



Caloosahatchee River Basin Modeling Support

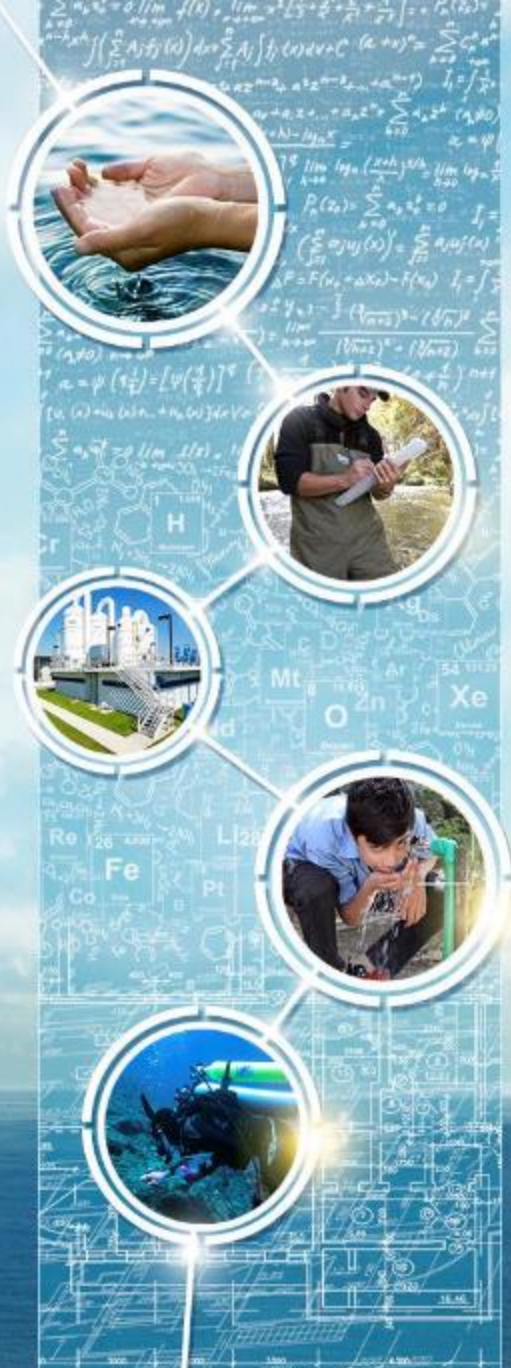
Task 2 HSPF Hydrology Draft Calibration, and
Task 5 EFDC Hydrodynamic Draft Calibration

August 10, 2016

Brian Watson, PE, PH, D.WRE

Erin Lincoln, PH

Marcy Frick, REM





Project Task Updates

Project Tasks

- Task 1. Evaluate HSPF and EFDC Model Integrity and Development of Project Templates
 - Completed and approved by DEP on April 19th
- Task 2. Evaluate Current HSPF Hydrology Calibration and Recalibration of HSPF Model
 - Draft (version 3) results and memo submitted to DEP on July 29th
- Task 3. Evaluate HSPF Water Quality Model Calibration and Recalibration of HSPF Water Quality Model
 - Draft results and memo submitted to DEP on August 5th

Project Tasks, continued

- Task 4. Convert the Existing Proprietary EFDC Model into a Public Domain Application and Incorporate the Light Module
 - Completed and approved by DEP on May 5th
- Task 5. Evaluate the EFDC's Existing Hydrodynamic Model Calibration and Recalibration of EFDC Hydrodynamic Model
 - Draft (version 2) results and memo submitted to DEP on August 5th
- Task 6. Evaluate the EFDC's Existing Water Quality Model Calibration and Recalibration of EFDC Water Quality Model
 - Working on draft EFDC model water quality results and memo

Project Tasks, continued

- Task 7. Create a Background Land Use Plus Lake Okeechobee Meeting its TMDL Scenario Run
 - Draft memo and model runs due to DEP in mid-October 2016
- Task 8. Communications and Meetings
 - Occurs throughout to coordinate with DEP and stakeholders
- Task 9. Documentation Final Report
 - Draft report documenting revisions and recalibration of models due to DEP in early January 2017
- Task 10. Training and Department Staff Support
 - Training and technological transfer for HSPF and EFDC models
 - Project completed end of February 2017

Task 2: HSPF Model Setup

Subbasin Delineation

- Revised subbasin delineation
 - Redelineated to 4 hydrologic gages
 - Split long, narrow subbasins
 - Included Deep Lagoon area
- Modified reach F-TABLES to account for ponding/water storage behind weirs
- Modified hydraulics of S-4 basin
 - Assumed inflow into basin through S-310 lock and seepage
 - Withdrew water from all reaches to satisfy S-4 pump demand

Weather Data

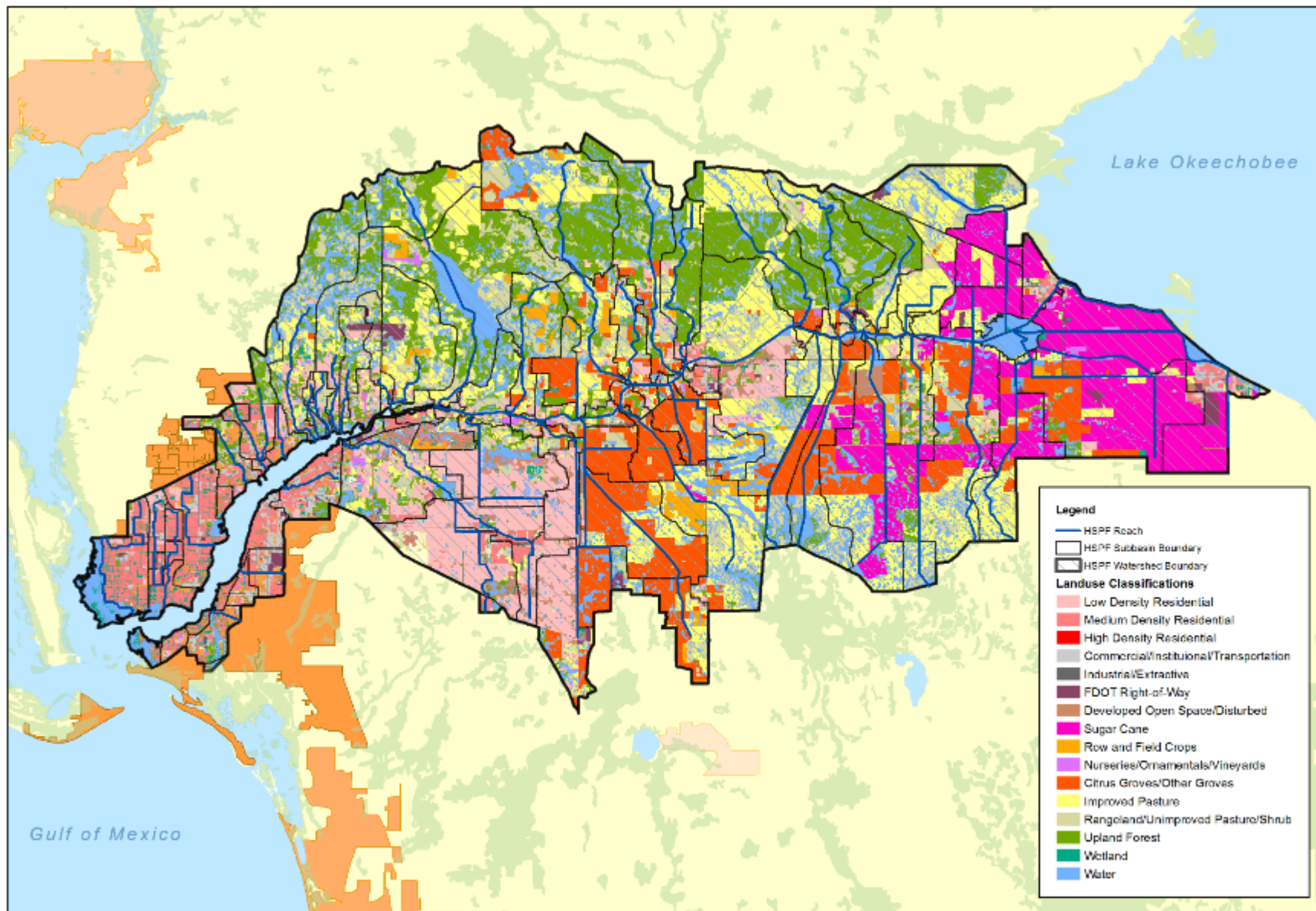
- Used SFWMD NEXRAD precipitation data
 - Provided consistent dataset for entire watershed
 - Had highest percent complete dataset for modeling period
 - Annual average precipitation volumes within 10% of Lee County and NCDC station at 8 of 10 stations reviewed
 - Individual storm event precipitation typically within 20% of ground stations
- Used WBAN 12835 climate data
 - Temperature, PET, wind speed, cloud cover, and solar radiation
 - Data were available at hourly time step

Land Use

- Used 2008-2009 SFWMD land use cover
 - Similar to 2004 and 2012 SFWMD
 - 16 land use classifications
 - Separate FDOT classification
 - 6 agricultural classifications
- Used 2011 NLCD Impervious Area
 - Similar to 2006 NLCD Impervious Area
 - Assumed impervious area in High Density land uses were directly connected to streams
 - Assumed fractions of impervious area in Medium Density, Low Density, and all other land uses were partially connected to streams
 - 7 impervious land use classifications

Land Use, continued

HSPF Land Use Code	Land Use Description	Land Segment	Total Acreage	% of Area
01	Low Density Residential (Pervious)	PERLND	74,606	8.5%
02	Developed Open Space / Disturbed (Pervious)	PERLND	21,587	2.5%
03	Medium Density Residential (Pervious)	PERLND	31,118	3.5%
04	High Density Residential (Pervious)	PERLND	6,162	0.7%
05	Commercial / Institutional / Transportation (Pervious)	PERLND	8,234	0.9%
06	Industrial / Extractive (Pervious)	PERLND	7,408	0.8%
07	FDOT Right-of-Way (Pervious)	PERLND	4,300	0.5%
08	Sugar Cane	PERLND	90,632	10.3%
09	Row and Field Crops	PERLND	13,753	1.6%
10	Nurseries / Ornamentals / Vineyards	PERLND	3,670	0.4%
11	Citrus Groves / Other Groves	PERLND	91,032	10.3%
12	Improved Pasture	PERLND	128,792	14.6%
13	Rangeland / Unimproved Pasture / Woodland Pasture / Shrub	PERLND	102,272	11.6%
14	Upland Forests	PERLND	121,115	13.8%
15	Wetlands	PERLND	13,963	1.6%
16	Water	PERLND	133,590	15.2%
01	Low Density Residential (Impervious)	IMPLND	4,691	0.5%
02	Medium Density Residential (Impervious)	IMPLND	9,924	1.1%
03	High Density Residential (Impervious)	IMPLND	3,760	0.4%
04	Commercial / Institutional / Transportation / Industrial / Extractive (Impervious)	IMPLND	7,017	0.8%
05	FDOT Right-of-Way (Impervious)	IMPLND	844	0.1%
06	Agriculture (Impervious)	IMPLND	699	0.1%
07	Other (Impervious)	IMPLND	1,242	0.1%
N/A	Total	TOTAL	880,408	100.0%



Caloosahatchee HSPF Model
HSPF Landuse Classifications

NAD 1983 UTM 17N
04.29.2016 E. Litton

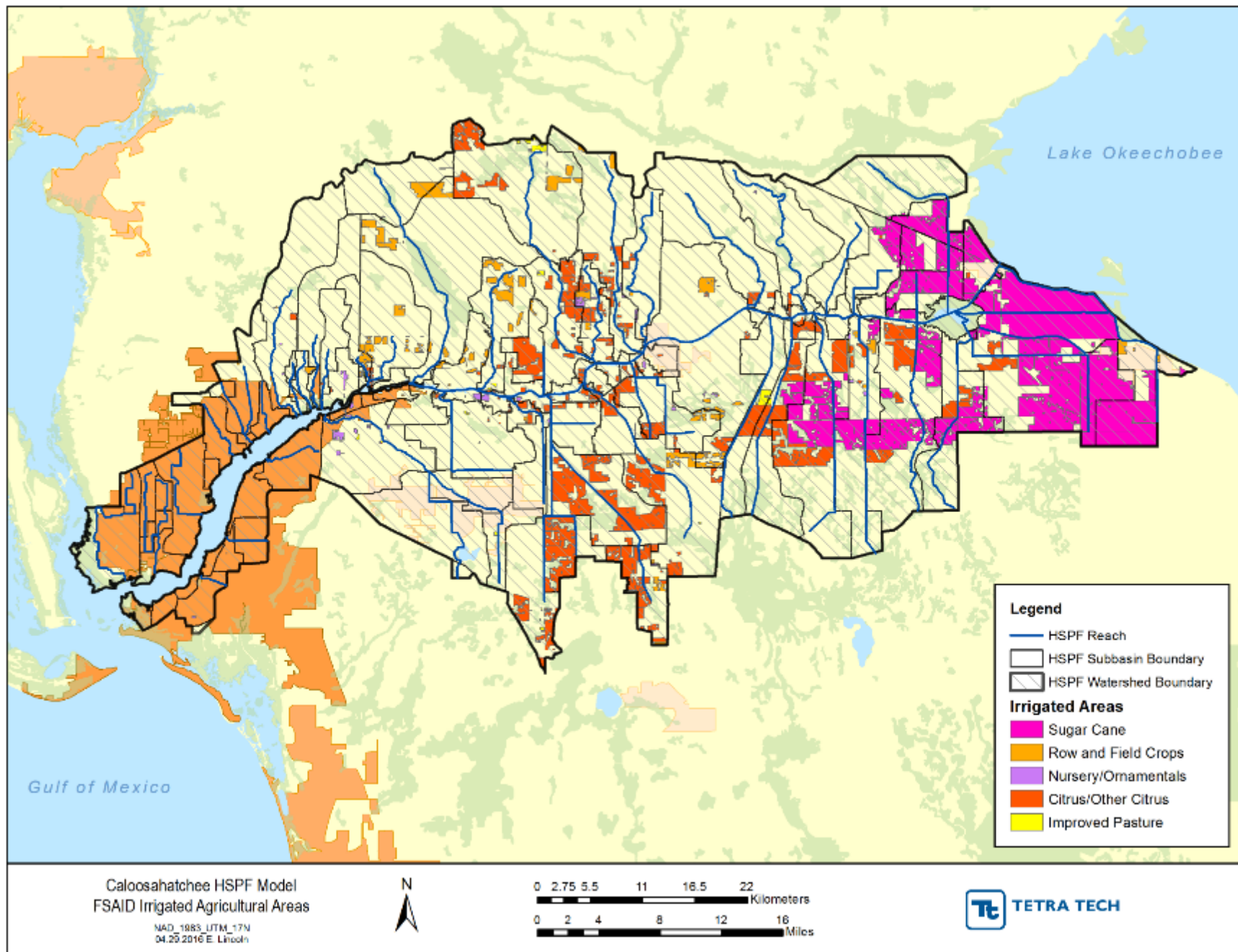


0 2.75 5.5 11 16.5 22 Kilometers
0 2 4 8 12 16 Miles



Agricultural Irrigation

- Developed demand-based agricultural irrigation time series:
 - Demand varied by crop type and was based on FDACS Blaney-Criddle model, SFWMD AFSIRS model, and IFAS report
 - Used 2010 FSAID report to determine irrigated area and crop type in each subbasin
- Agricultural irrigation water sources included surface water, shallow ground water, and deep ground water
- Agricultural irrigation water applied directly to land surface



Point Source and Reuse Facilities

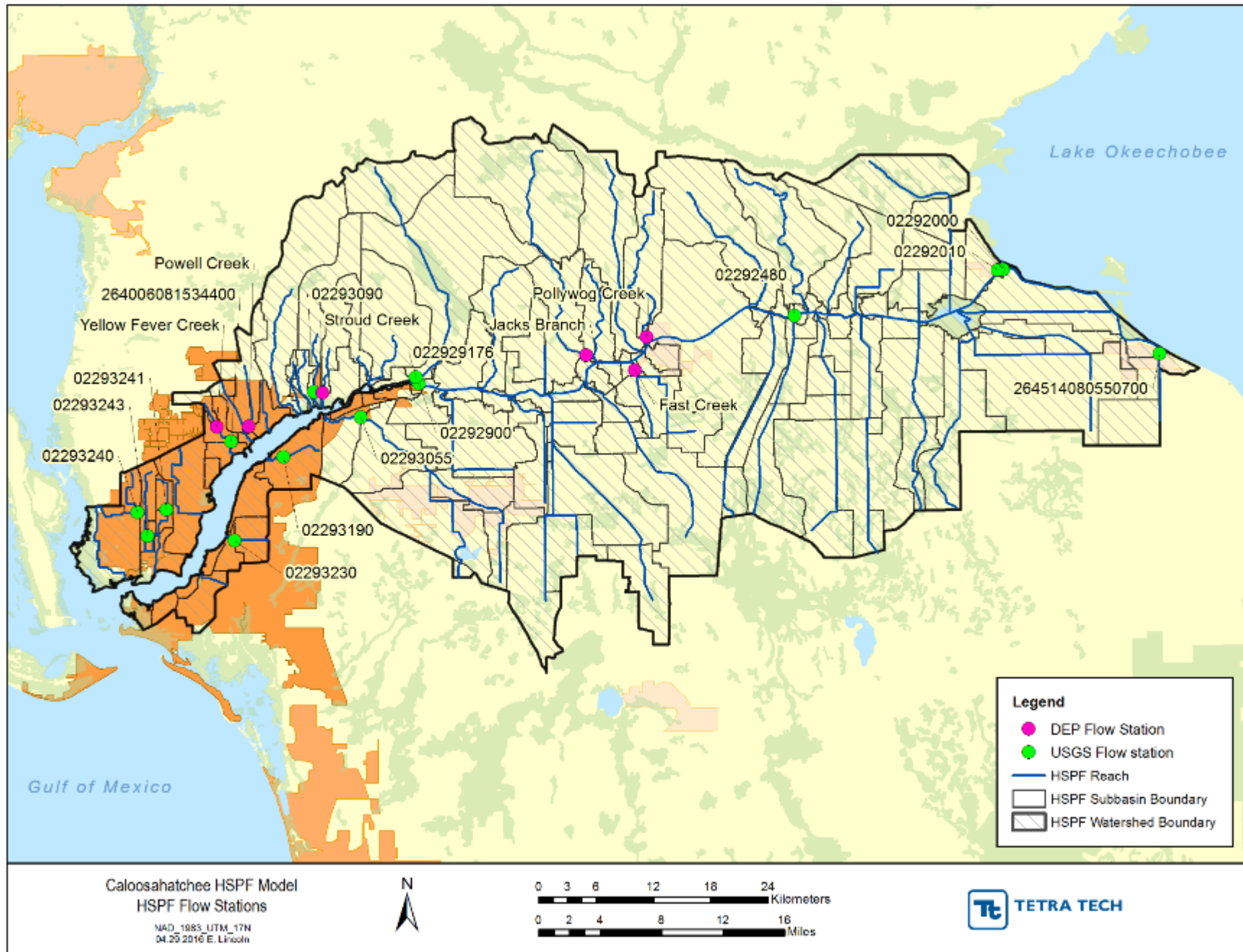
Facility ID	Facility Name	Facility Type	Discharge Type	Permitted Capacity (MGD)
FL0037541	E R Jahna Ind - Ortona Mine	IW	Point Source	4
FL0040088	Cape Coral, City of - RO WTP	IW	Point Source	1.2
FL0040665	Clewiston, City of - WWTF	DW	Point Source	1.5
FL0021261	Fort Myers Central AWWTF	DW	Reuse	6.0
FL0030007	Cape Coral, City of - Everest WRF	DW	Reuse	29.4
FL0039829	Fiesta Village Advance Wastewater Treatment Plant	DW	Reuse	2.976
FL0040665	Clewiston, City of - WWTF	DW	Reuse	2.02
FLA014283	LaBelle, City of	DW	Reuse	0.750
FLA014290	Port LaBelle	DW	Reuse	0.499
FLA014548	Del Prado WWTF (formerly North Fort Myers Utility)	DW	Reuse	5.251
FLA014565	Lehigh Acres WWTP	DW	Reuse	4.040
FLA014676	River Trails Mobile Home Park	DW	Reuse	0.097
FLA016891	Glades County Correctional	DW	Reuse	0.315
FLA144215	Fort Myers Beach STP	DW	Reuse	5.540

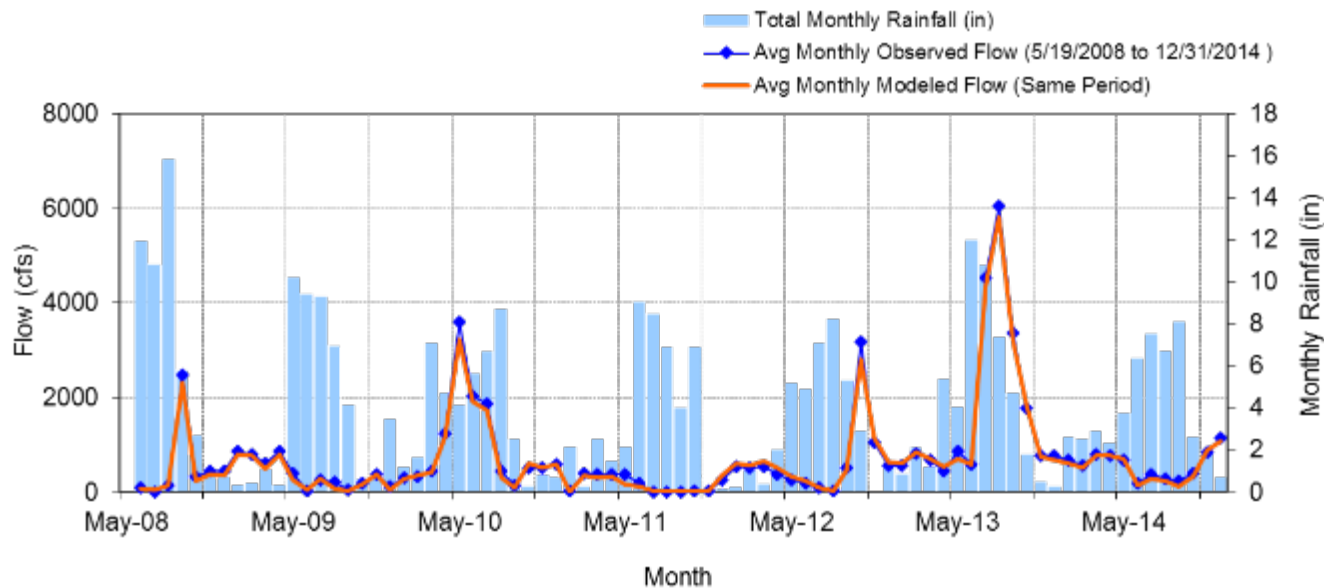
Septic Systems

- Used Lee County and FDOH GIS septic system coverage databases
- Estimated concentrations based on distance from stream or canal
 - Effluent concentrations and decay rates from USEPA
 - Decay rate for NO_x from the department
- Failing septic systems implicit in the upland buildup/washoff algorithms (Harper 1994 and SWET 2004)

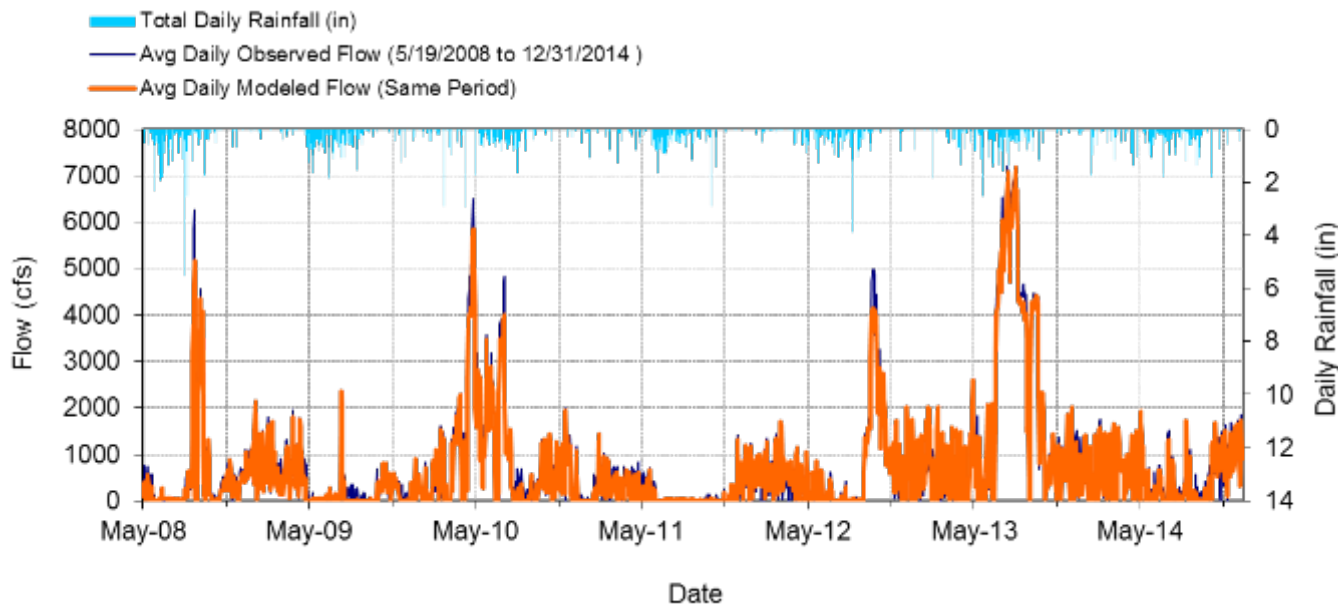
Parameter	<50 Meters Concentration (mg/L)	51-200 Meters Concentration (mg/L)	>200 Meters Concentration (mg/L)
BOD ₅	0.000	0.000	0.000
OrgN	0.000	0.000	0.000
TAM	0.000	0.000	0.000
NO _x	50.971	12.914	0.001
OrgP	0.044	0.000	0.000
PO ₄	0.000	0.000	0.000
TSS	0.000	0.000	0.000
DO	4.000	4.000	4.000
Temp (°C)	16.600	16.600	16.600

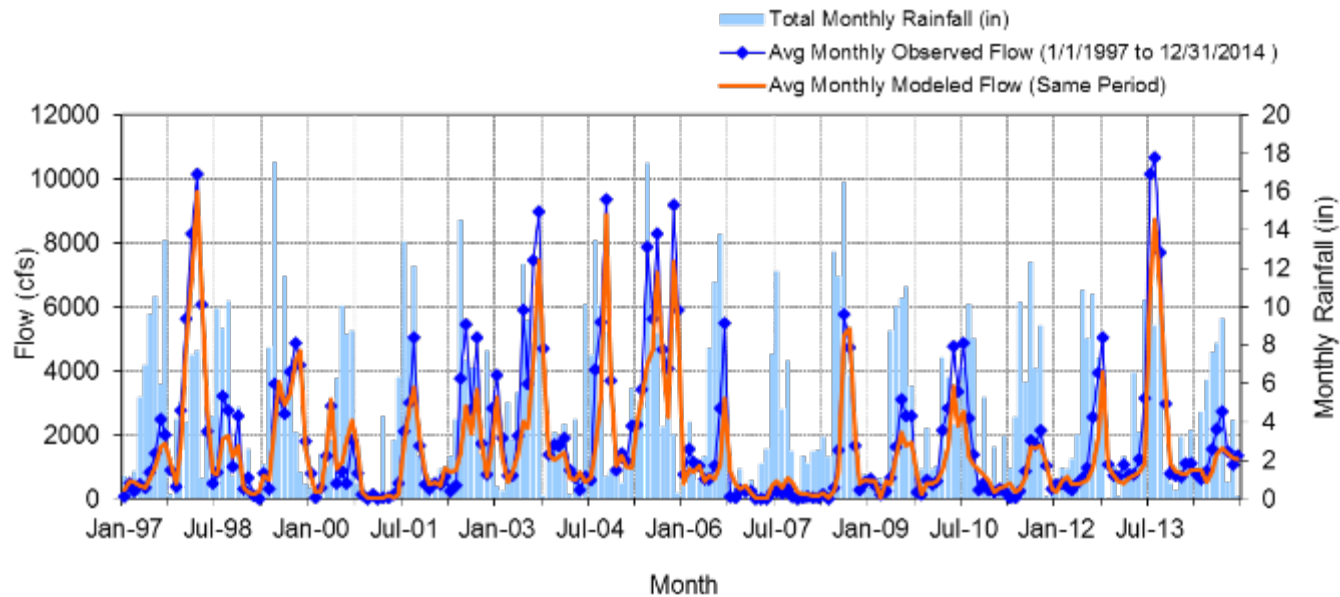
Task 2: Draft HSPF Model Setup and Hydrodynamic Calibration



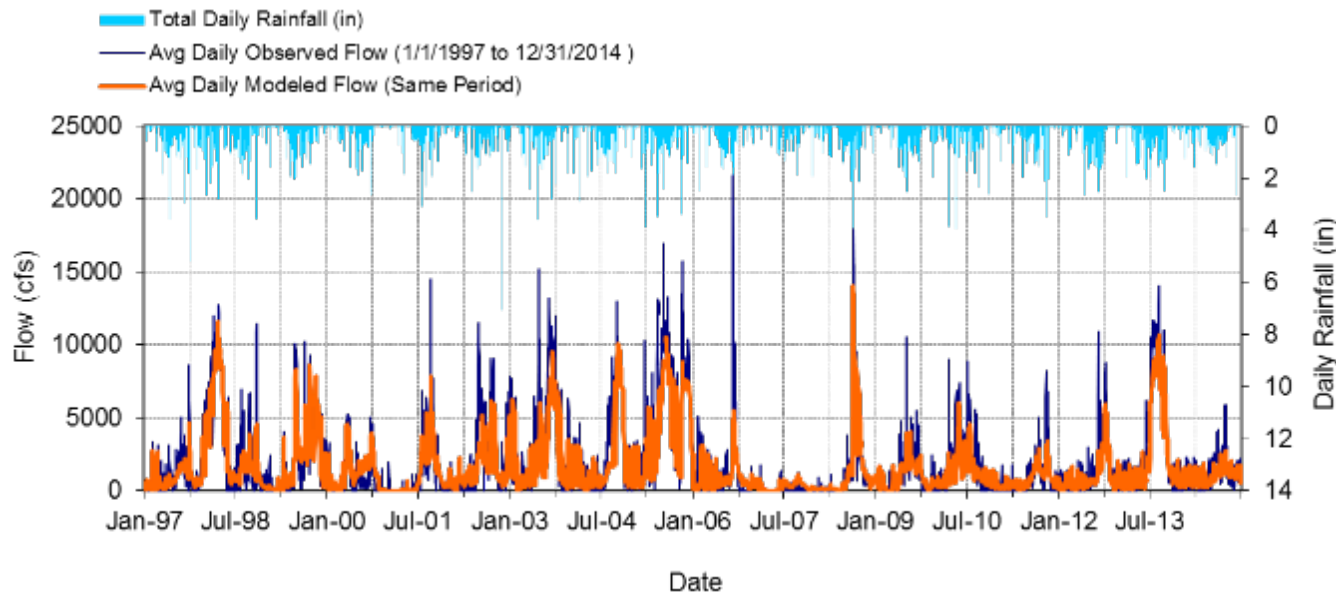


USGS 02292010
Caloosahatchee
River below S-77

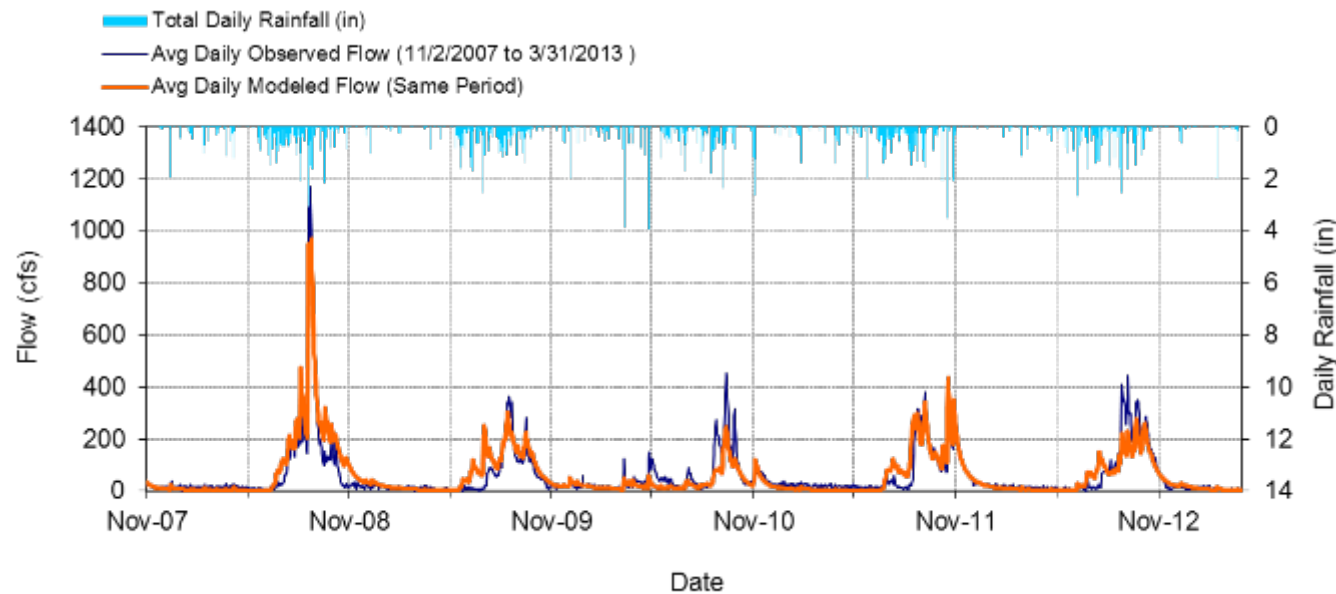
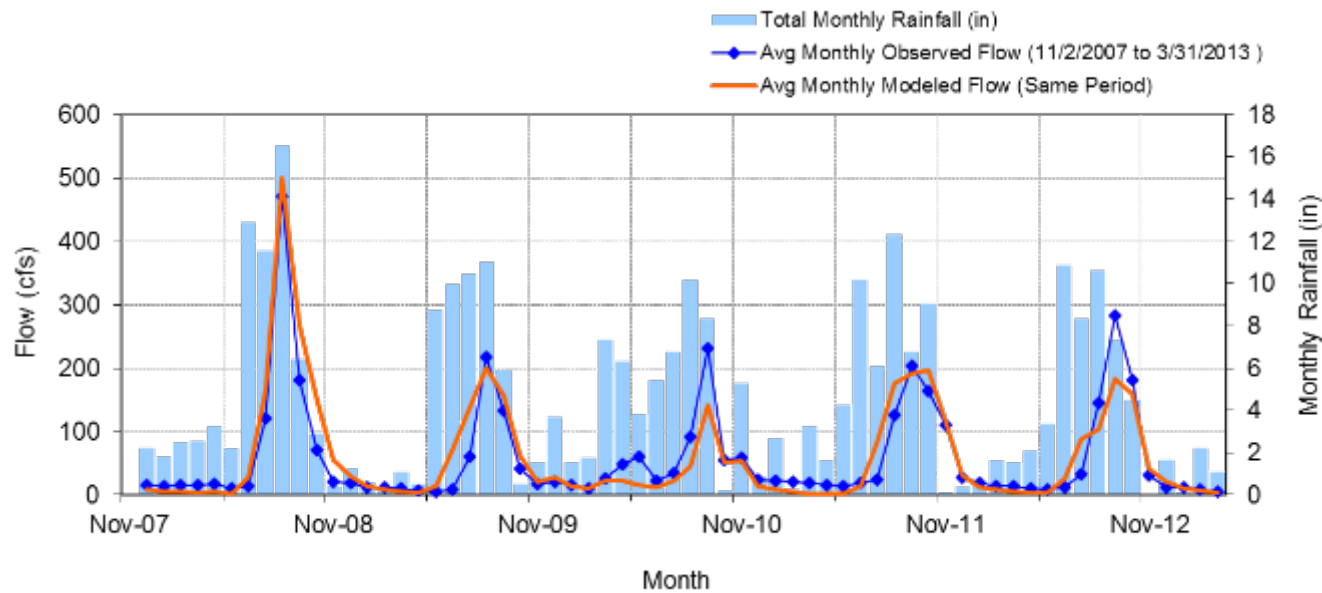




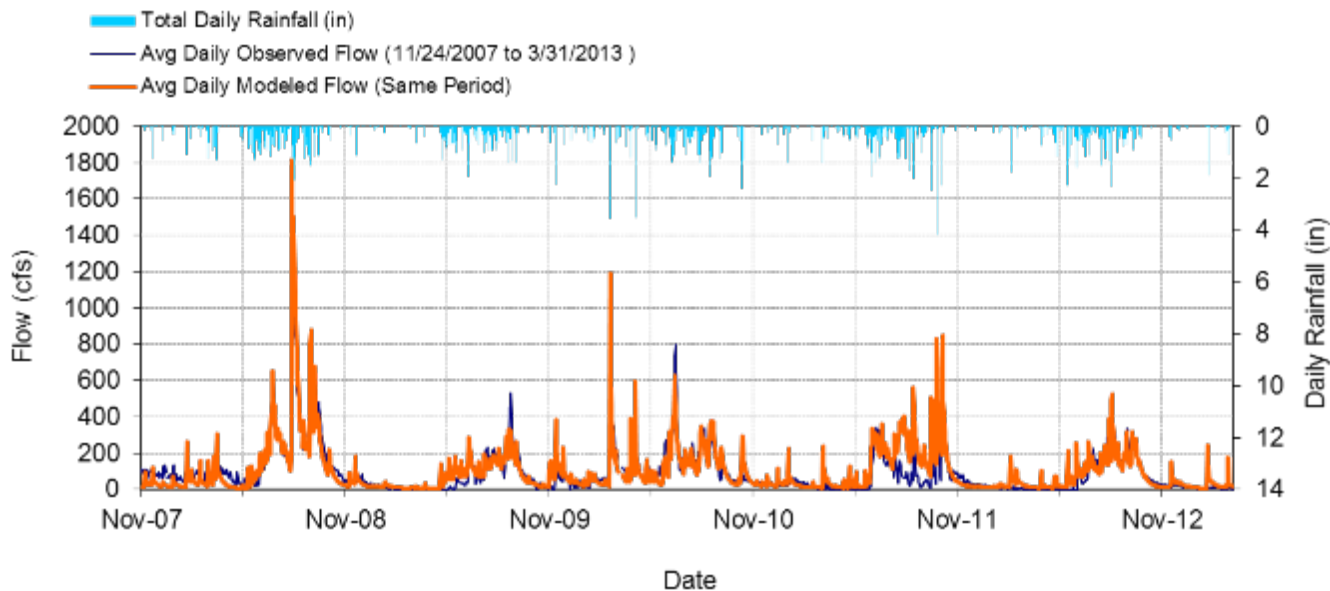
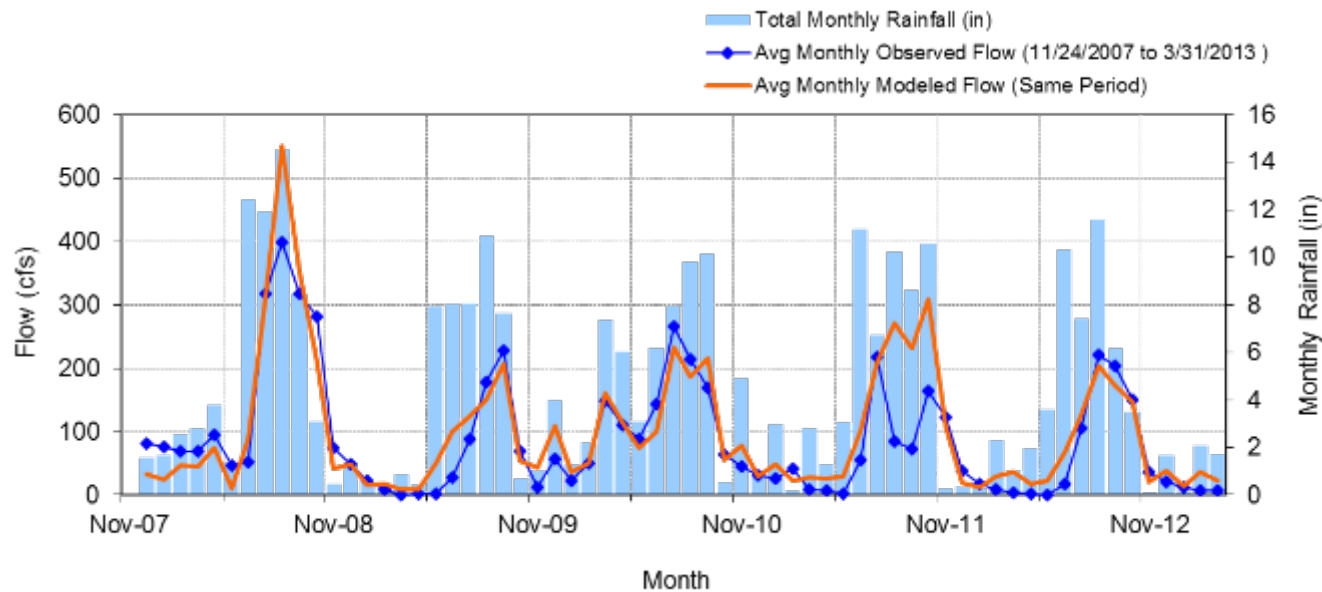
USGS 02292900
Caloosahatchee
River below S-79



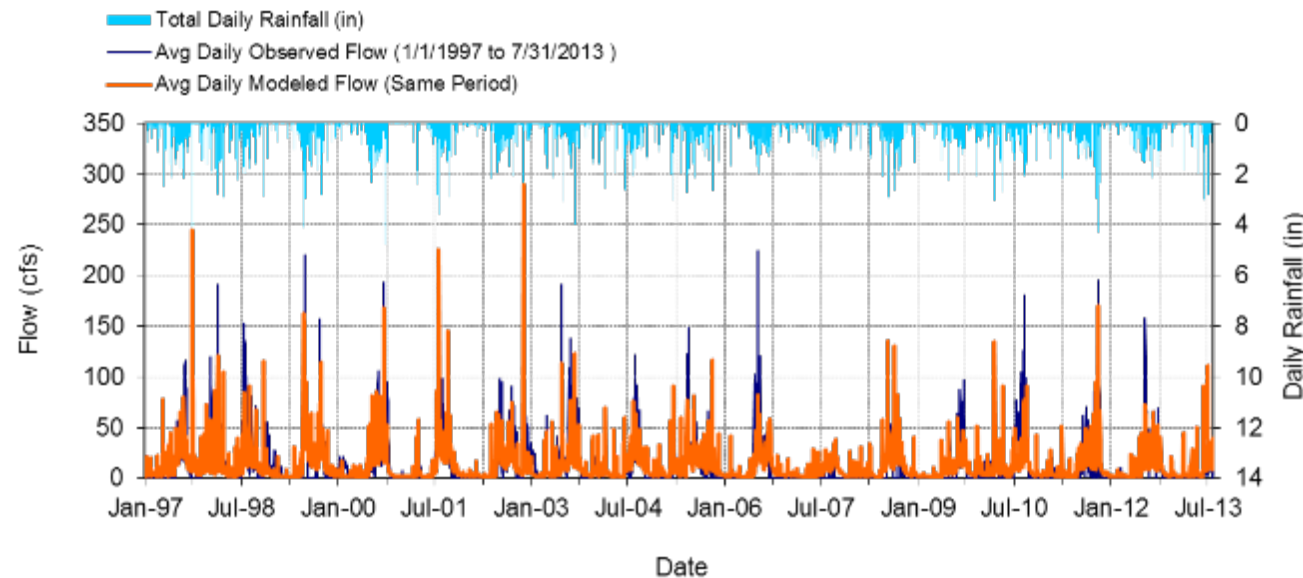
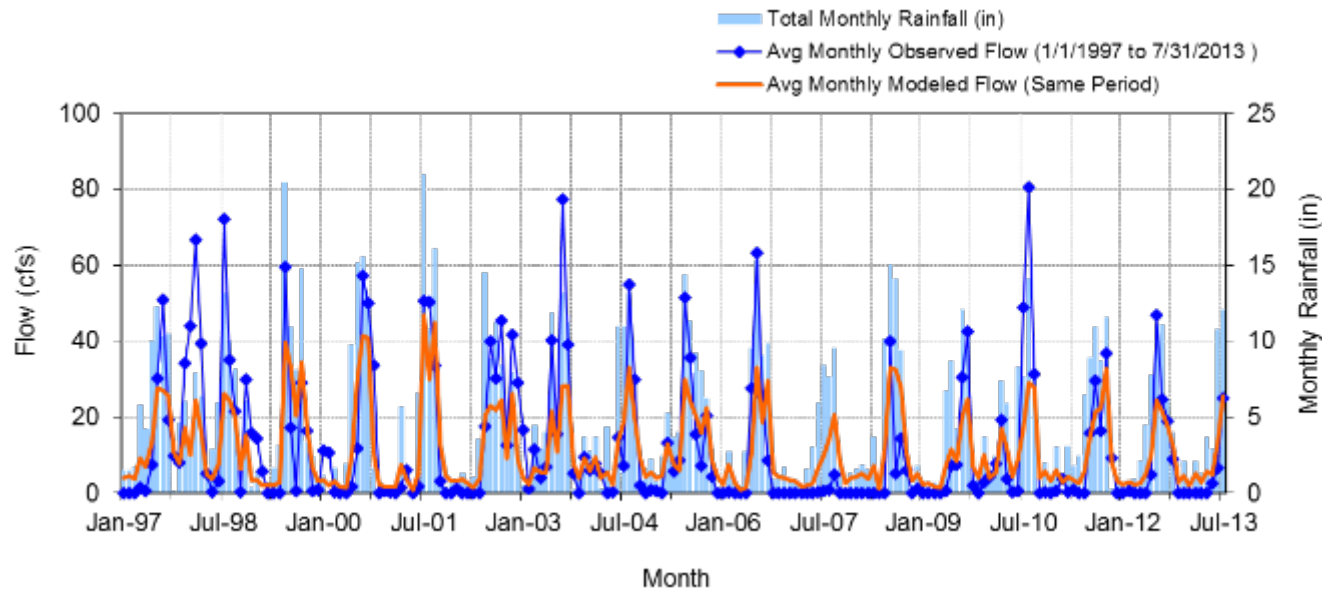
USGS 022929176 Telegraph Creek



USGS 2293055 Orange River



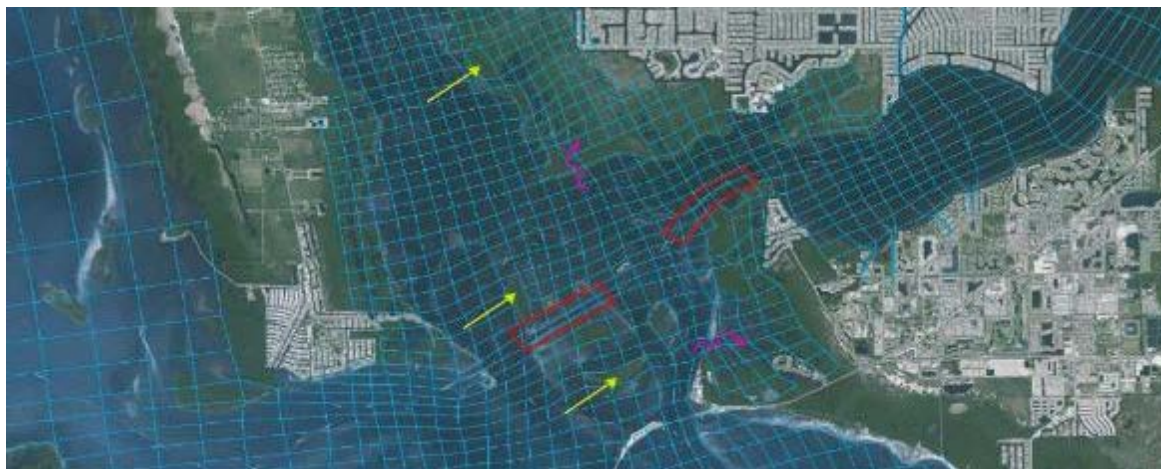
USGS 02293243 Courtney Canal



Task 5: EFDC Model Setup and Hydrodynamic Calibration

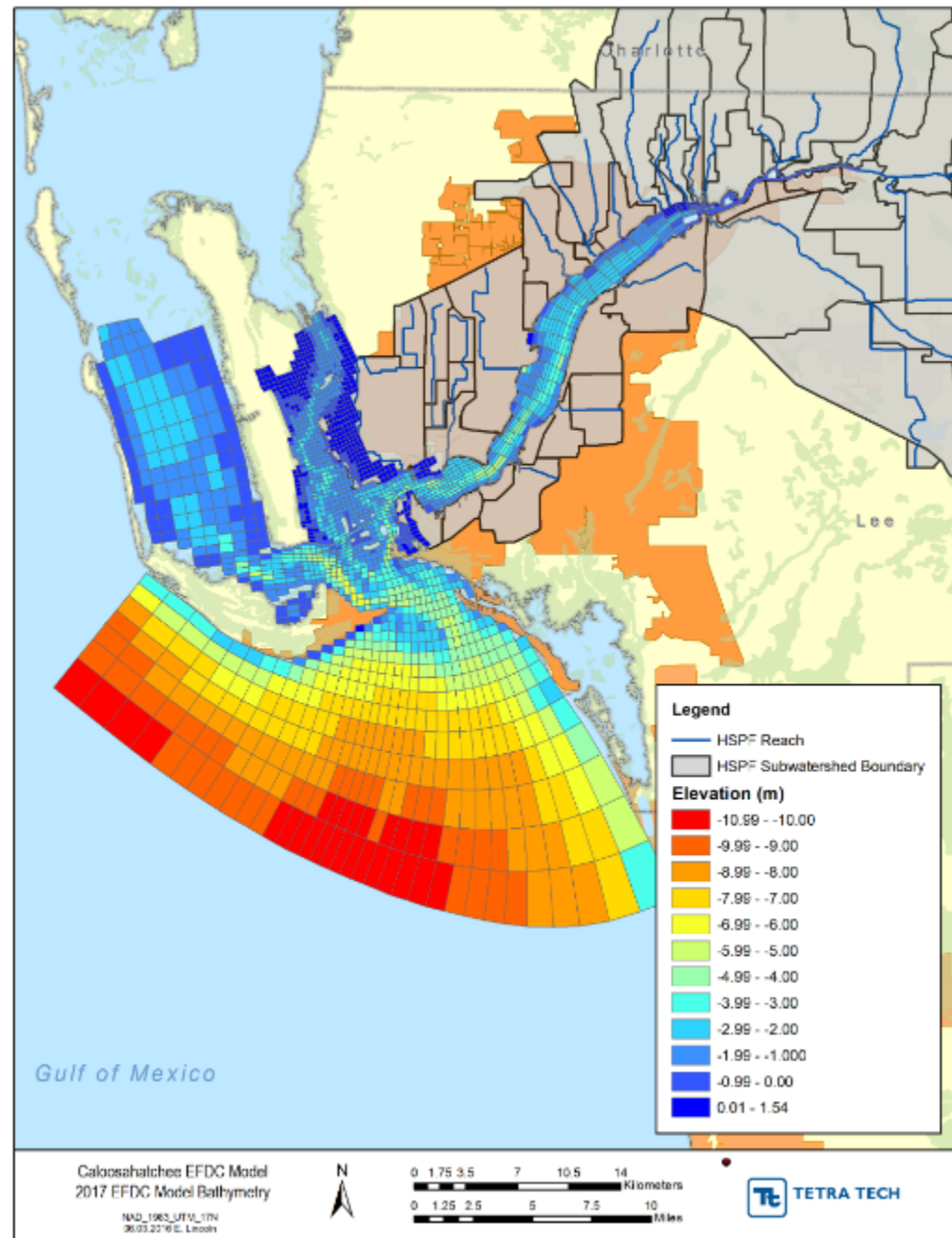
Grid

- Re-alignment of cells to represent the channel in the riverine region and sub-channels in the embayment area
- Removed cells to represent islands and obstructions restricting flow circulation in the system
- Reconfigured cells in marsh and mangrove areas
- Added seven tributaries that have bidirectional flow due to tidal propagation



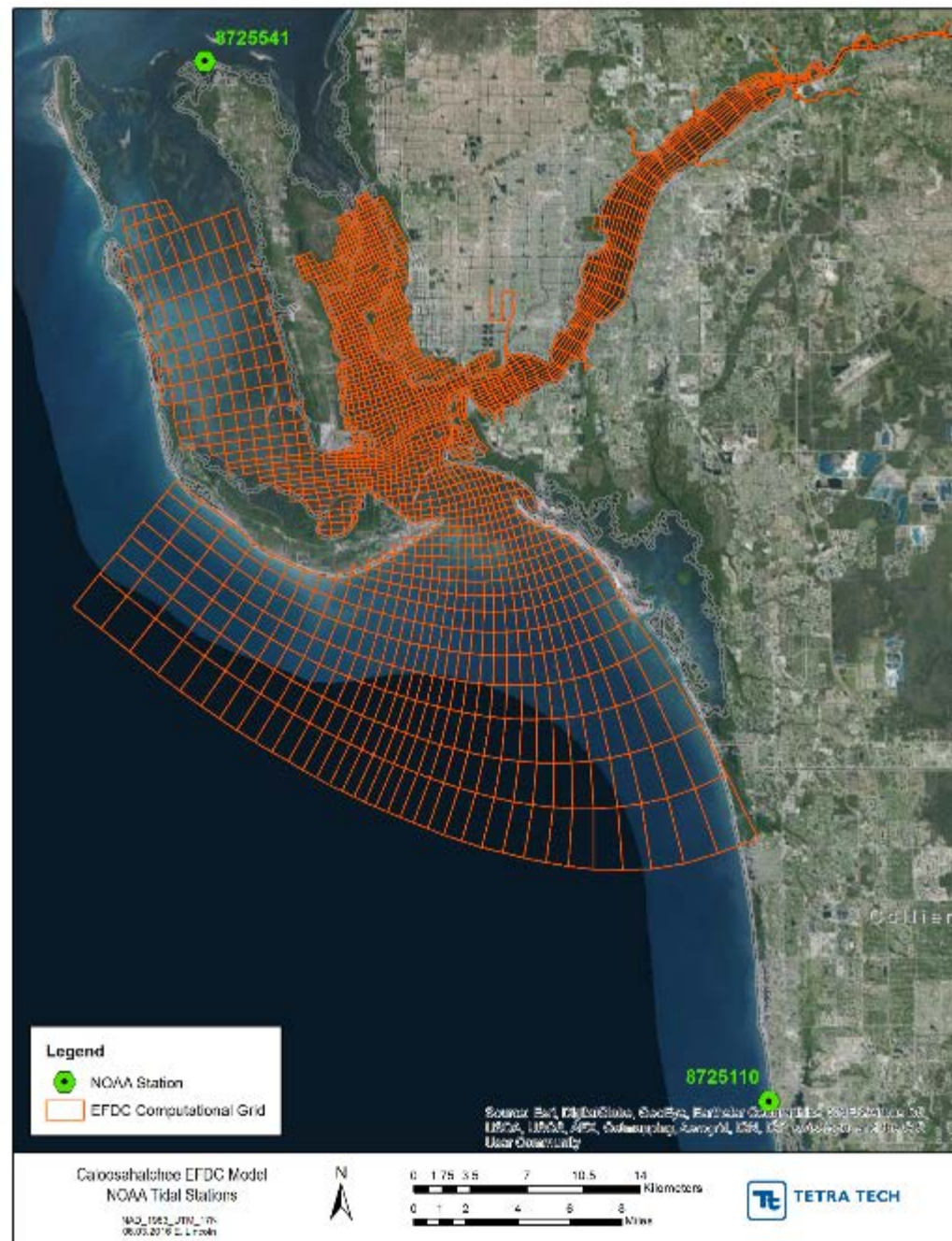
Bathymetry

- Used SFWMD Light Detection and Ranging (LiDAR) data
- Assigned the average bed elevation to each cell in the model grid
- Manually checked bathymetric depths to ensure an appropriate representation of the main channel



Boundary Conditions

- Water Surface Elevation
 - Charlotte Harbor NOAA 8725541 used for northern open boundaries (Matlacha Pass and Pine Island Sound)
 - Naples NOAA 8725110 used for southern open boundary (Gulf of Mexico).

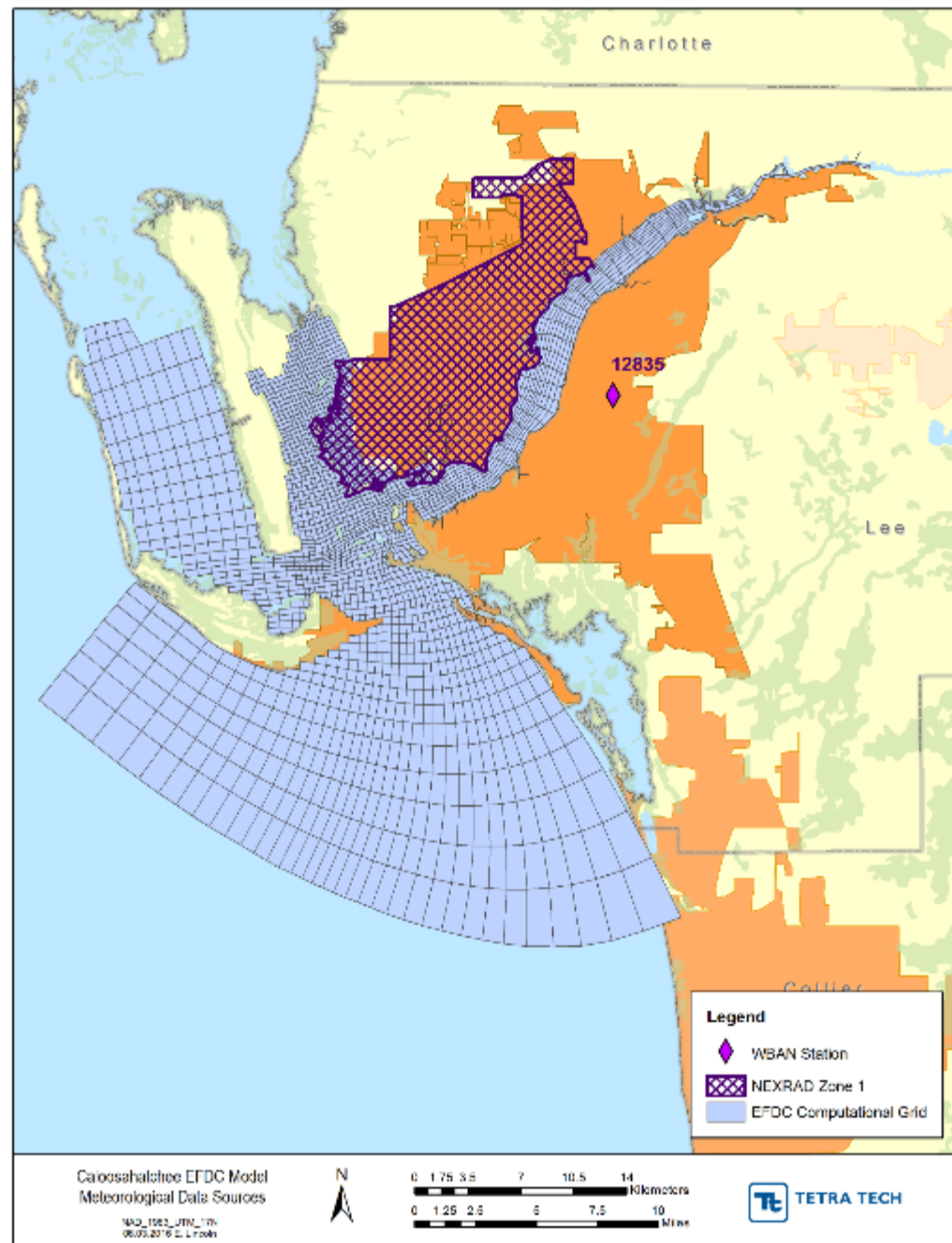


Boundary Conditions, continued

- Freshwater flows
 - USGS station 02292900 (Caloosahatchee River at S-79, Near Olga, FL) used for upstream boundary of the Caloosahatchee River
 - Tributary flows used 2017 HSPF Model predictions
- Salinity
 - Constant concentration of 35 PSU used at southern open boundary
 - Measured data used for northern open boundaries
- Temperature
 - Water temperature defined using initial draft water quality 2017 HSPF Model predictions.
 - Will be updated with final water quality 2017 HSPF Model predictions

Boundary Conditions, cont.

- Weather
 - SFWMD NEXRAD used for precipitation time series
 - WBAN 12835 used for climate data



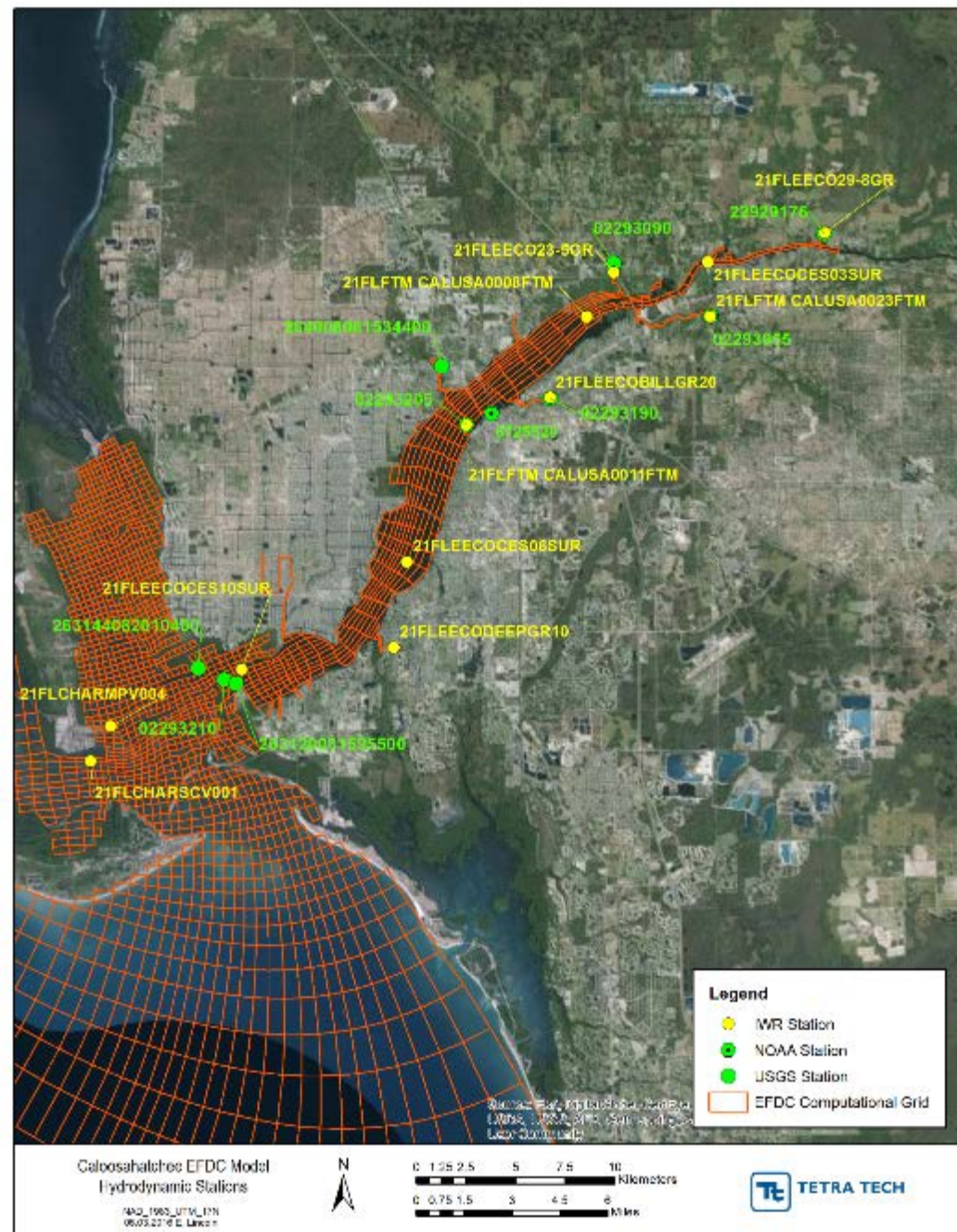
Point Sources and Withdrawals

NPDES ID	Facility Name	Facility Type	Input Type	Design Capacity (MGD)
FL0021261	Fort Myers Central AWWTF	DW	Point Source	11
FL0021270	South AWWT Facility	DW	Point Source	12
FL0030007	Cape Coral, City of - Everest WRF	DW	Point Source	15.1
FL0030325	Waterway Estates	DW	Point Source	5
FL0039829	Fiesta Village Advanced WWTF	DW	Point Source	1.5
FL0001490	Florida Power and Light Fort Myers	IW	Point Source	590.6
FPL Fort Myers Plant	Florida Power and Light Fort Myers	IW	Withdrawal	819

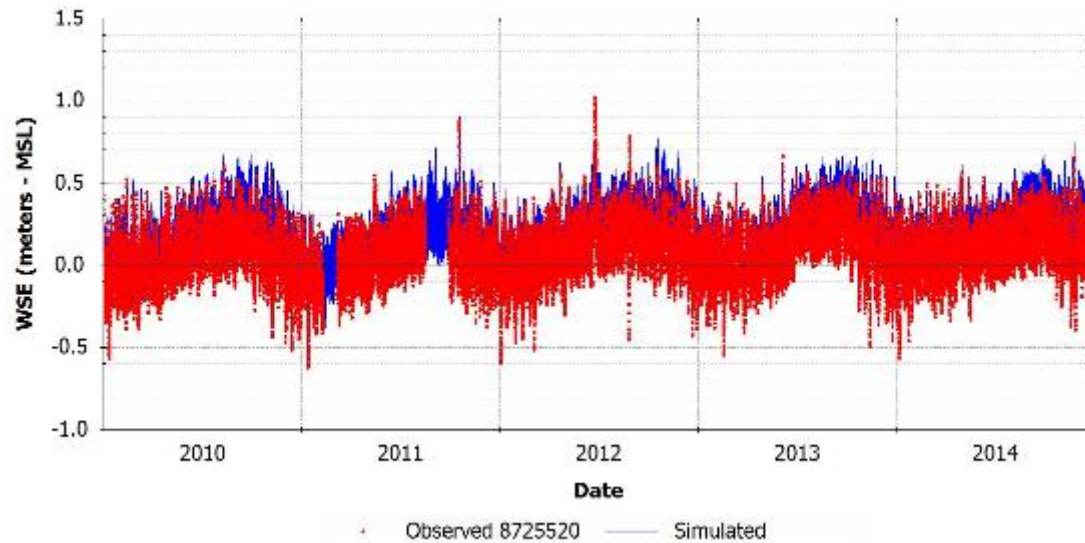
Task 5: Draft EFDC Model Calibration

Calibration Stations

- Hydrodynamic calibration stations
 - Water Surface Elevation
 - Temperature
 - Salinity
 - Flow

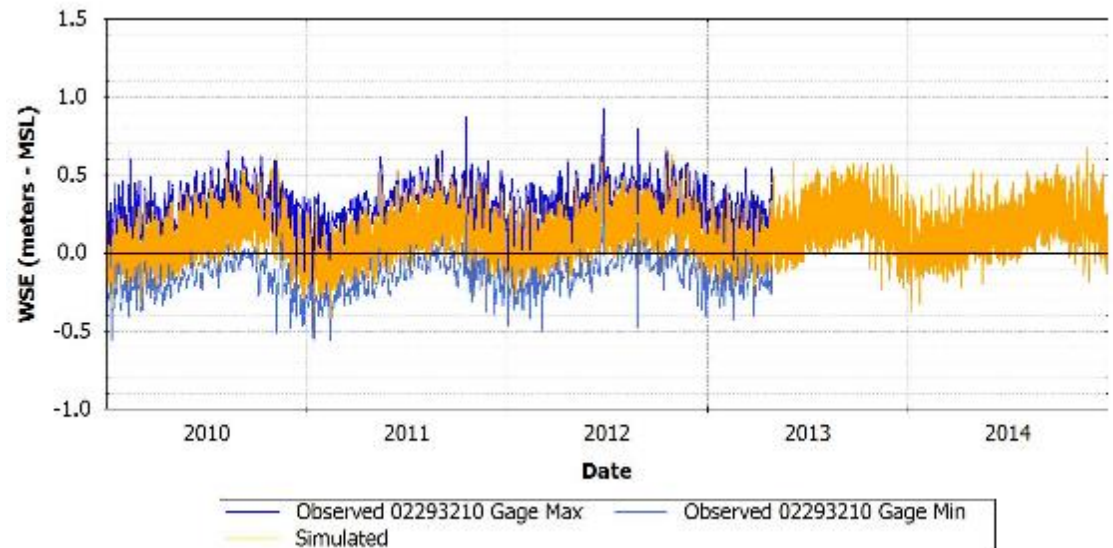


Water Surface Elevation Calibration

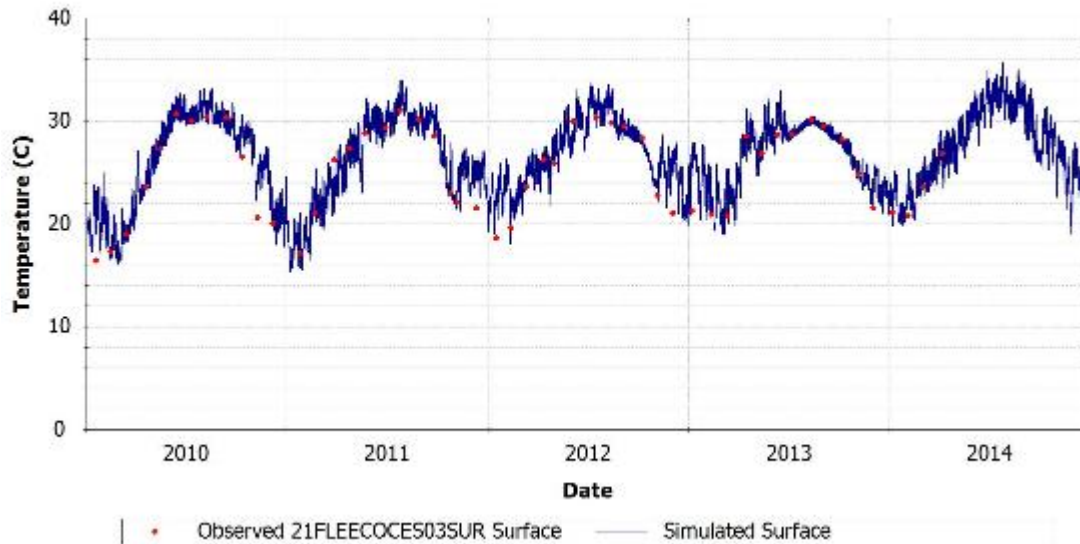


NOAA 8725520

USGS 02293210 (Shell Point)

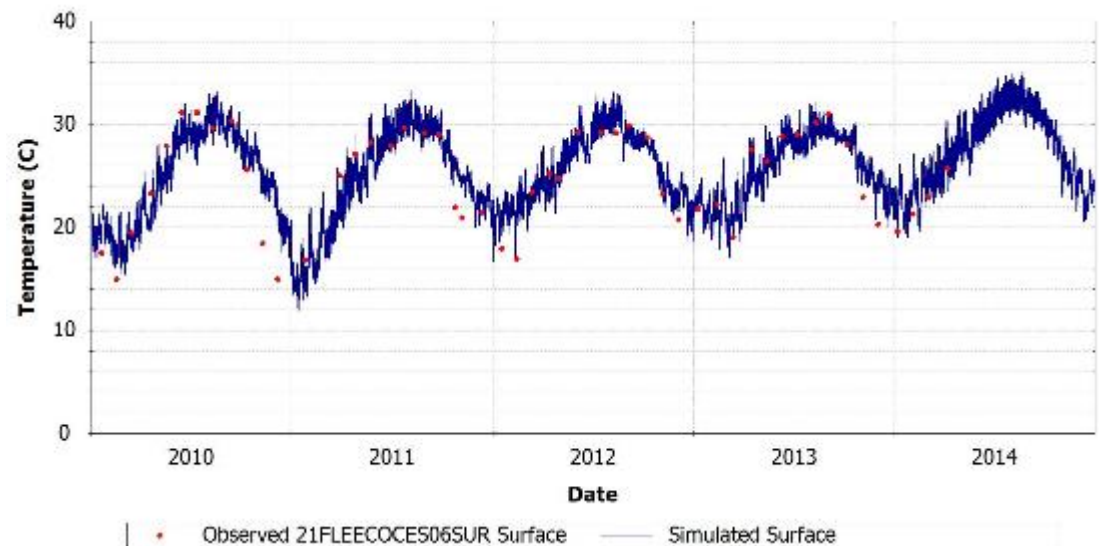


Temperature Calibration

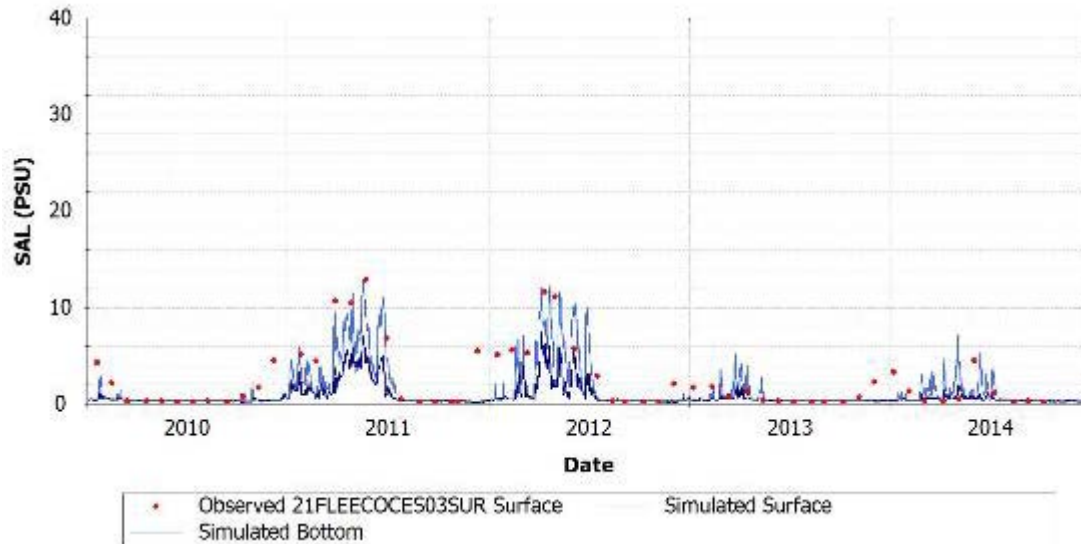


Station 21FLEECOCES03SUR

Station 21FLEECOCES06SUR

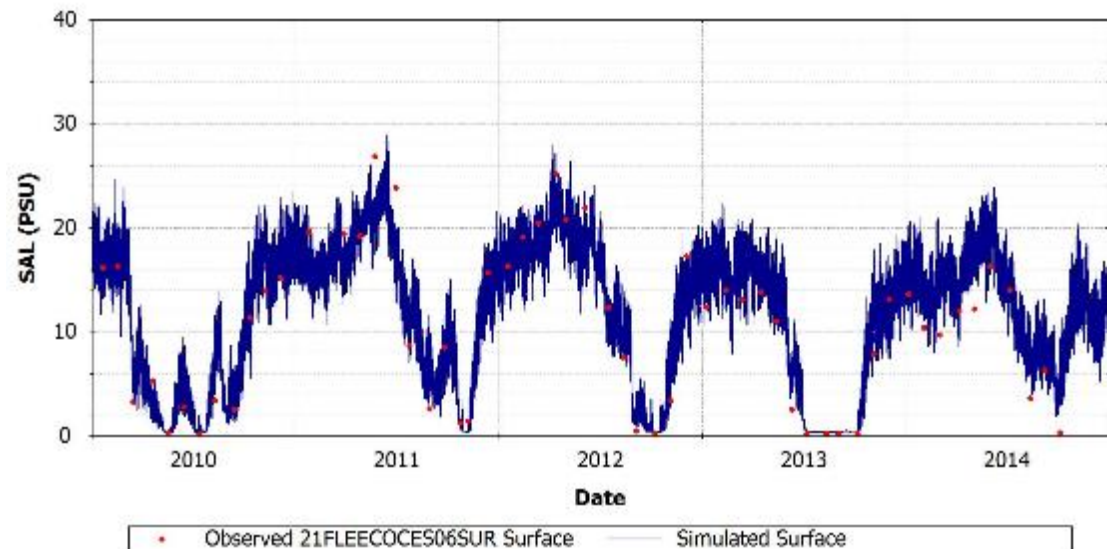


Salinity Calibration

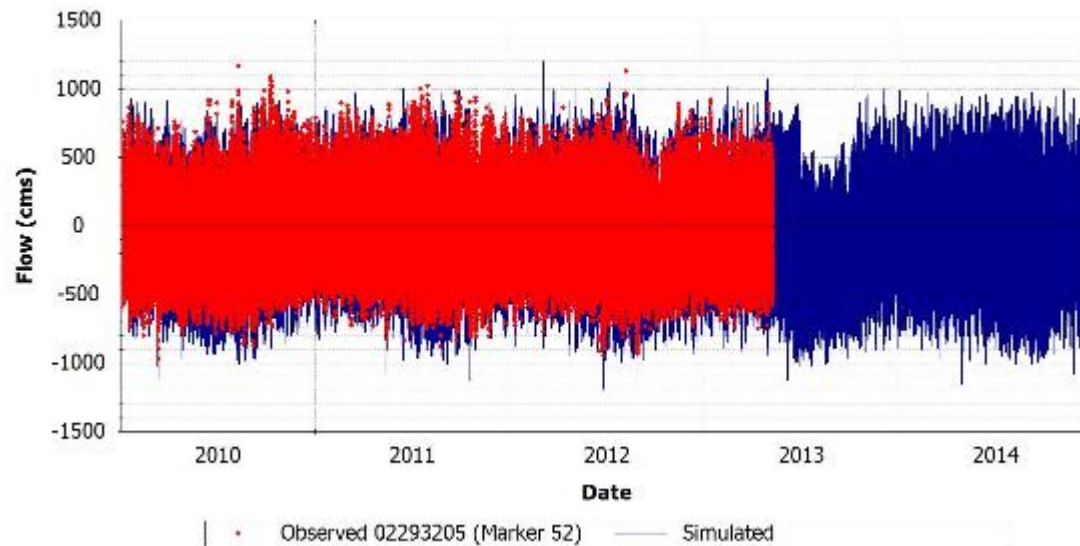


Station 21FLEECOCES03SUR

Station 21FLEECOCES06SUR

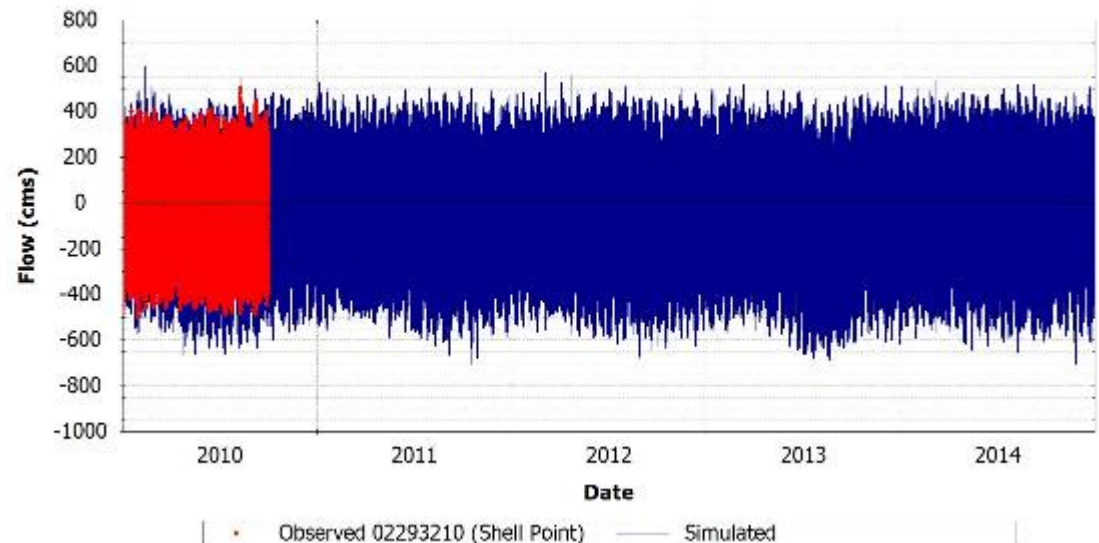


Flow Calibration



USGS 02293205 (Marker 52)

USGS 02293210 (Shell Point)



Next Steps

Next Steps

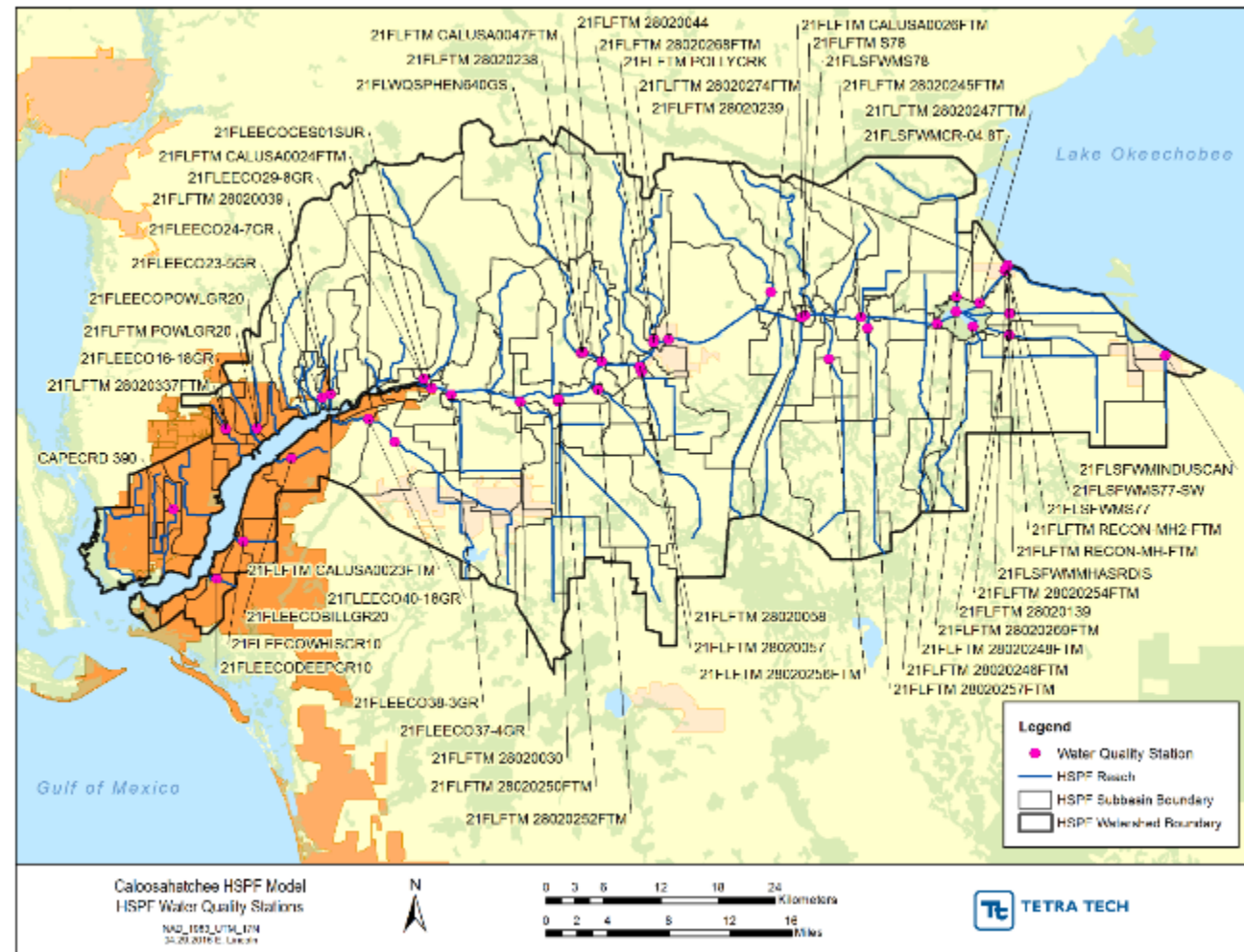
- Finalize HSPF (Task 2) and EFDC (Task 5) Hydrodynamic Calibrations:
 - Stakeholder comments due to DEP on **Friday, August 19th**
 - Tetra Tech and DEP will review and respond to comments
- Complete Final Draft HSPF (Task 3) and EFDC (Task 6) Water Quality Calibration:
 - Final Draft HSPF model water quality memo, calibration, and model files due to DEP on Friday, September 16th
 - Final Draft EFDC model water quality memo, calibration, and model files due to the department on Friday, October 14th

Task 3: HSPF Model Water Quality Calibration

- Direct source loading timeseries developed as part of Task 5
 - Septic systems, point sources, reuse facilities
 - May revise assumptions during calibration
- Atmospheric deposition added to model
- Used previous HSPF models for initial parameterization
 - Revise land uses and associated loadings to correspond with SWET agricultural loads, FDOT EMCs, and Harvey Harper EMCs

Task 3: HSPF Model Water Quality Calibration

- 50 Water quality stations
 - 33 unique locations
 - 32 stations have 5+ years of data
 - Co-located at flow stations

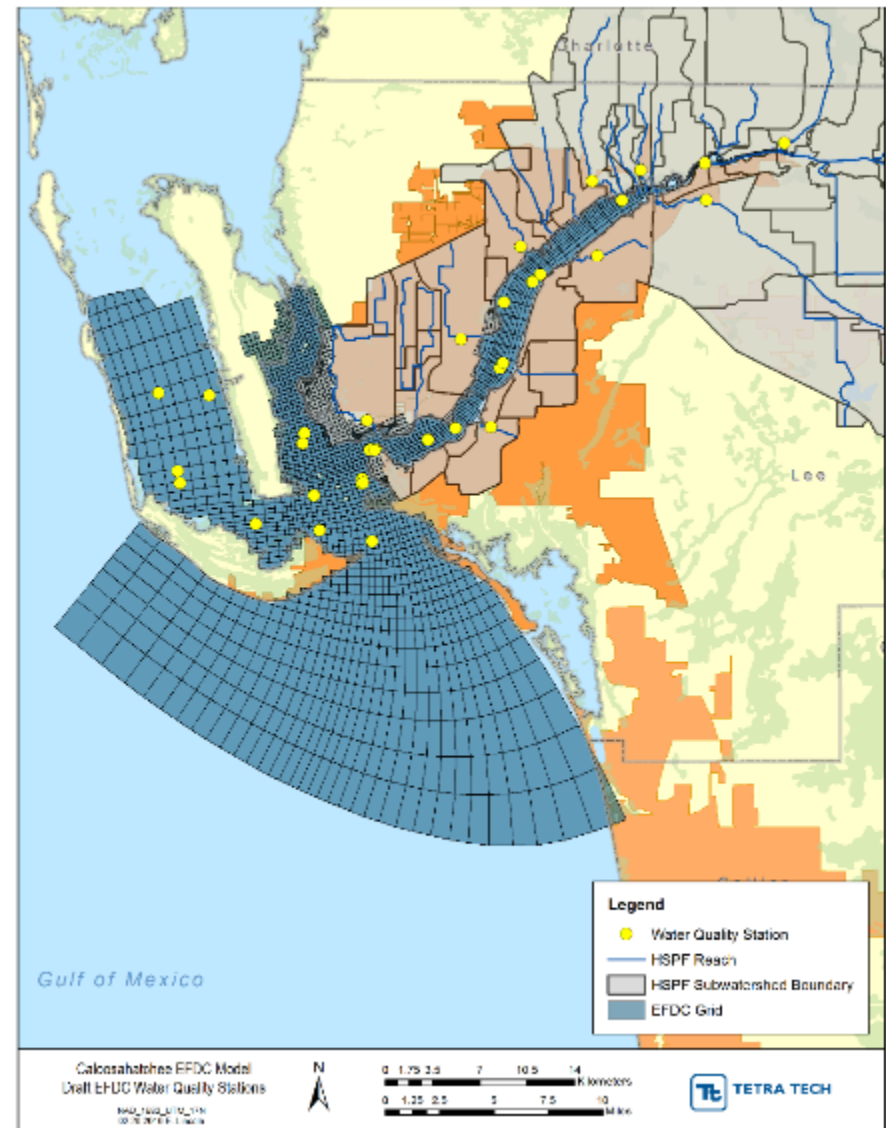


Task 6: EFDC Model Water Quality Calibration

- Point source loading timeseries developed as part of Task 2
 - May revise assumptions during calibration
- Atmospheric deposition added to model
- Used previous EFDC models for initial parameterization
 - Will revise to improve calibration

Task 6: EFDC Model Water Quality Calibration

- 35 Water quality stations
 - 26 unique locations
 - 9 located in tidal tributaries
 - 7 co-located at USGS stations
 - All have 4+ years of data



Contacts

Brian Watson
brian.watson@tetratech.com
(770) 738-6030

Erin Lincoln
erin.lincoln@tetratech.com
(770) 738-6040

Marcy Frick
marcy.frick@tetratech.com
(850) 536-8115

Erin Rasnake: Program Administrator
Erin.Rasnake@dep.state.fl.us
(850) 245-8338

Douglas Gilbert: Environmental Manager
Douglas.Gilbert@dep.state.fl.us
(850) 245-8450

Mohammad Sayemuzzaman (Sayem):
Environmental Specialist III
Mohammad.Sayemuzzaman@dep.state.fl.us
(850) 245-8465

Sara C Davis: Environmental Consultant
Sara.C.Davis@dep.state.fl.us
(850) 245-8825