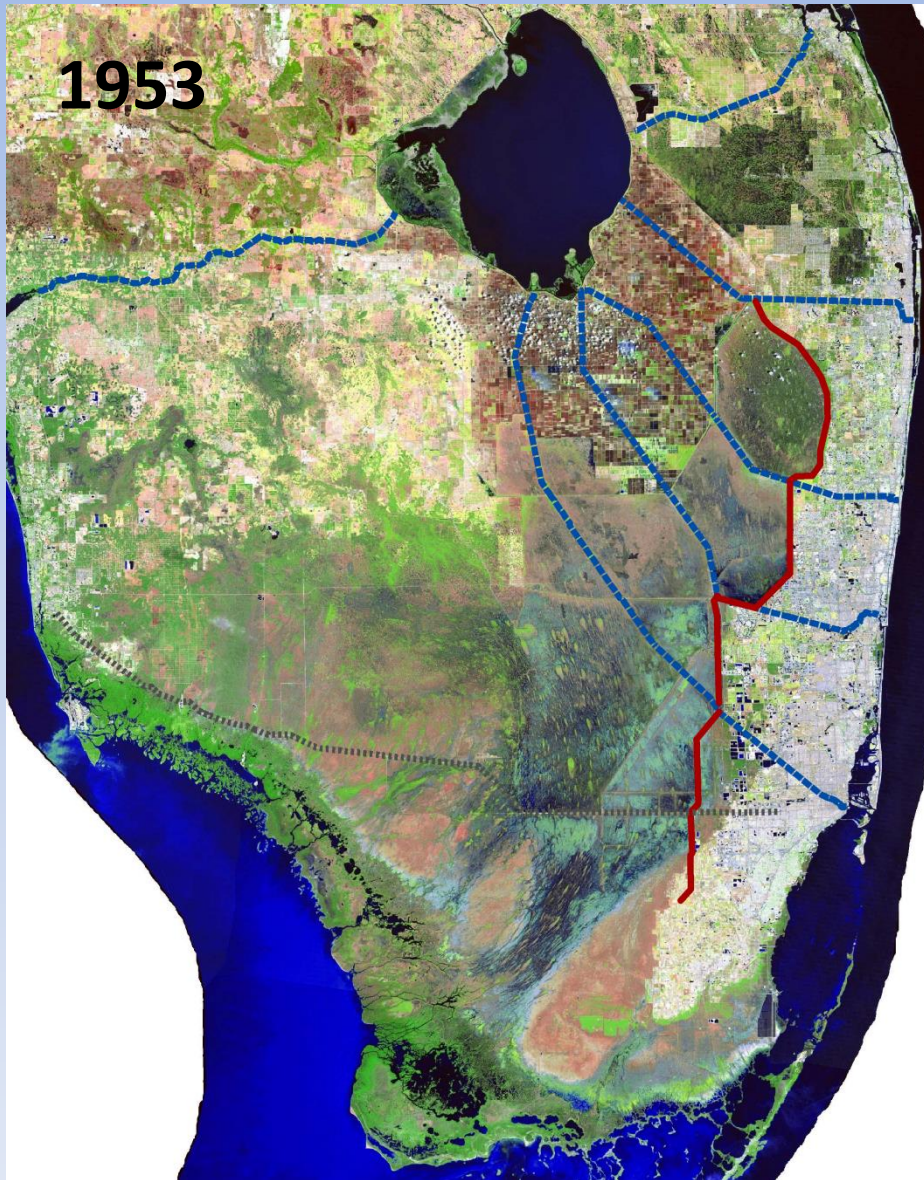
South Florida Natural Resources Center



1914

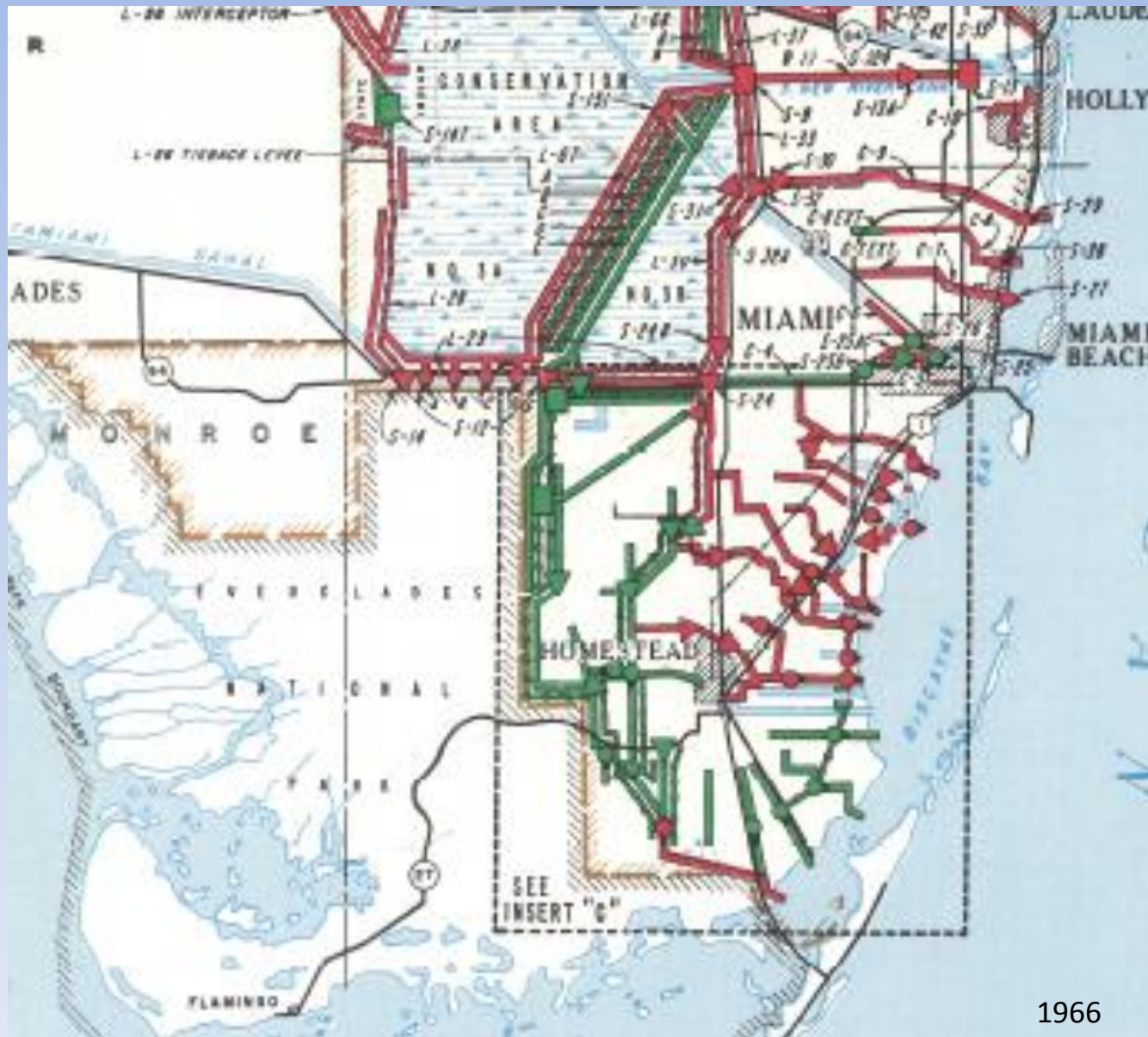
# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



**LEGEND**

- COMPLETED OR UNDER CONSTRUCTION
- REMAINDER OF PROJECT

**CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL PROJECT**

DESIGN AND CONSTRUCTION BY  
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE  
CORPS OF ENGINEERS  
JACKSONVILLE, FLORIDA

OPERATION AND MAINTENANCE BY  
CENTRAL AND SOUTHERN FLORIDA  
FLOOD CONTROL DISTRICT  
WEST PALM BEACH, FLORIDA

1966

# National Park Service



South Florida Natural Resources Center

The focus is on flow

How flow has varied with regional rainfall.  
This is indicative of upstream water management.

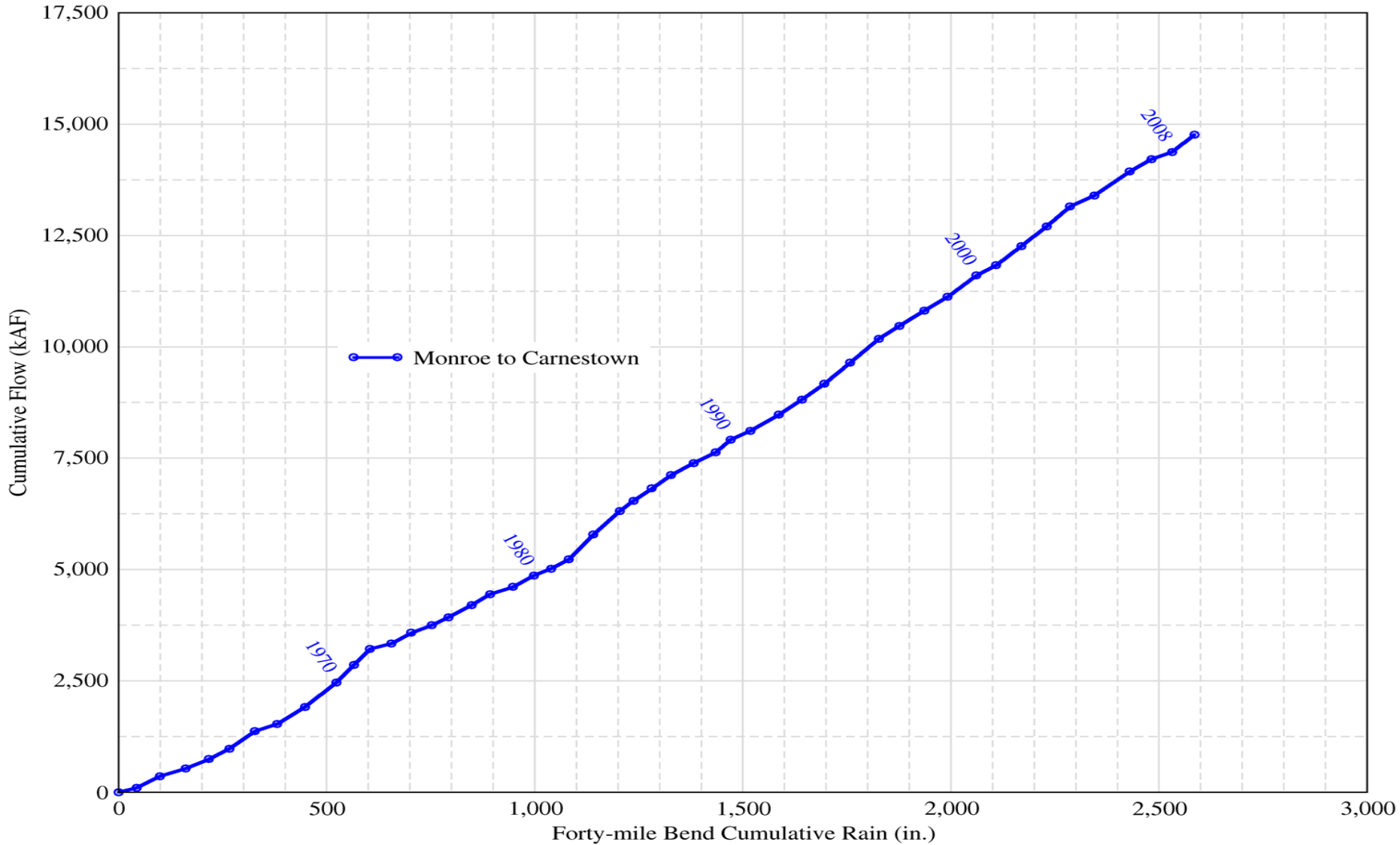
And how flow has varied with the water level in the L29 Canal.  
This analysis is from synoptic measurements (semi-monthly since 1940)  
and are indicative of physical conditions of the landscape downstream

We will also look at how flow has varied spatially through the culverts, and  
get a glimpse of the effects of the bridge with the 2 years of data available



# National Park Service

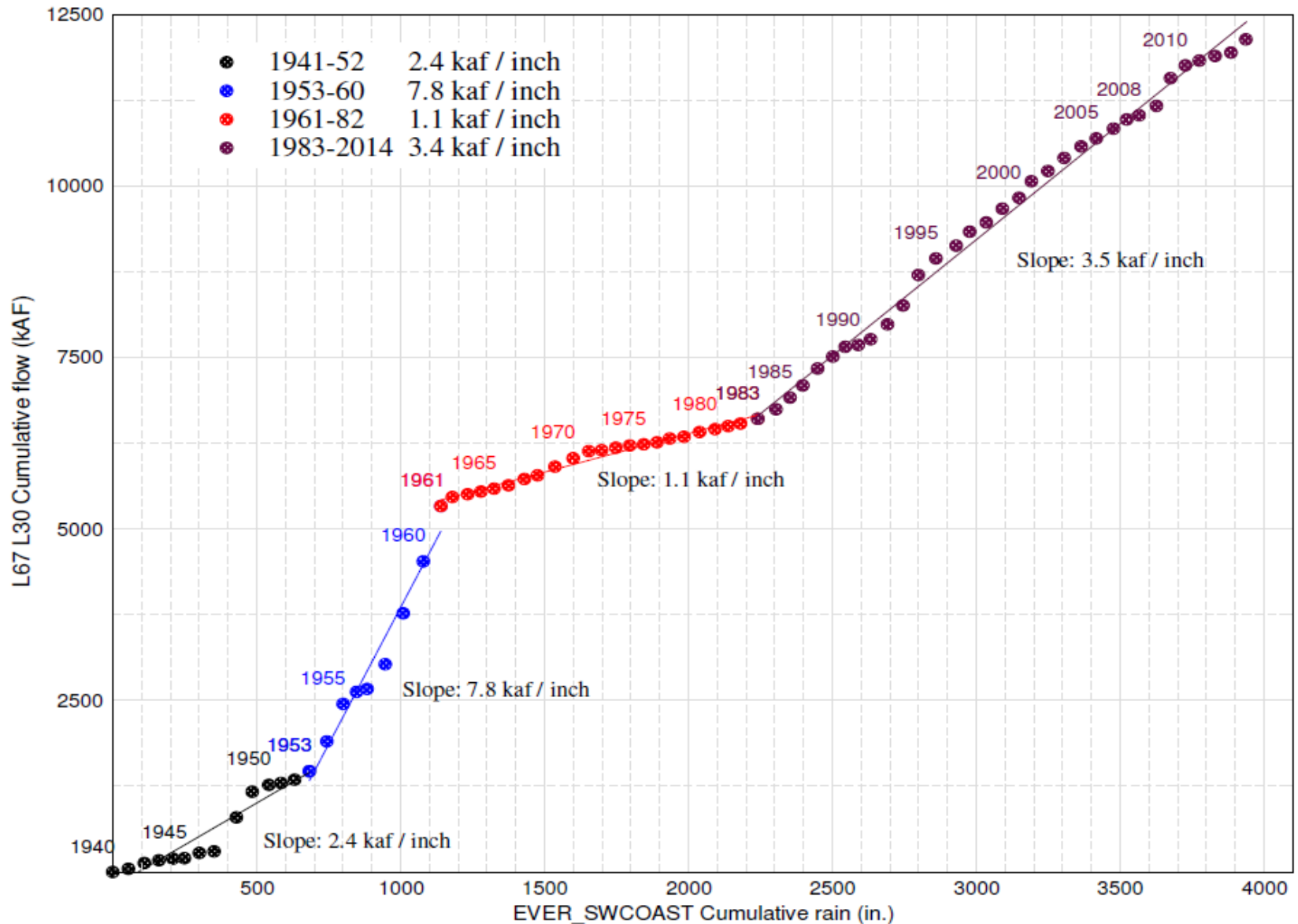
South Florida Natural Resources Center



# National Park Service



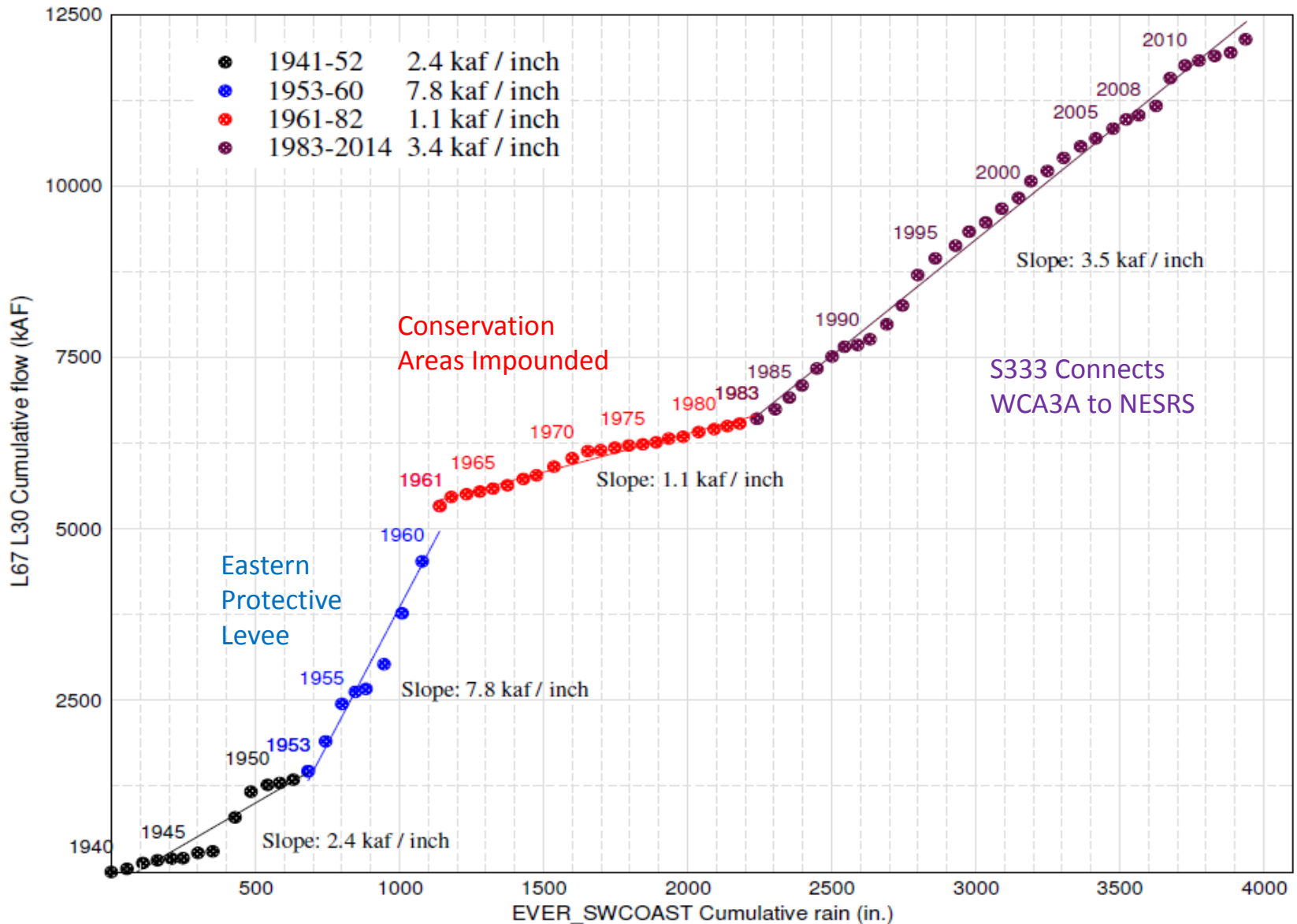
South Florida Natural Resources Center





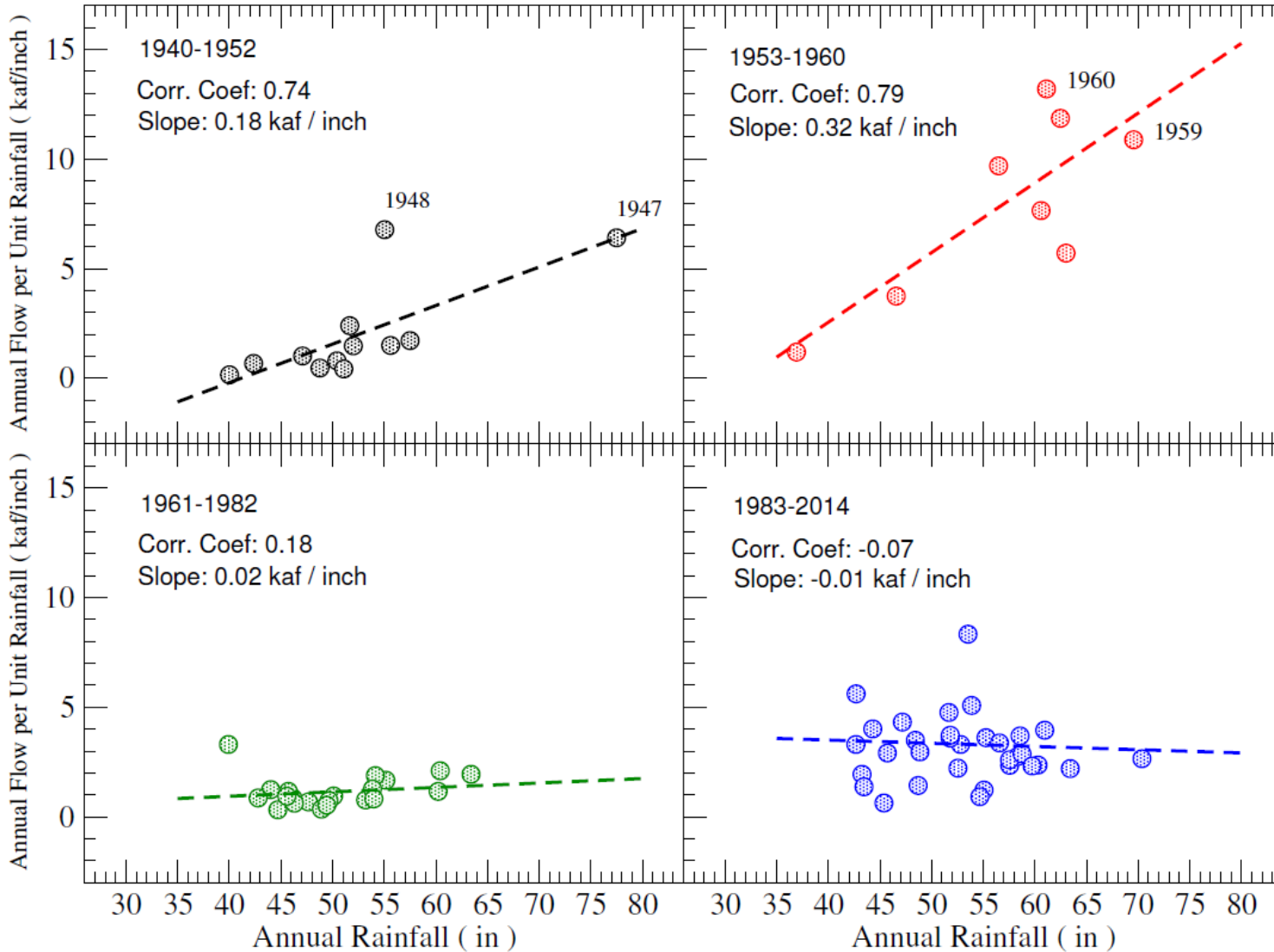
# National Park Service

South Florida Natural Resources Center



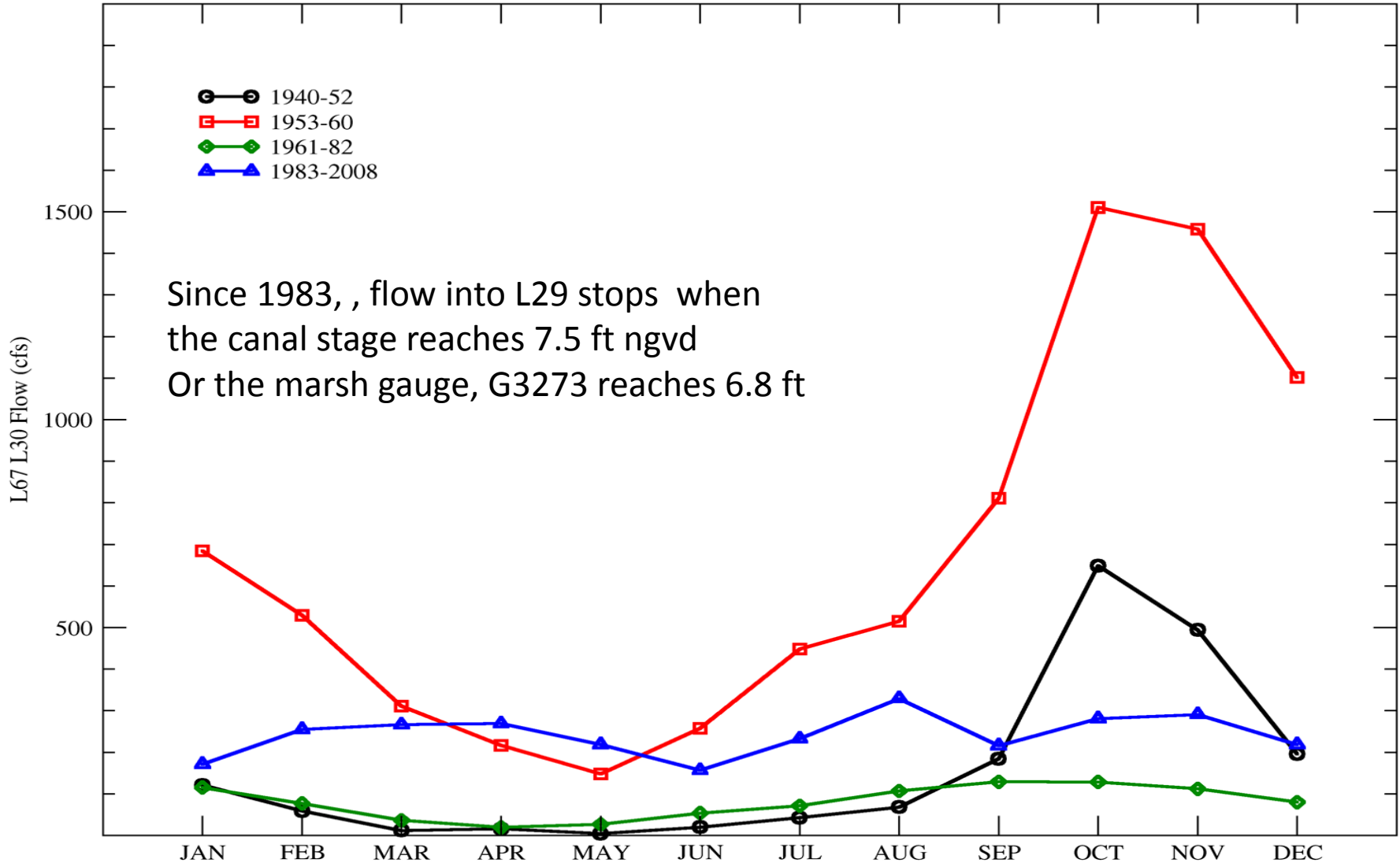
# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center



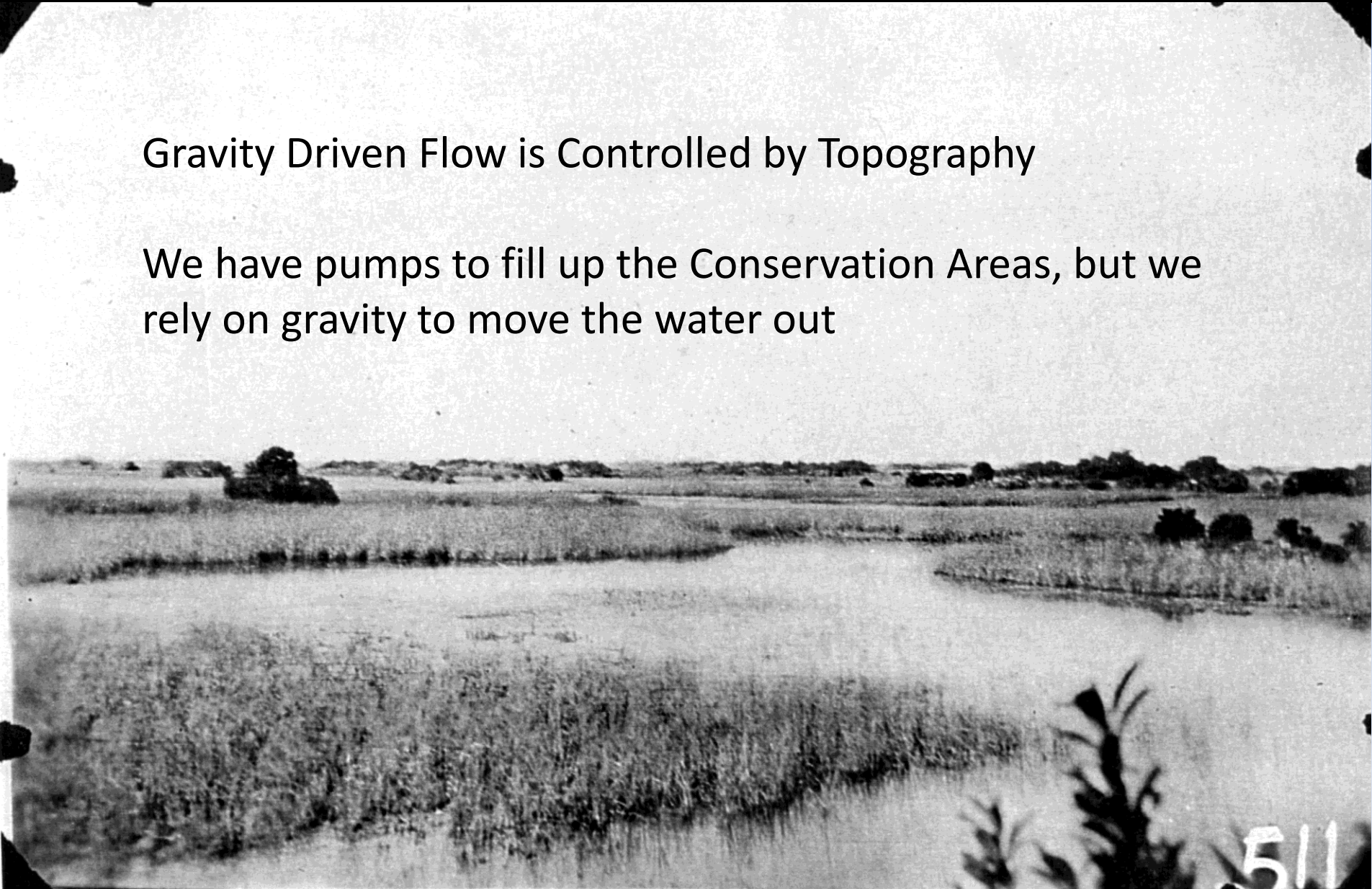
# National Park Service

South Florida Natural Resources Center



Gravity Driven Flow is Controlled by Topography

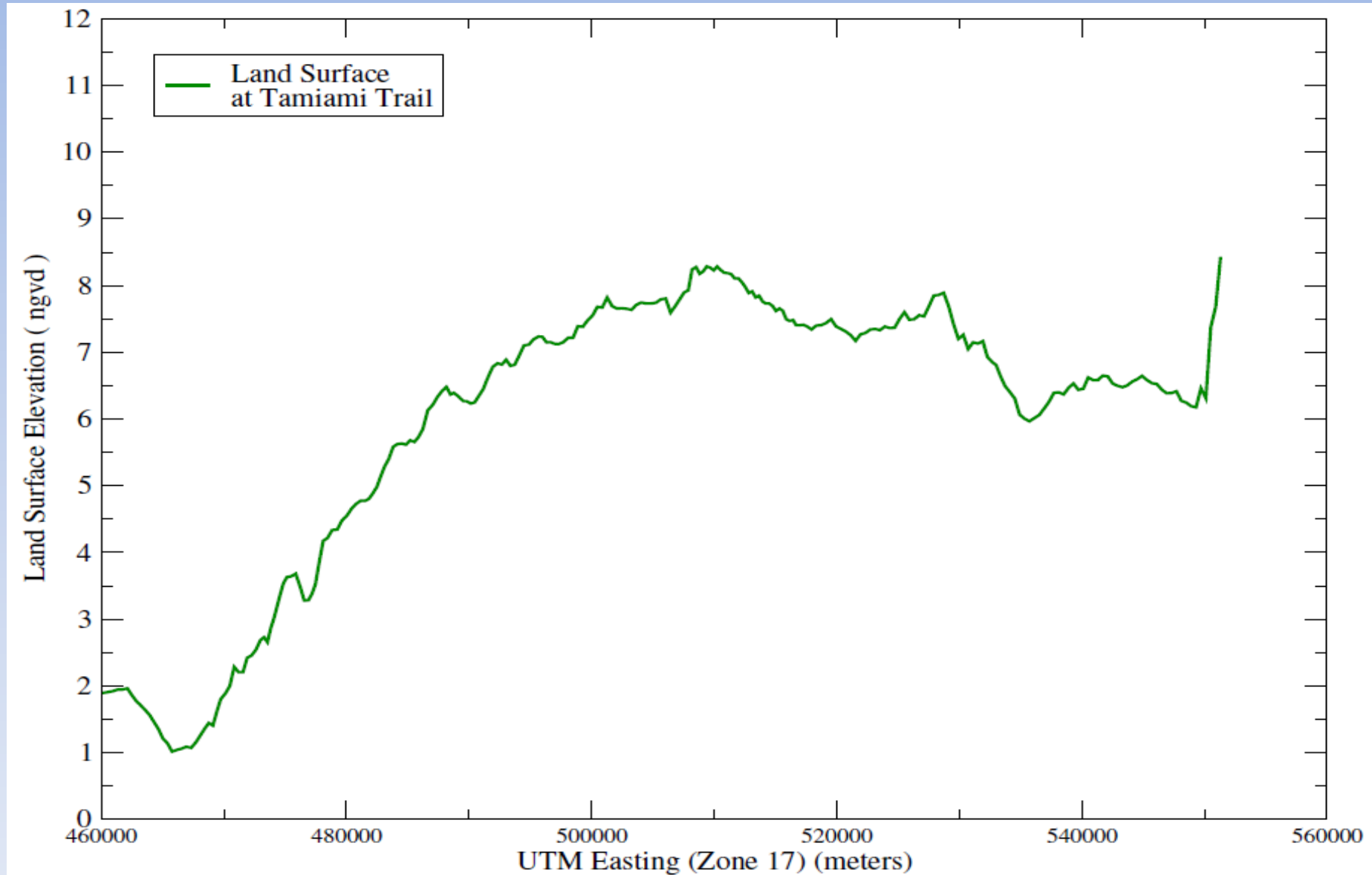
We have pumps to fill up the Conservation Areas, but we rely on gravity to move the water out



# National Park Service



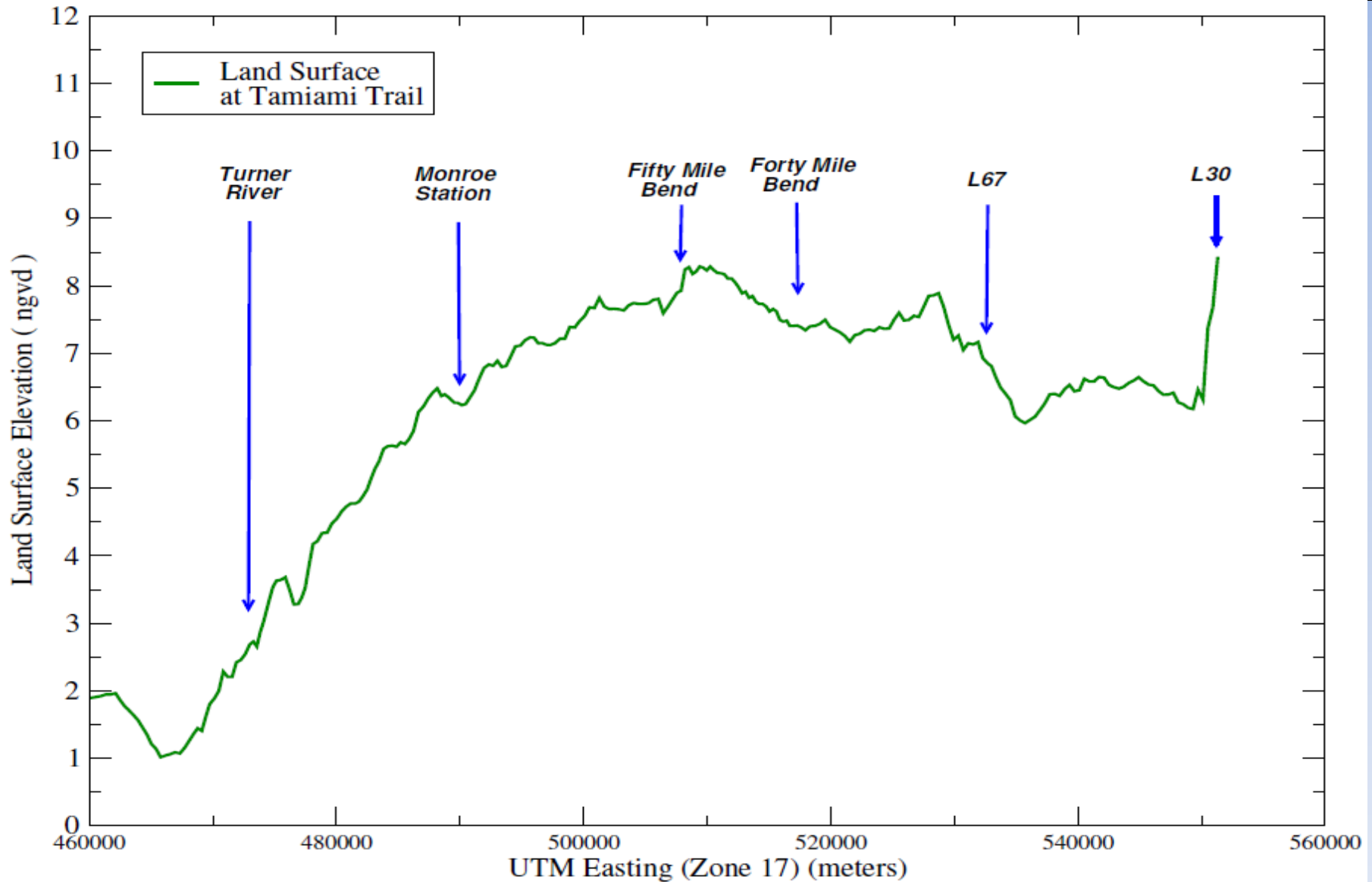
South Florida Natural Resources Center



# National Park Service



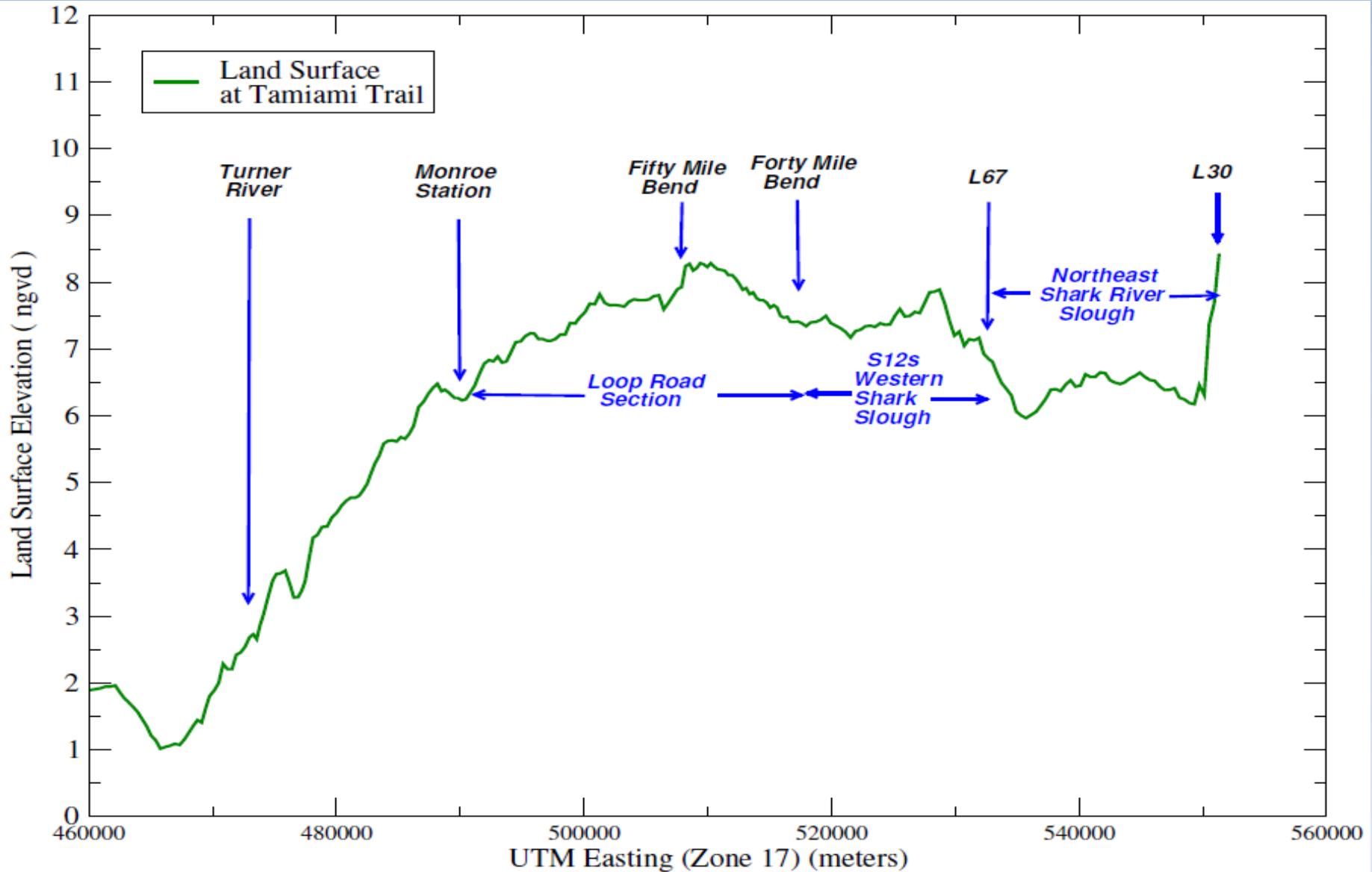
South Florida Natural Resources Center



# National Park Service



South Florida Natural Resources Center

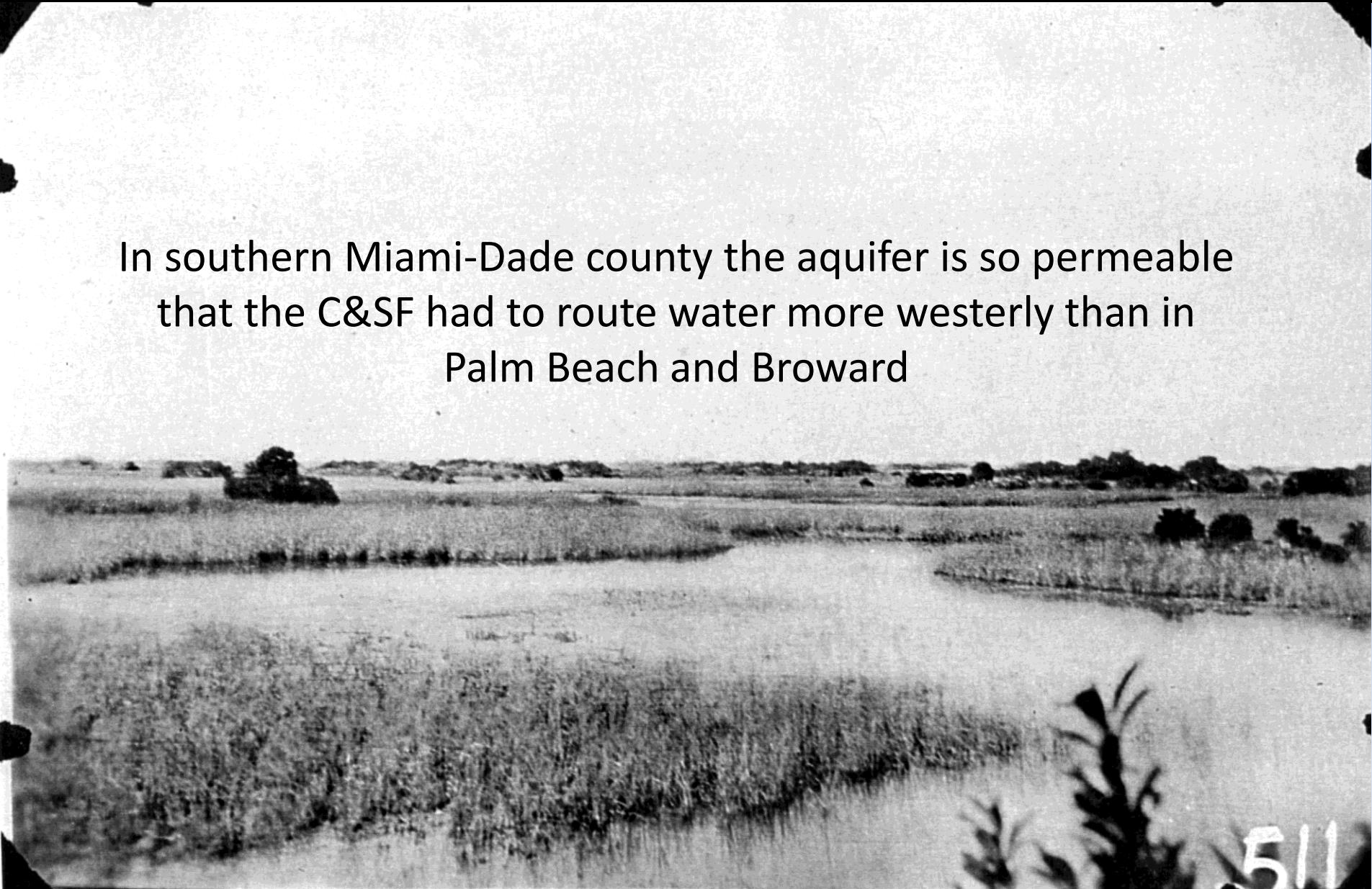


# National Park Service

South Florida Natural Resources Center



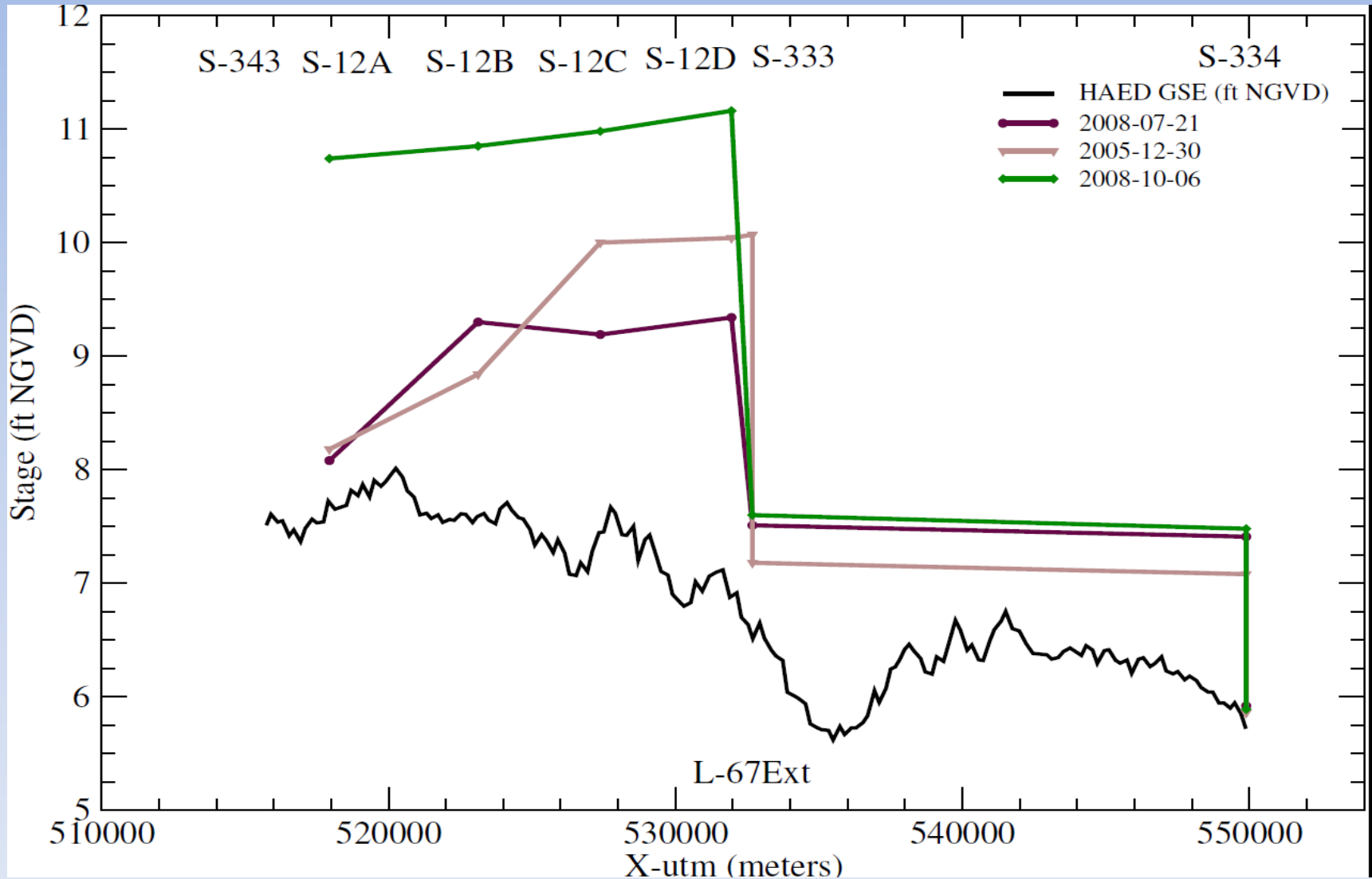
In southern Miami-Dade county the aquifer is so permeable that the C&SF had to route water more westerly than in Palm Beach and Broward





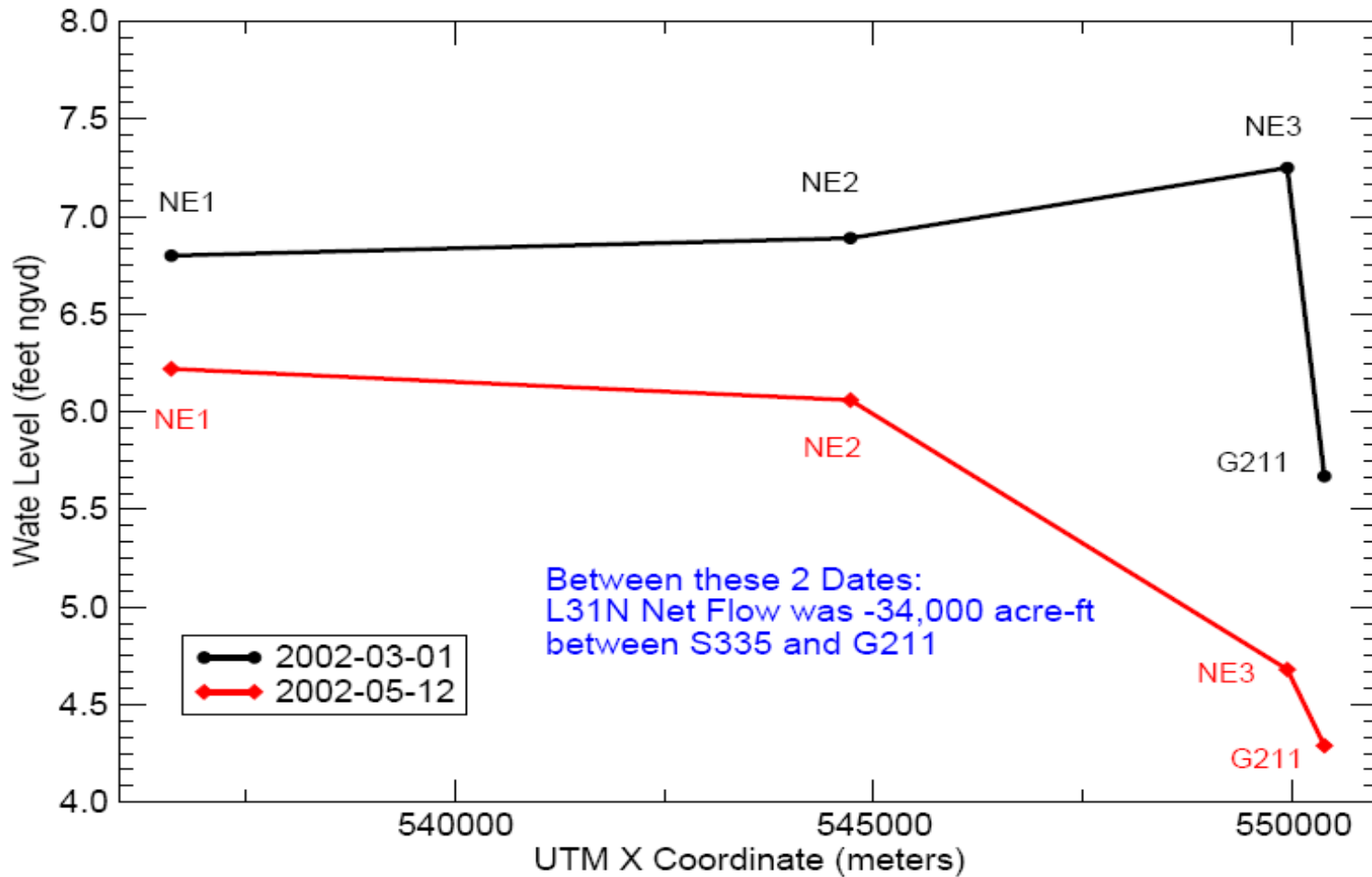
# National Park Service

South Florida Natural Resources Center

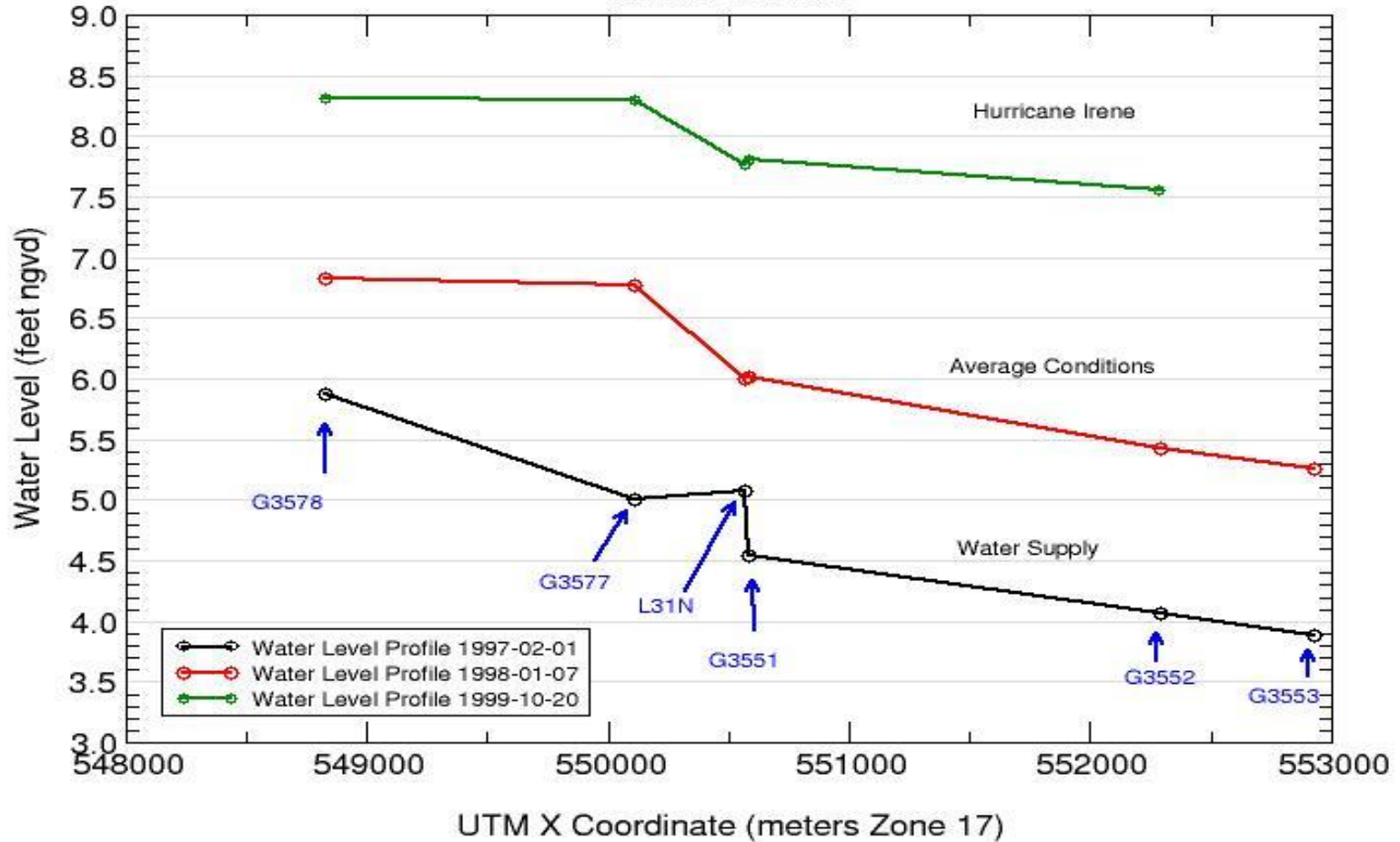




## NESS Water Surface Profiles



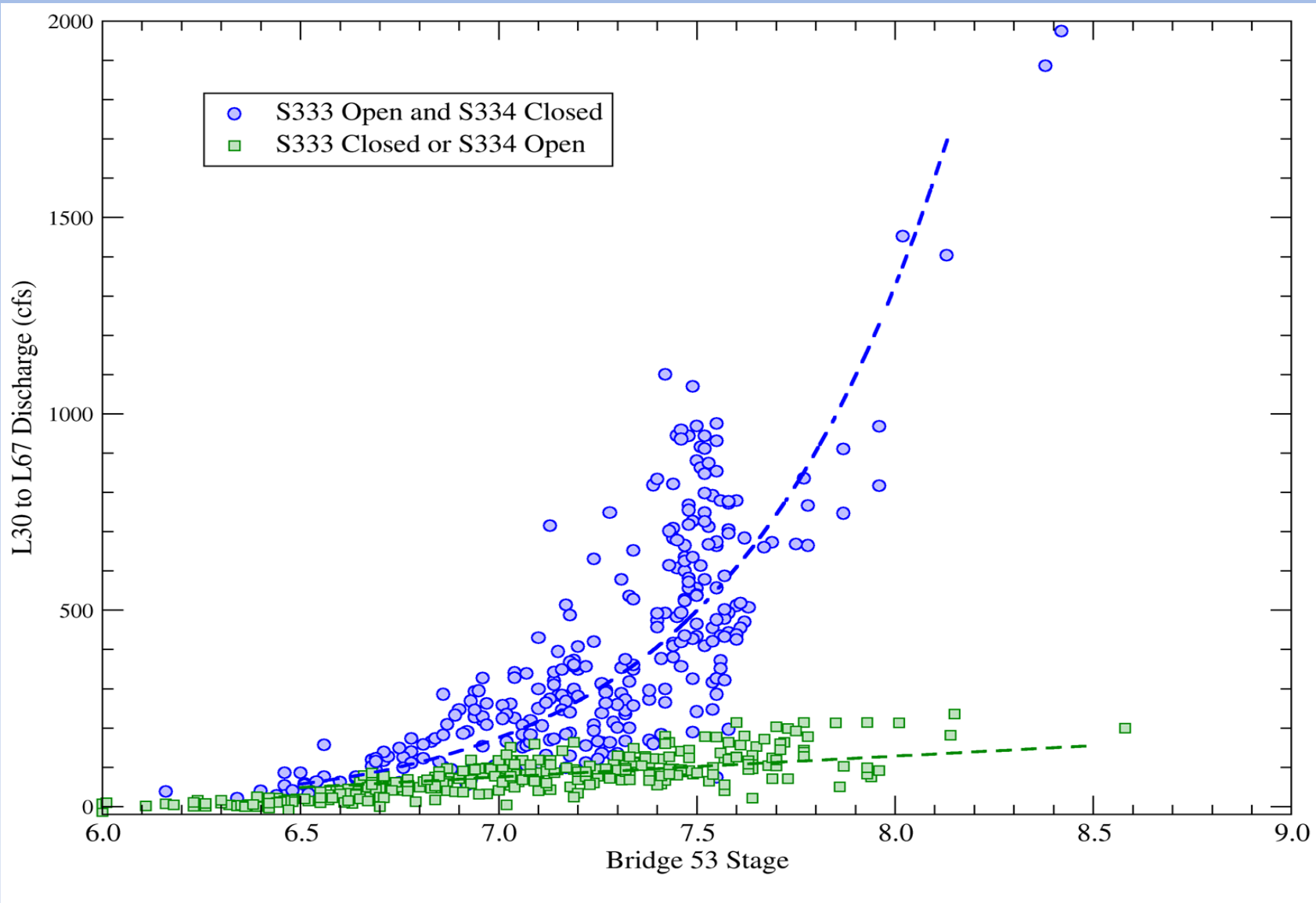
L31N Upper Reach West to East  
Water Level Profile





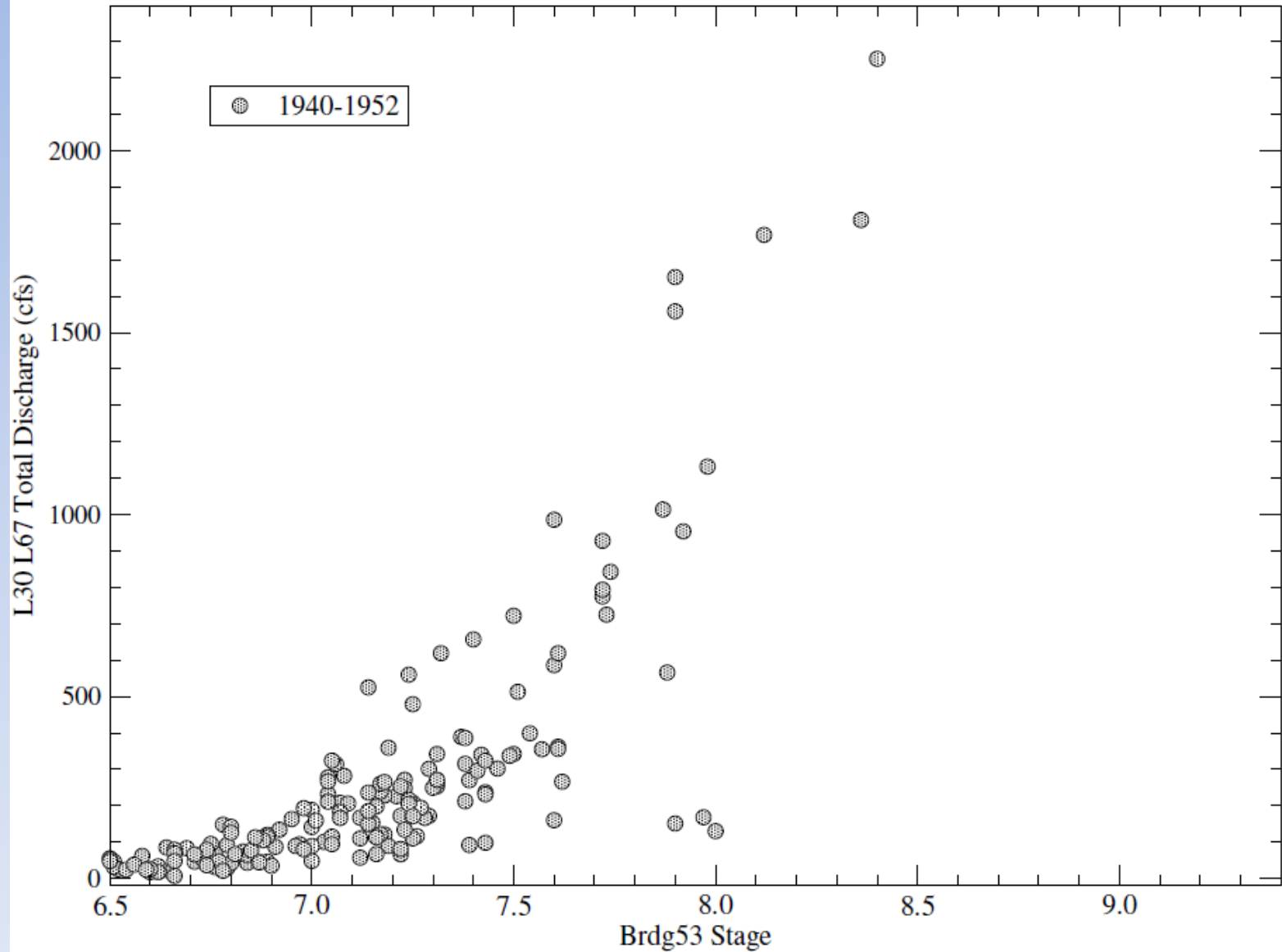
# National Park Service

South Florida Natural Resources Center



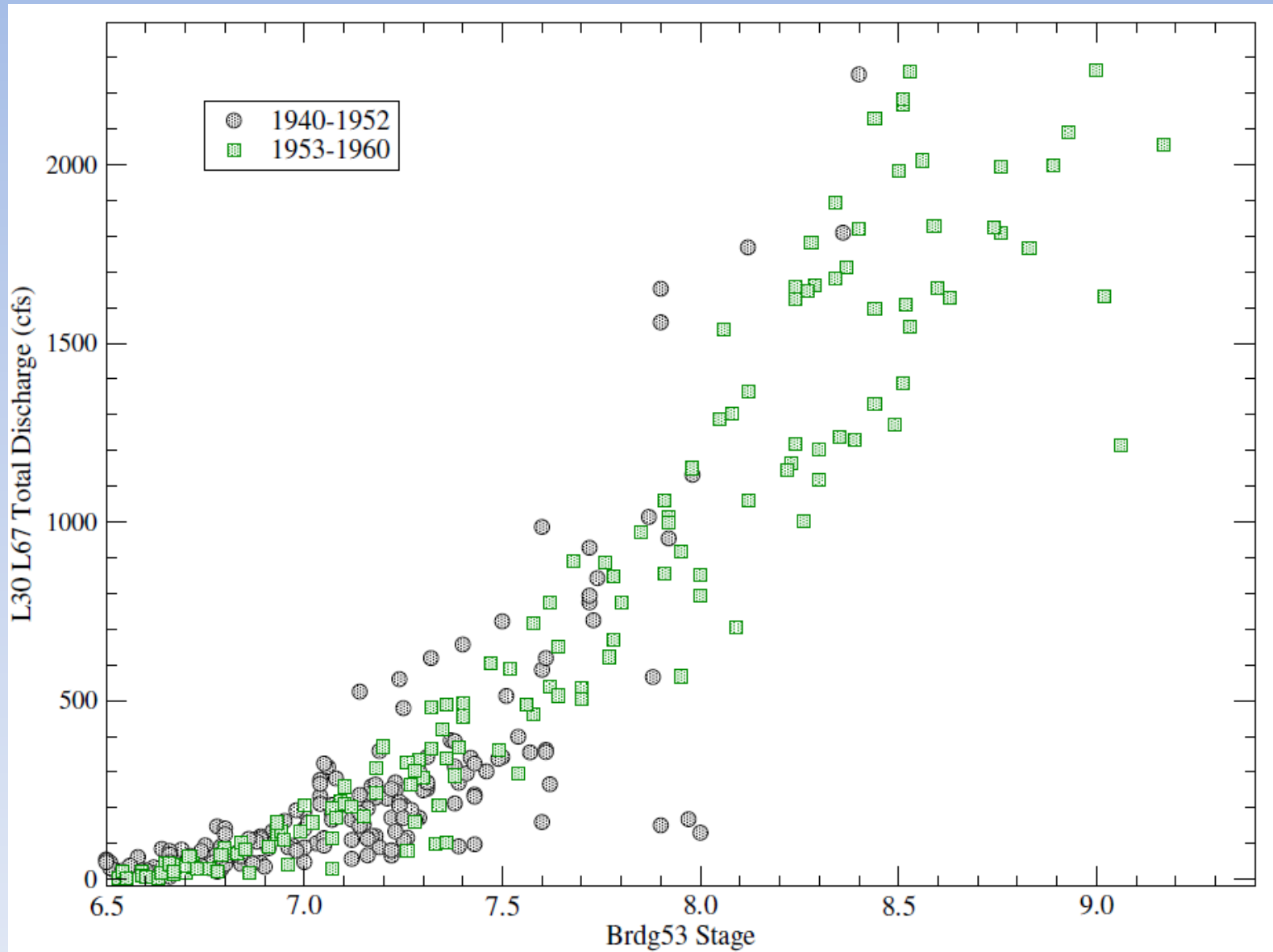
# National Park Service

South Florida Natural Resources Center



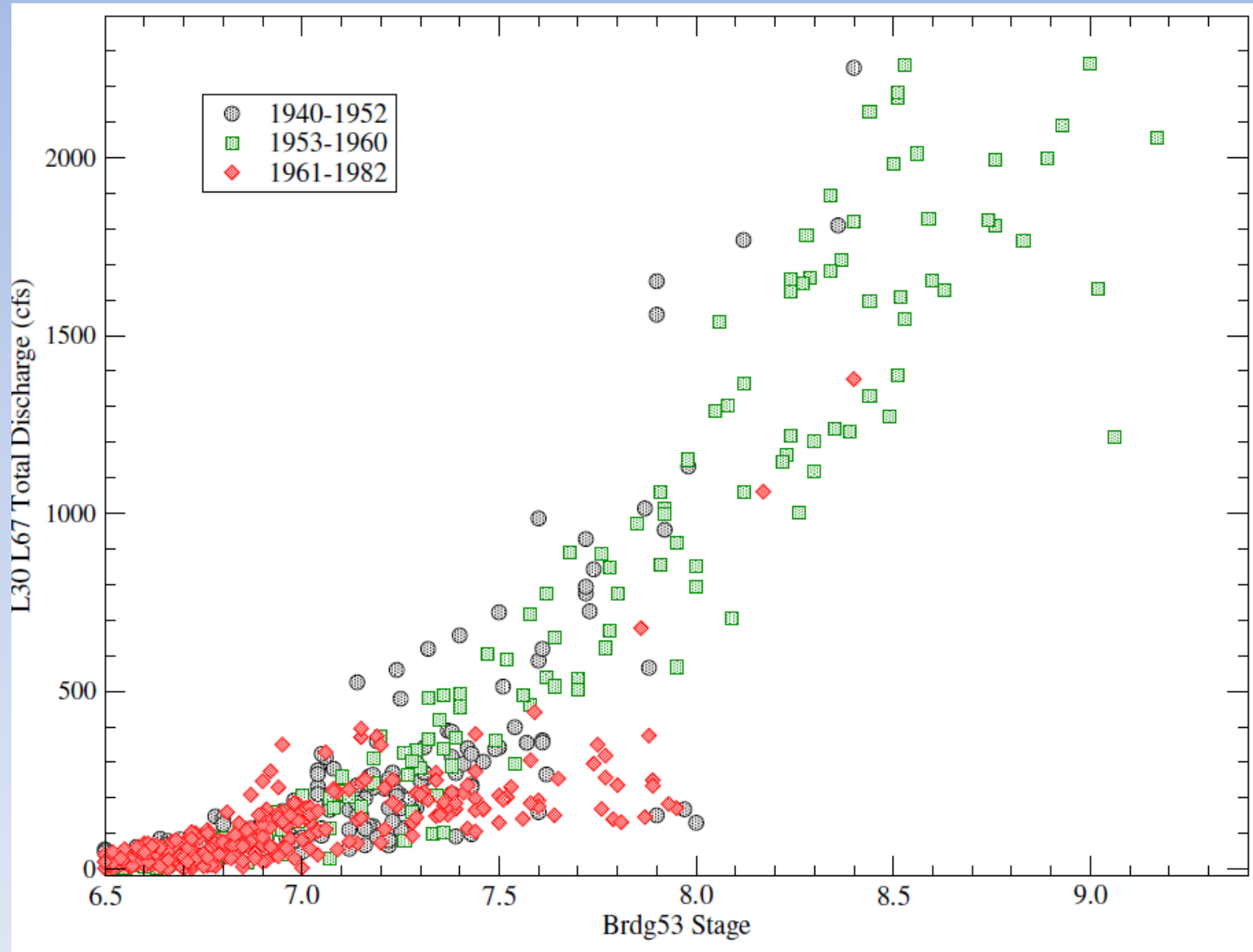
# National Park Service

South Florida Natural Resources Center



# National Park Service

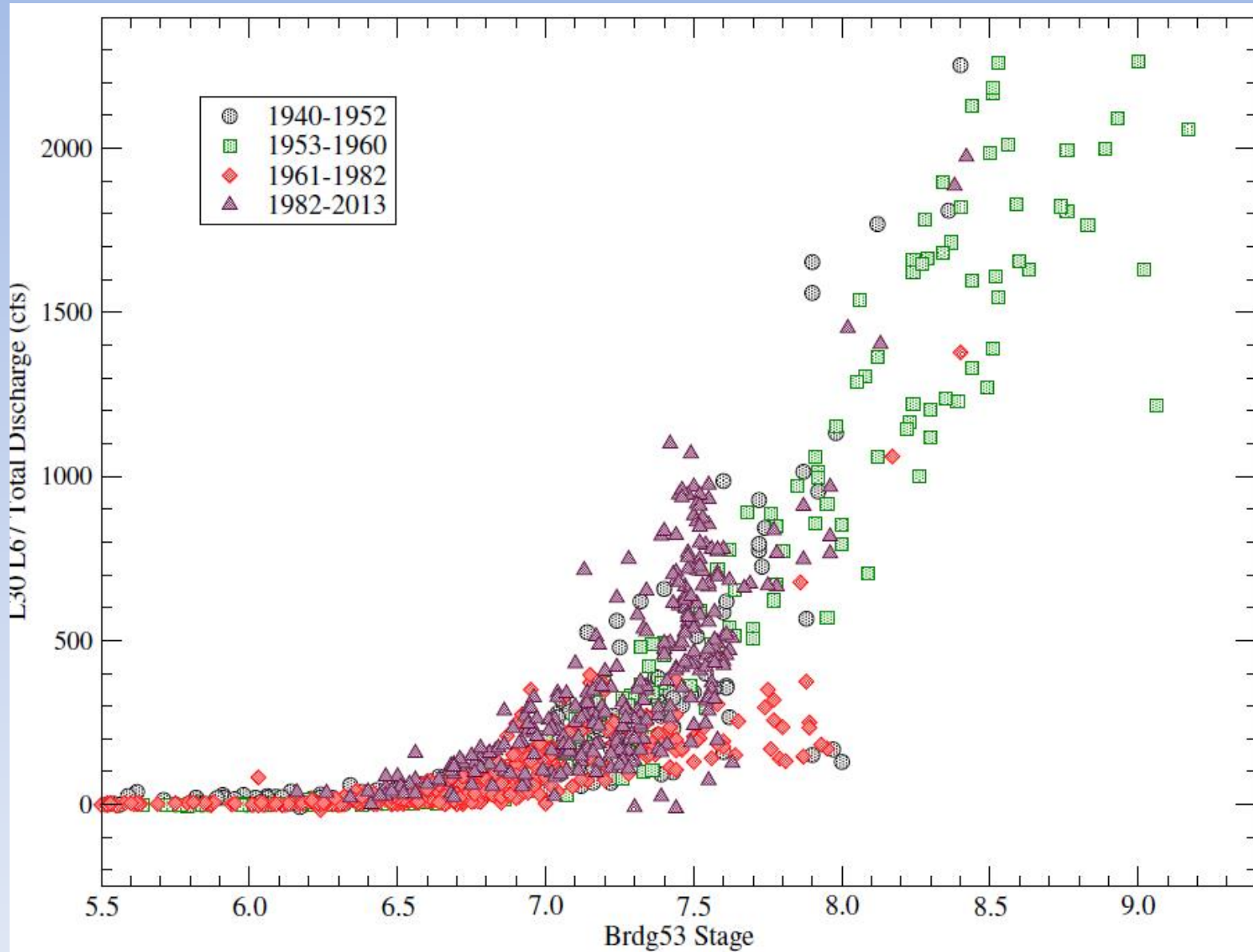
South Florida Natural Resources Center





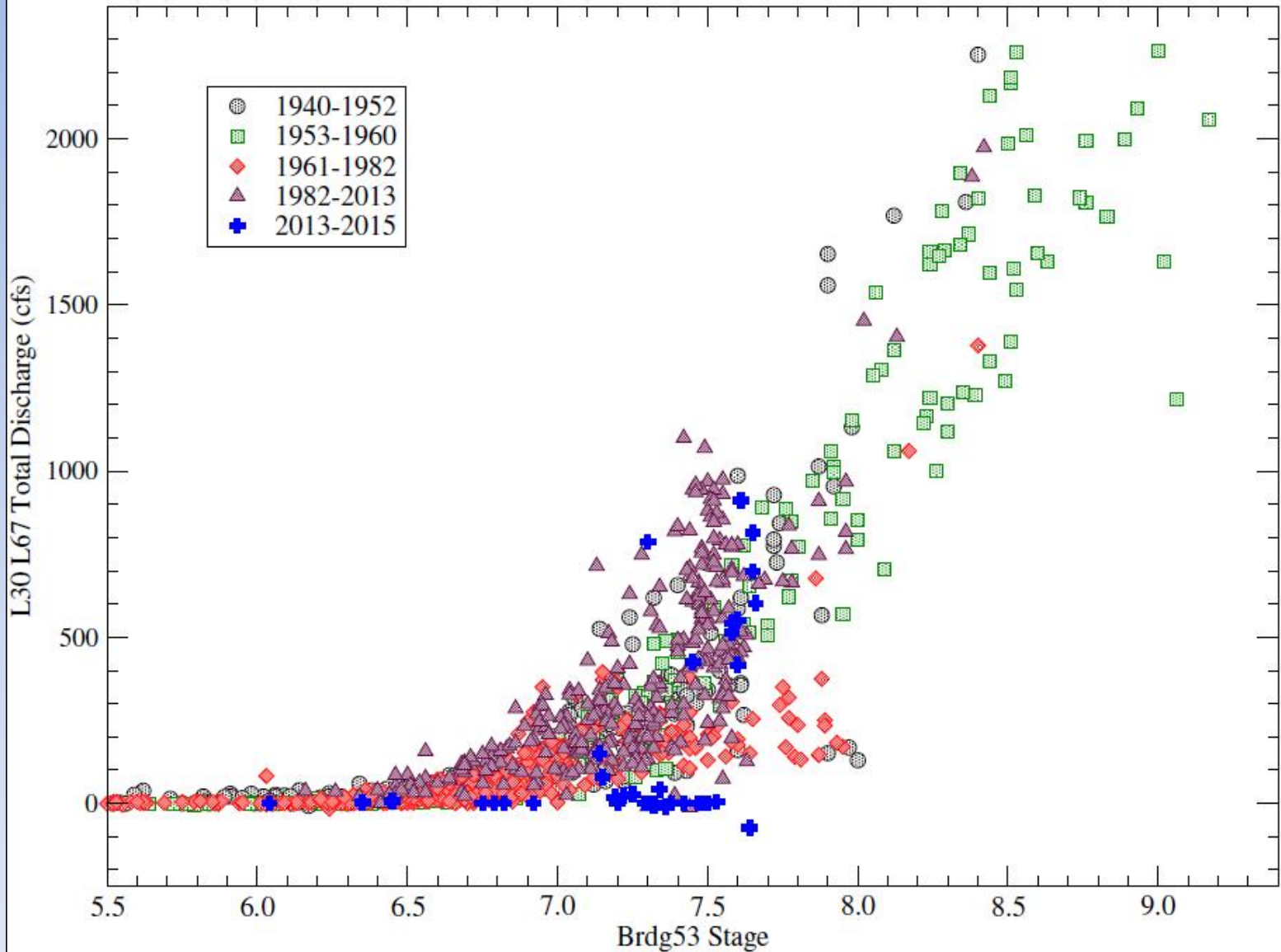
# National Park Service

South Florida Natural Resources Center



# National Park Service

South Florida Natural Resources Center

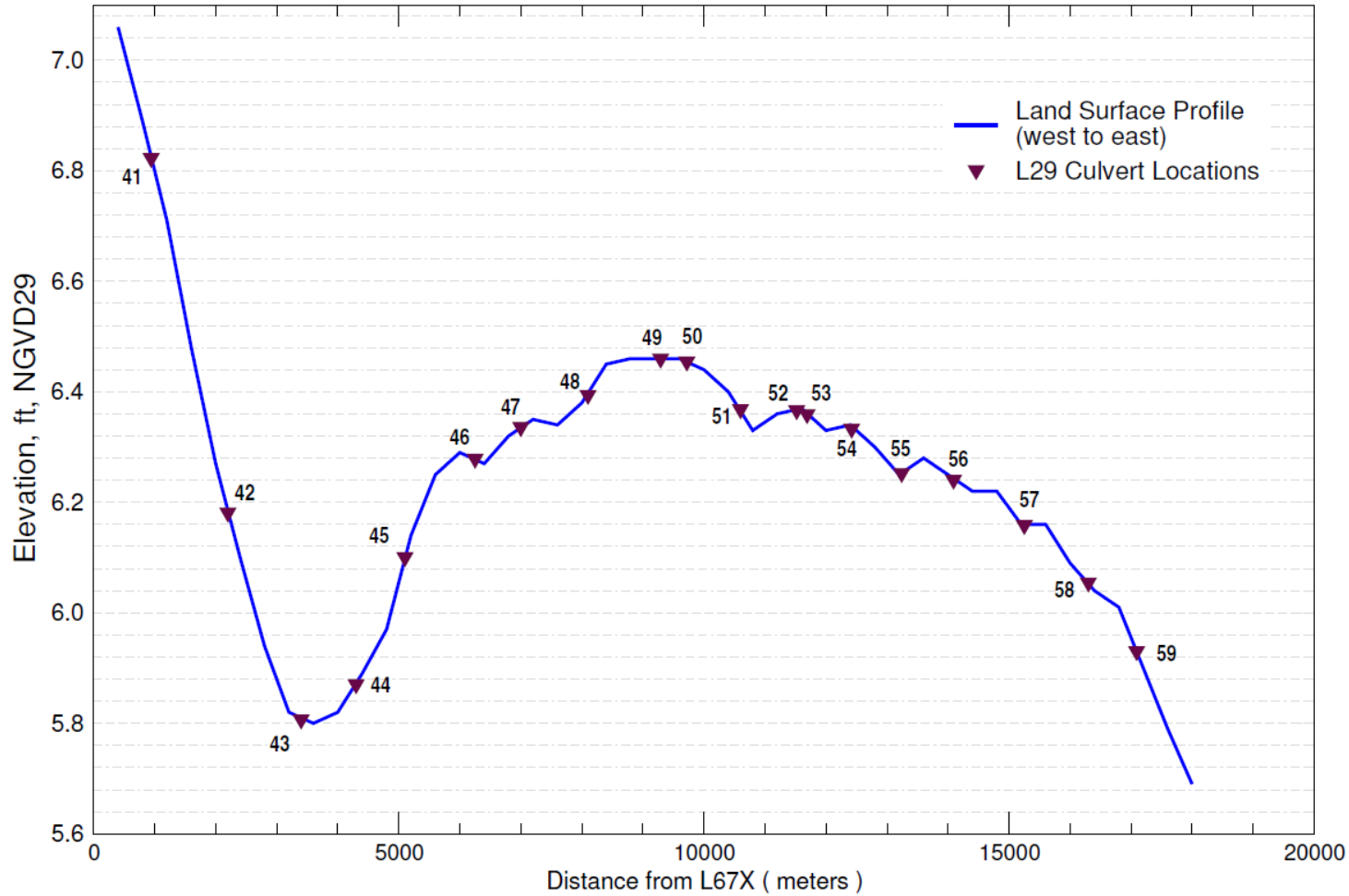


# National Park Service

South Florida Natural Resources Center



Land Surface Profile from L67 Extension to L31N  
Along Tamiami Trail

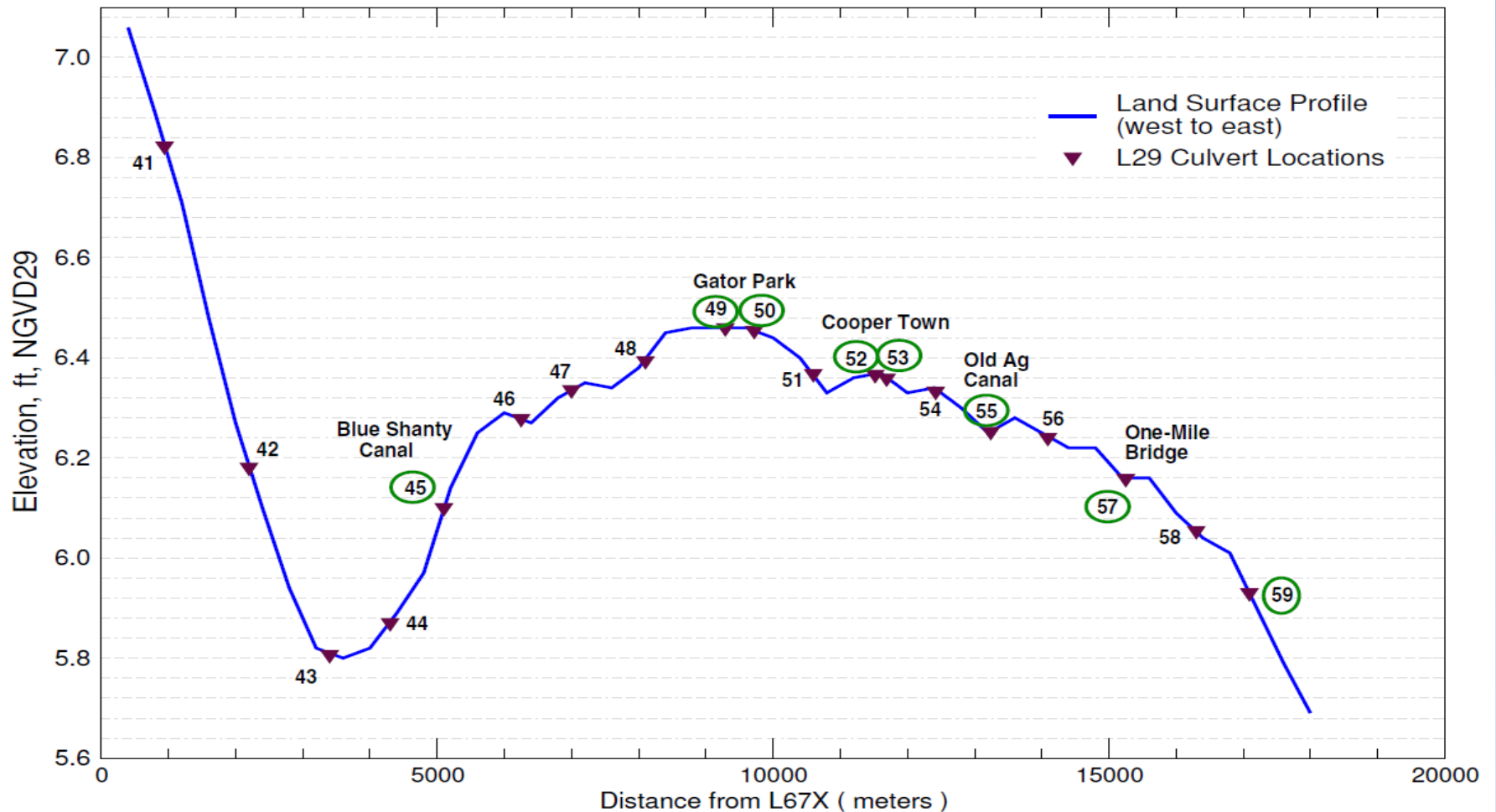


# National Park Service

South Florida Natural Resources Center



Land Surface Profile from L67 Extension to L31N  
Along Tamiami Trail

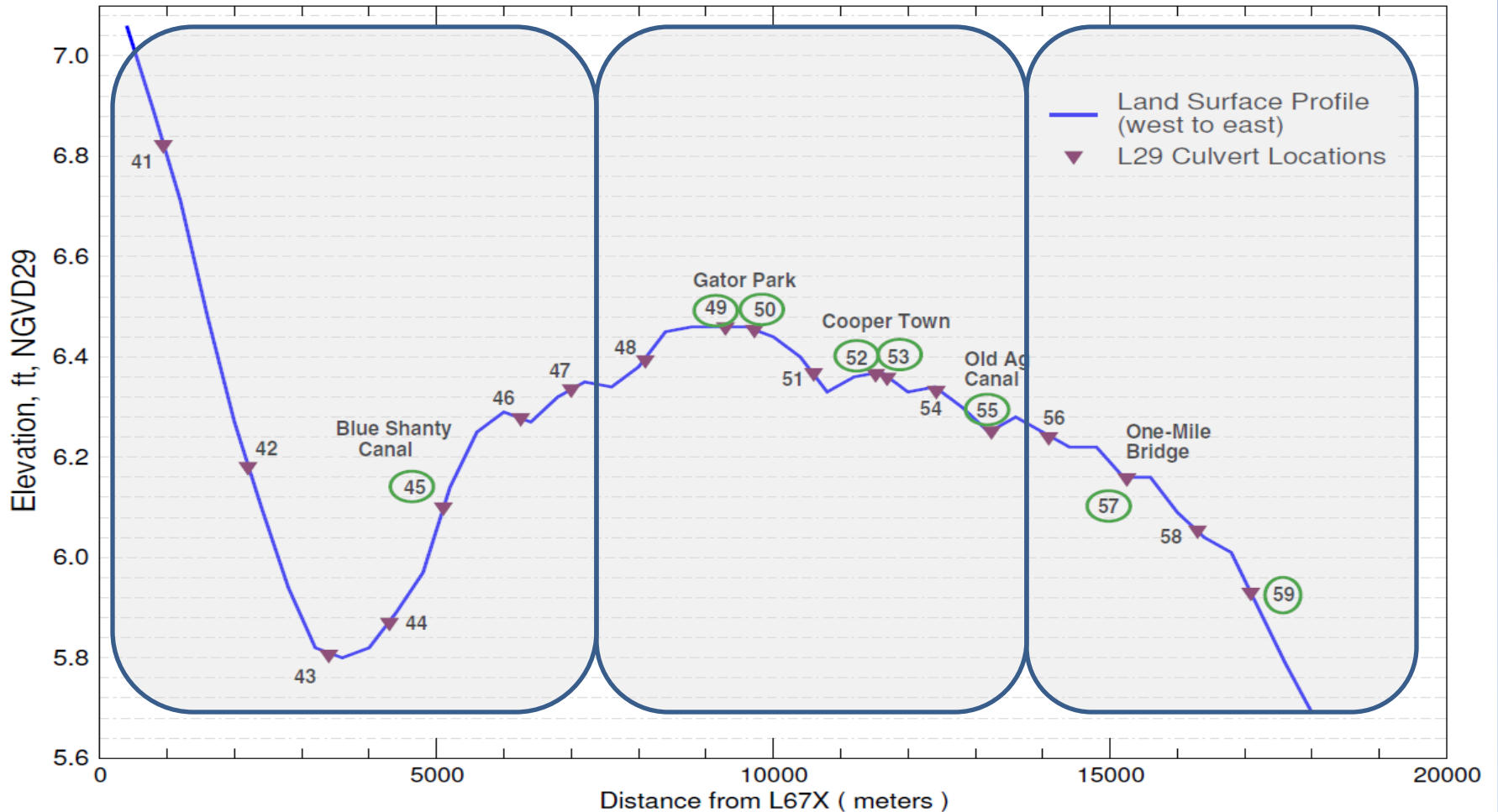


# National Park Service

South Florida Natural Resources Center



Land Surface Profile from L67 Extension to L31N  
Along Tamiami Trail



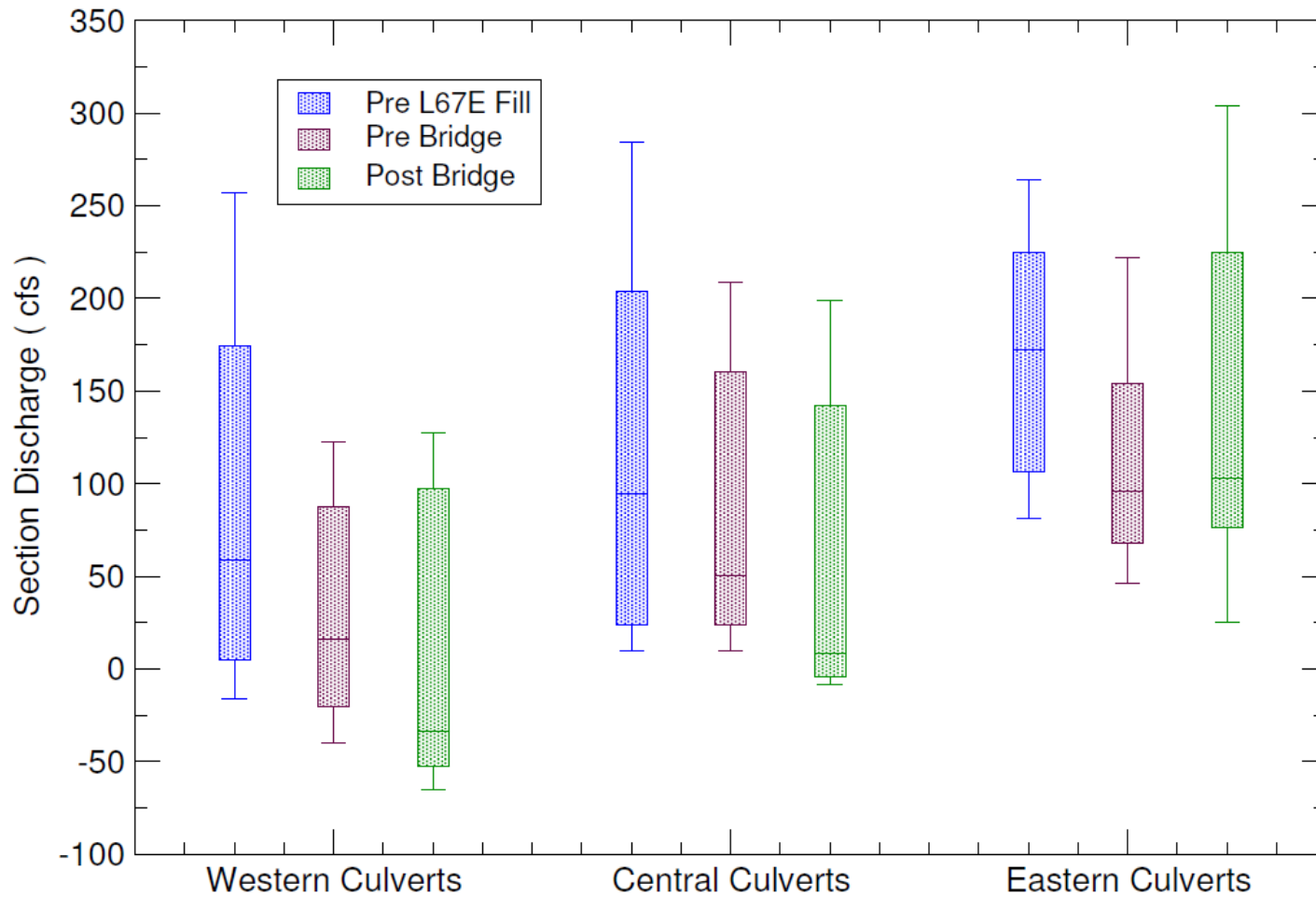
# National Park Service

South Florida Natural Resources Center



## Section Discharge Comparison

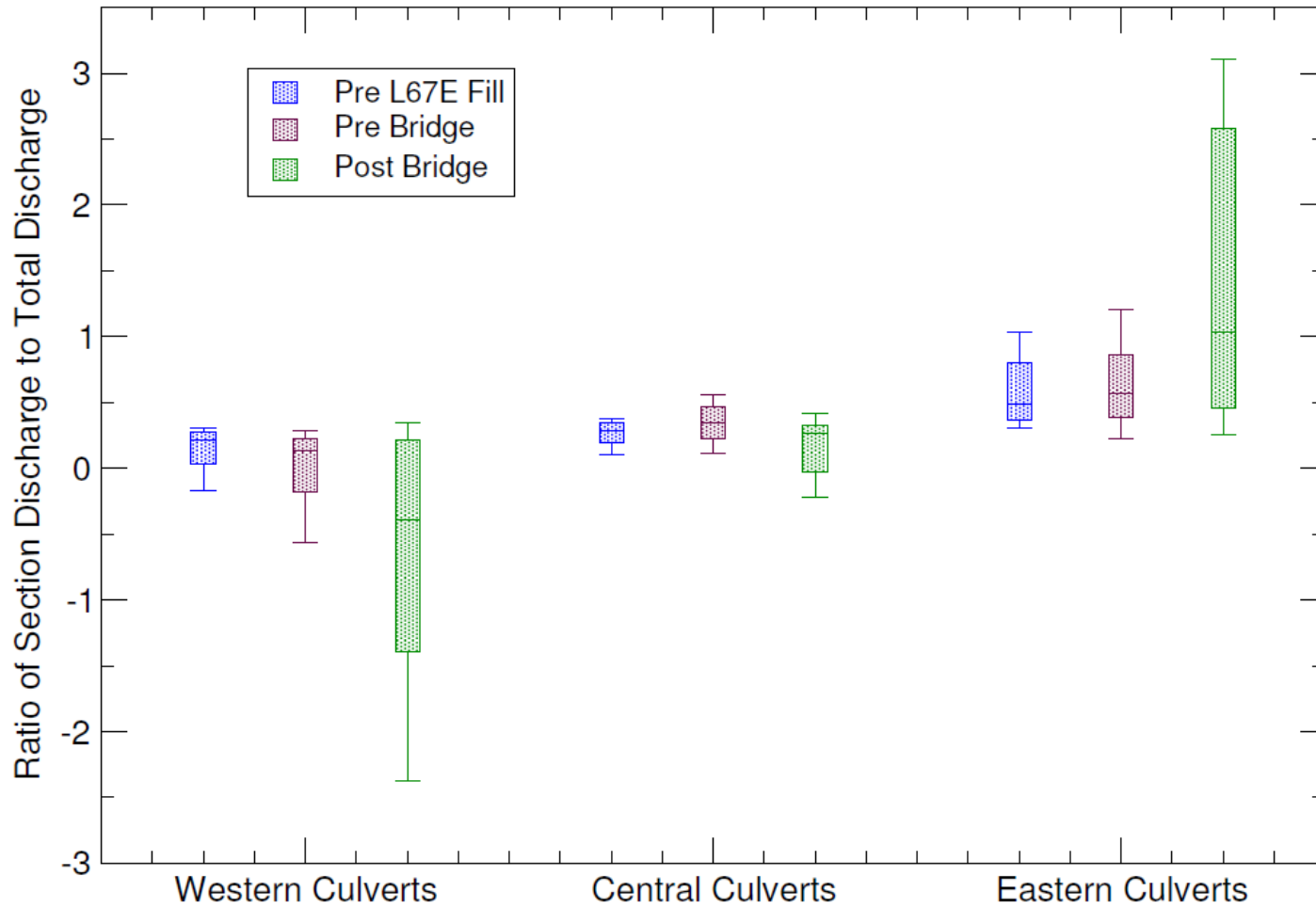
1982 - 2014





## Ratio of Section Discharge to Total Discharge

1982 - 2014

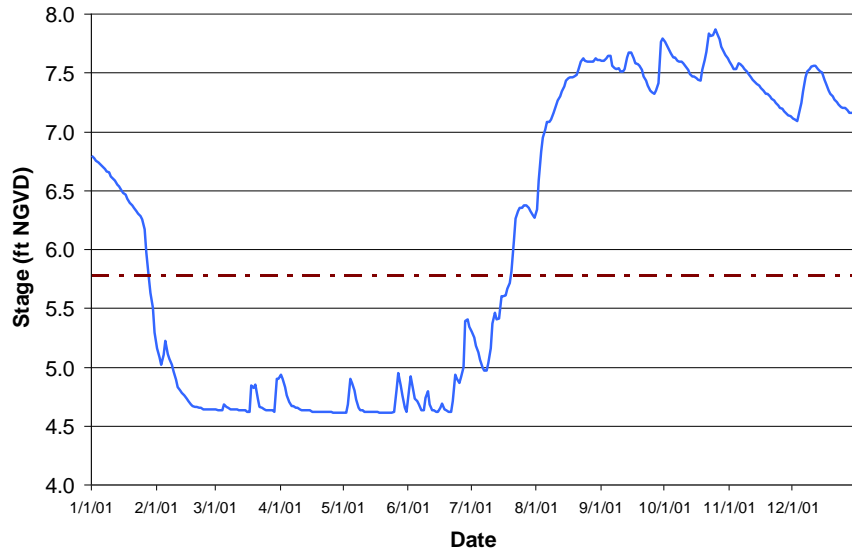


# National Park Service

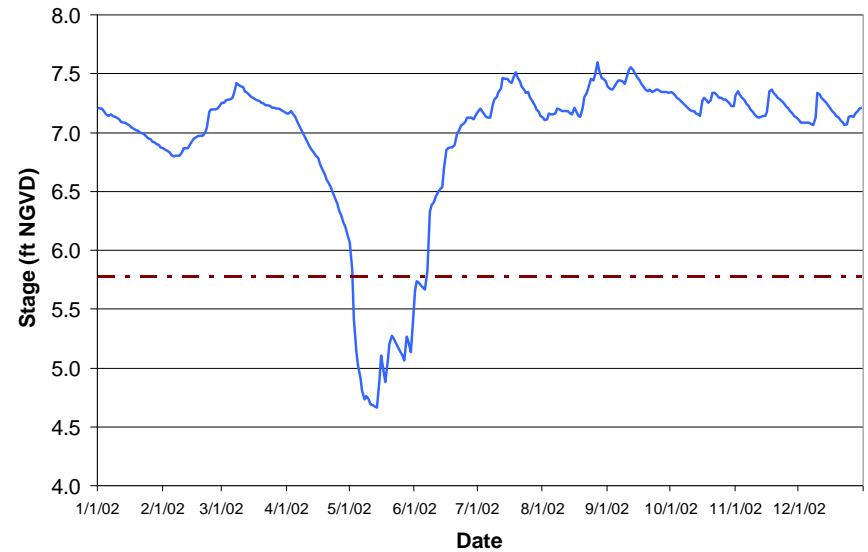
South Florida Natural Resources Center



**NE3 Stage 2001**  
(Hydroperiod = 192 days)



**NE3 Stage 2002**  
(Hydroperiod = 330 days)



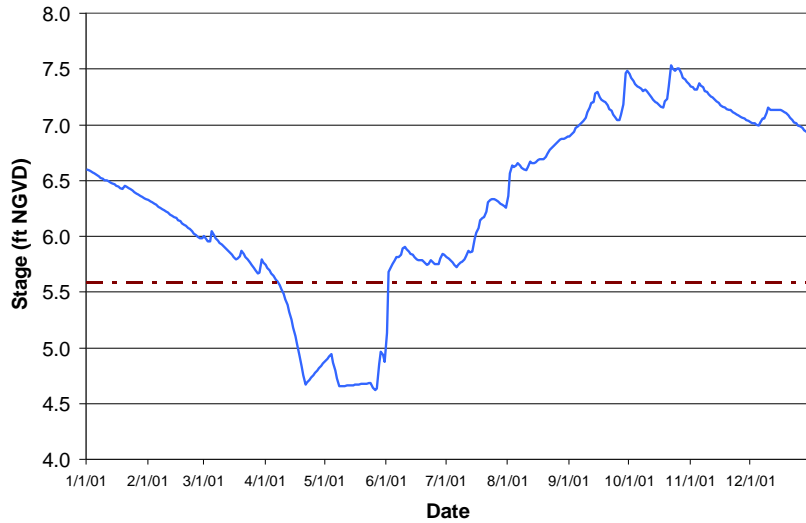


# National Park Service

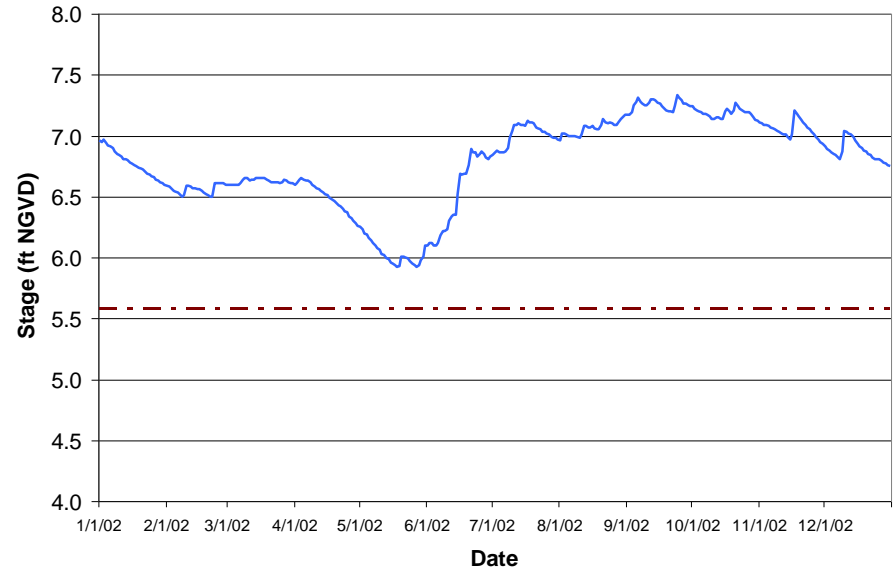
South Florida Natural Resources Center



**NE4 Stage 2001**  
(Hydroperiod = 310 days)



**NE4 Stage 2002**  
(Hydroperiod = 365 days)



# National Park Service



South Florida Natural Resources Center

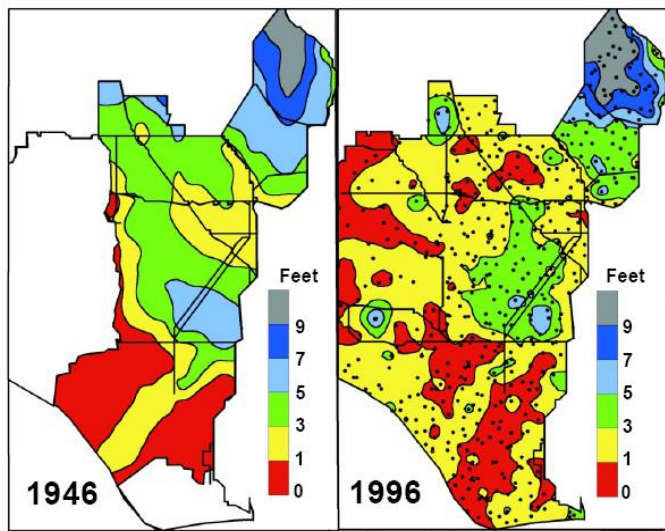


FIGURE 32. Soil thickness (feet) as reported by Davis in 1946 (left) and at 479 sites in 1995 to 1996 (this study).

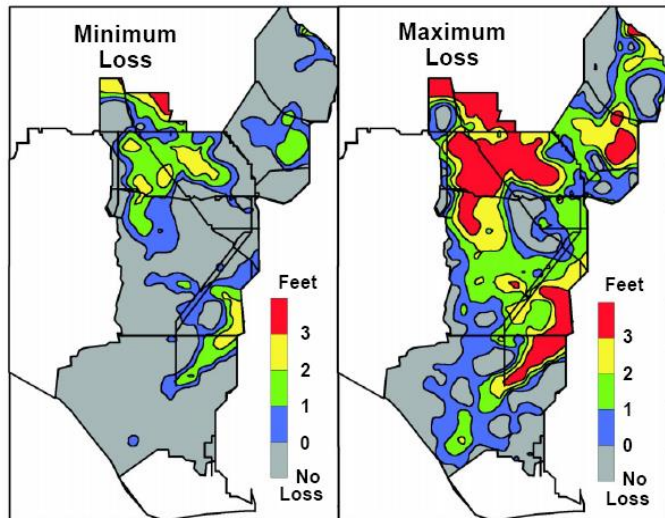
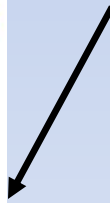


FIGURE 33. Soil loss (feet) from 1946 to 1996 for the Everglades.

Over 3 feet of soil loss in Northeast Shark River Slough due to dry conditions caused by seepage losses and cutting off of inflows

3 ft soil loss since 1946



# National Park Service



South Florida Natural Resources Center

## What's Next for NESRS?

Near Term (Over the Next 5 years):

Modified Water Deliveries Project – Incremental Field Test is scheduled  
To begin next month.

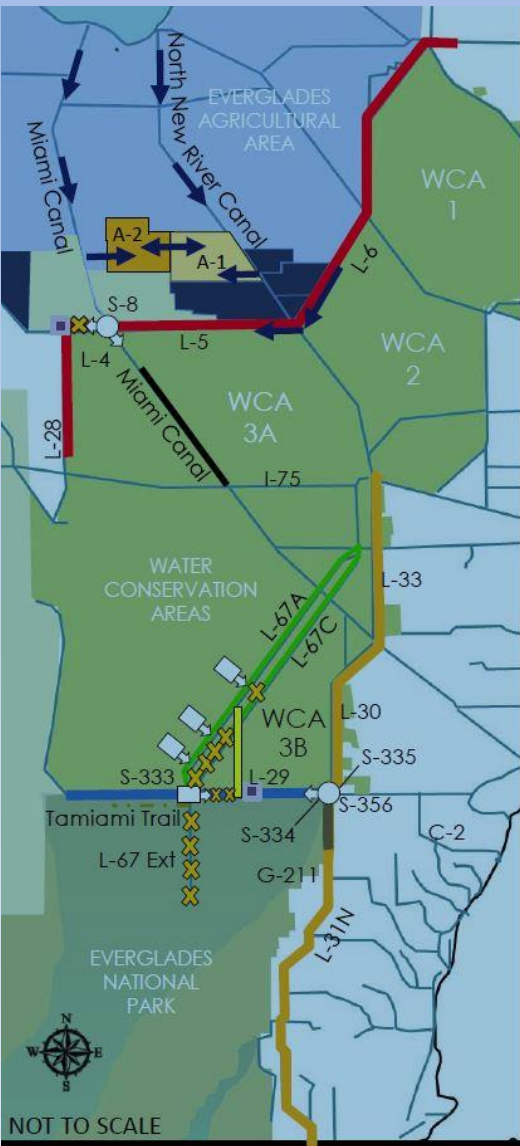
Increment 1 will maintain the 7.5 foot ngvd canal limit but remove the 6.8 foot ngvd  
Marsh gauge constraint at G3273

Increment 2 and 3 will raise the canal stage limit to 8.0 and then 8.5 feet ngvd.



# National Park Service

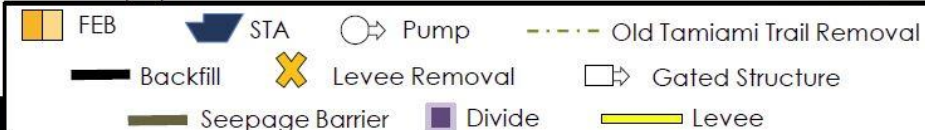
South Florida Natural Resources Center



## TENTATIVELY SELECTED PLAN

- STORAGE AND TREATMENT**
  - Construct A-2 FEB and integrate with A-1 FEB operations
  - Lake Okeechobee operation refinements within LORS
- DISTRIBUTION/CONVEYANCE**
  - Diversion of L-6 flows, Infrastructure and L-5 canal improvements
  - Remove western ~2.9 miles of L-4 levee (west of S-8 3,000 cfs capacity)
  - Divide structure at western terminus of L-4 levee removal
  - Backfill Miami Canal and Spoil Mound Removal ~1.5 miles south of S-8 to I-75
- DISTRIBUTION/CONVEYANCE**
  - Increase S-333 capacity to 2,500 cfs
  - Two 500 cfs gated structures in L-67A, 0.5 mile spoil removal west of L-67A canal north and south of structures
  - Construct ~8.5 mile levee in WCA 3B, connecting L-67A to L-29
  - Remove ~8 miles of L-67C levee in Blue Shanty flowway (no canal back fill)
  - One 500 cfs gated structure north of Blue Shanty levee and 6,000-ft gap in L-67C levee
  - Remove ~4.3 miles of L-29 levee in Blue Shanty flowway, divide structure east of Blue Shanty levee at terminus of western bridge
  - Tamiami Trail western 2.6 mile bridge and L-29 canal max stage at 9.7 ft (FUTURE WORK BY OTHERS)
  - Remove entire 5.5 miles L-67 Extension levee, backfill L-67 Extension canal
  - Remove ~6 mile Old Tamiami Trail road (from L-67 Ext to Tram Rd)
- SEEPAGE MANAGEMENT**
  - Increase S-356 pump station to ~1,000 cfs
  - Partial depth seepage barrier south of Tamiami Trail (along L-31N)
  - G-211 operational refinements; use coastal canals to convey seepage

Note: System wide operational changes and adaptive management considerations will be include in project



Long Term  
(20-25 Years)

Central Everglades  
Plan

# National Park Service

South Florida Natural Resources Center



Thank you.



511