A G E N D A

FISHEATING CREEK SUB-WATERSHED FEASIBILITY STUDY

WORKING TEAM MEETING

Archbold Biological Station Auditorium
123 Main Drive, Venus, FL 33960 (863) 465-2571

Thursday, July 30, 2009
10:00 a.m. to 3:00 p.m.

AM

1. Opening Remarks and Introductions
2. TMDL Update
3. Validation of FS Planning Targets
    a. Watershed Assessment Model Simulations
        i. Model Calibration
        ii. Existing Conditions Simulation
        iii. Pre-drainage Conditions Simulation
    b. Storage Target
    c. Water Quality Improvement Target

PM (working lunch)

4. Evaluation Criteria
    a. Introduction
    b. Group Discussion
5. Management Measures
    a. Introduction
    b. Groups Exercise
6. Next steps and Next Meeting
7. Action Items

Note: Lunch will be provided at a cost of $7.00 per person

Directions:

From the North: Take Hwy. 27 south to S.R. 70. Turn right onto S.R. 70 and go west 1 mile. Turn left onto Old S.R. 8 and go south 1.8 miles. Turn right into Archbold entrance. Follow Main Drive into parking lot.

From the West: Go 30 miles east from Arcadia. Immediately after railroad tracks, turn right onto Old S.R. 8. Head south 1.8 miles. Turn right into Archbold entrance. Follow Main Drive into parking lot.

From the East: Go 1 mile west from intersection of Hwy. 27 and S.R. 70. Turn left onto Old S.R. 8 and go south 1.8 miles. Turn right into Archbold entrance. Follow Main Drive into parking lot.

From the South: Take Hwy. 27 north to S.R. 70. Turn left onto S.R. 70 and go west 1 mile. Turn left onto Old S.R. 8 and go south 1.8 miles. Turn right into Archbold entrance. Follow Main Drive into parking lot.

Florida Department of
Environmental Protection

TMDL: Fisheating Creek

Jennifer C. Thera, TMDL Coordinator
Environmental Assessment and Restoration
Florida Dept of Environmental Protection,
South District Office

Watershed Management Approach

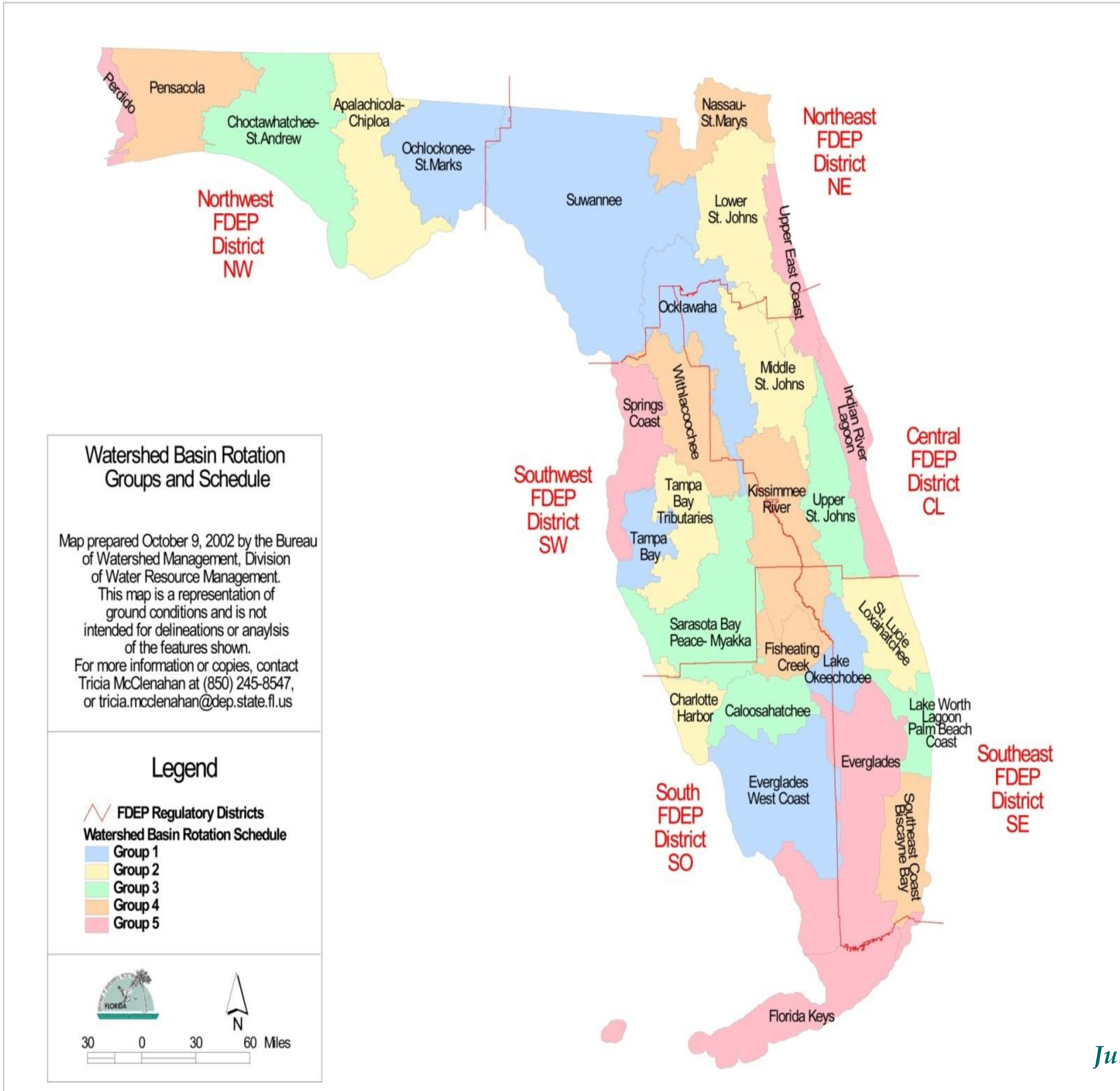
Phase 1
Preliminary Basin Evaluation

Phase 2
Targeted Monitoring

Phase 3
TMDL Development

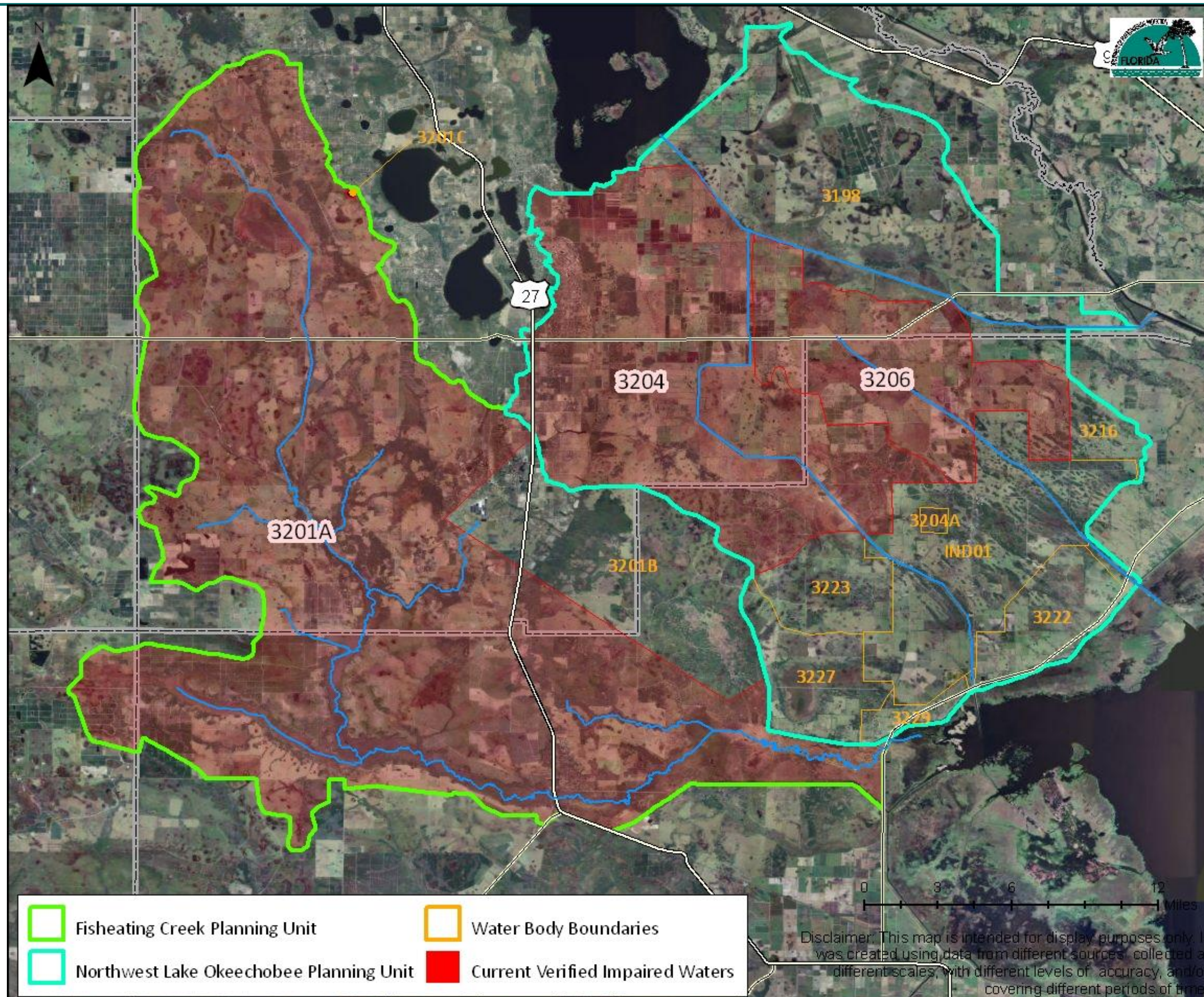
Phase 4
BMAP Development

Phase 5
TMDL Implementation



Perdido
Pensacola
Choctawhatchee-St.Andrew
Apalachicola-Chiploa
Ochlockonee-St.Marks
Suwannee
Nassau-St.Marys
Northeast FDEP District NE
Lower St. Johns
Upper East Coast
Northwest FDEP District NW
Ocklawaha
Withlacoochee
Springs Coast
Middle St. Johns
Indian River Lagoon
Central FDEP District CL
Southwest FDEP District SW
Tampa Bay Tributaries
Kissimmee River
Upper St. Johns
Tampa Bay
St. Lucie Loxahatchee
Sarasota Bay Peace- Myakka
Fisheating Creek
Lake Okeechobee
Charlotte Harbor
Caloosahatchee
Lake Worth Lagoon Palm Beach Coast
Southeast FDEP District SE
Everglades
South FDEP District SO
Everglades West Coast
Southeast Coast Biscayne Bay
Florida Keys
Watershed Basin Rotation Groups and Schedule
Map prepared October 9, 2002 by the Bureau of Watershed Management, Division of Water Resource Management. This map is a representation of ground conditions and is not intended for delineations or anaylsis of the features shown. For more information or copies, contact Tricia McClenahan at (850) 245-8547, or tricia.mcclenahan@dep.state.fl.us
Legend
FDEP Regulatory Districts
Watershed Basin Rotation Schedule
Group 1
Group 2
Group 3
Group 4
Group 5
N
30 0 30 60 Miles

Fisheating Creek Basin

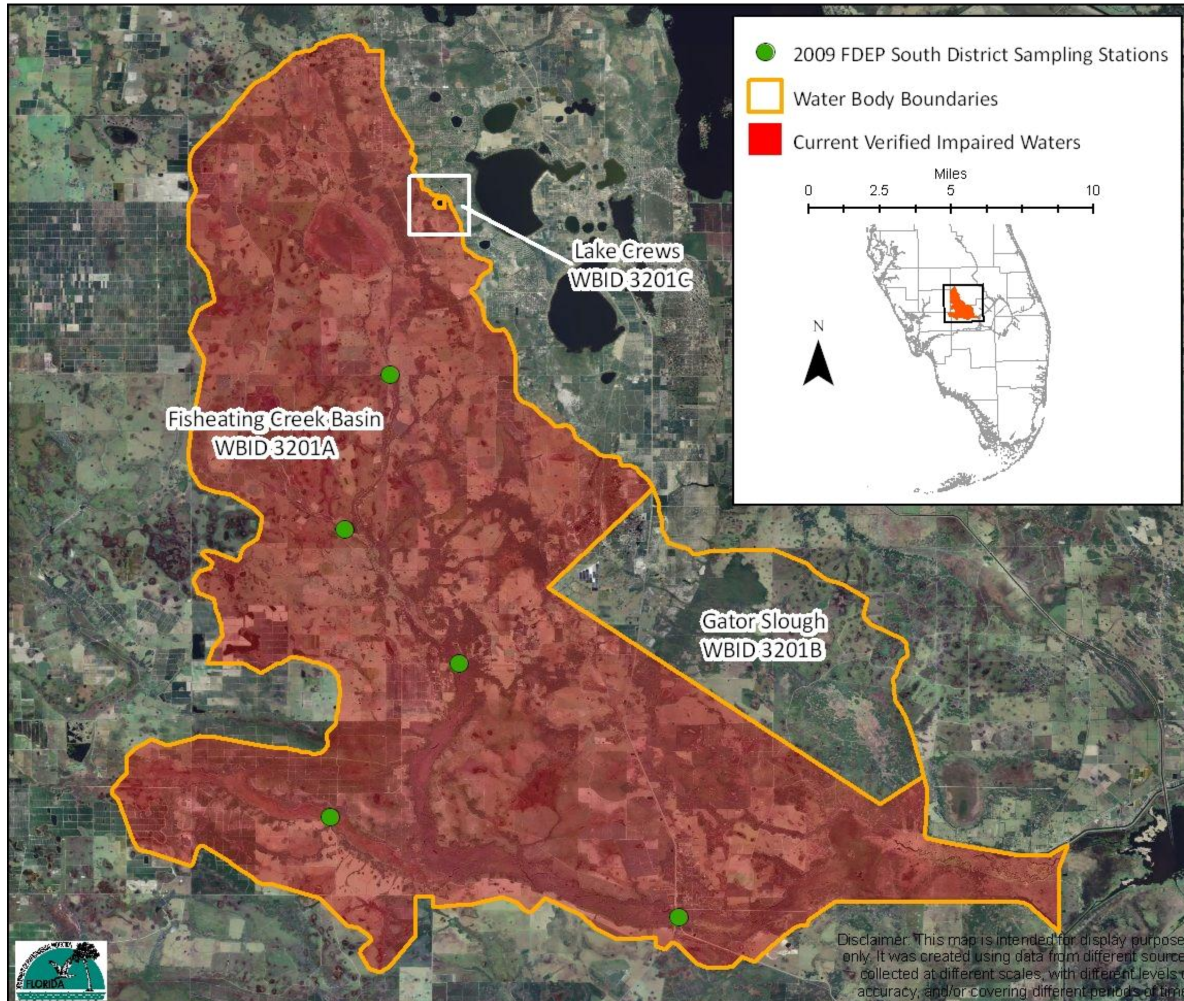


Fisheating Creek Planning Unit

Cycle 1:
Verified Impairments
Adopted 5/3/06

- Dissolved Oxygen
- Iron
- Nutrients (Chla)
- Nutrients (Historic Chla)

(Harney Pond (3204) and Indian Prairie Canal (3206) are impaired for Dissolved Oxygen and Nutrients)



Group 4 TMDL Schedule

- **1998** Impaired waters list released to EPA. No WBIDs in the Fisheating Creek Planning Unit were identified as impaired.
- **2006** Impaired waters list adopted by DEP. Impairments identified in the Fisheating Creek water body (**WBID 3201A**) for
  - **Dissolved Oxygen**: DO was observed < 5 mg/L. Nutrients were identified as a causative pollutant based on Chl a data.
  - **Iron**: Iron was observed at concentrations > 1.0 mg/L.
  - **Nutrients (Chla):** Annual average Chl a values exceeded 20 ug/L in 1999, 2000, and 2001.
  - **Nutrients (Historic Chla):** Annual average Chl a (ug/L) values exceeded the historical minimum value by more than 50%.
- **2009** DEP will conduct targeted monitoring where potential impairment were identified.
- **2010**: Expected draft verified list to be released in fall
- **2011**: Expected adoption of the 2011 final verified list
- **2011**: Expected development and adoption of TMDLs for **selected** impaired water bodies

Lake Okeechobee Total Phosphorus TMDL

- Lake Okeechobee TMDL is based on a five-year rolling average of **140 metric tons per year** (mt/yr) which includes atmospheric deposition of 35 mt/yr.
- This load was set to achieve an in-lake target phosphorus concentration of **40 parts per billion** in the pelagic zone of the lake.
- The original TMDL stated that implementation would follow a phased approach consistent with the Lake Okeechobee Protection Program now known as the Northern Everglades and Estuaries Protection Program (NEEPP).

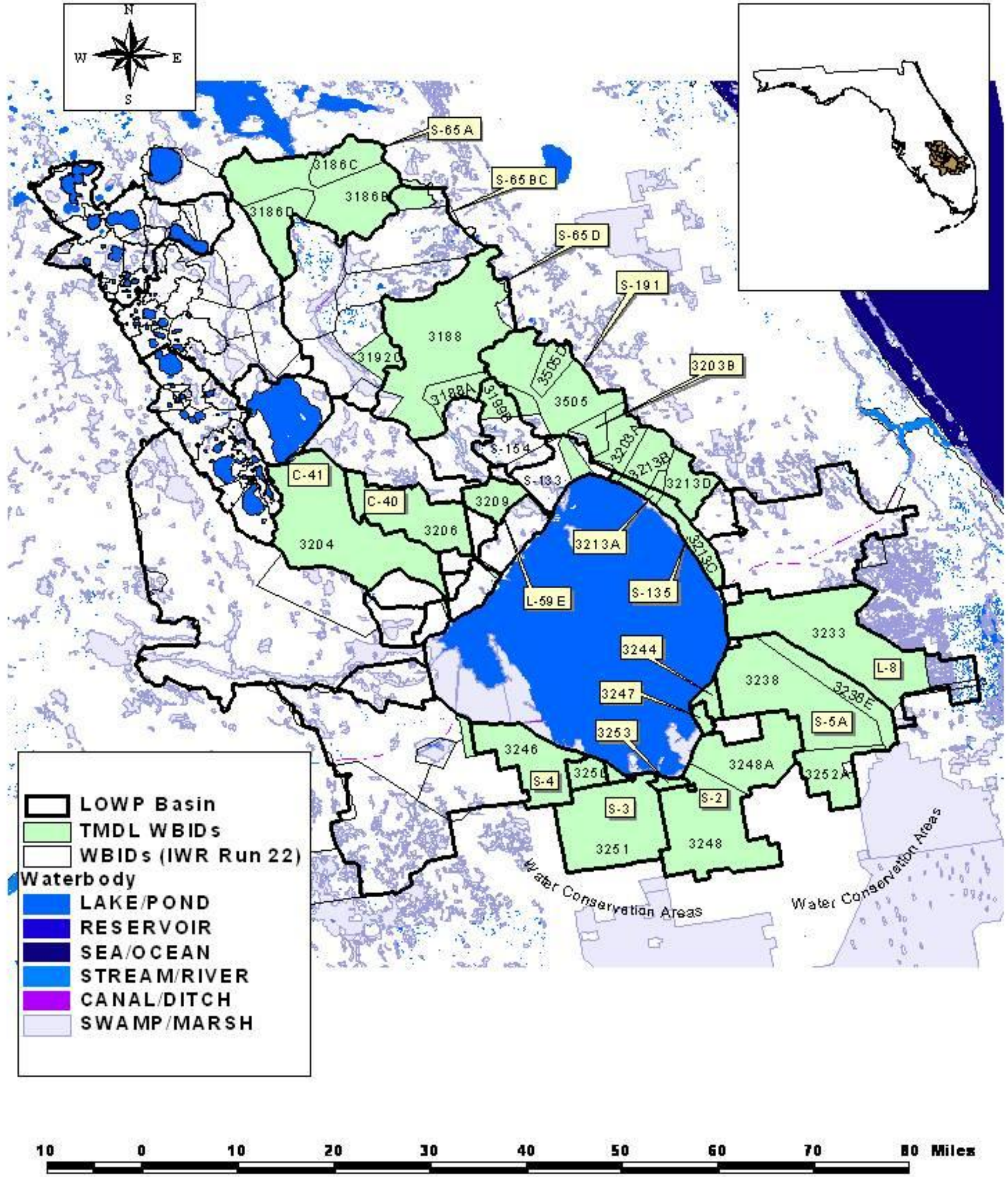
USEPA's Lake Okeechobee Tributary TMDLs

Released June 2008

The green WBIDs are where the USEPA has set tributary TMDLs and set load targets for TP and TN for Lake Okeechobee.

No WBIDs in the Fisheating Creek Planning Unit were identified as impaired, therefore not listed in the consent decree.

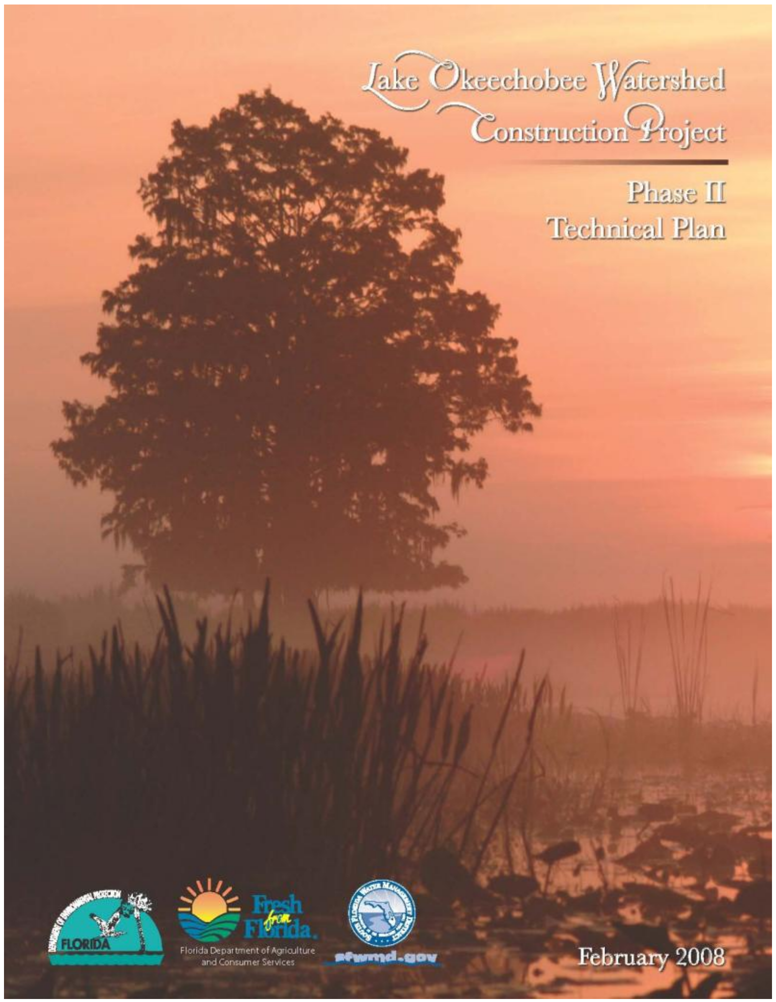
Therefore not in the USEPA Lake Okeechobee Tributary TMDL.



FDEP Lake Okeechobee Tributary TMDLs

- FDEP is working with USEPA to develop target concentrations for TP and TN for the 9 Northeastern Lake Okeechobee Tributaries, Fisheating Creek, and Kissimmee as one large watershed based group.
- FDEP will develop a TP and TN target concentration for Fisheating Creek as either
  - part of the entire Northern Lake Okeechobee Tributary watershed TMDL or
  - as individual TMDLs during the Group 4 basin cycle

Lake O Phase II Technical Plan



- Is the major NEEPP component for TMDL implementation
- Fisheating Creek's current average annual TP load calculated as **55 metric tons/year** (mt/yr)
- When the preferred plan is in place, the estimated TP load reduction is **33 mt/yr**

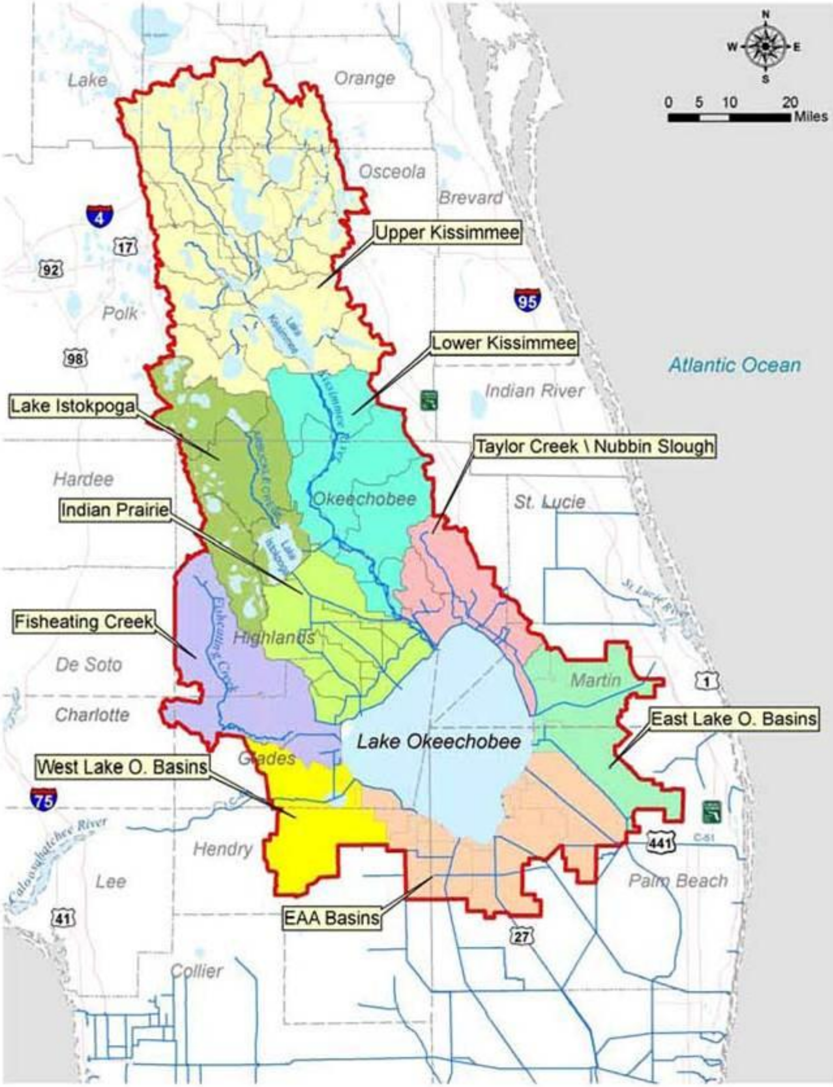


Figure 2-1. Phase II Technical Plan Boundary and Sub-Watersheds.

Lake O Phase II Technical Plan, cont.

The **Fisheating Creek** sub watershed (as well as Indian Prairie, Taylor Creek/Nubbin Slough) was found to **contribute disproportionately high phosphorus loads** to Lake Okeechobee relative to their flow contributions.

"Therefore, these sub-watersheds were targeted **for additional water quality measures**."

Summary

- FDEP currently has the Fisheating Creek WBID listed as impaired for nutrients in their Rotating Basin process with a current TMDL target of 2011
- Fisheating Creek was not part of the USEPA's Lake O Tributaries TMDL (Final released June 2008)
- Fisheating Creek is part of a large watershed based FDEP TMDL for Lake O and part of the overall Lake O Phase II Technical Plan

Fisheating Creek Feasibility Study

Working Group Meeting

July 30, 2009

Outline

- Tributary TMDLS
- FS Targets
  - WAM Simulations
  - Storage Target
  - Water Quality Target
- Evaluation Criteria
- Management Measures
- Next Steps

Validation of Feasibility Study Targets

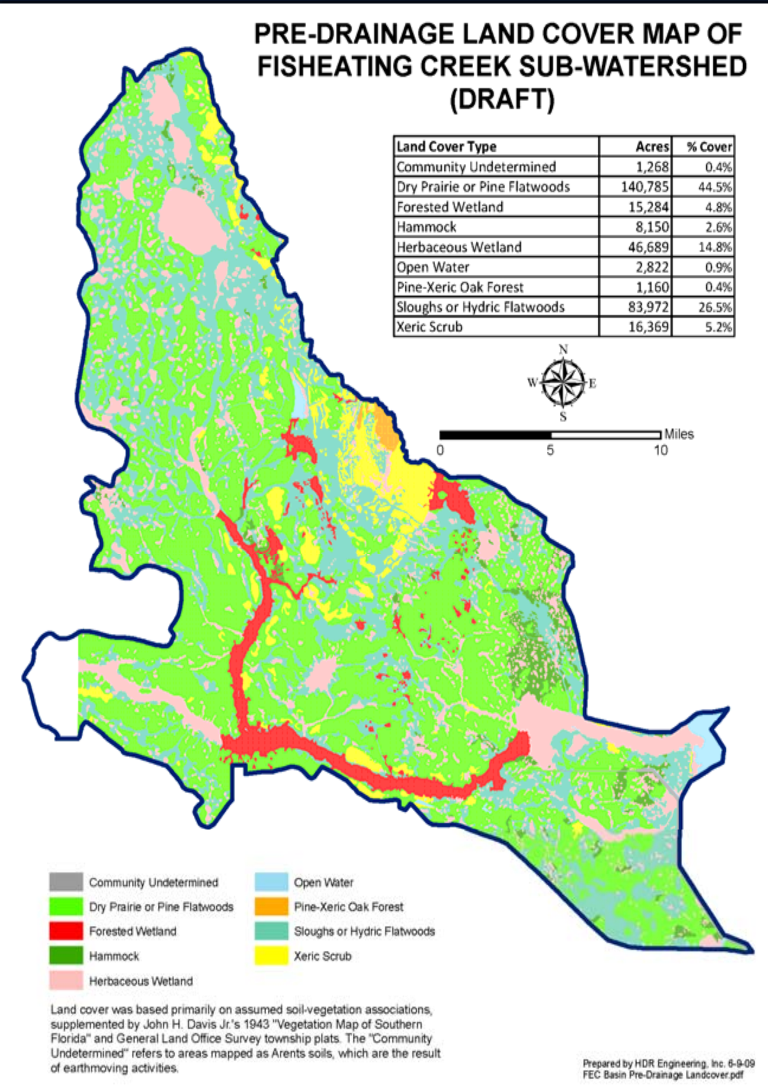
P2TP Recommended Targets

- 200,000 ac-ft storage capacity; 33 mt/yr P-load reduction
- Based on two very conceptual features
  - FEC RASTA - 41,580 ac-ft of storage
  - Nicodemus Slough RASTA - 158,400 ac-ft of storage. Store Lake O waters
- Need to be independently validated

Storage Target

- Why store water in FEC Sub-watershed?
  - restore natural flow patterns in FEC, and
  - contribute to improved stage management in Lake Okeechobee
- Complementary but distinct objectives with separate solutions and therefore discrete targets
- Storage Objective 1 – Restore FEC hydrology
- Storage Objective 2 – Contribute towards Lake O Stage Management

Restoring FEC Hydrology

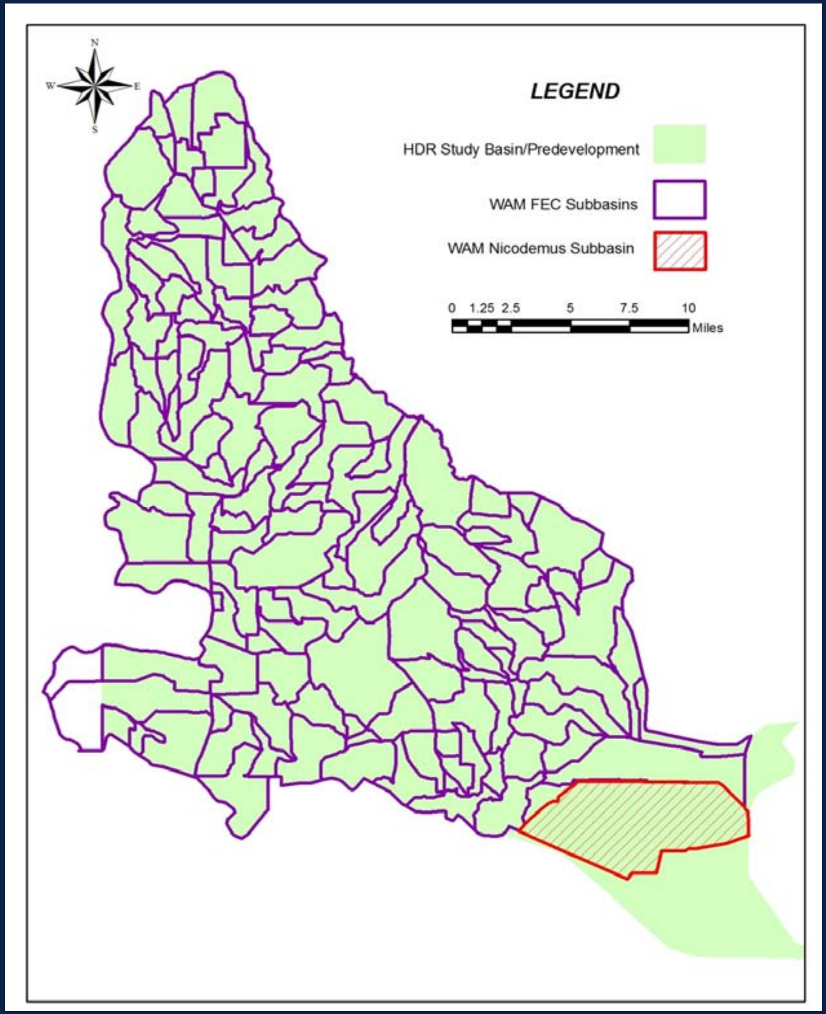


Land Cover Type	Acres	% Cover
Community Undetermined	1,268	0.4%
Dry Prairie or Pine Flatwoods	140,785	44.5%
Forested Wetland	15,284	4.8%
Hammock	8,150	2.6%
Herbaceous Wetland	46,689	14.8%
Open Water	2,822	0.9%
Pine-Xeric Oak Forest	1,160	0.4%
Sloughs or Hydric Flatwoods	83,972	26.5%
Xeric Scrub	16,369	5.2%

- How much storage is needed?
- Proposed approach
  - Compare existing and pre-drainage (pre-1950s) flow patterns
  - Estimate differences in daily flows at representative locations
  - Target based on storage needed to restore pre-drainage flow patterns
- Existing conditions simulation based on 2006 land use data
- Pre-drainage simulation based on pre-1950's vegetation cover
  - Derived from historical soil types and Davis map

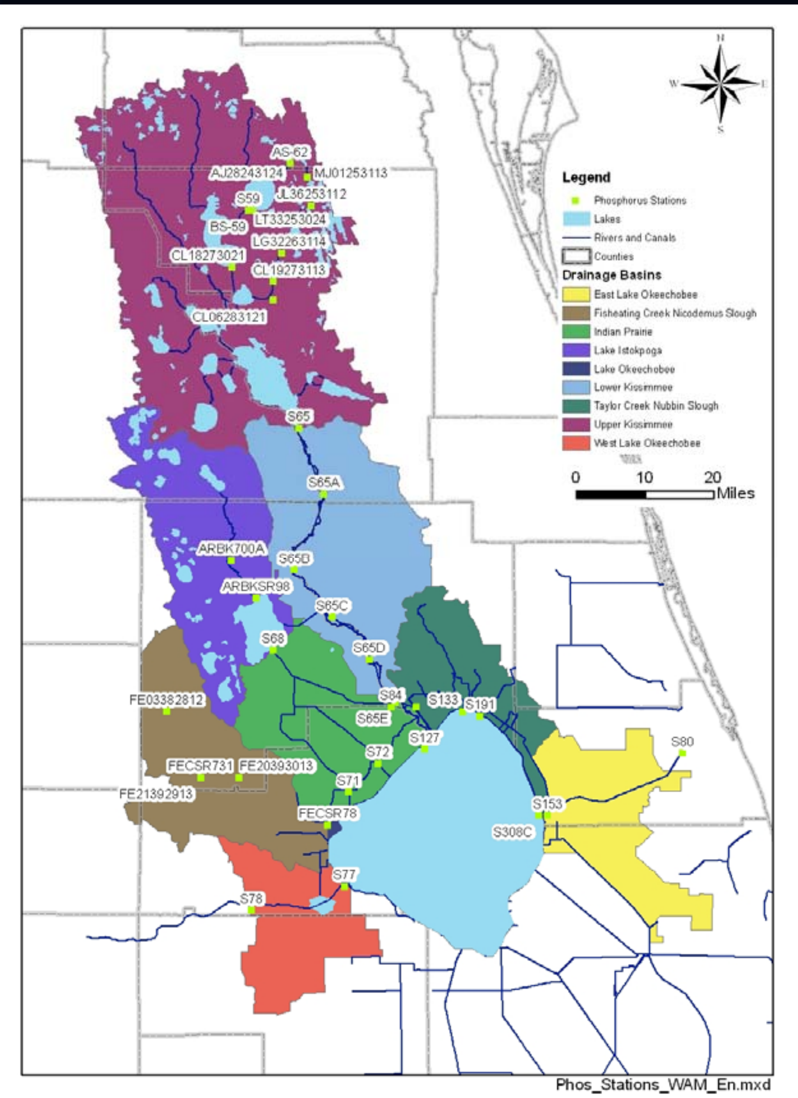
WAM Simulations

Model Setup



- Base Run - Existing Conditions
  - 2006 Land Use
- Pre-drainage Run – Native Conditions
  - Merged Existing Native Land Uses with Native Vegetation associated with Soil Types under Anthropogenic Land Uses

Model Calibration



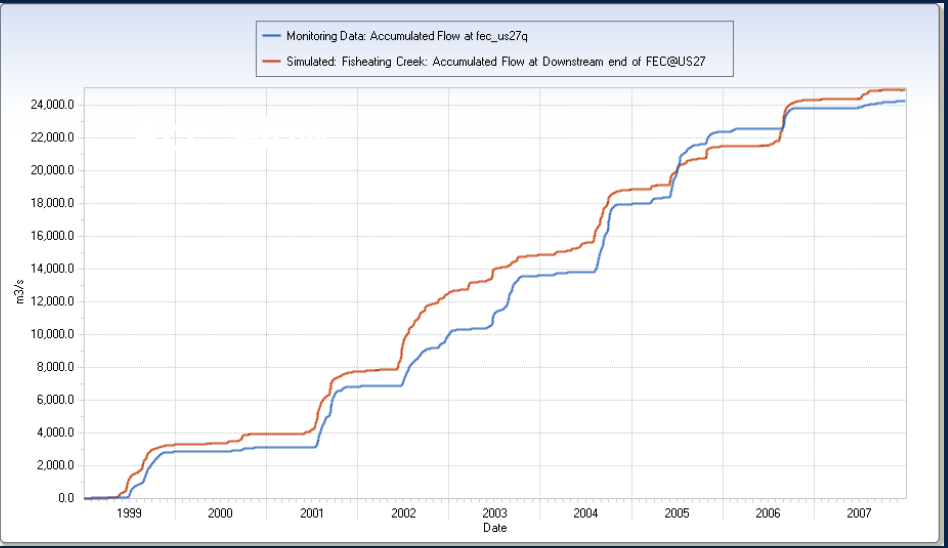
- **Completed as Task 3 of the recent**

  "WAM Enhancement and Application in the Lake Okeechobee Watershed " Project"

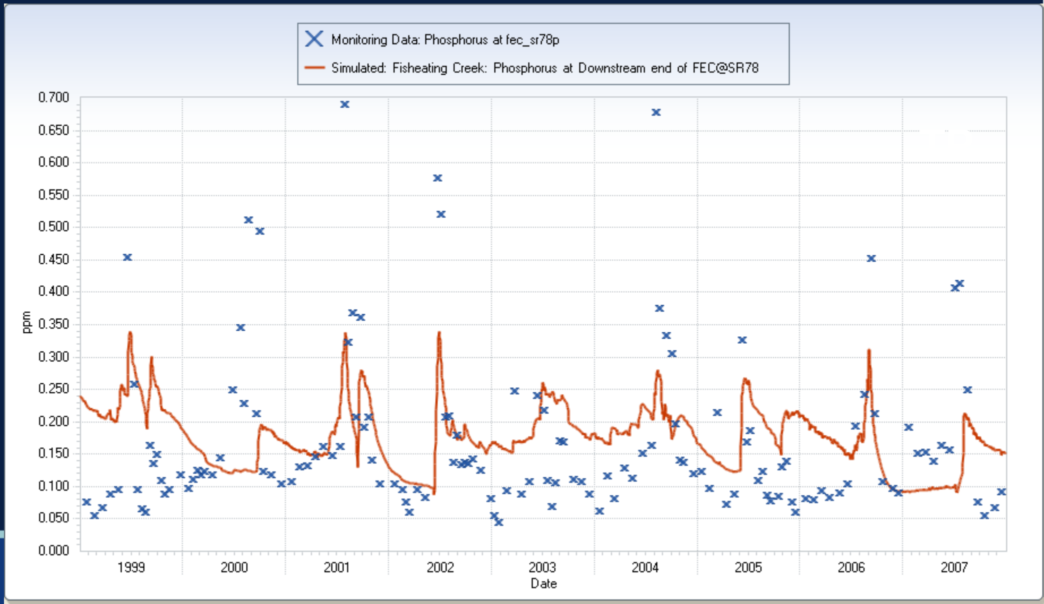
Calibration Process

- Verify Physical Characterization Data
- Run from 1995-2007 and disregarded 1995-1998 for spin up
- Flow calibration/verification
  - Rainfall verification
  - ET and Irrigation verification
  - Deep Groundwater and Dike Seepage
- TP calibration/verification
  - Adjust land use characteristics
  - Adjust P assimilation Coefficients

Calibration Results

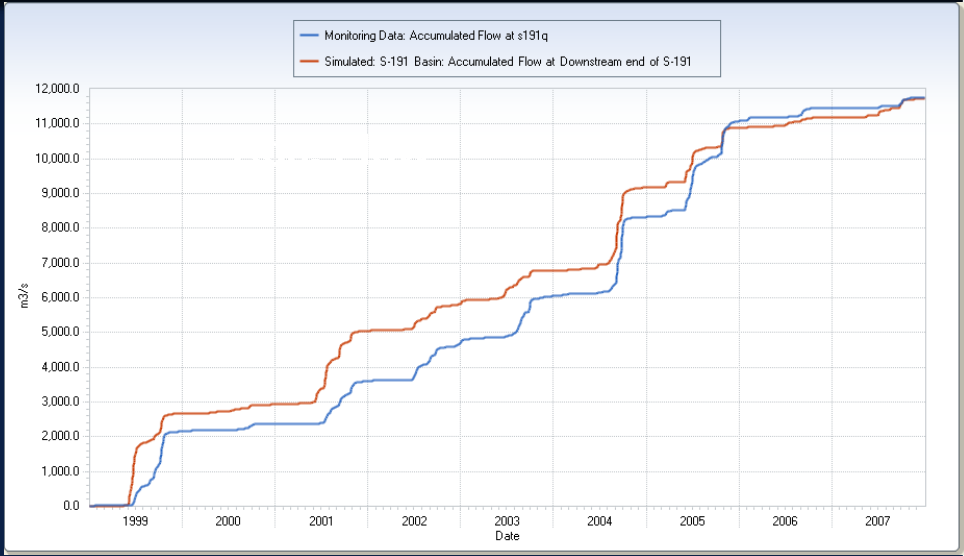


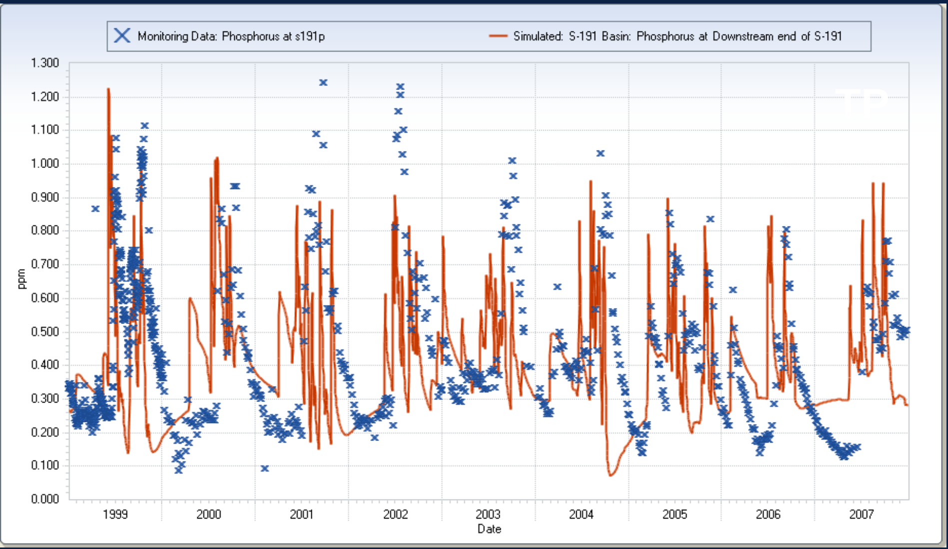
Fisheating Creek



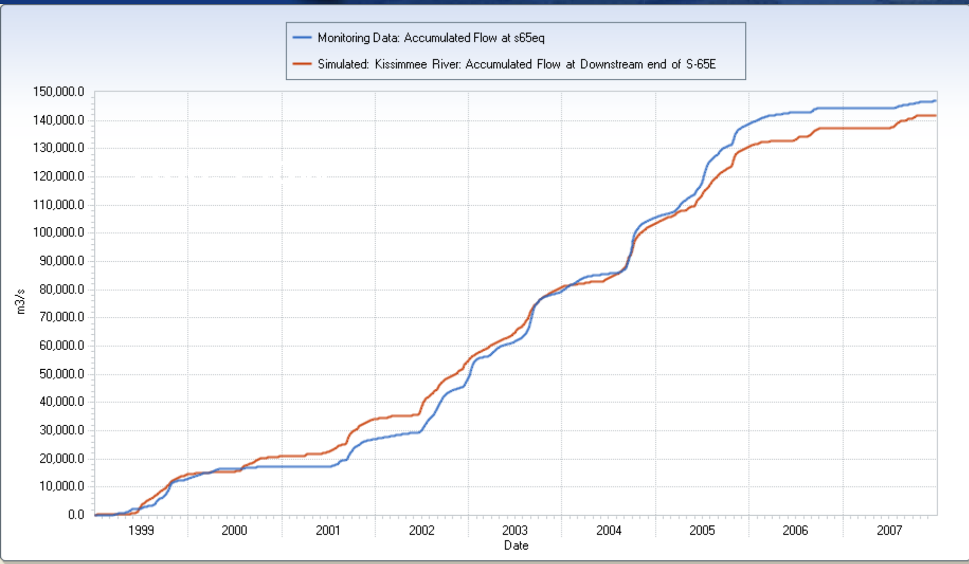
Example Calibration

S-191 Basin

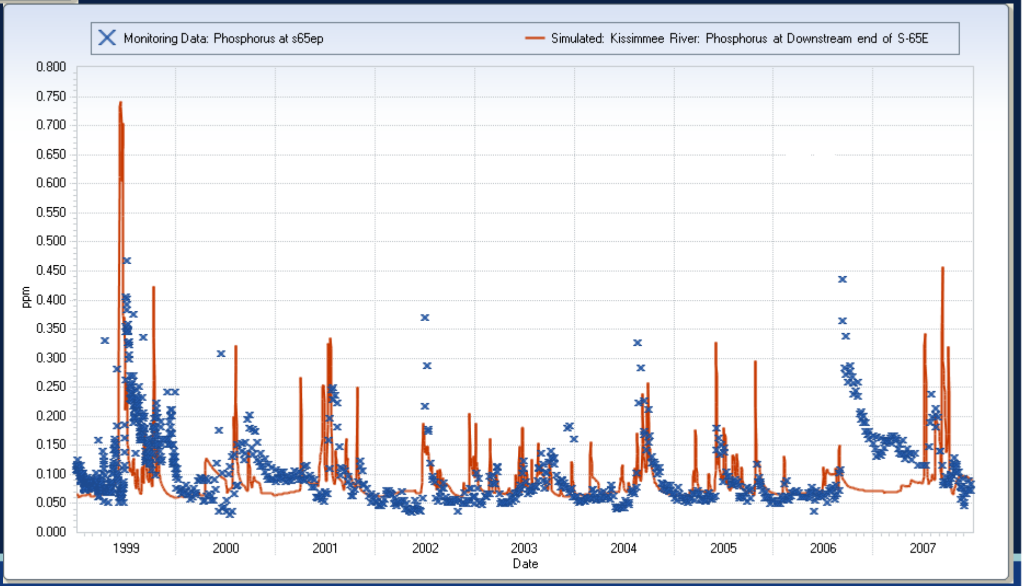




Example Calibration



Kissimmee River @ S65E



Summary of Flows and TP

Basin	Structure	WAM Reach	Annual Average Flow (m3x106)			Annual Average TP Load (mt)			Years
			Measured	Simulated	% Diff	Measured	Simulated	% Diff	
C-38	S-65	836	974	1021	5%	82.1	83.5	2%	99-07
	S-65A	602	1045	1108	6%	87.4	92.0	5%	99-07
	S-65C	519	1204	1227	2%	96.5	101.7	5%	99-07
	S-65D	87	1318	1343	2%	125.3	137.6	10%	99-07
	S-65E	79	1410	1362	-3%	150.8	153.1	1%	99-07
	S-68	657	346	352	2%	25.4	26.6	5%	99-07
C-43	S-78	2	1201	1195	0%	149	160	7%	99-07
C-44	S-80	5	470	542	15%	102	115	12%	99-07
L-8	L-8@C-51	3	108	98	-9%				99-07
	WPB PS2	49				2.1	3	67%	98-02
L-48	S-127	2	12	13	6%	3.0	3.0	-1%	99-07
L-49	S-129	2	14	14	-7%	1.1	1.2	10%	99-07
S-131	S-131	2	11	11	-8%	1.3	1.5	10%	99-07
S-133	S-133	2	23	22	-5%	5.6	6.1	8%	99-07
S-135	S-135	2	22	22	1%	2.8	3.1	10%	99-07
S-191	S-191	2	116	116	0%	72.7	75.3	4%	99-07
FEC	US-27	60	233	239	3%				99-07
	SR-78	4				57.8	52.3	-10%	99-07

Development of Pre-drainage Conditions

- Developed relationship between soils and pre-drainage land cover / vegetative type.
- Converted to land use spatial map from soil map.
- Extracted all existing mapped native vegetation areas and burned into above land use map.

Relationship Between Vegetation Type, Soils, and Associated WAM Codes

Soil COMPNAME	Associated Vegetation Type	FLUCCS	WAM LUCODE	WAM SoilCODE
ANCLOTE	Forested Wetland	6220	15	7
ARCHBOLD	Xeric Scrub	3200	5	16
ARENTS	Community Undetermined	4110	5	18
ASTATULA	Pine-Xeric Oak Forest	4340	7	21
ASTOR	Herbaceous Wetland	6410	16	22
BASINGER	Sloughs or Hydric Flatwoods	6172	12	26
BOCA	Dry Prairie or Pine Flatwoods	4110	5	42
BRADENTON	Hammock	4250	8	50
BRIGHTON	Forested Wetland	6220	15	52
CHOBEE	Herbaceous Wetland	6410	16	76
DAYTONA	Xeric Scrub	3200	5	93
DUETTE	Xeric Scrub	3200	5	102
EAUGALLIE	Dry Prairie or Pine Flatwoods	4110	5	108
FELDA	Sloughs or Hydric Flatwoods	6172	12	129
FLORIDANA	Herbaceous Wetland	6410	16	134
FT. DRUM	Dry Prairie or Pine Flatwoods	4110	5	140
GATOR	Herbaceous Wetland	6410	16	145
HALLANDAL	Hammock	4250	8	155
HICORIA	Herbaceous Wetland	6410	16	161
HONTOON	Forested Wetland	6220	15	166
IMMOKALEE	Dry Prairie or Pine Flatwoods	4110	5	171
KALIGA	Herbaceous Wetland	6410	16	183
LAUDERHIL	Herbaceous Wetland	6410	16	202
MALABAR	Herbaceous Wetland	6410	16	221

Assumptions for WAM Runs

- SFWMD 2006 land use coverage/feature class used for base condition
- Rainfall conditions from 1978 – 2008 are sufficient to represent long term variability
- Detailed in-field drainage systems are represented for base run, but not for pre-drainage
- Major drainage features are the same for both runs

Land Use Summary

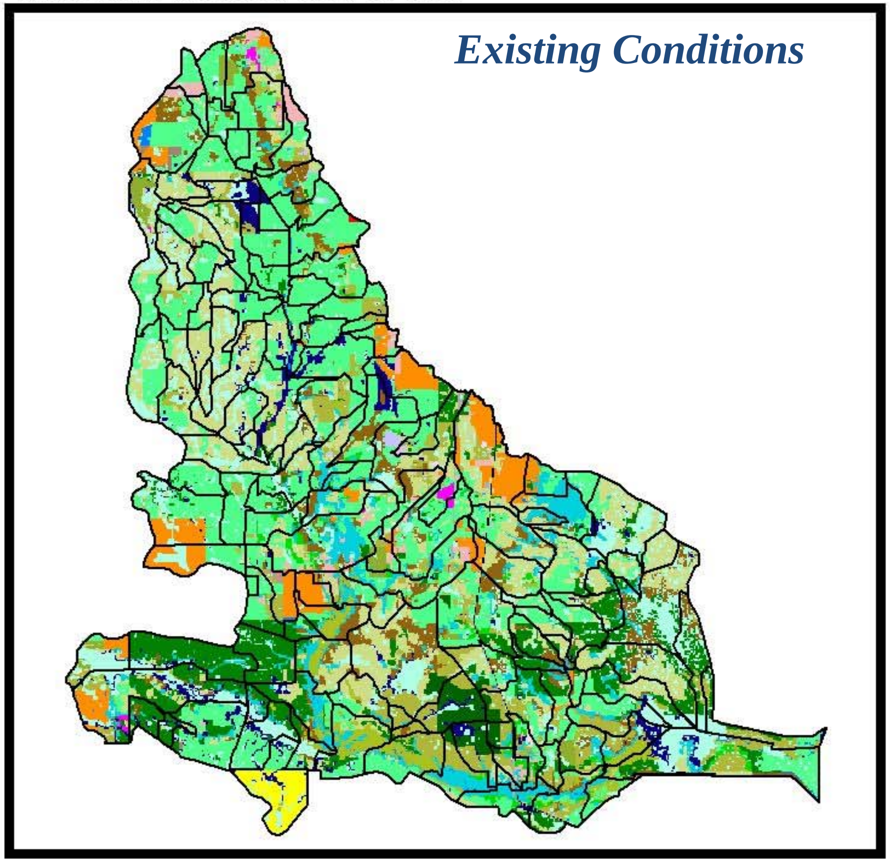
LAND_USE	Predrainage			BaseRun		
	Area (ac)	P Unit Load (lb/ac/yr)	Total P Load (lbs/yr)	Area (ac)	P Unit Load (lb/ac/yr)	Total P Load (lbs/yr)
Low Density Residential	0	0	0	3927	0.174	542
Commercial and Services	0	0	0	563	1.079	483
Rural Land in Transition	0	0	0	62	0.032	2
Scrub and Brushland (Pine/Palmetto Praire)	135276	0.024	2480	46270	0.018	651
Hardwoods	5049	0.020	83	7809	0.020	123
Hardwood Conifer Mixed	0	0	0	15225	0.024	285
Coniferous Plantations	0	0	0	17983	0.063	898
Open Water	1194	0.193	182	979	0.176	137
Bay Swamps	823	0.838	548	823	0.838	548
Mixed Wetland Hardwoods	63528	0.627	31672	8424	0.757	5073
Cypress	5832	0.771	3574	5832	0.771	3574
Wetland Forested Mixed	16211	0.827	10658	16171	0.829	10648
Freshwater Marshes	55801	0.775	34383	36477	0.741	21483
Barren Land	0	0	0	161	0.564	72
Transportation Corridors	0	0	0	435	0.448	155
Medium Density Residential	0	0	0	94	0.774	58
Row Crops	0	0	0	205	3.389	552
Improved Pasture	0	0	0	78704	1.721	107719
Unimproved Pasture	0	0	0	18714	0.692	10295
Woodland Pasture	0	0	0	2822	0.774	1736
Groves and Orchards	0	0	0	5	0.037	0
Tree Nurseries	0	0	0	3474	10.870	30019
Sod Farms	0	0	0	2451	3.305	6441
Ornamental Nurseries	0	0	0	568	0.544	246
Horse Farms	0	0	0	17	0.488	7
Dairies	0	0	0	22	0.562	10
Aquaculture	0	0	0	54	2.209	95
Field Crops	0	0	0	259	1.436	296
Sugar Cane	0	0	0	2271	0.612	1103
Undeveloped Urban Land	0	0	0	2	0.185	0
Ranchettes	0	0	0	133	0.123	13
Citrus Groves	0	0	0	12776	1.137	11545
TOTAL	**283713**		**83579**	**283713**		**214812**

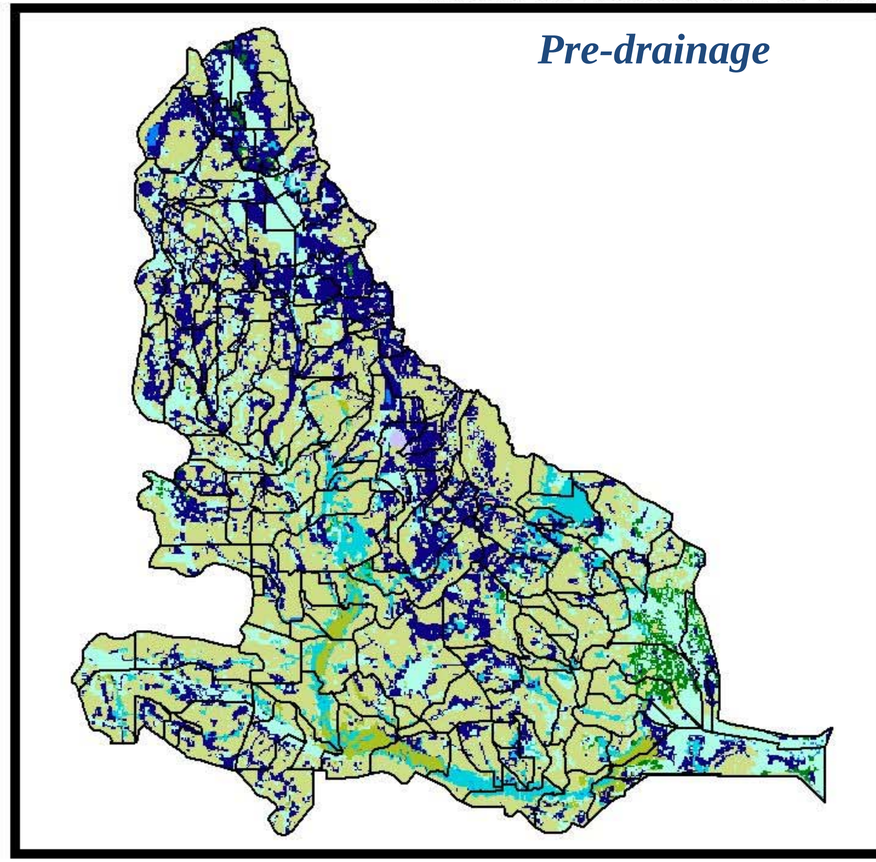
Lake Okeechobee Protection Plan Watershed Assessment Model

Fisheating Creek Basin

EXISTING LAND USE SCENARIO

MODIFIED LAND USE SCENARIO





Land Use

- Aquaculture
- Barren Land
- Bay Swamps
- Blueberries
- Cattle Feeding Operations
- Commercial and Services
- Coniferous Plantations
- Cypress
- Dairies
- Dairy Boundary Pastures
- Field Crops
- Freshwater Marshes
- Citrus Groves
- Groves and Orchards
- Hardwood Conifer Mixed
- Hardwoods
- High Density Residential
- Horse Farms
- Improved Pasture
- Industrial
- Low Density Residential
- Managed Landscape
- Medium Density Residential
- Mining
- Mixed Wetland Hardwoods
- Multiple Dwelling Units
- Open Water
- Ornamental Nurseries
- Phosphate Mines
- Phosphate Processing
- Potatoes
- Poultry Feeding Operations
- Prisons
- Ranchettes
- Row Crops
- Rural Land in Transition
- Salt Barrens
- Scrub and Brushland
- Sewage Treatment
- Sod Farms
- Solid Waste Disposal
- Sugar Cane
- Swine Feeding Operations
- Transportation Corridors
- Tree Nurseries
- Undeveloped Urban Land
- Unimproved Pasture
- Wetland Forested Mixed
- Woodland Pasture
- User Defined Land Use

Land Use

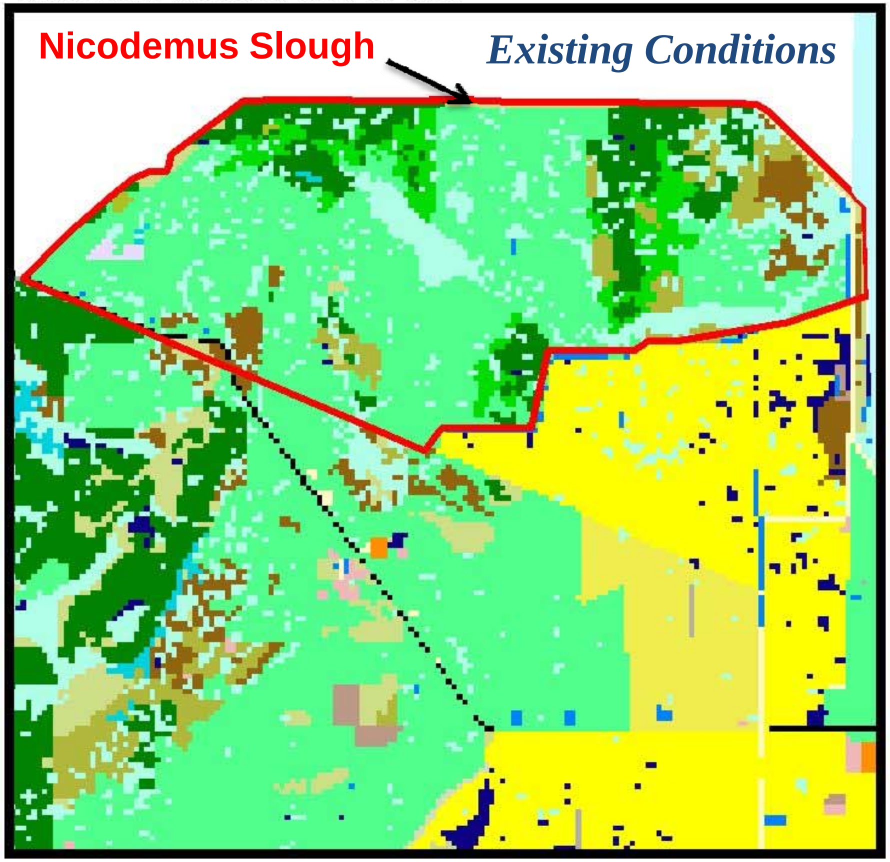
Aquaculture
Barren Land
Bay Swamps
Blueberries
Cattle Feeding Operations
Commercial and Services
Coniferous Plantations
Cypress
Dairies
Dairy Boundary Pastures
Field Crops
Freshwater Marshes
Citrus Groves
Groves and Orchards
Hardwood Conifer Mixed
Hardwoods
High Density Residential
Horse Farms
Improved Pasture
Industrial
Low Density Residential
Managed Landscape
Medium Density Residential
Mining
Mixed Wetland Hardwoods
Multiple Dwelling Units
Open Water
Ornamental Nurseries
Phosphate Mines
Phosphate Processing
Potatoes
Poultry Feeding Operations
Prisons
Ranchettes
Row Crops
Rural Land in Transition
Salt Barrens
Scrub and Brushland
Sewage Treatment
Sod Farms
Solid Waste Disposal
Sugar Cane
Swine Feeding Operations
Transportation Corridors
Tree Nurseries
Undeveloped Urban Land
Unimproved Pasture
Wetland Forested Mixed
Woodland Pasture
User Defined Land Use

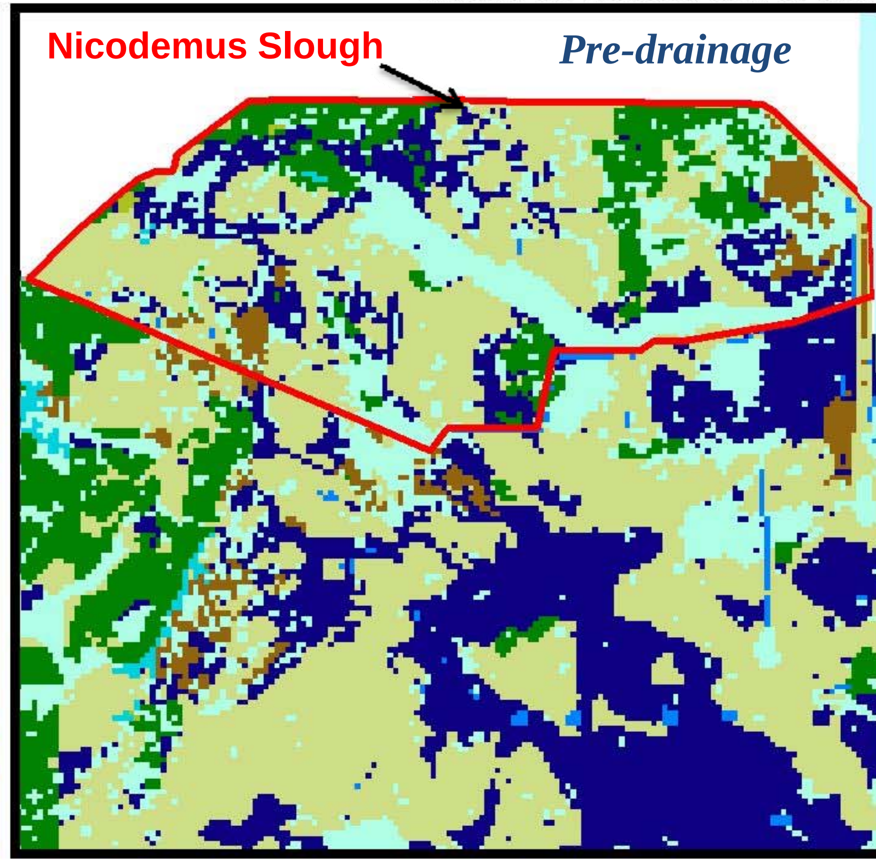
Lake Okeechobee Protection Plan Watershed Assessment Model

East Caloosahatchee Basin

EXISTING LAND USE SCENARIO

MODIFIED LAND USE SCENARIO





Land Use

Aquaculture
Barren Land
Bay Swamps
Blueberries
Cattle Feeding Operations
Commercial and Services
Coniferous Plantations
Cypress
Dairies
Dairy Boundary Pastures
Field Crops
Freshwater Marshes
Citrus Groves
Groves and Orchards
Hardwood Conifer Mixed
Hardwoods
High Density Residential
Horse Farms
Improved Pasture
Industrial
Low Density Residential
Managed Landscape
Medium Density Residential
Mining
Mixed Wetland Hardwoods
Multiple Dwelling Units
Open Water
Ornamental Nurseries
Phosphate Mines
Phosphate Processing
Potatoes
Poultry Feeding Operations
Prisons
Ranchettes
Row Crops
Rural Land in Transition
Salt Barrens
Scrub and Brushland
Sewage Treatment
Sod Farms
Solid Waste Disposal
Sugar Cane
Swine Feeding Operations
Transportation Corridors
Tree Nurseries
Undeveloped Urban Land
Unimproved Pasture
Wetland Forested Mixed
Woodland Pasture
User Defined Land Use

Land Use

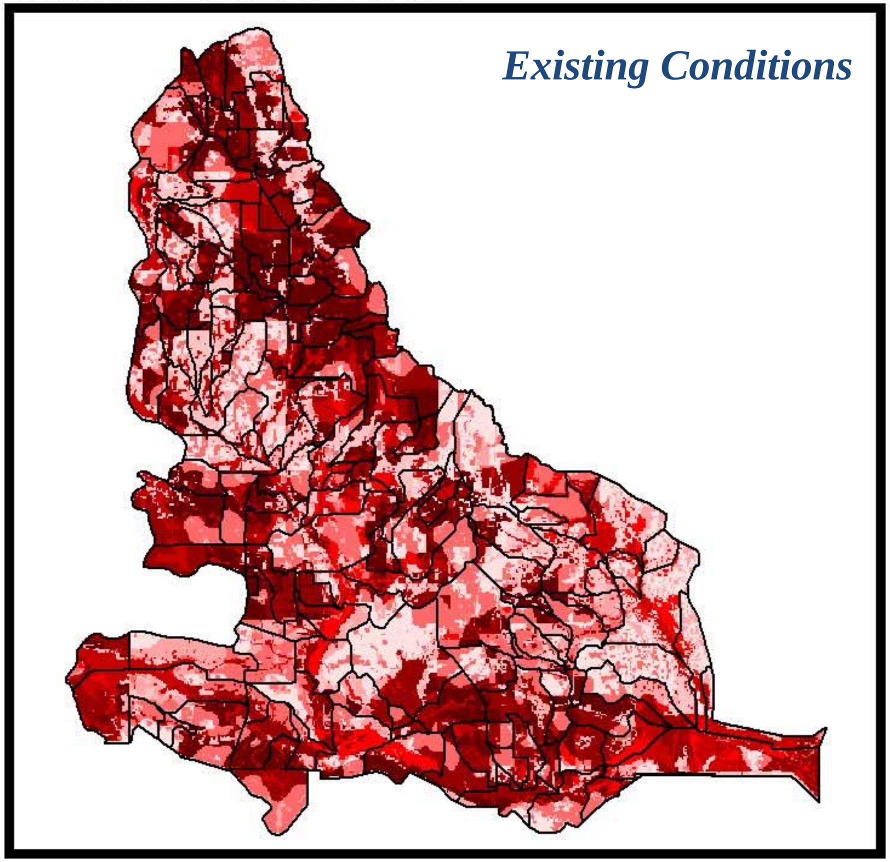
Aquaculture
Barren Land
Bay Swamps
Blueberries
Cattle Feeding Operations
Commercial and Services
Coniferous Plantations
Cypress
Dairies
Dairy Boundary Pastures
Field Crops
Freshwater Marshes
Citrus Groves
Groves and Orchards
Hardwood Conifer Mixed
Hardwoods
High Density Residential
Horse Farms
Improved Pasture
Industrial
Low Density Residential
Managed Landscape
Medium Density Residential
Mining
Mixed Wetland Hardwoods
Multiple Dwelling Units
Open Water
Ornamental Nurseries
Phosphate Mines
Phosphate Processing
Potatoes
Poultry Feeding Operations
Prisons
Ranchettes
Row Crops
Rural Land in Transition
Salt Barrens
Scrub and Brushland
Sewage Treatment
Sod Farms
Solid Waste Disposal
Sugar Cane
Swine Feeding Operations
Transportation Corridors
Tree Nurseries
Undeveloped Urban Land
Unimproved Pasture
Wetland Forested Mixed
Woodland Pasture
User Defined Land Use

Lake Okeechobee Protection Plan Watershed Assessment Model

Fisheating Creek Basin

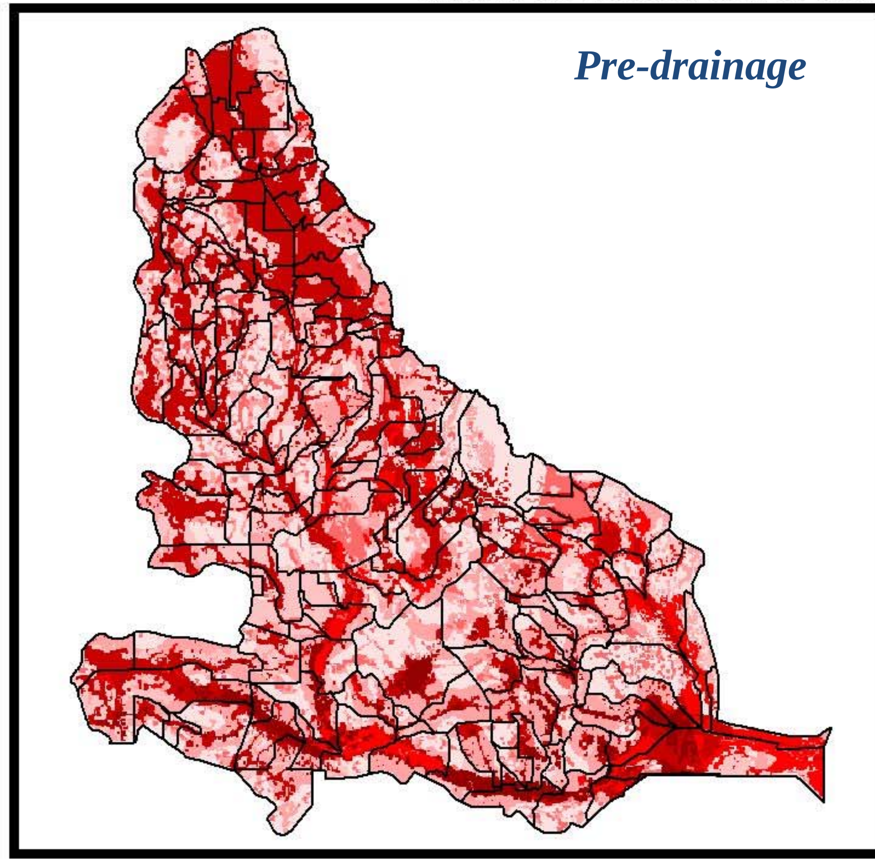
EXISTING LAND USE SCENARIO

MODIFIED LAND USE SCENARIO



Soluble P Source Load (attenuated)

- 0 - 5
- 6 - 26
- 27 - 58
- 59 - 209
- 210 - 457
- 458 - 750
- 751 - 1632
- > 1633



Soluble P Source Load (attenuated)

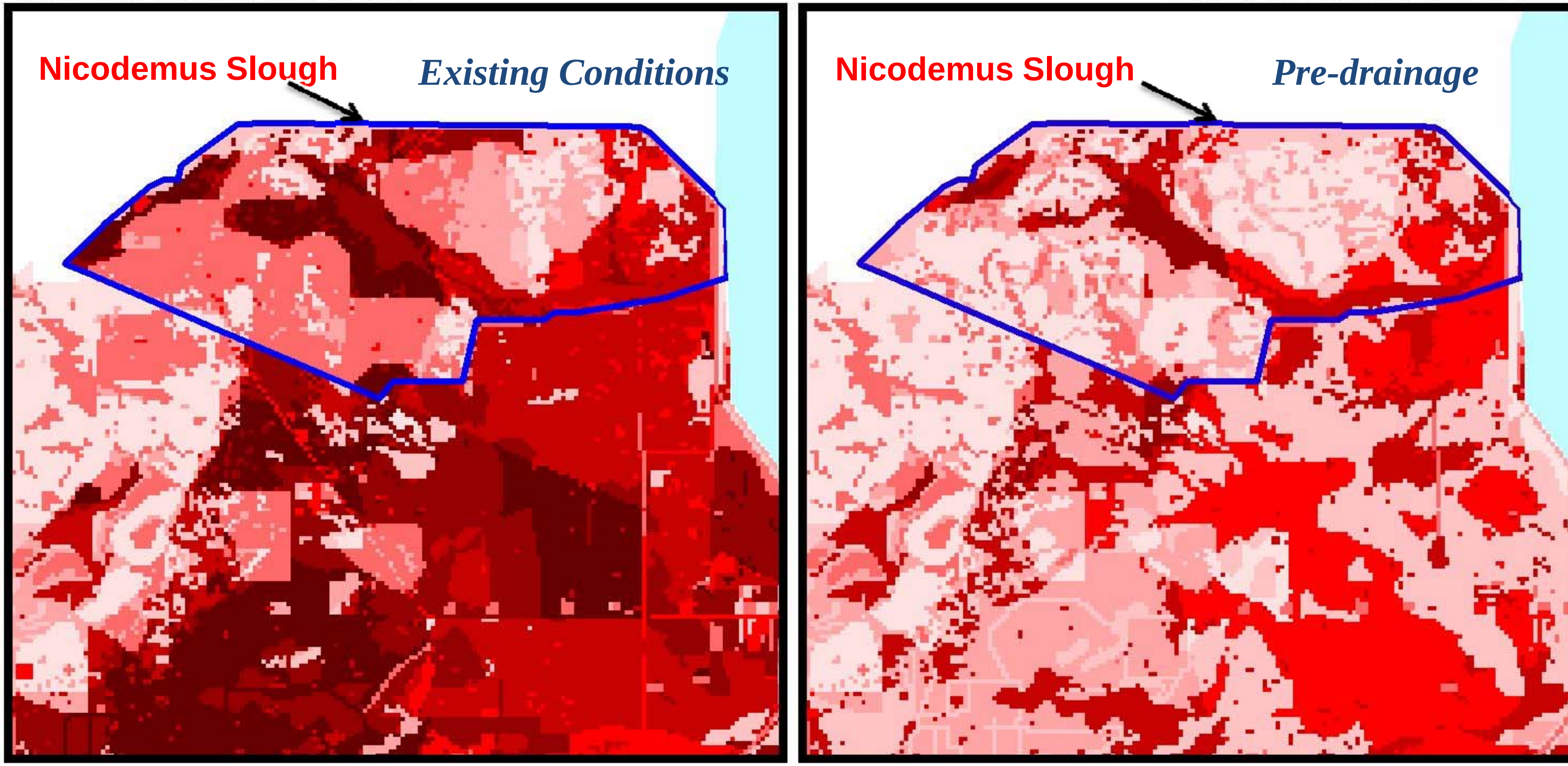
- 0 - 5
- 6 - 26
- 27 - 58
- 59 - 209
- 210 - 457
- 458 - 750
- 751 - 1632
- > 1633

Lake Okeechobee Protection Plan Watershed Assessment Model

East Caloosahatchee Basin

EXISTING LAND USE SCENARIO

MODIFIED LAND USE SCENARIO



Soluble P Source Load (attenuated)

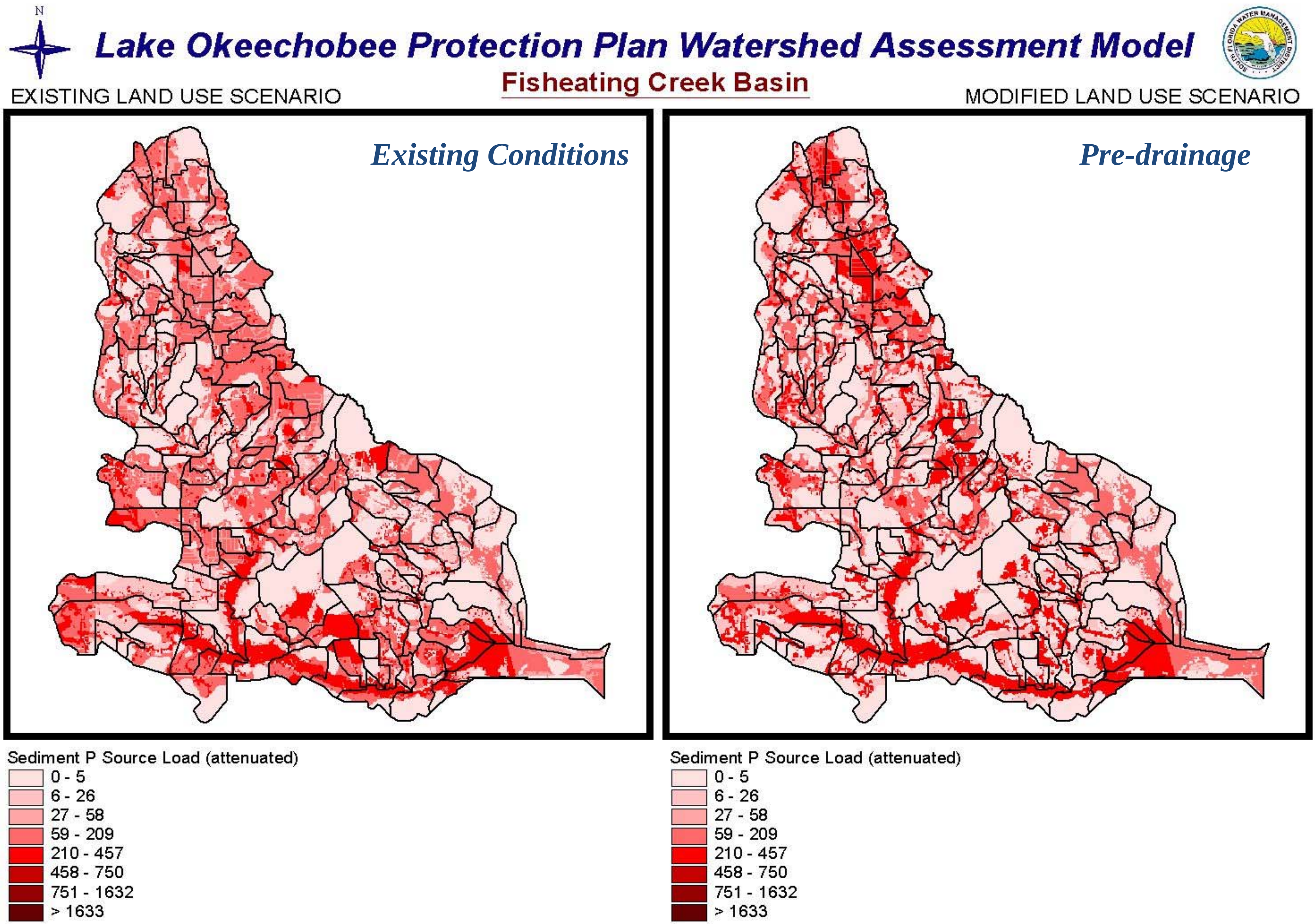
- 0 - 5
- 6 - 26
- 27 - 58
- 59 - 209
- 210 - 457
- 458 - 750
- 751 - 1632
- > 1633

Lake Okeechobee Protection Plan Watershed Assessment Model

Fisheating Creek Basin

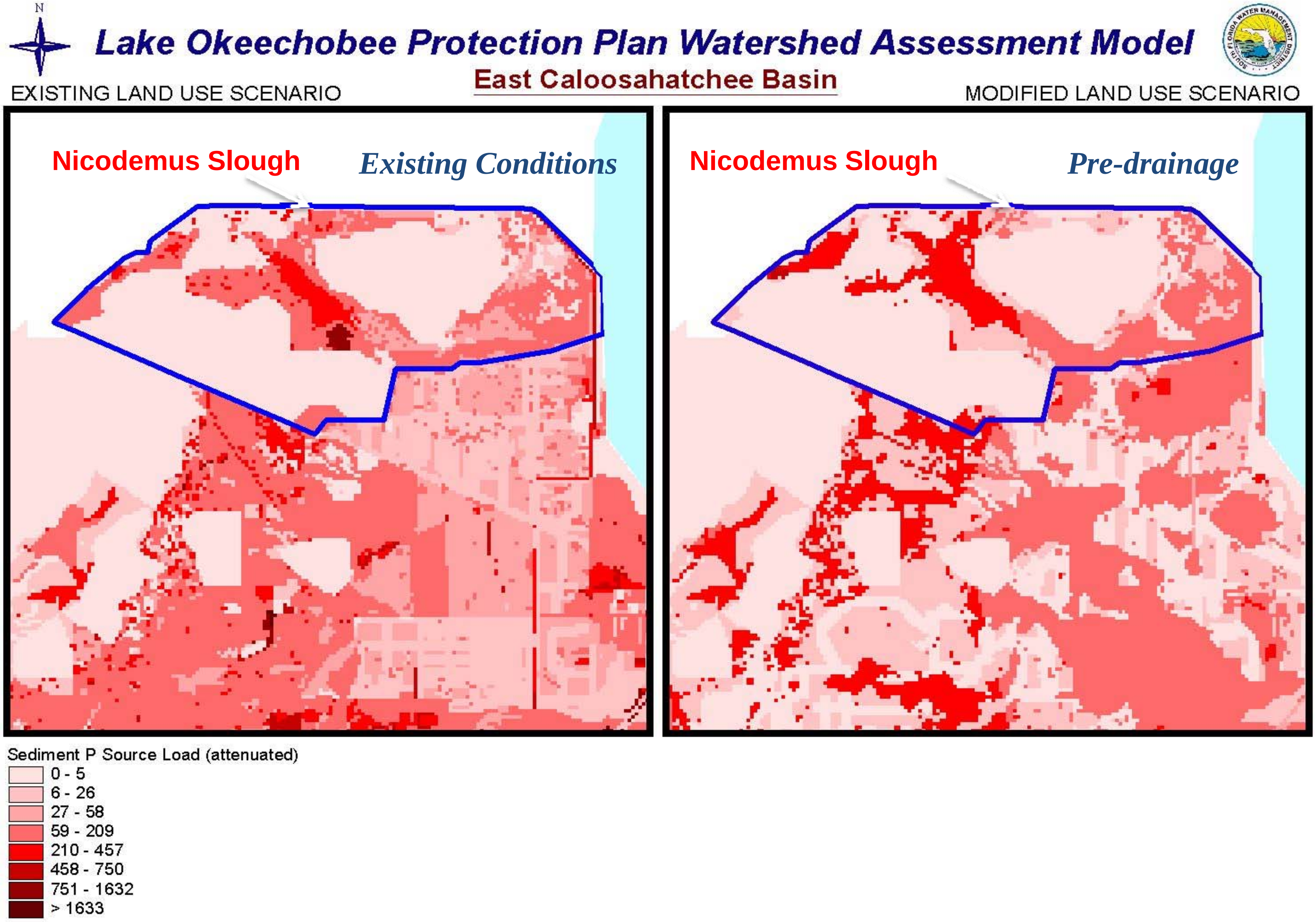
EXISTING LAND USE SCENARIO

MODIFIED LAND USE SCENARIO



Lake Okeechobee Protection Plan Watershed Assessment Model

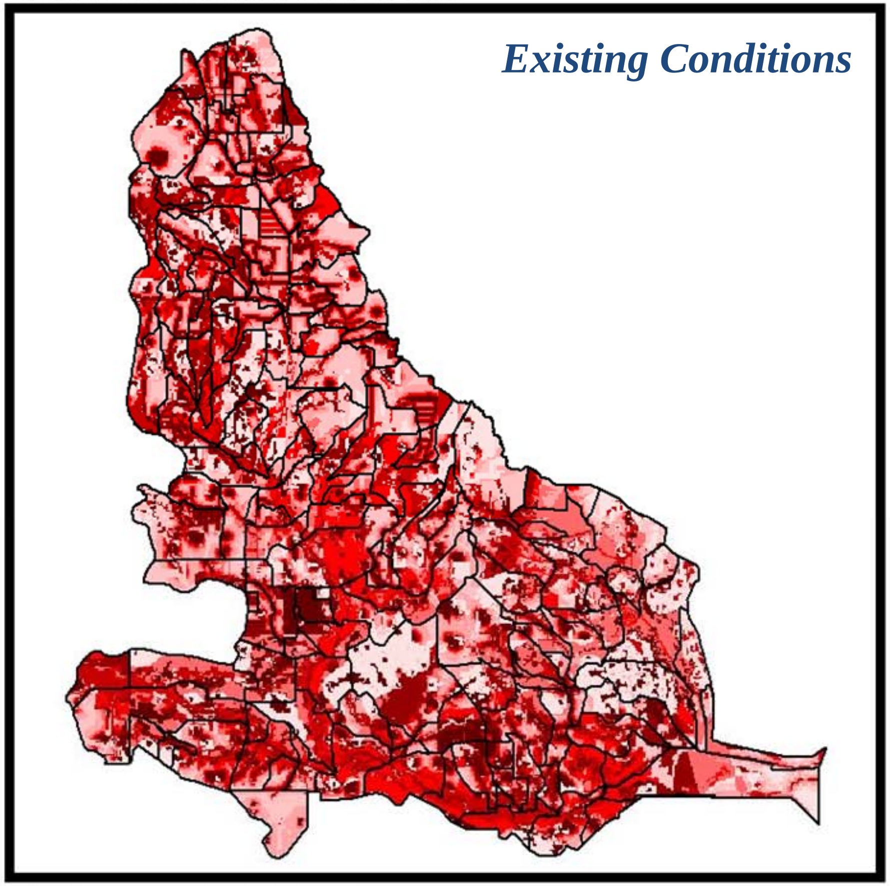
East Caloosahatchee Basin



Lake Okeechobee Protection Plan Watershed Assessment Model

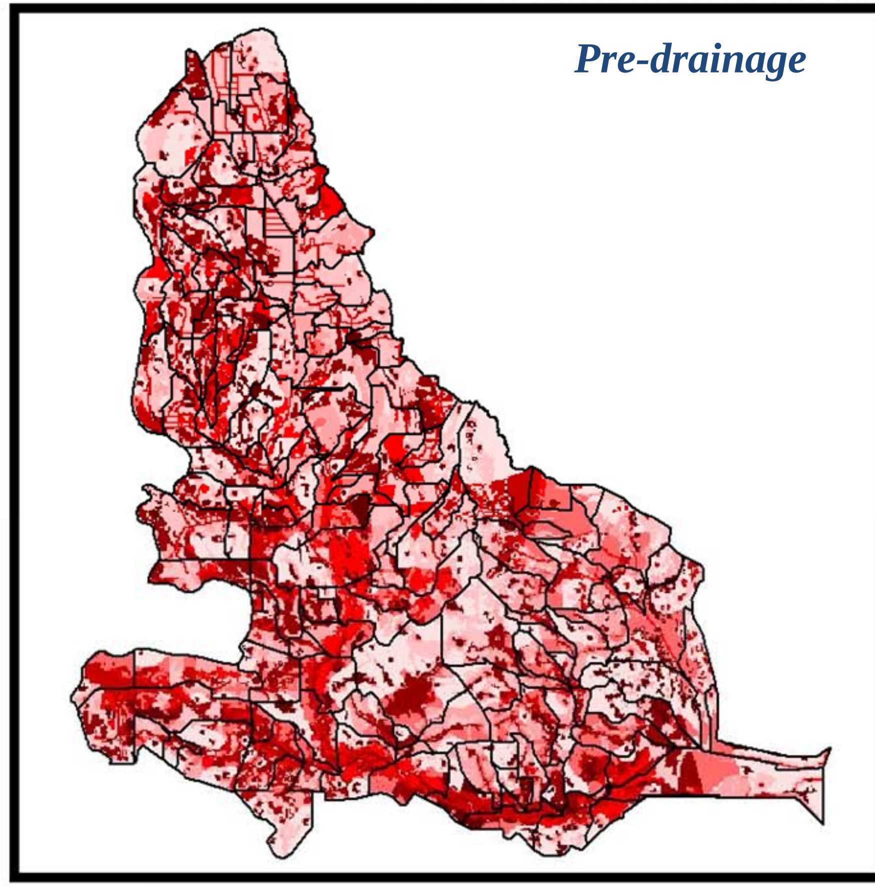
Fisheating Creek Basin

EXISTING LAND USE SCENARIO



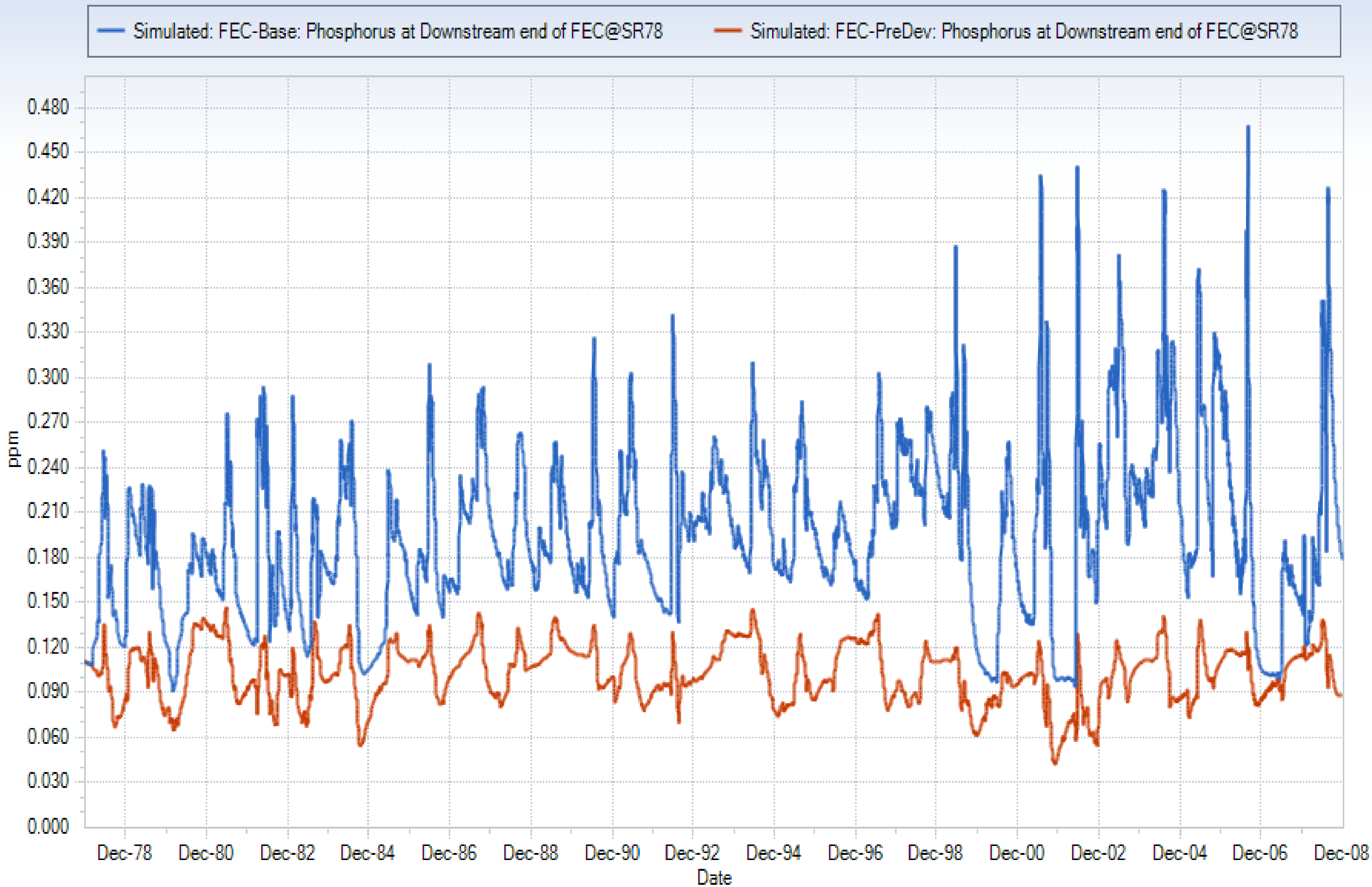
Soluble N Source Load (attenuated)
- 0 - 786
- 787 - 1841
- 1842 - 3450
- 3451 - 5189
- 5190 - 7466
- 7467 - 8641
- 8642 - 11089
- > 11090

MODIFIED LAND USE SCENARIO

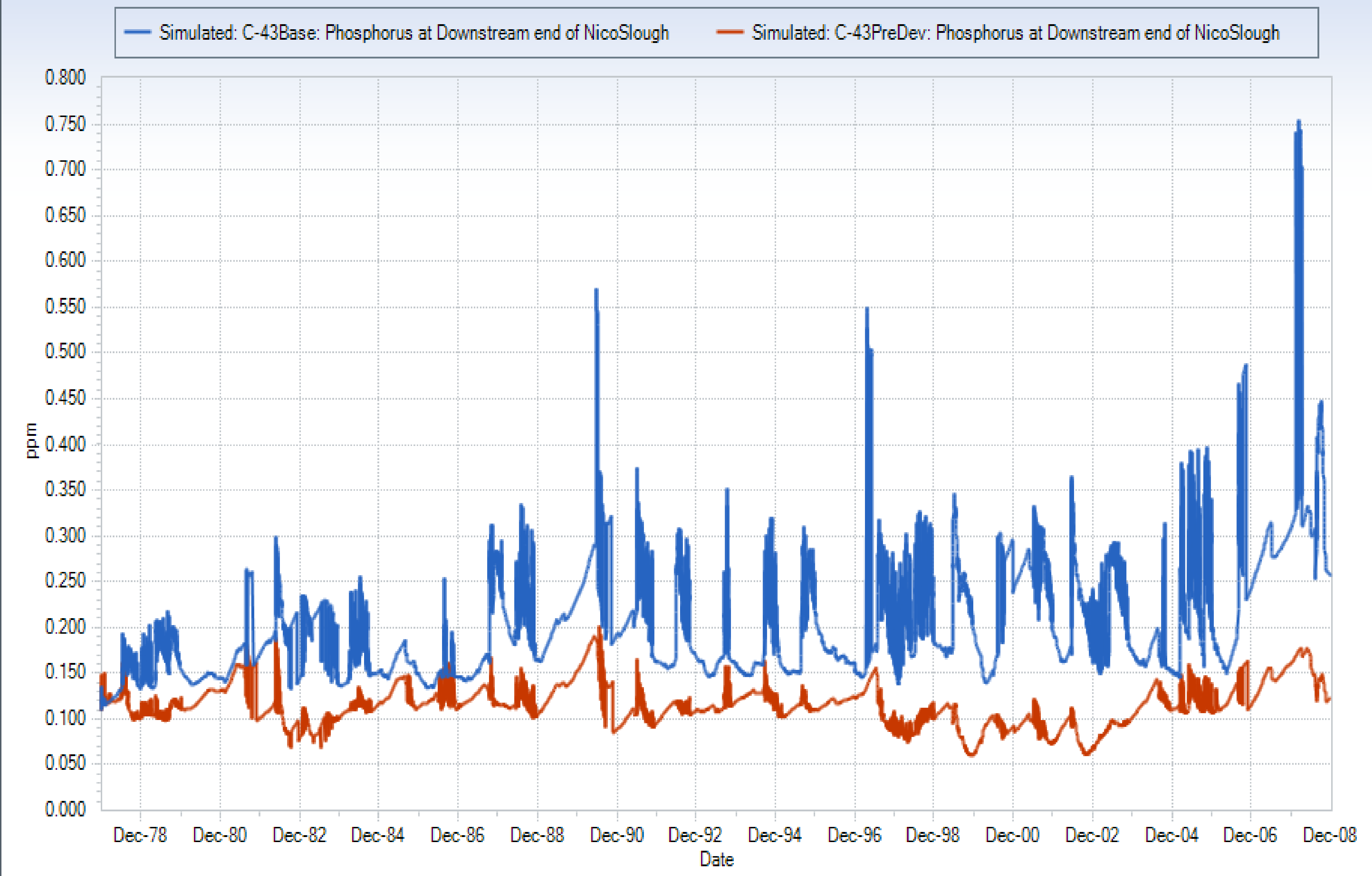


Soluble N Source Load (attenuated)
- 0 - 786
- 787 - 1841
- 1842 - 3450
- 3451 - 5189
- 5190 - 7466
- 7467 - 8641
- 8642 - 11089
- > 11090

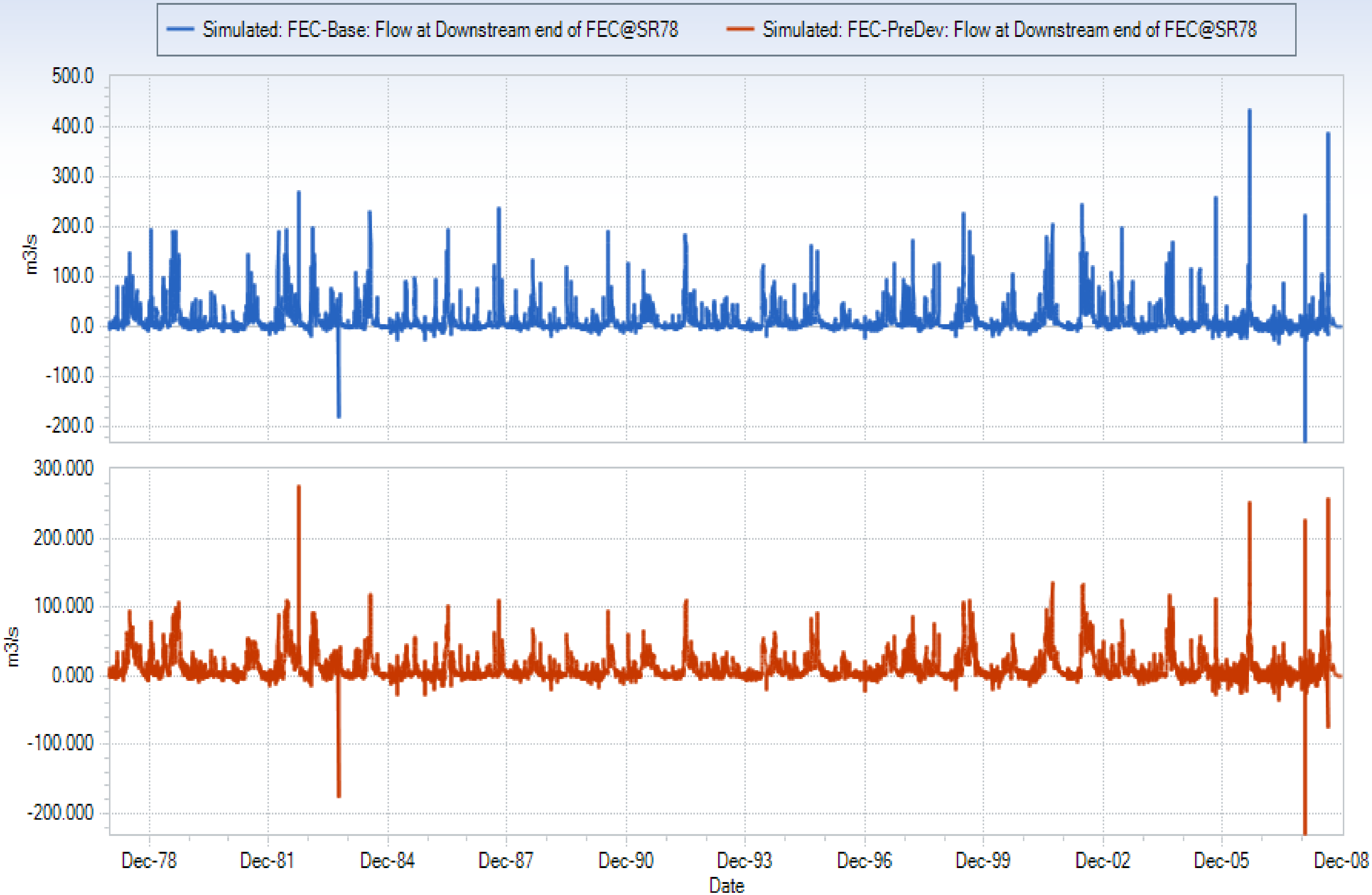
Fisheating Creek TP Discharge



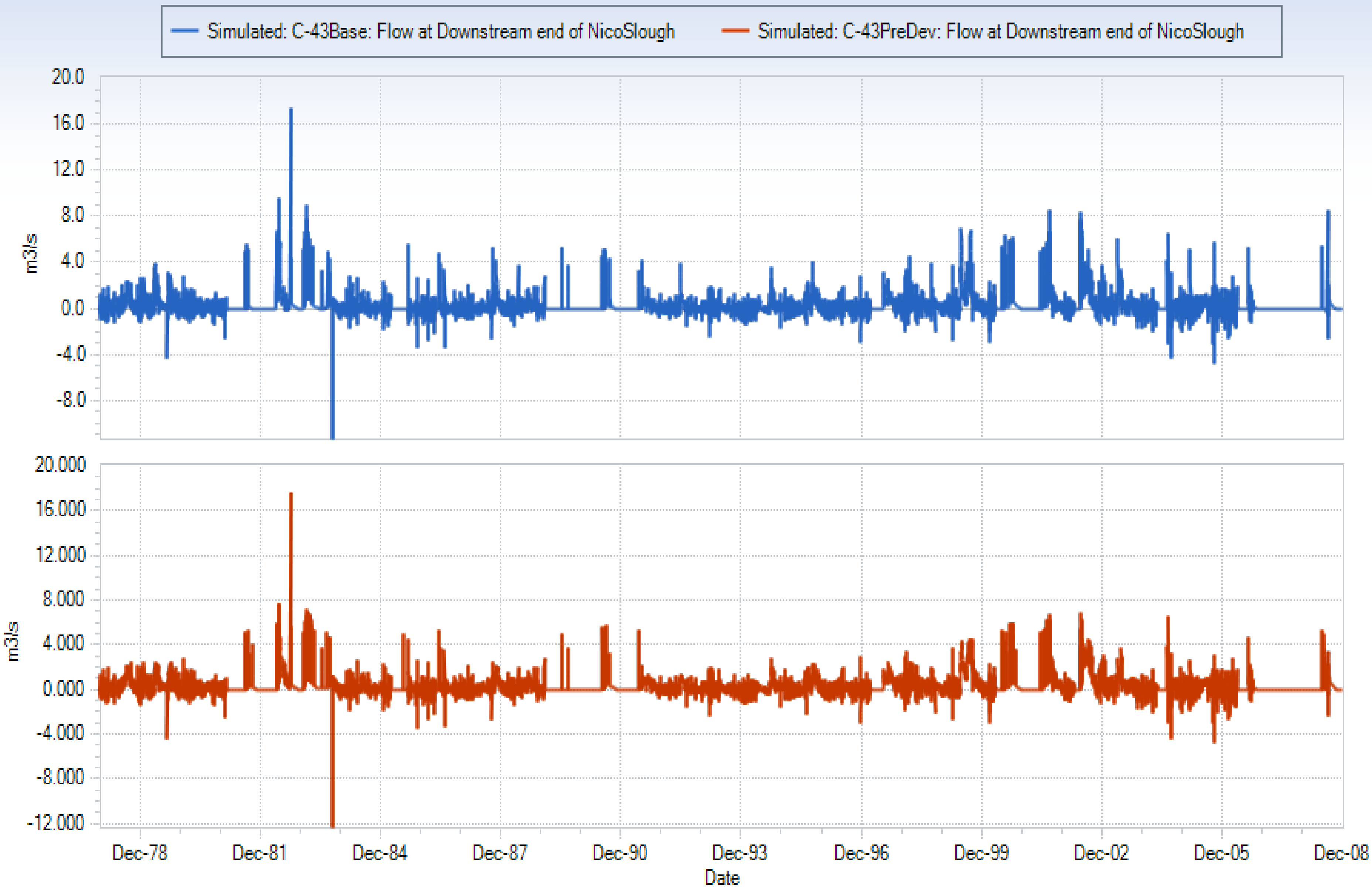
Nicodemus Slough TP Discharge



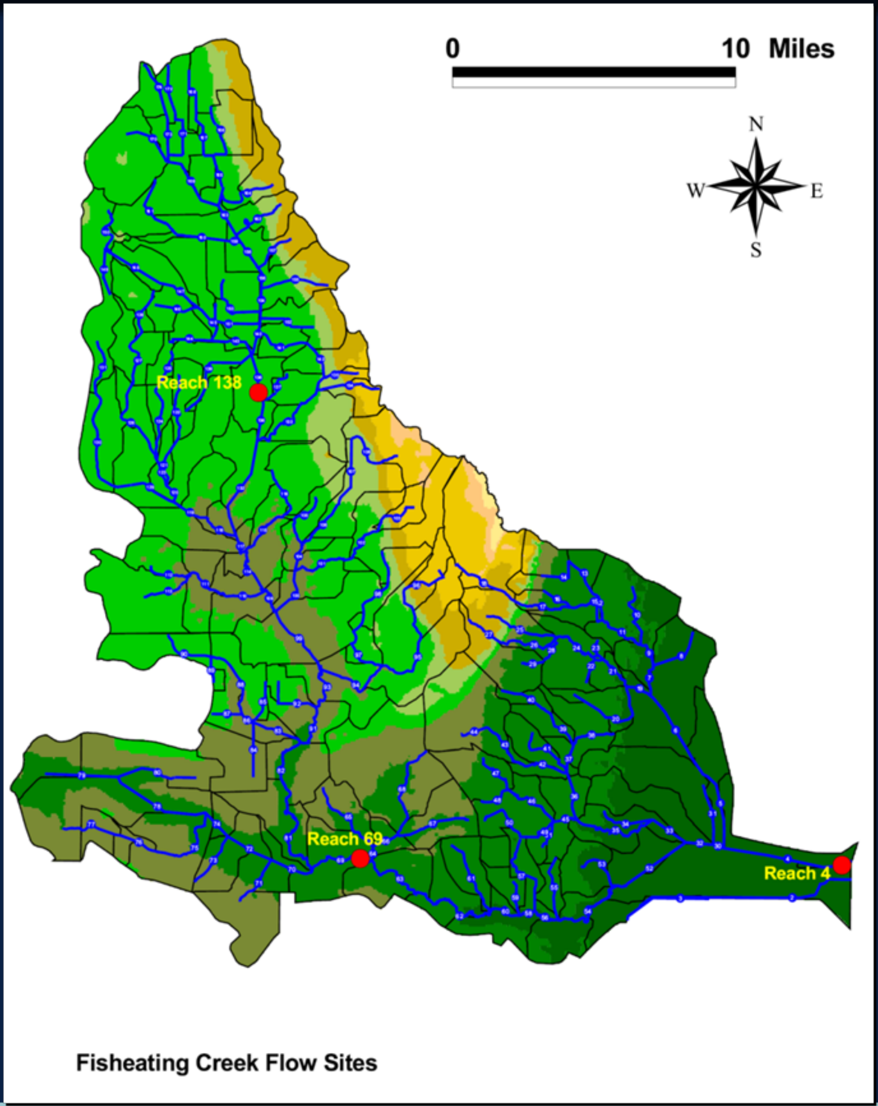
Fisheating Creek OutFlow



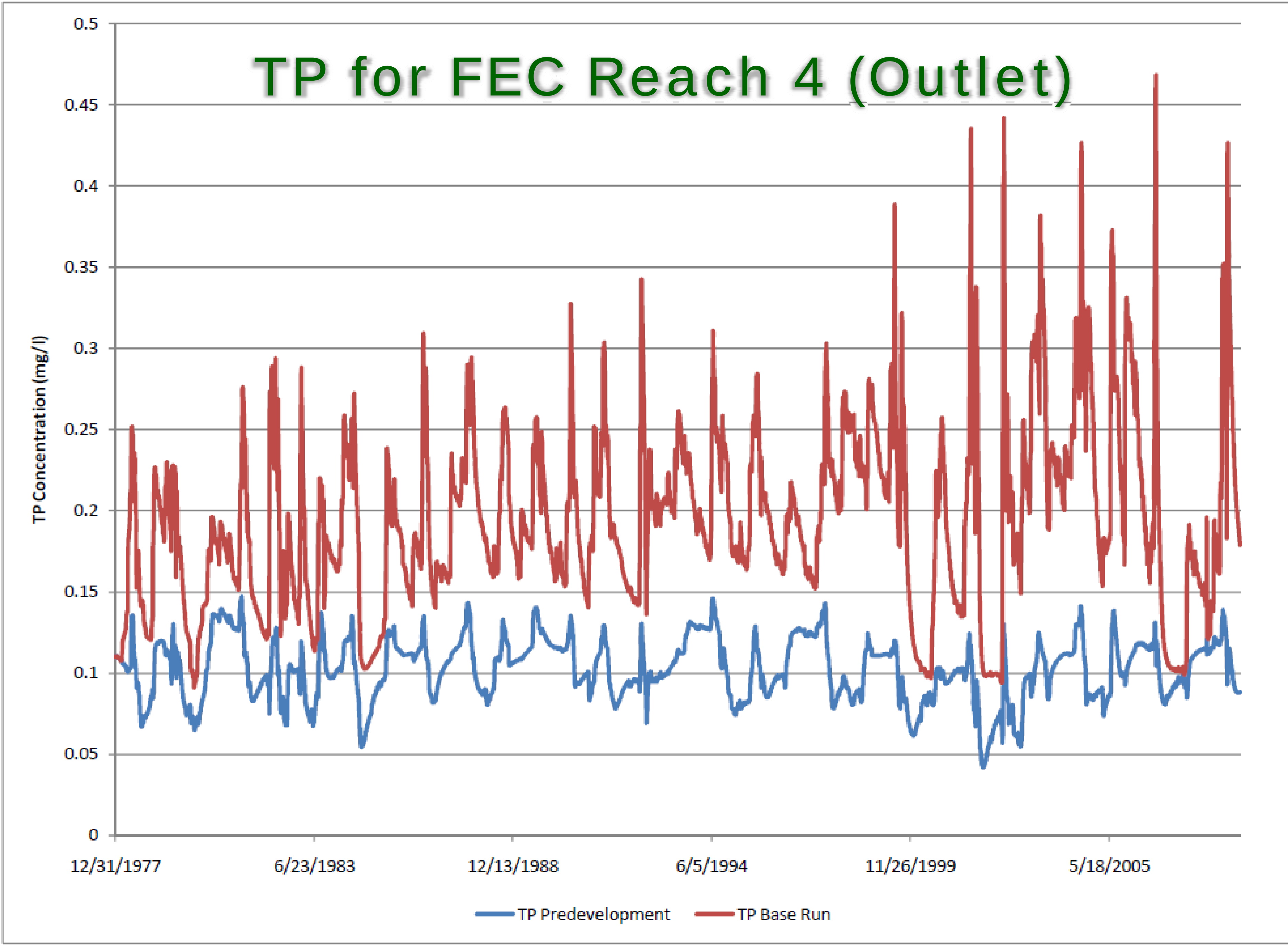
Nicodemus Slough Outflow

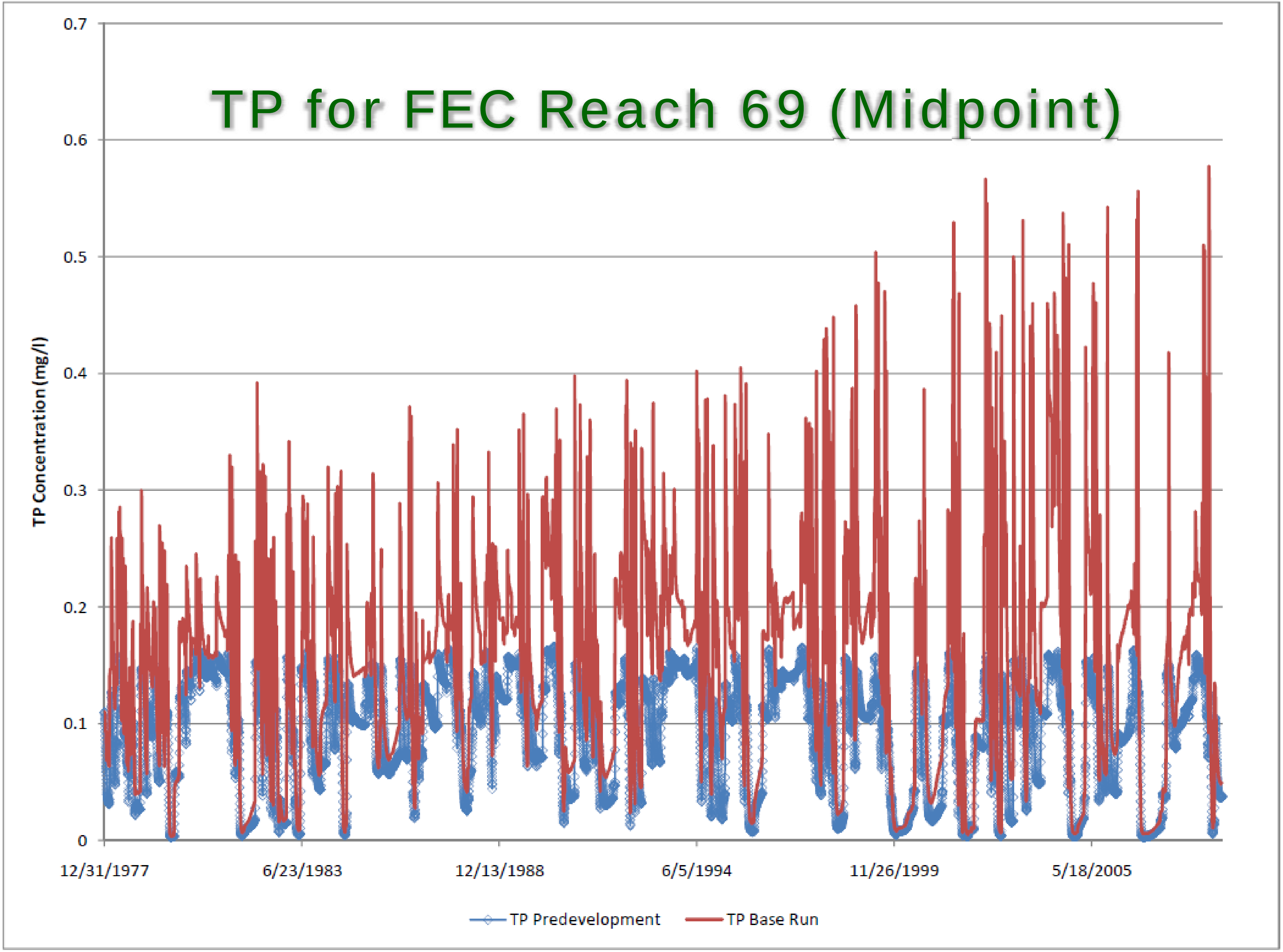


WAM Reaches for TP Comparison

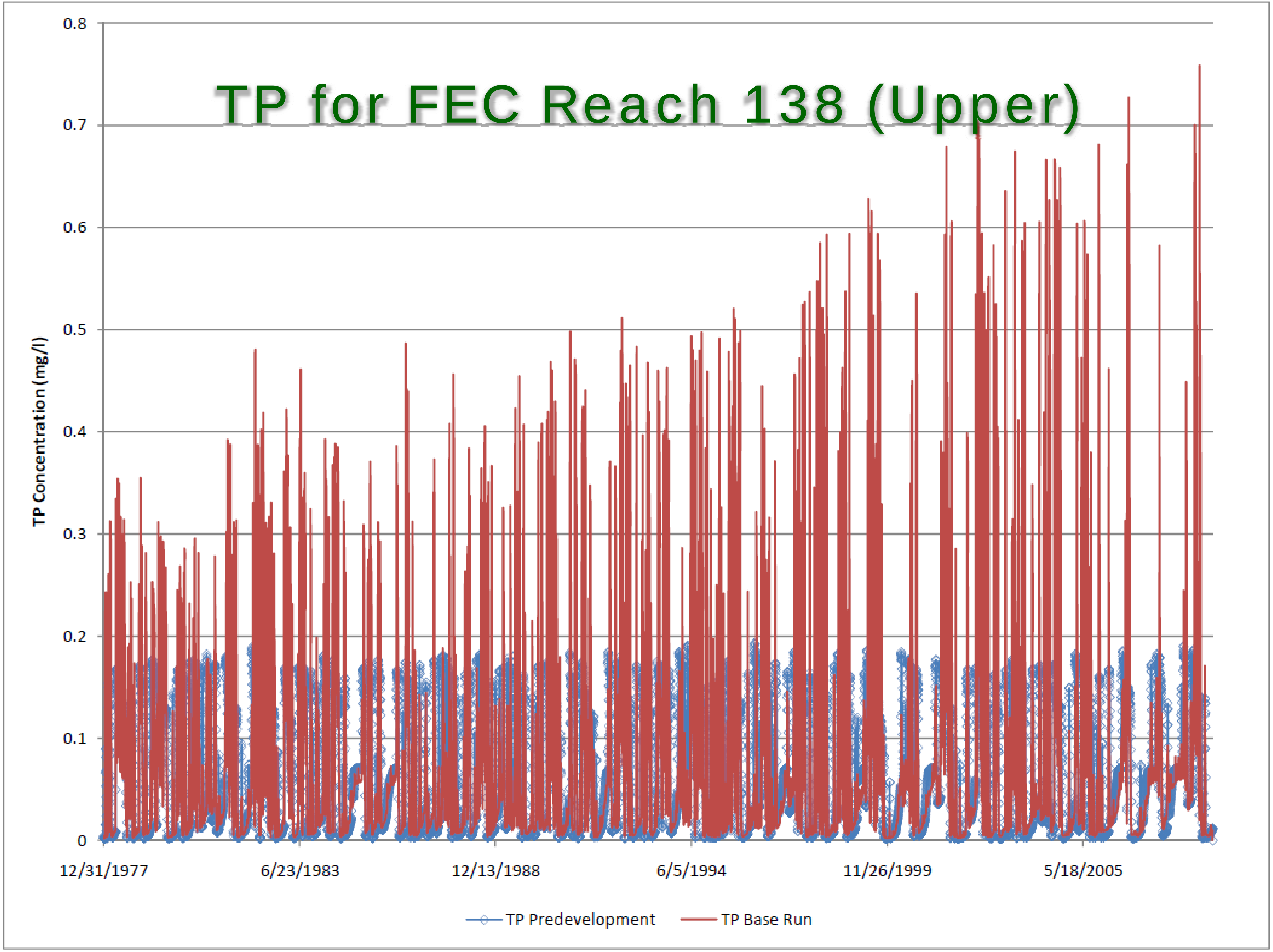


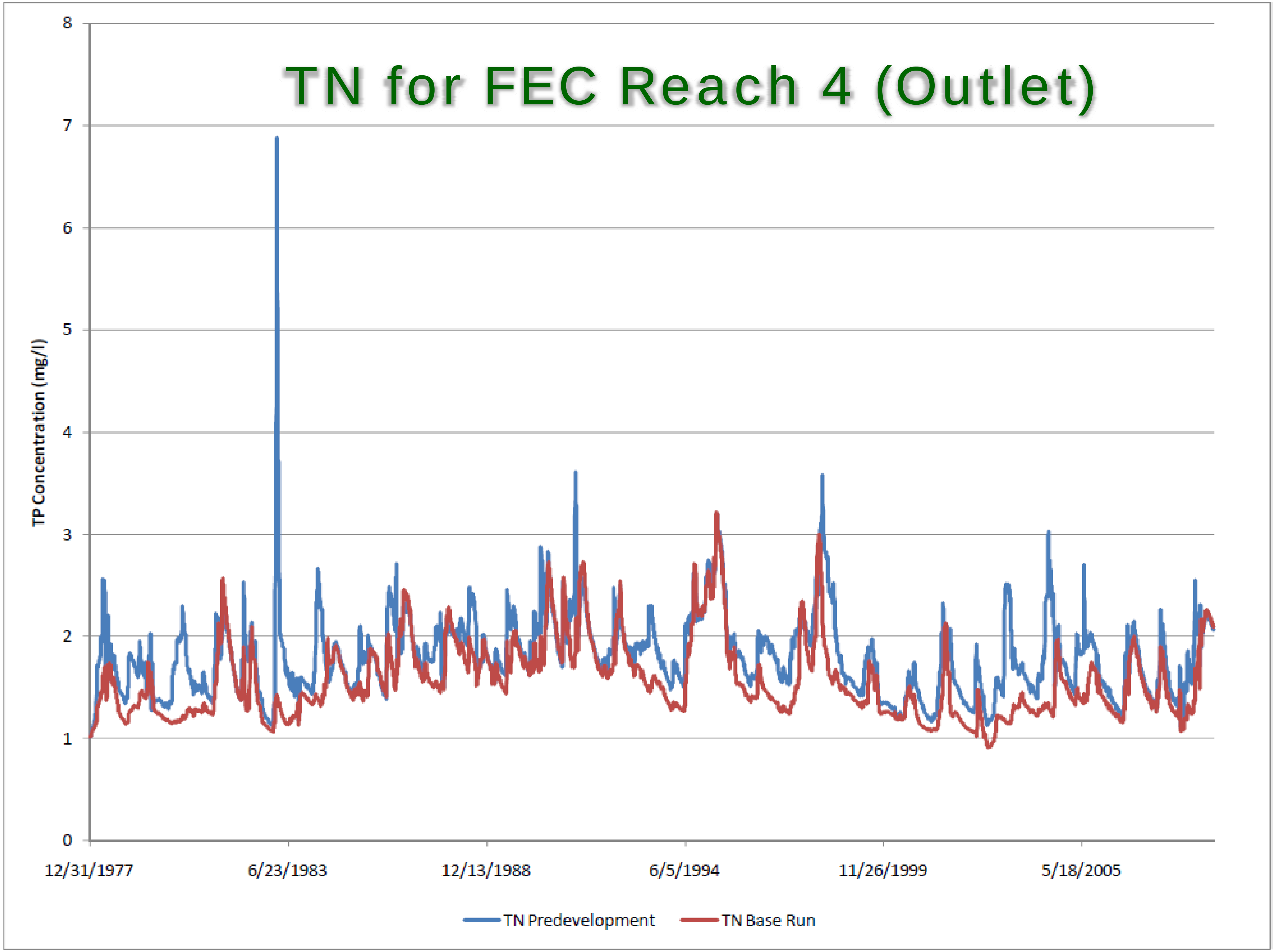
- Reach 4 – downstream reach
- Reach 69 – midstream reach
- Reach 138 – upstream reach

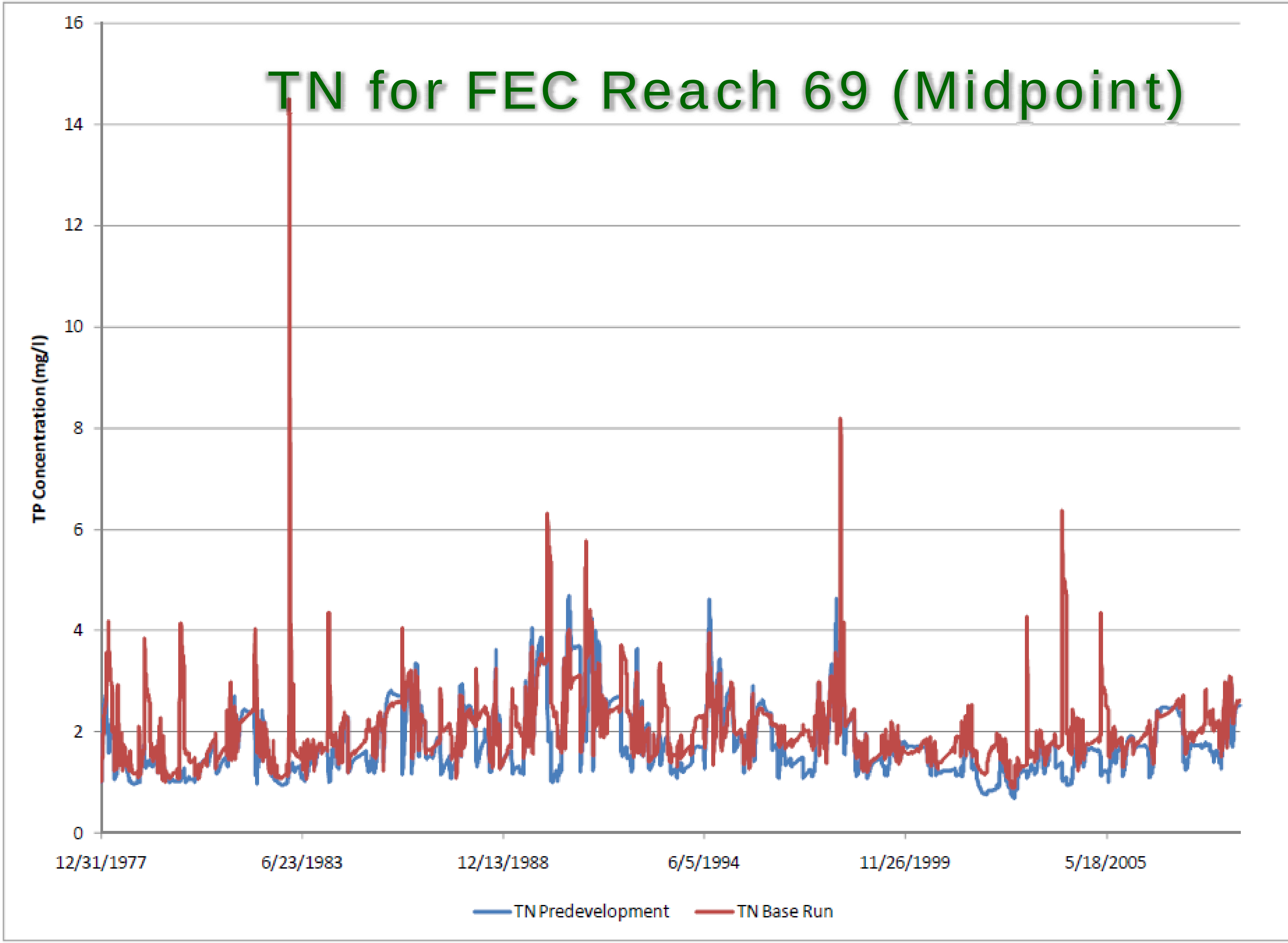

TP for FEC Reach 4 (Outlet)
TP Concentration (mg/l)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TP Predevelopment
TP Base Run



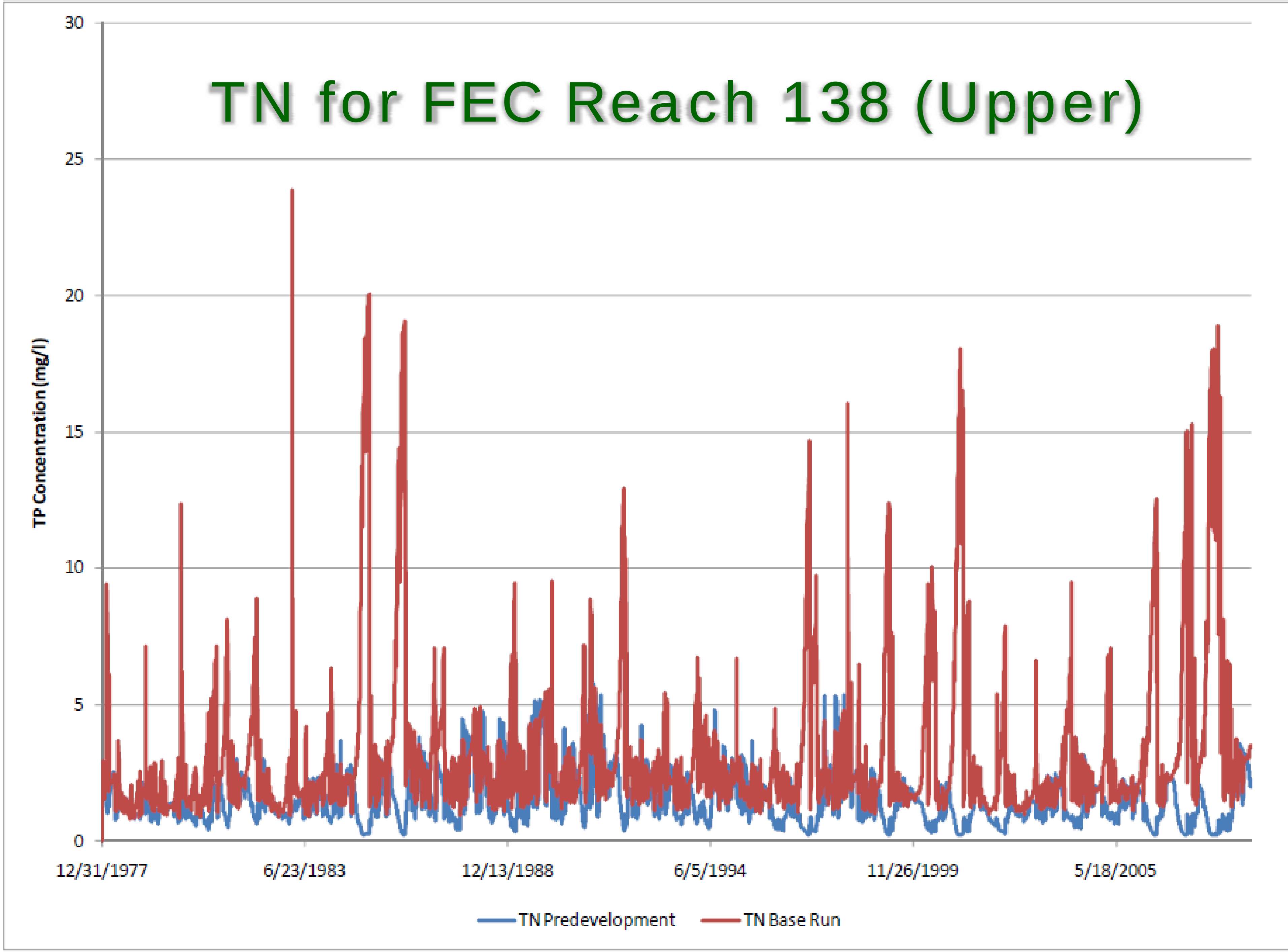
TP for FEC Reach 69 (Midpoint)
TP Concentration (mg/l)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TP Predevelopment
TP Base Run


TP for FEC Reach 138 (Upper)
TP Concentration (mg/l)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TP Predevelopment
TP Base Run


TN for FEC Reach 4 (Outlet)
TP Concentration (mg/l)
8
7
6
5
4
3
2
1
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TN Predevelopment
TN Base Run

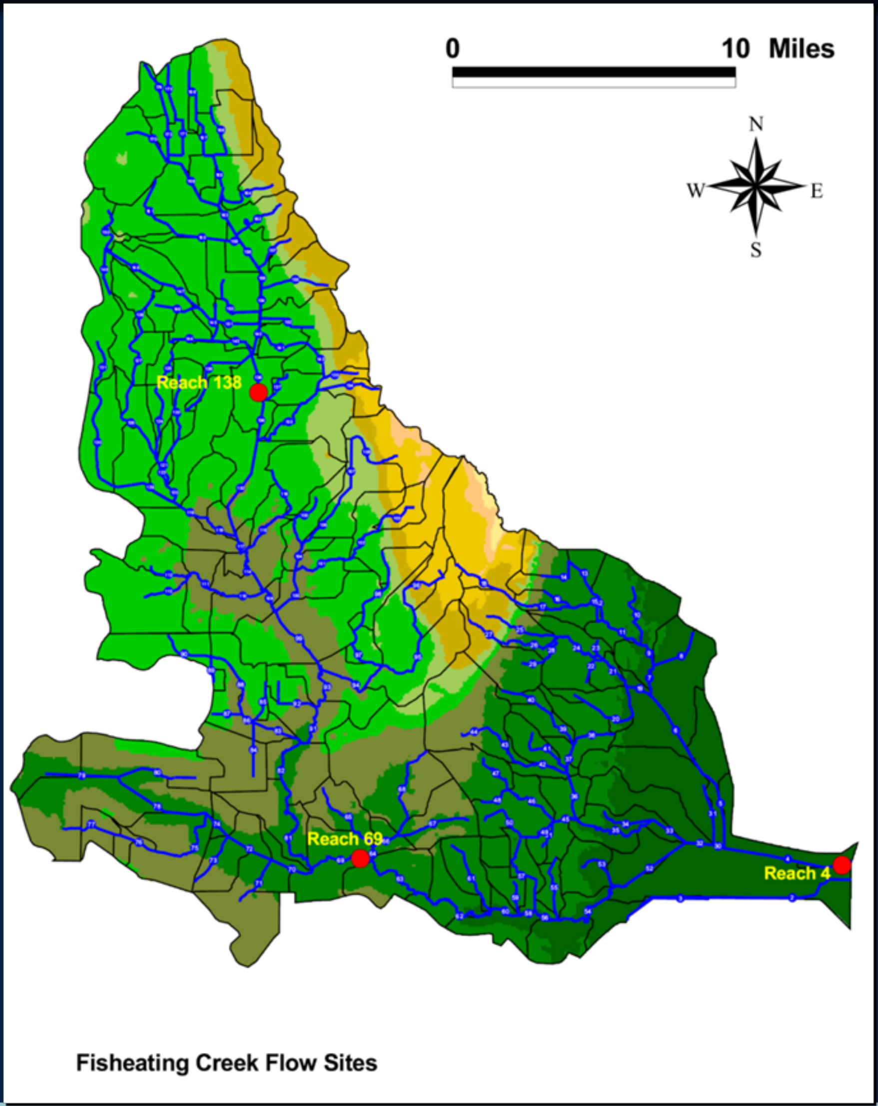


TN for FEC Reach 69 (Midpoint)
TP Concentration (mg/l)
16
14
12
10
8
6
4
2
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TN Predevelopment
TN Base Run


TN for FEC Reach 138 (Upper)
TP Concentration (mg/l)
30
25
20
15
10
5
0
12/31/1977
6/23/1983
12/13/1988
6/5/1994
11/26/1999
5/18/2005
TN Predevelopment
TN Base Run

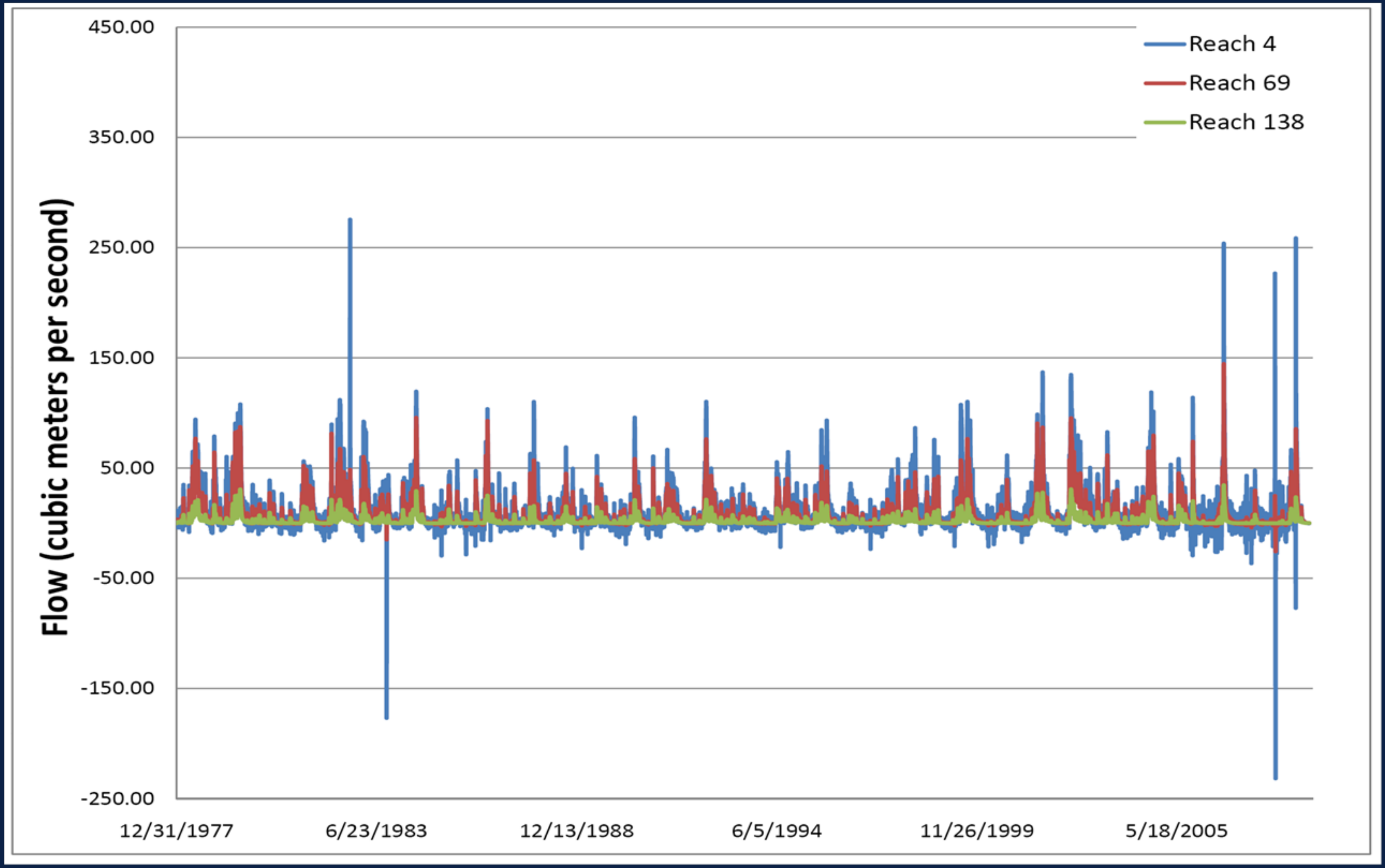
WAM Simulation Data Analyses

WAM Reaches

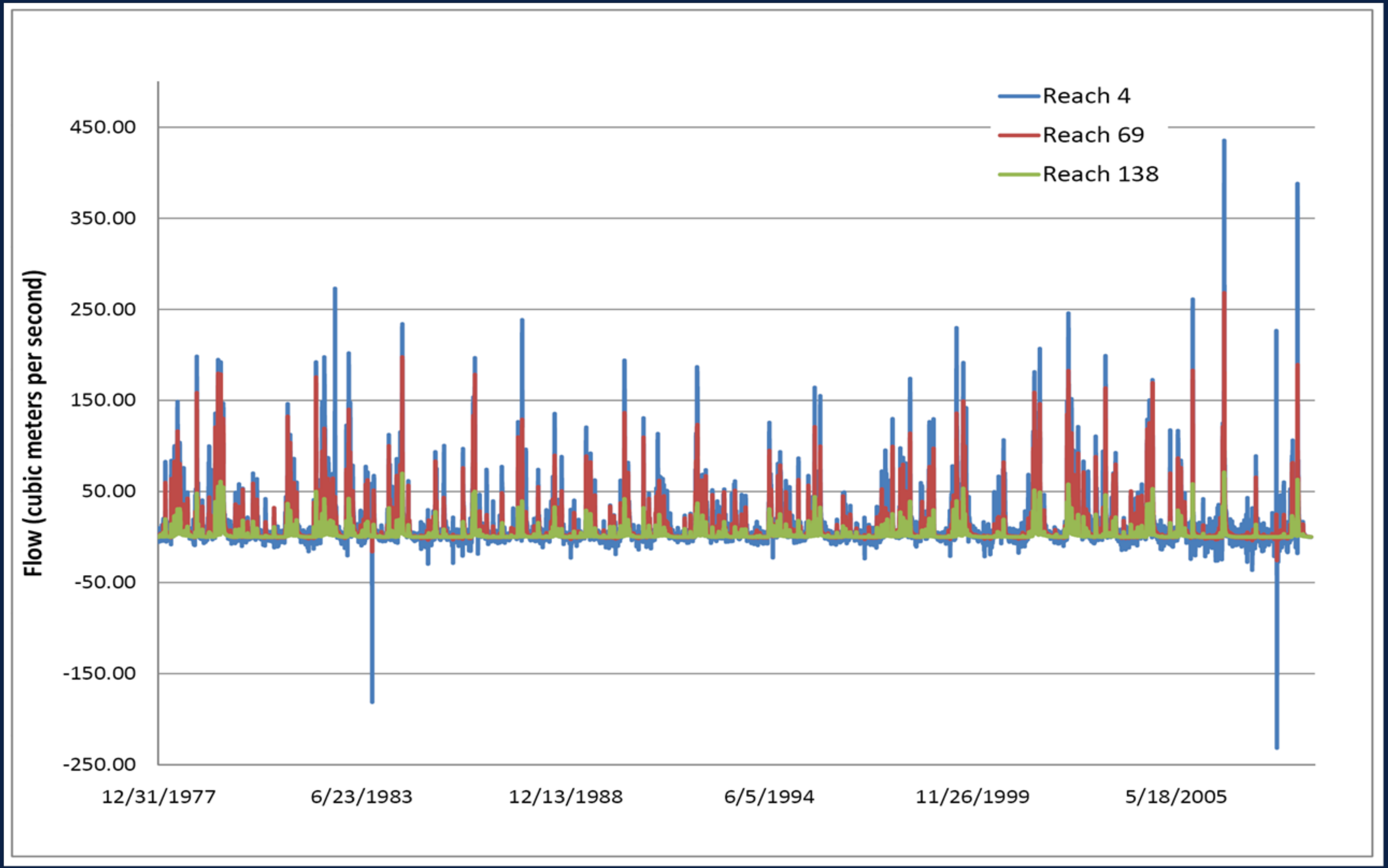


- Reach 4 – downstream reach
- Reach 69 – midstream reach
- Reach 138 – upstream reach

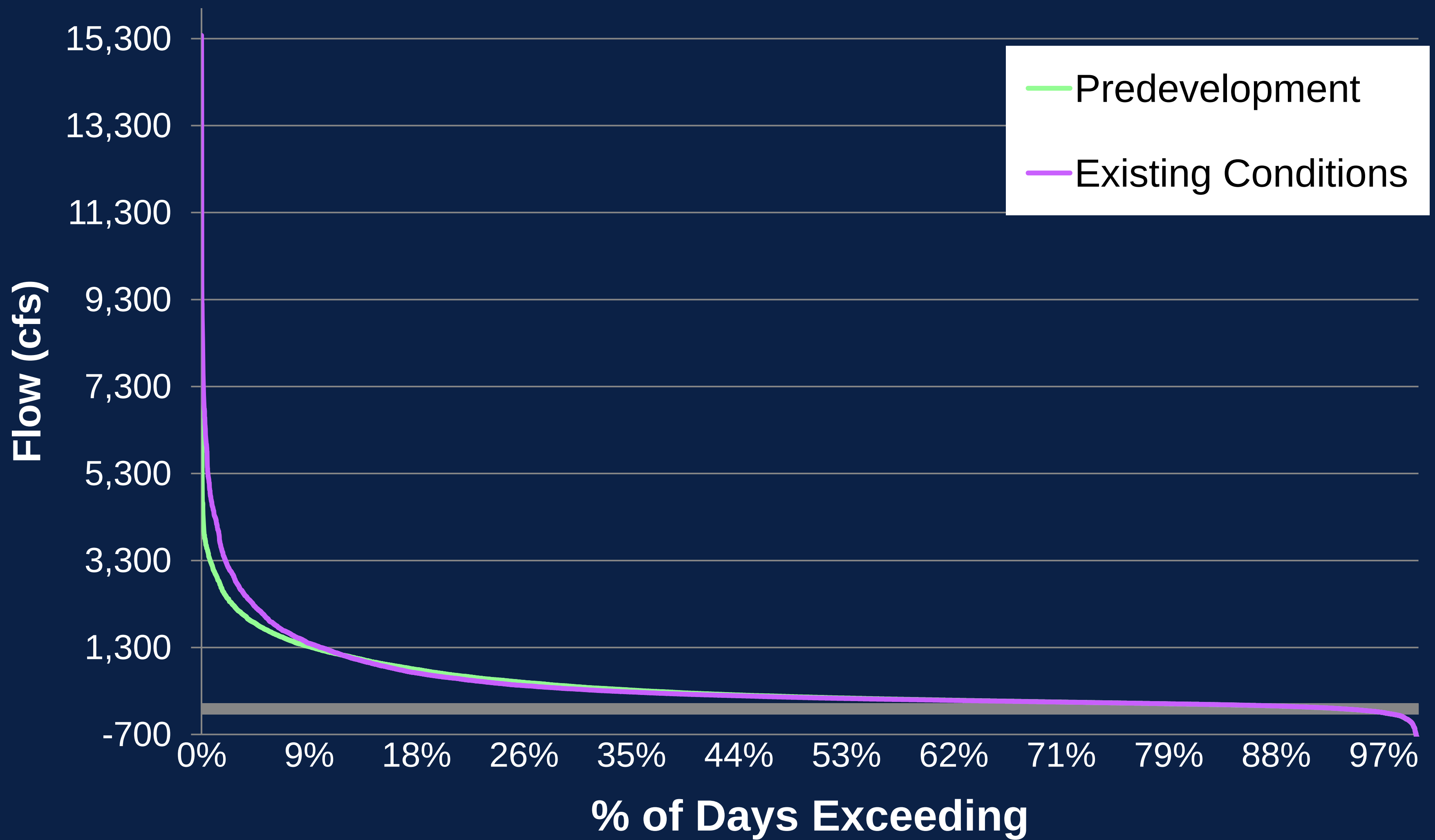
Pre-drainage Flows



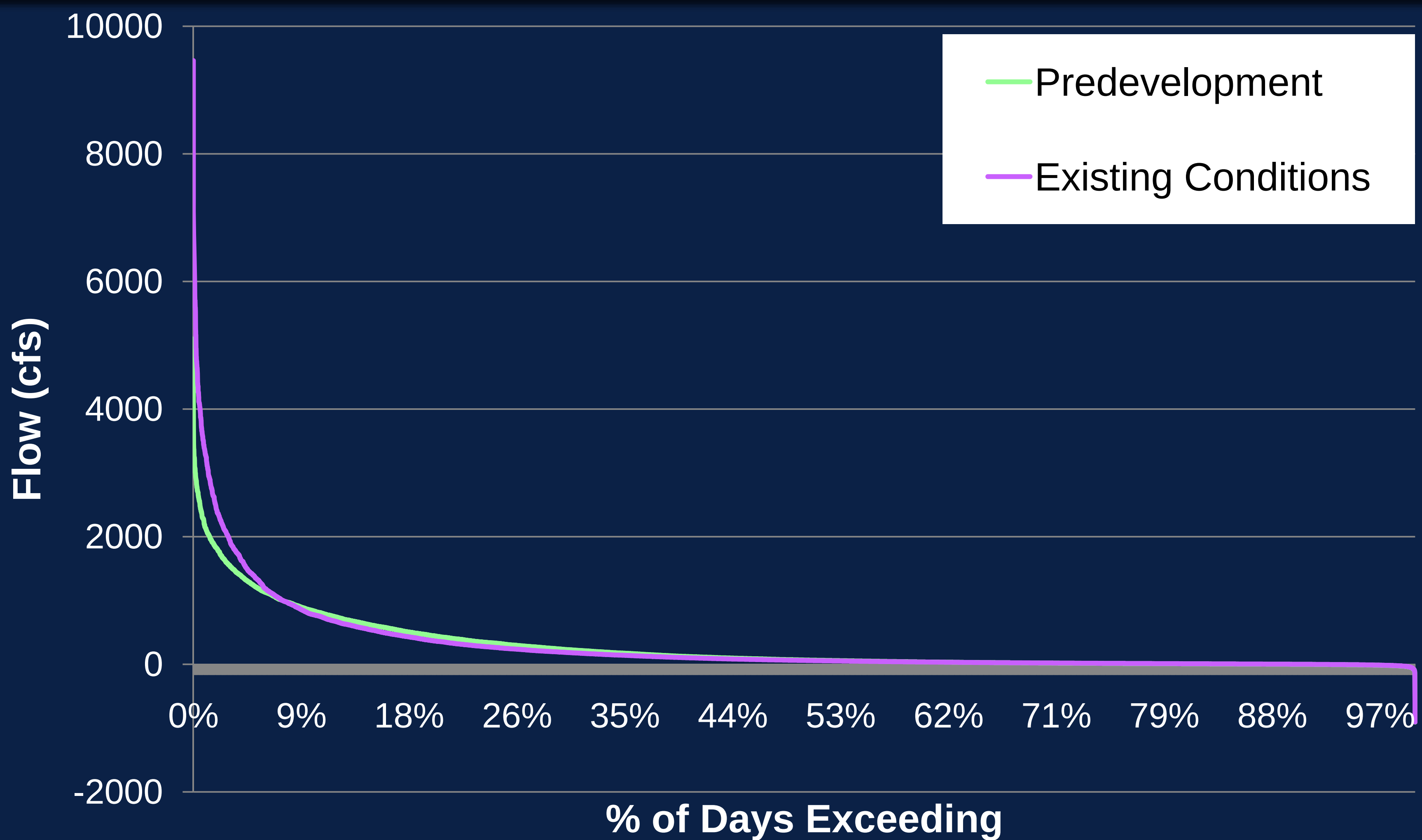
Existing Conditions Flows



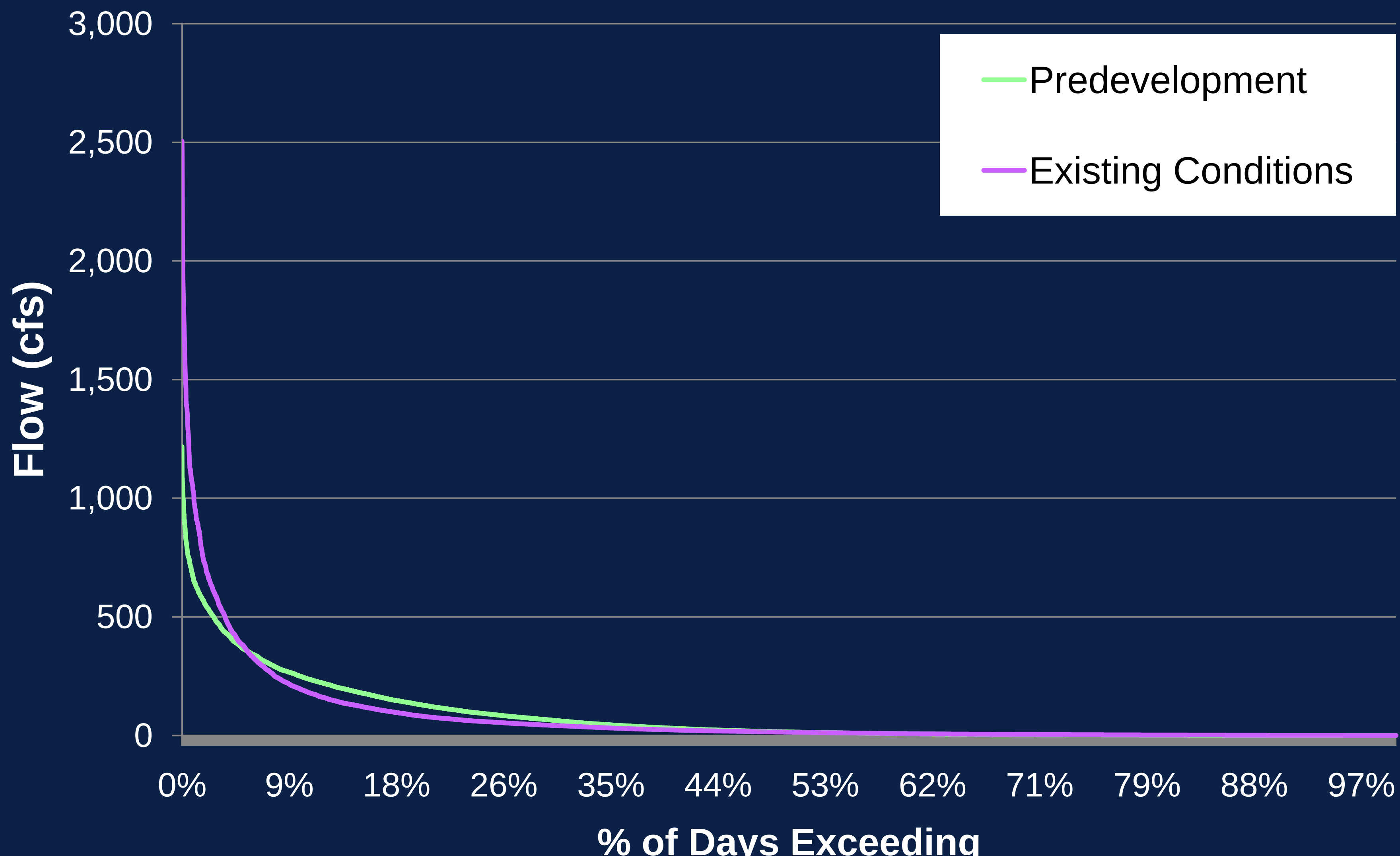
Reach 4 – Flow Exceedance



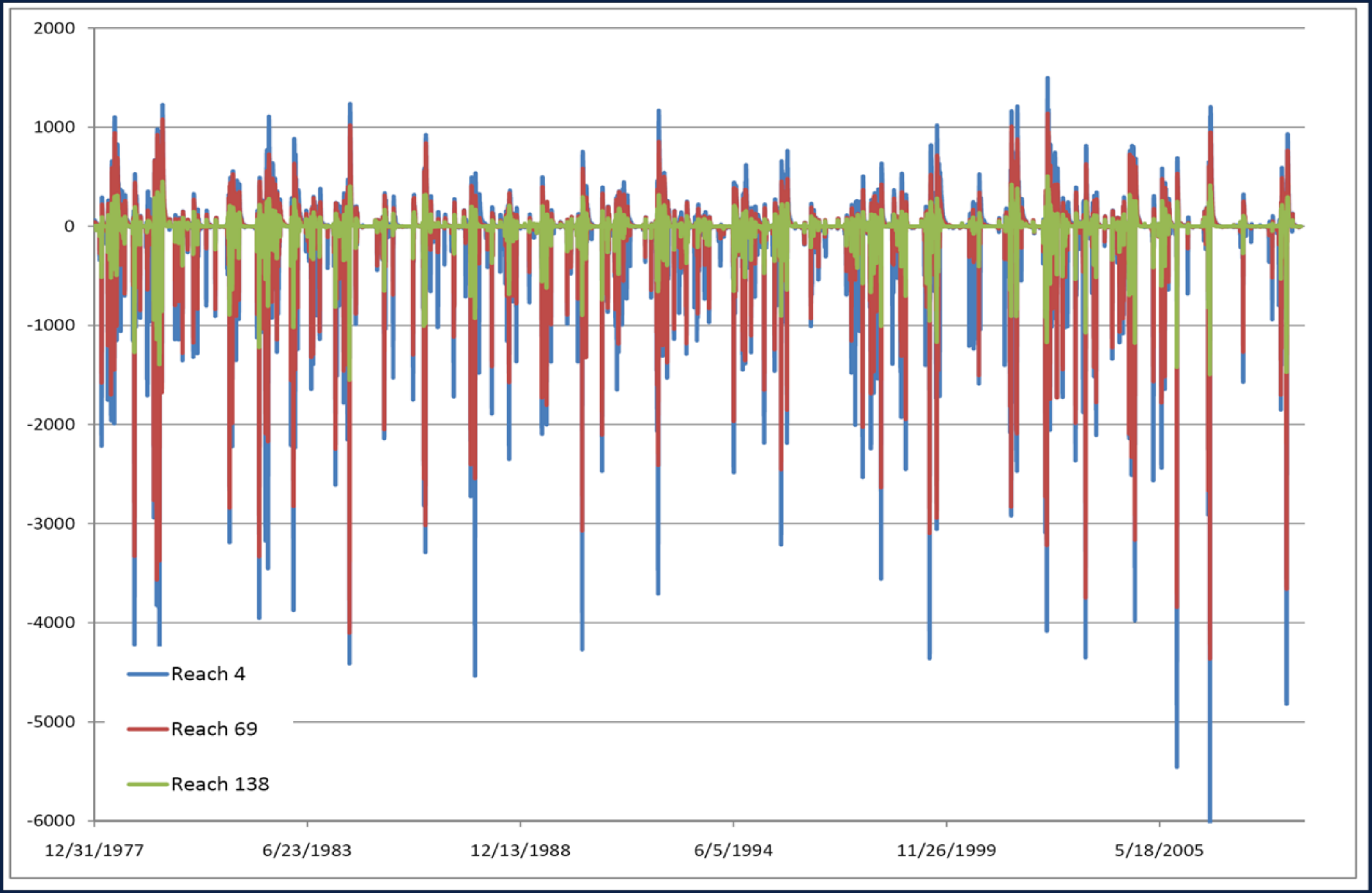
Reach 69 – Flow Exceedance



Reach 138 – Flow Exceedance



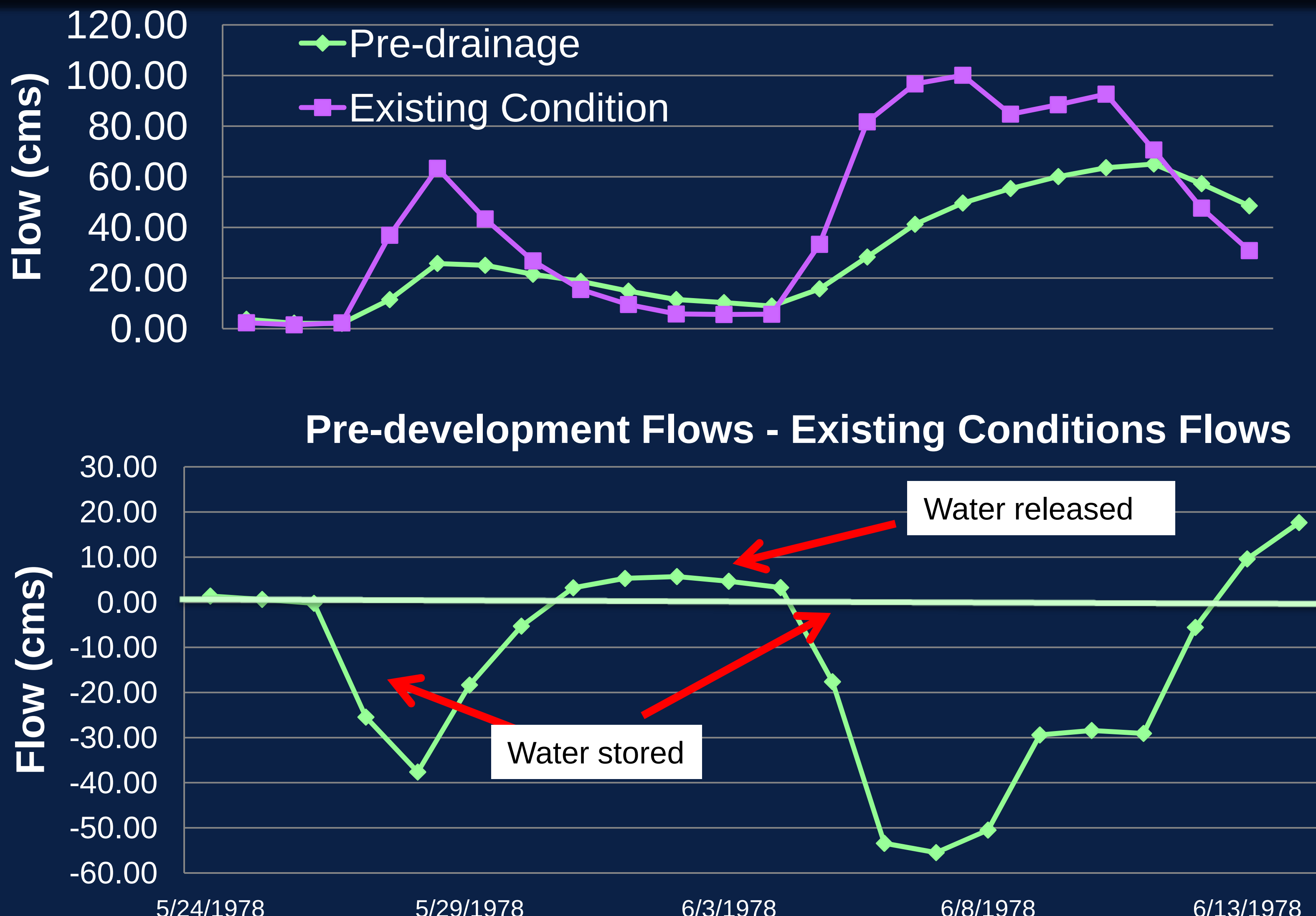
Difference in Daily Flows



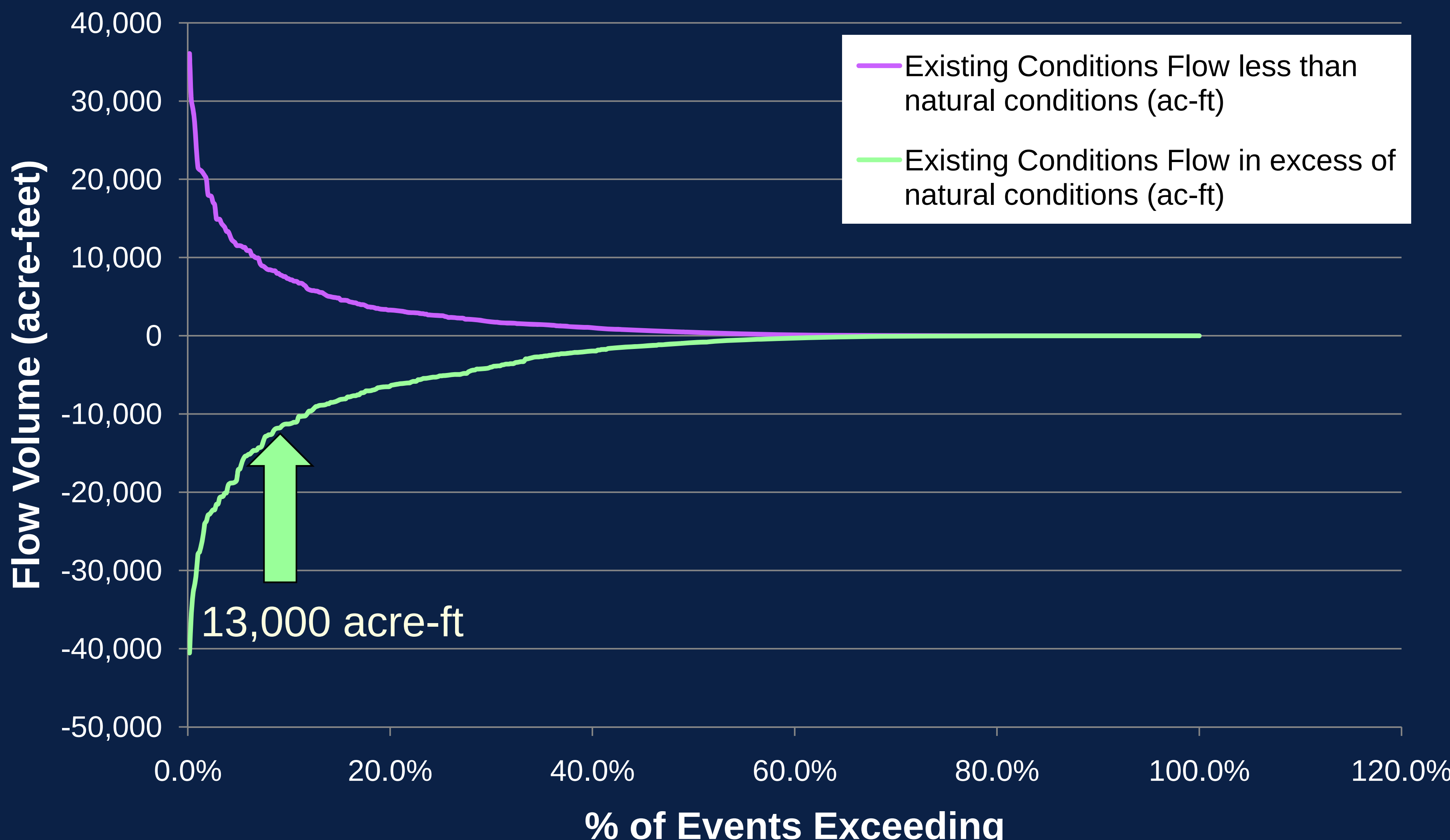
Pre-drainage vs. Existing Condition Flows

	Reach 4			Reach 69			Reach 138		
Exceedance Level	Pre-drainage (cfs)	Existing Conditions (cfs)	% Diff	Pre-Drainage (cfs)	Existing Conditions (cfs)	% Diff	Pre-Drainage (cfs)	Existing Conditions (cfs)	% Diff
Max	9,722	15,374	37%	5,101	9,463	46%	1,217	2,505	51%
1%	3,067	4,434	31%	2,138	3,288	35%	647	984	34%
5%	1,755	2,085	16%	1,230	1,382	11%	367	382	4%
25%	537	459	-17%	327	260	-25%	92	58	-58%
50%	159	145	-10%	68	61	-12%	15	14	-8%
60%	97	92	-6%	37	36	-4%	7	8	6%
70%	48	47	-3%	20	22	6%	3	4	26%
Ave Annual Flow (AF)	291,076	317,342	8%	195,660	208,607	6%	56,797	55,432	-2%

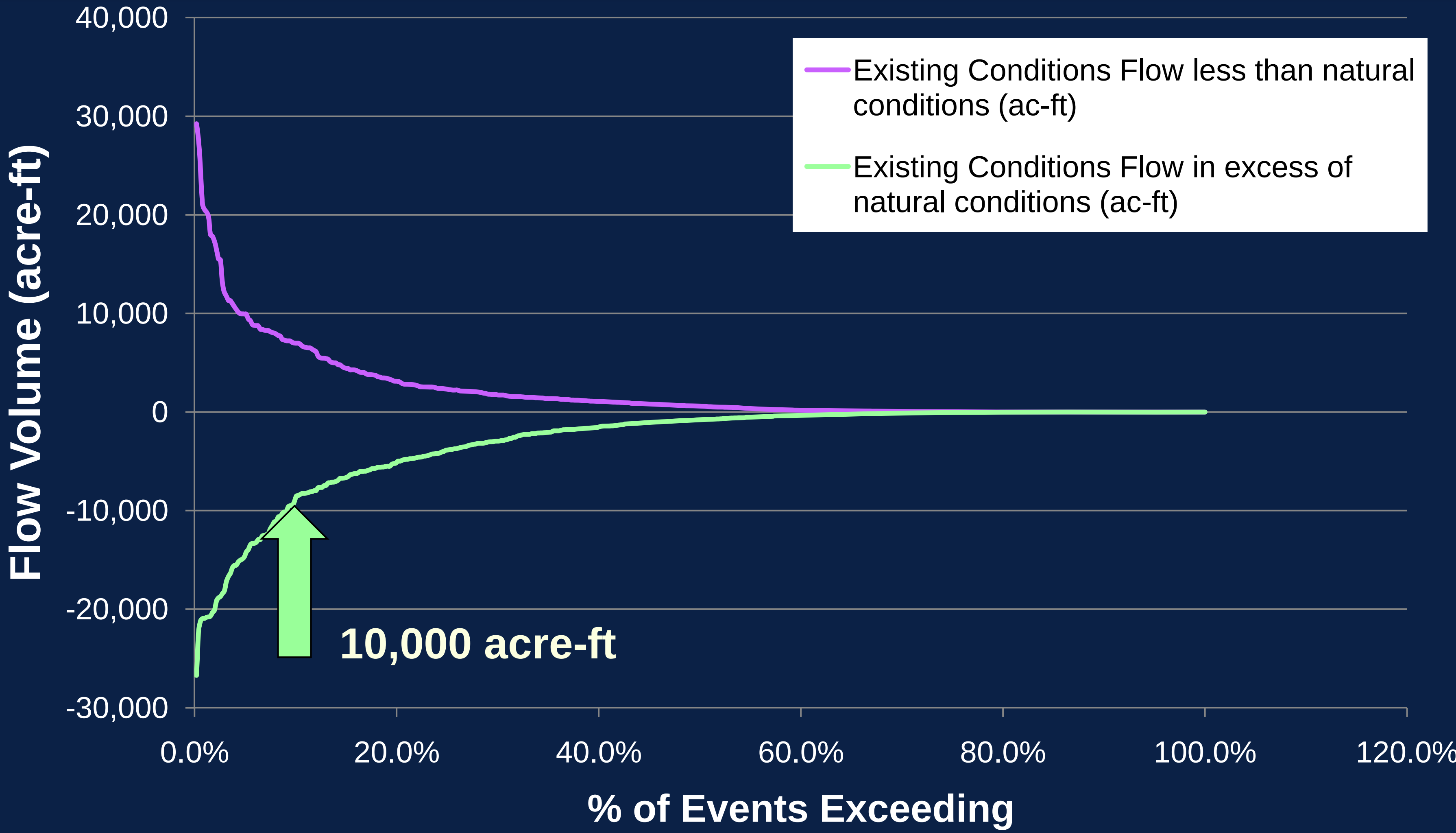
Example of Storage Event Estimates



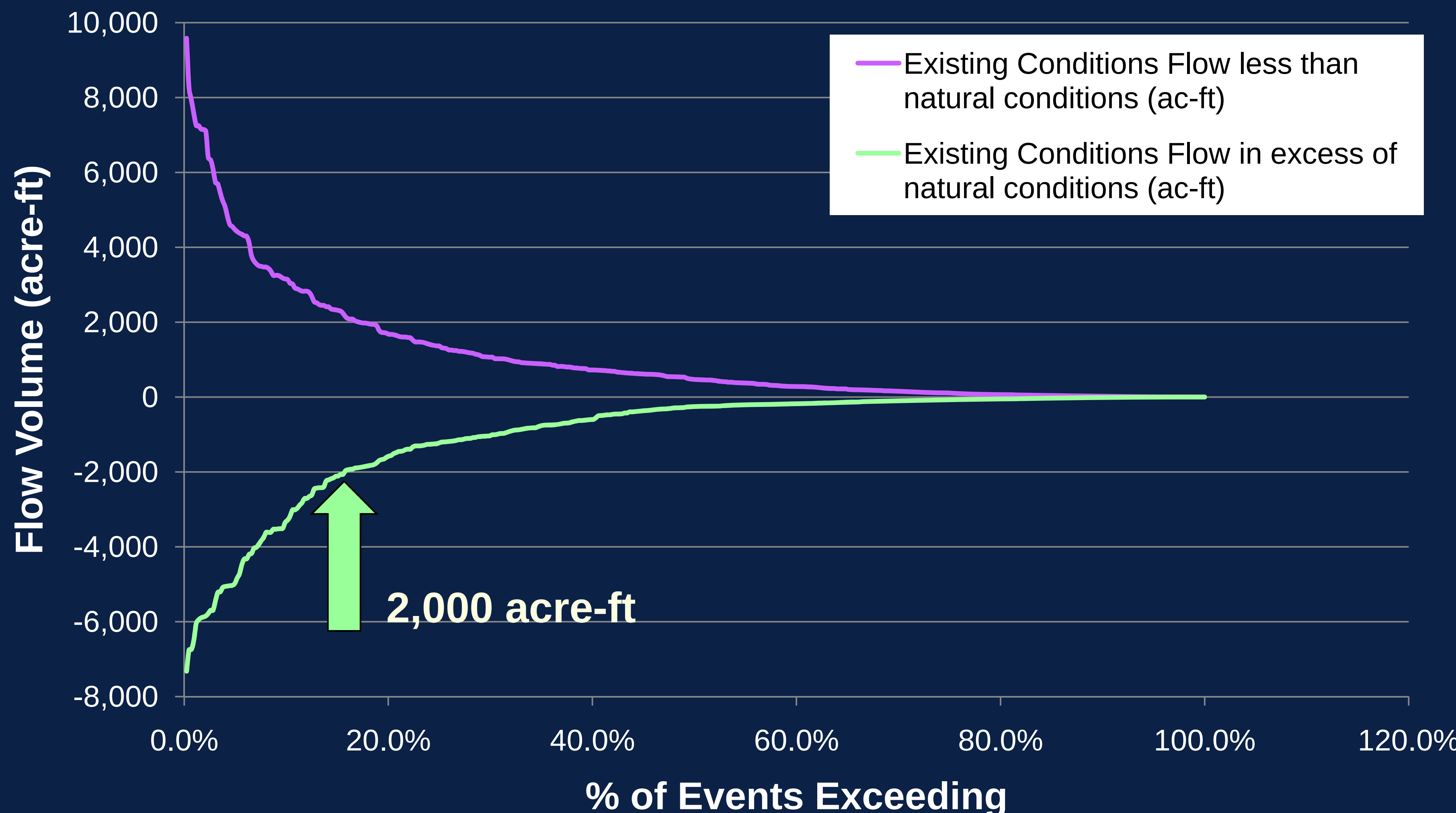
Reach 4 Flow Exceedance Volumes



Reach 69 Flow Exceedance Volumes



Reach 138 Flow Exceedance Volumes



FEC Storage Requirement Summary

- Spatial distribution of storage requirements can be defined

Reach	Total Upstream Cost Effective Storage (ac-ft)
138	2,000
69	10,000
4	13,000

FEC Segment	Storage by FEC Segment (ac-ft)
Upstream of 138	2,000
69 – 138	8,000
4 - 69	3,000

FEC Hydrologic Restoration

- Conclusions:
  - Storage capacity between 10 and 15K ac-ft would capture about 90% of the excess flow events
  - Incremental increases beyond 10-15K range produce diminishing returns
  - Storage requirements diminish with upstream distance
  - Storage required at multiple locations
  - Frequent cycles of storage and release are required

Maintain Lake O' Water Levels

- **Storage Objective 2 – Contribute towards Lake O Stage Management**
- **P2TP target of 900K – 1.3M ac-ft total**
  - **no option of sending additional flows south**
  - **200K P2TP target in FEC also provides storage of lake waters**
- **ROG has provided an opportunity to send additional flow South**
  - **ROG is currently evaluating storage needs North vs. storage needs South**

Maintain Lake O' Water Levels ...

- **Conclusions:**
  - **Relatively large volumes will be required**
  - **Cycles of storage and release would typically be longer term**
  - **Could be achieved at a single location**
  - **Most effective close to the lake**
  - **Target to be determined**

FS WQ Target

- **P2TP Water Quality Target**

	P2TP*
Ave Annual P-load to Lake Okeechobee	55
Ave Annual P Concentration (ppb)	199
Total Load Reduction (18 mt from BMPs and 15 mt from future projects)	33
Adjusted Remaining Load (mt)	21

*** Period of Record: 1991-2005**

FS WQ Target ...

- WAM Simulation Output

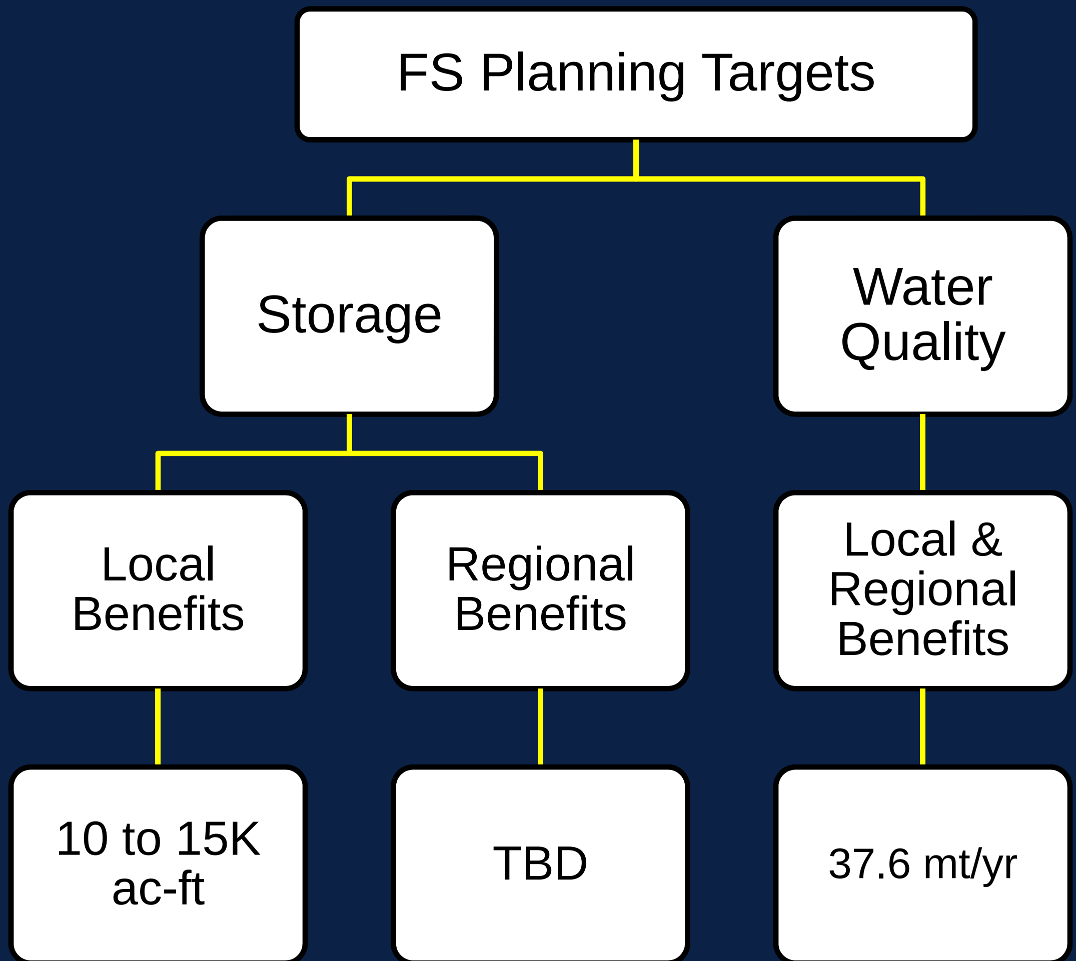
	Pre-drainage Conditions*	Existing Conditions*
Ave Annual Flow (ac-ft)	291,000	317,000
Ave P concentration (ppb)	102	195
Ave Annual P load to Lake Okeechobee (mt/yr)	37.6	90.6

*** Period of Record: 1978-2008**

FEC WQ Target Recommendation

- Objective = restore pre-drainage P–loading to the lake
- Target = 37.6 mt/yr max
  - based on WAM simulation of pre-drainage conditions (1978 – 2008 POR)

FS Planning Targets Summary



BREAK

Evaluation Criteria

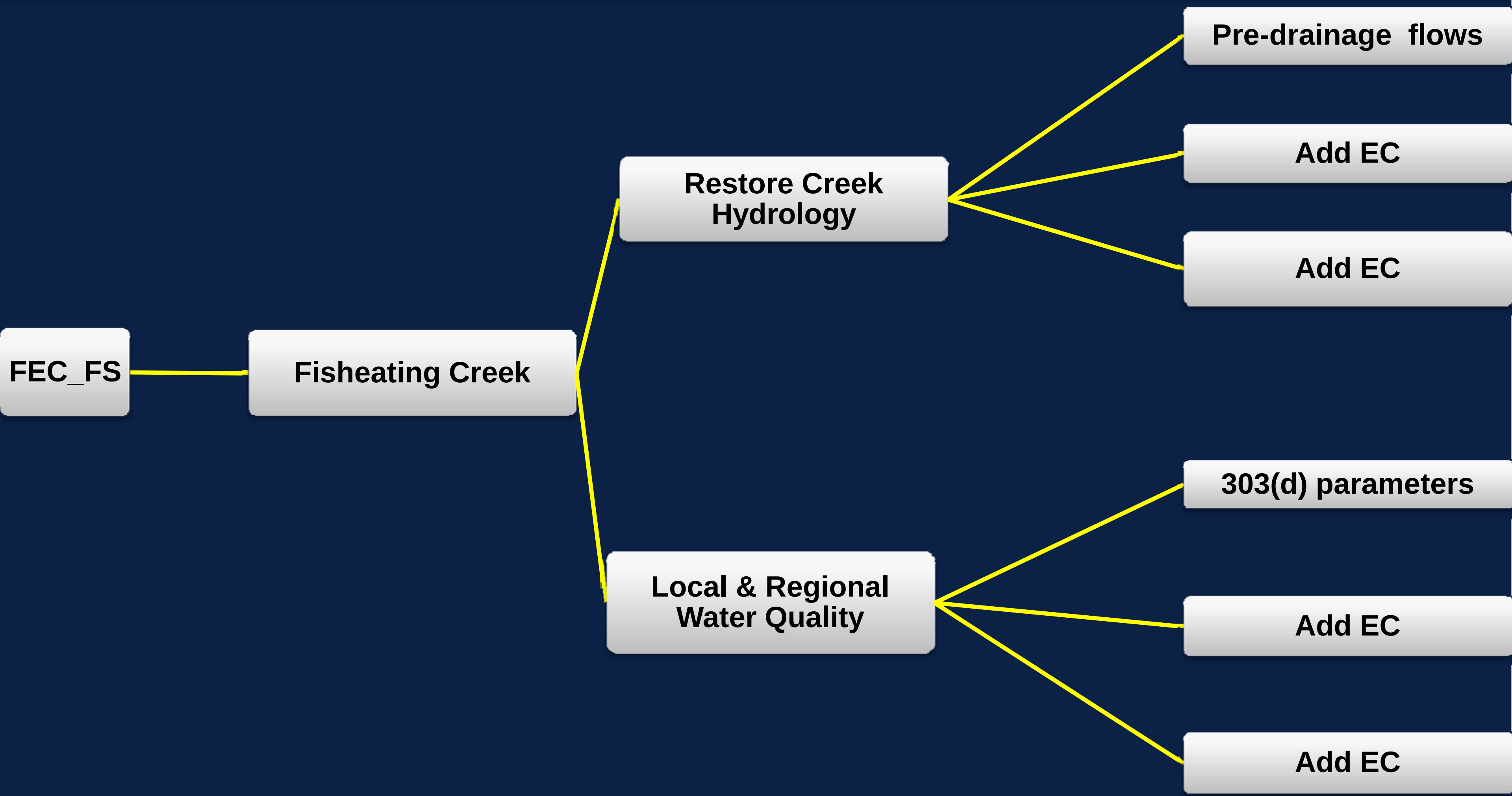
Evaluation Criteria

- Guide plan formulation, evaluation, and comparison of alternative plans
- Based on the problems and opportunities in the sub-watershed
- Characterize the effectiveness of an alternative plan's ability to meet project goals and objectives
- Working Group input
  - Identifying additional local and sub-watershed level Evaluation Criteria

Evaluation Criteria Hierarchy

- FEC_FS
  - Fisheating Creek
    - Restore Creek Hydrology
      - Pre-drainage flows
    - Tributary Water Quality
      - 303(d) parameters
  - Lake Okeechobee
    - Stage Management
      - Lake stage envelope
    - Water Quality
      - Meet TP TMDL (140 mt/yr)
  - Project Implementation
    - Project Cost
      - Planning level costs
    - Regional Economic Impacts
      - Local economic Impacts

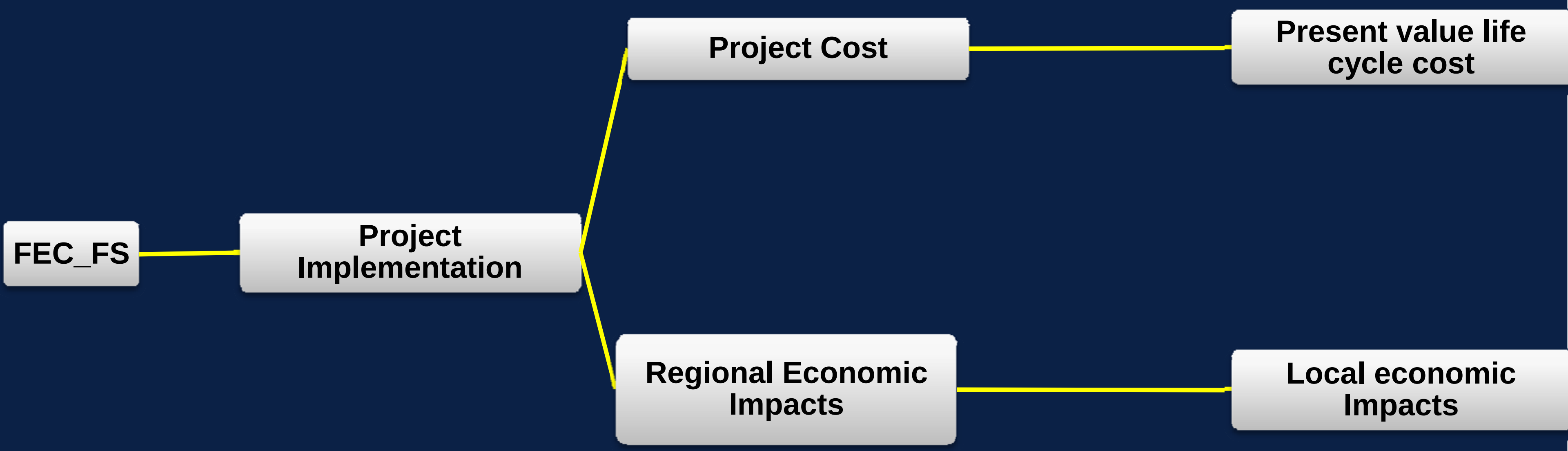
Sub-watershed Level Evaluation Criteria Hierarchy



Regional Evaluation Criteria Hierarchy

- FEC_FS
  - Lake Okeechobee
    - Stage Management
      - Lake stage envelope
    - Water Quality
      - Meet TP TMDL (140 mt/yr)

Project Level Evaluation Criteria Hierarchy



Evaluation Criteria Fact Sheets

FISHEATING CREEK SUB-WATERSHED FEASIBILITY STUDY
Working Group Meeting
July 30, 2009

Example Evaluation Criteria Fact Sheet

Performance Measure: Lake Okeechobee Stage Envelope – Score Within Envelope

Description – Lake stages fluctuate in response to a combination of seasonal, annual, and inter-annual climatic conditions and operational practices. Research (Havens 2002) has confirmed that lakes stage should ideally vary seasonally between 12.5 ft, NGVD (June-July low) and 15.5 ft, NGVD (November-January high) within a desirable envelope (Figure 1). A healthy variation of lake stages result in annual flooding and drying of the littoral zone, promoting development of diverse plant and animal communities. Decreasing water levels toward the end of winter and spring allow wading birds to easily prey on resources in the littoral zone. However, if the lake stage falls below the envelope too frequently, the littoral zone is threatened.

Rationale – The littoral zone and shoreline areas of Lake Okeechobee support submerged plant life. Extreme high stages (above 17 ft NGVD) allow wind-driven waves to directly impact the littoral emergent plant and near-shore submerged plant communities, causing physical uprooting of plants. Overall, high lake stages result in extirpation or reduced growth of submerged plants, adverse impacts to germination of submerged plants, reductions in fish spawning and fish reproductive success, and undesirable shifts among species that comprise the macroinvertebrate community. Detailed research results regarding high stage impacts on the lake's plant and animal communities can be found in Maceina and Soballe (1990), Havens (1997), Havens et al. (1999), and Havens et al. (2001).

If the lake stage is frequently below the envelope, the vegetation does not receive the water it requires to flourish. Without submerged aquatic vegetation, the habitats of wading birds, reptiles, fish, amphibians, and apple snails are endangered. These species rely on a surplus of aquatic plants for foraging and recruitment activities. When the lake stage falls below the envelope, it creates optimal conditions for invasive plant species such as torpedo grass and Melaleuca to replace the original native vegetation. At levels below 11 ft, NGVD, access to the lake for fishermen and recreational boaters becomes limited to channels and boat trails. It should be noted that the Lake Okeechobee commercial and recreational fishery is valued at over $480 million dollars (Furse and Fox 1994)

Lake stages below the envelope are beneficial in moderate occurrences. Periodic exposure of seed banks helps control plant dominance and can provide nutrition to animal communities. Low lake stages also expose the littoral zone to oxidation of the organic material that accumulates over time, creating a healthy and clean system. Fires can arise in times of low lake stage which, in moderation, can prevent plant dominance such as cattail. A decrease in lake level during spring time helps to concentrate prey resources and promote wading bird nesting on the lake.

Target – For deviations of lake stages, the target is established as no more than 192 ft weeks of lake stages outside of the envelope. This score allows for the optimal range of both dry and flooded periods to encourage a thriving and diverse community.

Evaluation Method – The O-SLOW Model will be employed for all evaluations. The evaluations will be based on simulation of the period from 1978 through 2008. For each week of the model simulation, the absolute value of the deviation (ft) of average weekly lake stage outside (above or below) the envelope is determined. The number of foot-weeks outside the envelope provides the raw score. The response curve (below) is utilized to calculate the score between 100% (best) and 0% (worst). The worst case scenario occurs when the hydrograph remains constantly in the poor zone (1,872 ft weeks). Therefore, the response curve is a line between the target (192 ft weeks or less) and the worst case scenario (1,872 ft weeks). Raw scores are calculated from the following equation:

$$\text{Score (\%)} = \text{raw score} * -0.0595 + 111.429$$

FISHEATING CREEK SUB-WATERSHED FEASIBILITY STUDY
Working Group Meeting
July 30, 2009

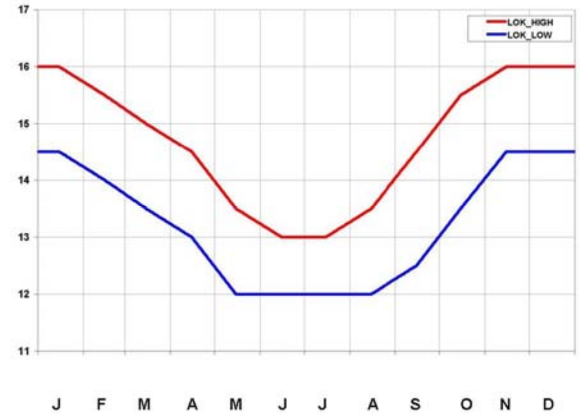


Figure 1 Lake Okeechobee Stage Envelope

Evaluation Criteria Fact Sheets

- Evaluation Criteria Fact Sheet (see handout)
  - Description – what is being measured and why?
  - Rationale – technical basis for why the evaluation criteria is being utilized
  - Target – specific description of how success or failure will be measured
  - Evaluation Method – description of what model or analytical method will be utilized

Available Data & Tools

- WAM Simulation Output (Flows & Loads)
- O-SLOW Simulation Output
- GIS Layers (see handout)
- Schedule
  - Draft EC fact sheets due by Aug 21st, 2009
  - FS Team will compile and evaluate WG input by Sep 4th, 2009

FISHEATING CREEK SUB-WATERSHED FEASIBILITY STUDY
Working Group Meeting
July 30, 2009

Example Evaluation Criteria Fact Sheet

Performance Measure: Lake Okeechobee Stage Envelope – Score Within Envelope
Description – Lake stages fluctuate in response to a combination of seasonal, annual, and inter-annual climatic conditions and operational practices. Research (Havens 2002) has confirmed that lakes stage should ideally vary seasonally between 12.5 ft, NGVD (June-July low) and 15.5 ft, NGVD (November-January high) within a desirable envelope (Figure 1). A healthy variation of lake stages result in annual flooding and drying of the littoral zone, promoting development of diverse plant and animal communities. Decreasing water levels toward the end of winter and spring allow wading birds to easily prey on resources in the littoral zone. However, if the lake stage falls below the envelope too frequently, the littoral zone is threatened.
Rationale – The littoral zone and shoreline areas of Lake Okeechobee support submerged plant life. Extreme high stages (above 17 ft NGVD) allow wind-driven waves to directly impact the littoral emergent plant and near-shore submerged plant communities, causing physical uprooting of plants. Overall, high lake stages result in extirpation or reduced growth of submerged plants, adverse impacts to germination of submerged plants, reductions in fish spawning and fish reproductive success, and undesirable shifts among species that comprise the macroinvertebrate community. Detailed research results regarding high stage impacts on the lake's plant and animal communities can be found in Maceina and Soballe (1990), Havens (1997), Havens et al. (1999), and Havens et al. (2001). If the lake stage is frequently below the envelope, the vegetation does not receive the water it requires to flourish. Without submerged aquatic vegetation, the habitats of wading birds, reptiles, fish, amphibians, and apple snails are endangered. These species rely on a surplus of aquatic plants for foraging and recruitment activities. When the lake stage falls below the envelope, it creates optimal conditions for invasive plant species such as torpedo grass and Melaleuca to replace the original native vegetation. At levels below 11 ft, NGVD, access to the lake for fishermen and recreational boaters becomes limited to channels and boat trails. It should be noted that the Lake Okeechobee commercial and recreational fishery is valued at over $480 million dollars (Furse and Fox 1994) Lake stages below the envelope are beneficial in moderate occurrences. Periodic exposure of seed banks helps control plant dominance and can provide nutrition to animal communities. Low lake stages also expose the littoral zone to oxidation of the organic material that accumulates over time, creating a healthy and clean system. Fires can arise in times of low lake stage which, in moderation, can prevent plant dominance such as cattail. A decrease in lake level during spring time helps to concentrate prey resources and promote wading bird nesting on the lake.
Target – For deviations of lake stages, the target is established as no more than 192 ft weeks of lake stages outside of the envelope. This score allows for the optimal range of both dry and flooded periods to encourage a thriving and diverse community.
Evaluation Method – The O-SLOW Model will be employed for all evaluations. The evaluations will be based on simulation of the period from 1978 through 2008. For each week of the model simulation, the absolute value of the deviation (ft) of average weekly lake stage outside (above or below) the envelope is determined. The number of foot-weeks outside the envelope provides the raw score. The response curve (below) is utilized to calculate the score between 100% (best) and 0% (worst). The worst case scenario occurs when the hydrograph remains constantly in the poor zone (1,872 ft weeks). Therefore, the response curve is a line between the target (192 ft weeks or less) and the worst case scenario (1,872 ft weeks). Raw scores are calculated from the following equation: Score (%) = raw score * -0.0595 + 111.429

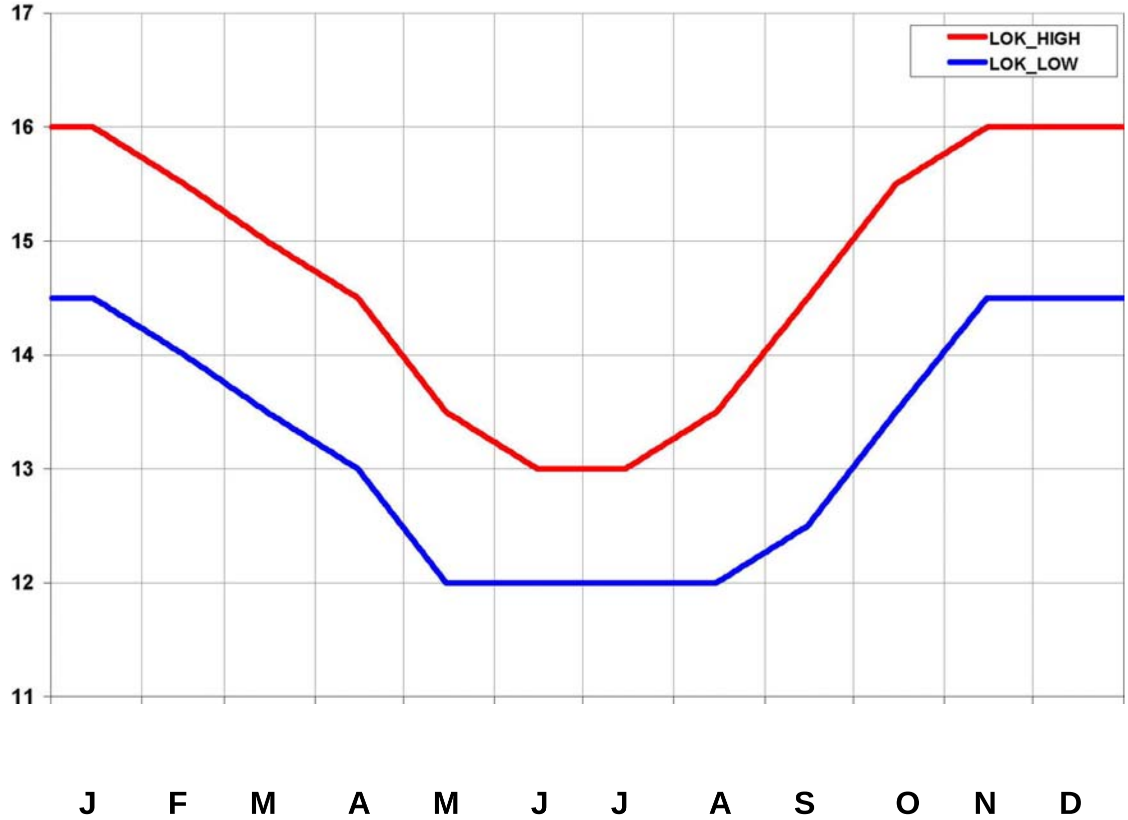


Figure 1 Lake Okeechobee Stage Envelope

FISHEATING CREEK SUB-WATERSHED FEASIBILITY STUDY
Working Group Meeting
July 30, 2009

<u>Evaluation Criteria Fact Sheet</u> Blank Template

Evaluation criteria:
Description: *What is being measured and why?*
Rationale: *What is the technical basis for why the evaluation criterion is being utilized?*
Target: *Provide a specific description of how success or failure will be measured*
Evaluation Method: *Describe model output, post-processing, or analytical method will be utilized.*
Other Relevant Information: *References, Your contact information, etc.*

Management Measures

What is a Management Measure?

- A feature or activity that can be implemented at a specific geographic site to address one or more planning objectives
- Feature – a structural element that requires construction or assembly on-site
  - Reservoirs, STAs, RaSTAs, pump stations, canals, levees, etc.
- Activity – a non-structural action or a practice that is implemented to achieve one or more project goals
  - BMPs, reservoir operating schedules, modifying water releases, etc.

MM are building blocks for alternative plans

- Key steps:
  1. Brainstorming
  2. Screening
  3. Apply siting / screening criteria
  4. Formulate plans
- P2TP MM inventory for FEC
  - 20 MM (see handout)

Working Group Input

- Feasibility Study MM Inventory
- Break out into groups and brainstorm
- Storage and Water Quality MM
- MM Fact Sheet (see handout)
- Schedule:
  - MM List by the end of the meeting
  - Fact Sheet due Aug 21st, 2009

Questions?

Example Management Measures Fact Sheet

Project Feature/Activity: Agricultural BMPs

Level: 1

General Description/Background: Since 2002, considerable effort has been expended on the implementation of agricultural BMPs and water-quality improvement projects to immediately reduce the discharge of P from the watershed to the lake. Agricultural Nutrient Management Plans (AgNMPs) for the 22 active dairies in the watershed were completed in 2002, covering more than 31,000 acres (12,545 ha). Detailed planning, engineering, and design for implementing the stormwater component of the AgNMPs, at four of the dairies, will be completed by June 2007. Implementation of all of the dairy AgNMPs is expected to be completed by FY 2015.

Completed conservation plans now cover approximately 474,200 acres (191,902 ha) in the watershed, and BMPs are in various stages of implementation. The majority of this acreage lies within the four priority basins. Plans are being developed for an additional approximately 600,000 acres (242,811 ha) of agricultural operations. These figures reveal that more than half of the agricultural acreage in the entire watershed is currently under voluntary FDACS programs to plan and implement practices to control offsite movement of P. At the current rate of participation, FDACS is on schedule to complete BMP-based plans for the remainder of the agricultural acreage in the watershed by July 2010, and fully implement BMPs by 2015, as required by the Lake Okeechobee Protection Plan.

Purpose: Improve water quality by reducing transport of nutrients (primarily phosphorus) via runoff and leaching into regional system from agricultural and non-agricultural land uses

Location/Size/Capacity: Primarily within Lake Okeechobee watershed; expanding into estuary watersheds

Initiative Status:

Agricultural- underway; need update from FDACS

Urban- underway; need update from FDEP

Estimate of Water Quality Benefits

- Minimum: 72 mt/yr
- Maximum: 72 mt/yr
- Most Likely: 72 mt/yr
- Level of Certainty: Conceptual
- Assumptions: Water quality benefits will be rolled up into a single “urban” category

Estimate of Water Quantity Benefits

- Minimum: Unknown
- Maximum: Unknown
- Most Likely: Unknown
- Level of Certainty: Unknown
- Assumptions: NA

Contact: Rich Budell; FDACS; 850-488-6249.

Management Measures Fact Sheet Blank Template

Project Feature/Activity: (*MM Name)*

Level:

(L*evel 1 – Already constructed/ implemented or construction/implementation is imminent;*
Level 2 – Construction/implementation likely; detailed design/activity development on-going; siting location well defined
Level 3 – Implementation certainty unknown; conceptual level of design/activity development complete; siting location may be defined
Level 4 – Implementation certainty unknown; conceptual idea with rough order of magnitude costs and siting location
Level 5 – Implementation certainty unknown; conceptual idea with limited information)

General Description/Background: (*describe the MM)*

Purpose: (*What is the MM intended to accomplish?)*

Location/Size/Capacity: (*If known, provide a general location, size, and storage capacity or P-load reduction potential of the MM)*

Initiative Status: (*Identify if the MM is part of an on-going or future planned initiative, program or project, describe the current status of this initiative)*

Estimate of Water Quality Benefits (*If known, provide an estimate of projected water quality benefits. Indicate level of certainty of the projected benefits (high, low, conceptual). Include assumptions made to determine the benefits)*

- Minimum:
- Maximum:
- Most Likely:
- Level of Certainty:
- Assumptions:

Estimate of Water Quantity Benefits (*If known, provide an estimate of projected water quantity benefits. Indicate level of certainty of the projected benefits (high, low, conceptual). Include assumptions made to determine the benefits)*

- Minimum:
- Maximum:
- Most Likely:
- Level of Certainty:
- Assumptions:

Contact Information: *(Name, affiliation, address, phone number, e-mail address)*

Meeting Notes

Subject:	Fisheating Creek Feasibility Study Working Group Meeting Notes		
Meeting Date:	July 30, 2009	**Meeting Time:**	10:00am to 3:00pm
Meeting Location:	Archbold Biological Station	**Minutes Prepared by :**	HDR
Project Name:	Fisheating Creek Feasibility Study		

Attendees: List of attendees is included in the attached sign-in sheet

Meeting Notes:

1. **Issues Discussed**:

   a. TMDL Update

   Jennifer Thera (FDEP) presented the status of the state-wide TMDL program with specific reference to the Fisheating Creek (FEC) sub-watershed. FEC was listed on the 2006 list of impairments for dissolved oxygen (DO), chlorophyll, iron, and nutrients. As part of the Florida Department of Environmental Protection (FDEP) rotating TMDL cycle, monitoring is occurring this year in the FEC sub-watershed. Impairments will be verified by fall 2010 and impairment list should be adopted by 2011 after which TMDL development will be initiated. FDEP plans to use recommendations from this Feasibility Study (FEC FS) as a basis for the Basin Management Action Plan (BMAP) process. EPA has no plans for TMDL development since FEC was not on the 303(d) list of impaired waters in 1998 when the consent decree was adopted.

   b. Validation of FS Planning Targets

   The Lake Okeechobee Watershed Construction Project Phase 2 Technical Plan (P2TP) identified a storage target of 900,000 to 1,300,000 acre-ft for the Lake Okeechobee Watershed. Of this total storage target, approximately 200,000 acre-ft of storage was conceptually identified for the Fisheating Creek Watershed. This included storage for both local watershed runoff and additional storage to assist with Lake Okeechobee water level management. In addition, the P2TP identified a total phosphorus load reduction target of 33 metric tons per year (mt/yr) for the FEC sub-watershed. Approximately 18 mt/yr of load reduction would be provided by BMPs and the remaining 15 mt/yr would be achieved by future load reduction projects. The purpose of the Fisheating Creek Feasibility study is to perform additional more detailed analysis to refine the targets identified in the P2TP and to develop project specific details.

   One of the initial steps in the FEC FS was to reevaluate the P2TP storage and water quality targets and refine as appropriate. The Watershed Assessment Model (WAM) is being utilized to assist with this evaluation. Therefore WAM calibration and simulation results were presented. Model setup for simulation of existing hydrology and water quality conditions included updating rainfall data in the model for the 1978-2008 period of record and extending the Fisheating Creek Sub-watershed boundary to include portions of the Nicodemus Slough that drains to Lake Okeechobee. Existing conditions model simulation output matched recorded flows and total phosphorus loads in FEC reasonably well. WAM simulations of adjacent basins in the Lake Okeechobee Watershed also calibrated well indicating that the model results can be used with reasonable confidence.

Model setup for the pre-drainage condition simulations included updating rainfall data for the 1978-2008 period of record, extending the sub-watershed boundary to include portions of Nicodemus Slough, and development and coding of pre-drainage land use feature class for the sub-watershed based on relationships between soil classifications and native vegetation types.

Flows and loads under pre-drainage and existing conditions were compared for three representative locations within the creek and the reasons for the variations were discussed. Model results seem to indicate that in order to restore existing FEC flow to pre-drainage conditions, water will have to be stored during periods when existing conditions flow exceeds pre-drainage flow and released from storage when existing conditions flows are less than pre-drainage flows. To determine a storage volume, the 90% point along the volume exceedance curve was considered to represent the most cost effective point. Achieving more than 90% would most likely results in the expenditure of substantial funds for minimal additional benefit. Based on this analyses a storage target of approximately 3,000 ac-ft for areas between Reaches 4 and 69, about 8,000 acre-ft for areas between Reaches 69 and 138, and about 3,000 acre-ft for areas upstream of Reach 138 was recommended. As a result, a refined storage target of between 10,000 and 15,000 ac-ft is recommended for restoring FEC watershed hydrology.

Based on a period of record of 1978 to 2008, WAM simulations output indicated total phosphorus loading of approximately 37.6 mt/yr under pre-drainage conditions compared to approximately 90 mt/yr for existing conditions. If the goal is to restore phosphorus loading to pre-drainage conditions, then the FS would have to target approximately 53 mt/yr of load reduction.

Differences between flows and loads analyzed by the P2TP and the WAM projected flows and loads were discussed. It was pointed out the flows and loads could not be directly compared due to differences in the analytical tools and more importantly the period of record.

Question: Could the variability of total phosphorus in part be due to the AMO affect?
Response: Total phosphorus trend is not weather based.

Question: What drainage features were included in the pre-drainage model?
Response: Existing farm-level drainage features were not included in the pre-drainage simulation.

Question: Why is there a difference in flow?
Response: Drainage improvements over time have accelerated runoff delivery, less natural storage associated with wetlands, and increased development has led to an increase in the peaks between wet and dry conditions.

Question: Nicodemus Slough at one point was connected to the system and is now disconnected because of the dike. Could this be the reason for the additional flow? Could a diversion of flow into Nicodemus Slough be an option for addressing the required storage to restore FEC to historic conditions? The hydrologic timing of the events with relation to the available storage in Nicodemus Slough would have to be accounted for as well.
Response: Restoring Nicodemus Slough flows could be an option. Further analysis will have to be performed to determine the timing of the peaks and flows to determine whether diverting flows to Nicodemus Slough could be used as a storage option during peaks within the FEC sub-watershed.

Question: Where did the total phosphorus loads change? Changes in total phosphorus loading are closely related to changes in land use. The majority of the land use changes that are in the existing conditions are in the upper reaches of the FEC Sub-watershed. Therefore, the majority of increased total phosphorus runoff originates in this area.
Response: Further analysis with respect to the total phosphorous loads, land use, and soil type will have to be conducted between pre-drainage and existing conditions. The team will conduct further analysis to assess differences and changes in phosphorus loading. This item will be discussed further at future meetings.

Question: Since the FEC TMDL is not set, which target does the FS need to consider?
Response: It is not possible to identify a definitive target specifically for FEC total phosphorus concentrations or loads at this time. However, FEC is a contributor to total phosphorus loading to the lake that is well in excess of the Lake's TMDL. It is important to make progress toward increasing nutrient load reduction in FEC and the lake. Therefore, we are considering a target of restoring the pre-drainage total phosphorus loading to the lake of 37.6 mt/yr which will require a reduction in total phosphorus loading of 53 mt/y based on initial WAM simulations. Additional discussions regarding existing conditions and appropriate targets will occur at the next meeting. Input and suggestions of Working Group participants are encouraged.

c. Evaluation Criteria/Management Measures

Information on evaluation criteria (EC) was presented. Working Group input was sought on identifying sub-watershed level EC. Quantifiable EC's are preferable to qualitative criteria. Tools available for analyzing the criteria include output from model s such as WAM and the Oasis Lake Okeechobee Watershed (O-SLOW) and GIS layers. Emphasis should be placed on water quality related EC rather than criteria based on storage of excess flows.

Information on management measures (MM) was presented. Working Group input was sought on identifying MMs that would be considered by the FS. Handouts containing template EC and MM forms were provided to the Working Group. Attendees were encouraged to participate actively in the identification of the EC and MM.

Meeting participants pointed out relatively few landowners were present and that additional outreach to the landowners is needed before moving forward with identifying MMs. District staff acknowledged that additional stakeholder participation in the FS would be useful and asked for suggestions on reaching out to the broader community. The FEC Landowners Association (FECLA) is the only landowners association in the sub-watershed; however it only represents landowners in the northern portions of the sub-watershed. FECLA president authorized FDACS to release the mailing list of those FECLA members to the District so they can be contacted for future meetings. District staff will coordinate with FDACS with regards to increasing landowner awareness and participation in the FS. It was also pointed out that meetings should be held either in late afternoon or in the evening to make it easy for people to attend.

Question: Is the Urban Turf Fertilizer Rule accounted for? While the rule itself is not considered a management measure, a local ordinance requiring and enforcing the adherence to this rule is considered a management measure.
Response: Local fertilizer rule enforcement will be discussed at future management measure development meetings with all stakeholders.

Question: What is causing the total phosphorus hot spots by sub-basin? Is it land use driven? How much area is composed of high total phosphorus loads? Recent historical and ongoing total phosphorus monitoring data will be shared by FDEP.
Response: Further analysis of the relationship between land use, soils, and phosphorous loading will have to be conducted to establish the reasons for the hotspots. FDEP has shared the data taken thus far in Fisheating Creek as part of the Group 4 TMDL monitoring cycle. Data from the last two quarters of 2009 will be shared by FDEP.

Question: What are the plans to mine the build-up of phosphorous? This mining is in reference to Lake Okeechobee, FEC, and any future reservoir projects utilized for the settlement of total phosphorus out of the flow. SFWMD also mentioned source control to prevent total phosphorus from entering the watershed as one way to prevent the need to mine the total phosphorus.
Response: While there are no specific plans at this point to mine the build-up of phosphorous within Lake Okeechobee, or its watershed, projects addressing legacy phosphorus could be considered as a potential management measure as part of the FEC FS.

Question: What is the area of organic soils? Is there a possibility of rebuilding those wetland areas with organic soils?
Response: Further analysis of pre-drainage and existing conditions soil types, with special attention being provided for the identification of organic soils, will have to be conducted. The rebuilding of wetland areas can be added as a management measure. This can be discussed further after the results of the soils analysis have been completed.

Question: Are there any monitoring locations downstream of peat deposits?
Response: Further analysis of existing monitoring sites in relation to existing conditions soil types will need to be conducted.

Question: Is there a possibility to collaborate future land use with storage or water quality impoundments through contractual agreements?
Response: SFWMD encouraged all stakeholders to submit these types of ideas or suggestions as part of a management measure so they can all be considered.

Question: Can a map be generated showing the total phosphorus assimilation coefficients used by land use or by table?
Response: The assimilation coefficients used in the model will be summarized for future meetings.

Question: What is the average total phosphorus contribution per FLUCCS code?
Response: Further analysis of the relationship between phosphorous loading and land use by FLUCCS code will have to be conducted to determine this.

Question: How much total phosphorus in FEC is a result of scour of the stream bank? The FEC Marsh Watershed Project from ~1961 resulted in the design of FEC upstream of Palmdale. Previously it was predominantly wetland upstream of FEC. The purpose of the project was to keep water levels up, dry out the muck, and help with summer fires. One project could be to design a stream channel with vegetation to help with total phosphorus uptake, decrease scour/sediment transport, and maintain conveyance capacity.
Response: Assumptions made in the model for existing conditions with regards to assimilation coefficients assume that there is some "legacy" phosphorous in the existing soil conditions. This project could be included as a management measure. This will be discussed further with all stakeholders at future meetings addressing the identification of management measures.

Question: What LiDAR data is there for FEC? Most of the SFWMD LiDAR data is around Lake Okeechobee. There is some LiDAR for the Archbold area.
Response: The LiDAR data available from SFWMD is limited to the dike around Lake Okeechobee and the Archbold area. Coordination with SWFWMD will be conducted to determine if LiDAR data exists within their database for any areas within the FEC sub-watershed.

Question: What are our goals and how will we know when we've achieved them? Monitoring data?
Response: FDEP has shared the monitoring data they have collected and assimilated to date. FDEP will also share the data collected from their last two events for 2009. Monitoring data collected by SFWMD is available within the DBHydro database. The goals and means with which to measure our goals will be an evolving process as coordination occurs with FDEP, as TMDLs become available, and as additional coordination occurs with the FEC stakeholders.