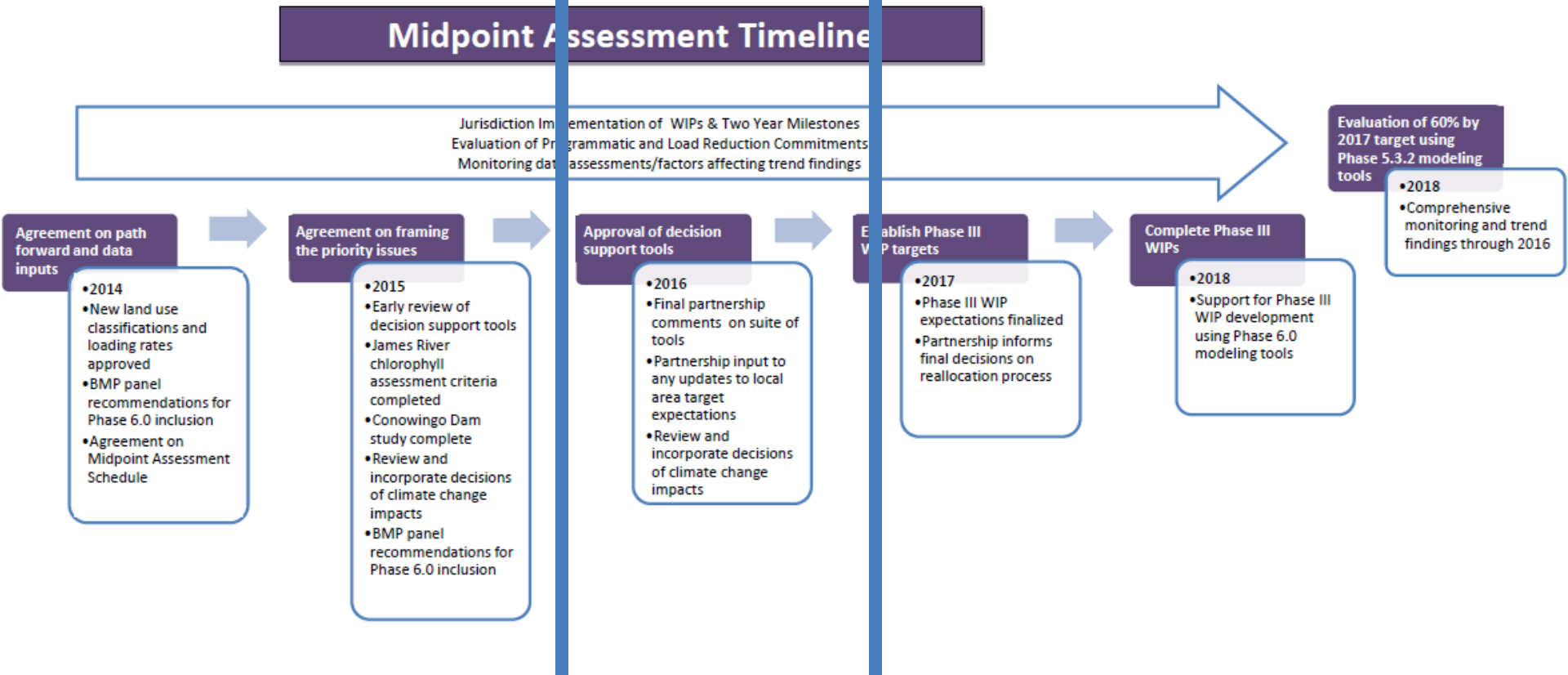
Representation of the Conowingo Reservoir in the Phase 6 Watershed Model

Gopal Bhatt
Penn State University
STAC Conowingo Infill Workshop
1/13/2016



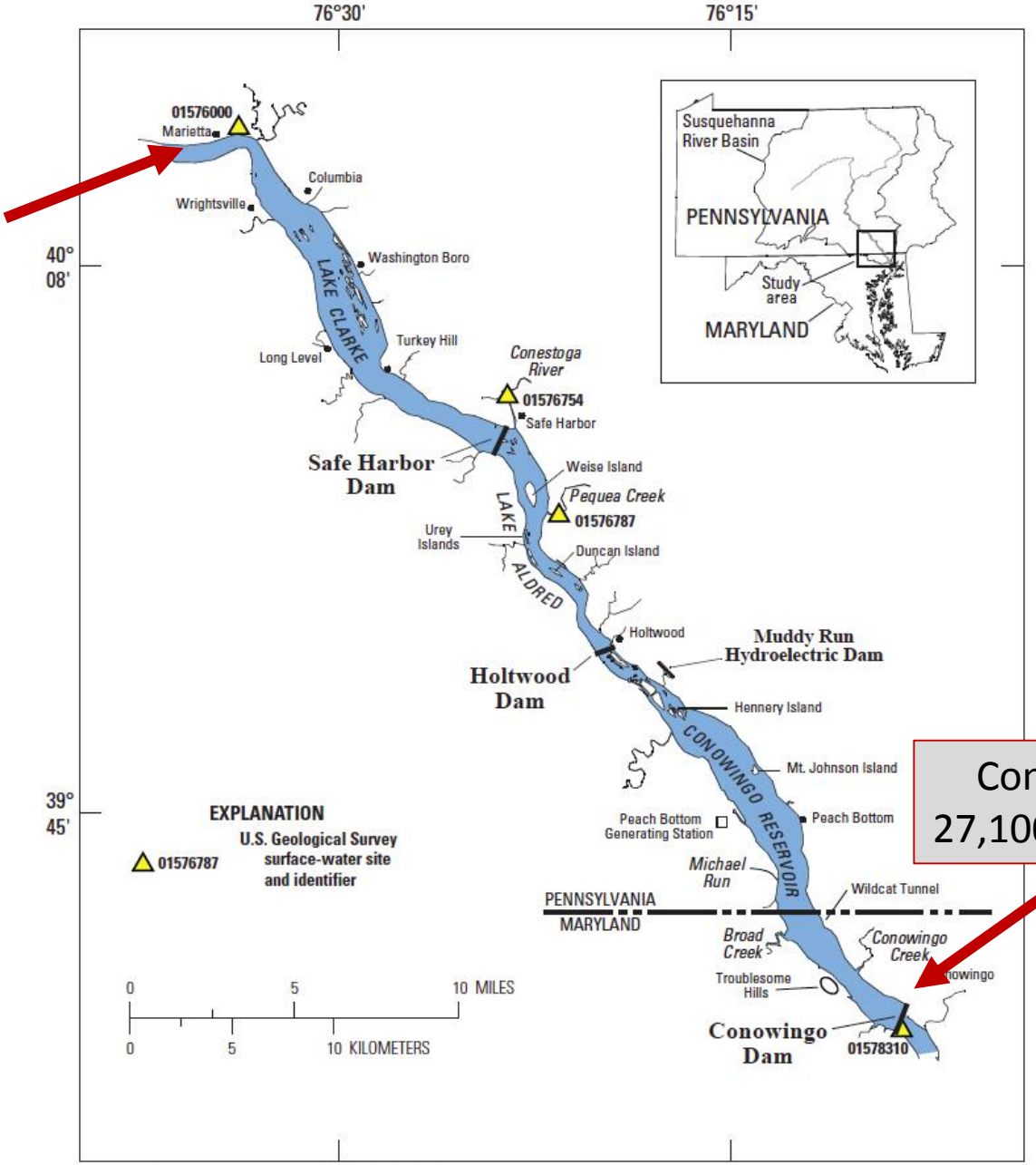
BUILD the models

REVIEW & REVISE the models

USE the models

The Reservoir System in the Lower Susquehanna River Basin

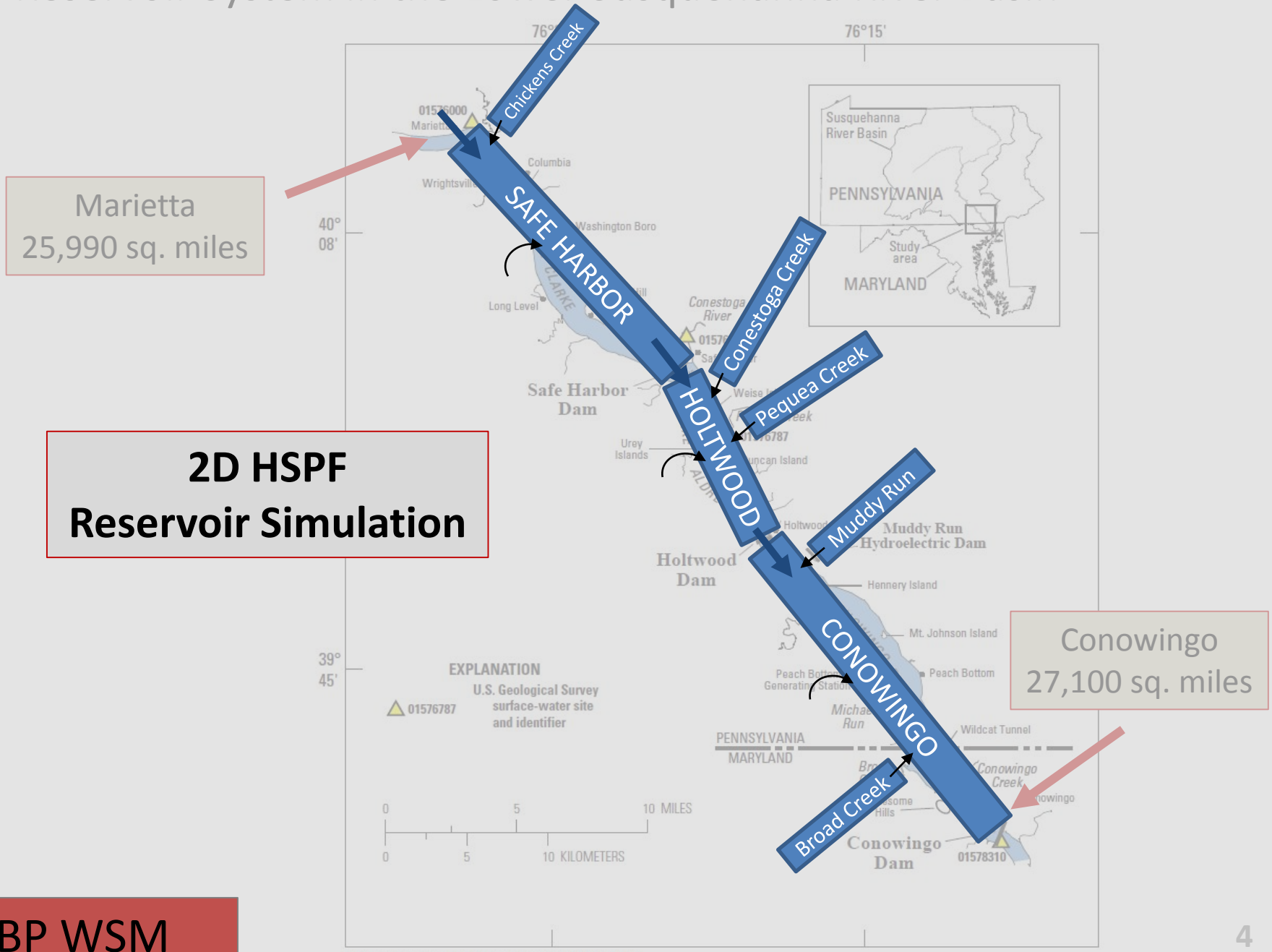
Marietta
25,990 sq. miles



Conowingo
27,100 sq. miles

Langland, 2015

The Reservoir System in the Lower Susquehanna River Basin

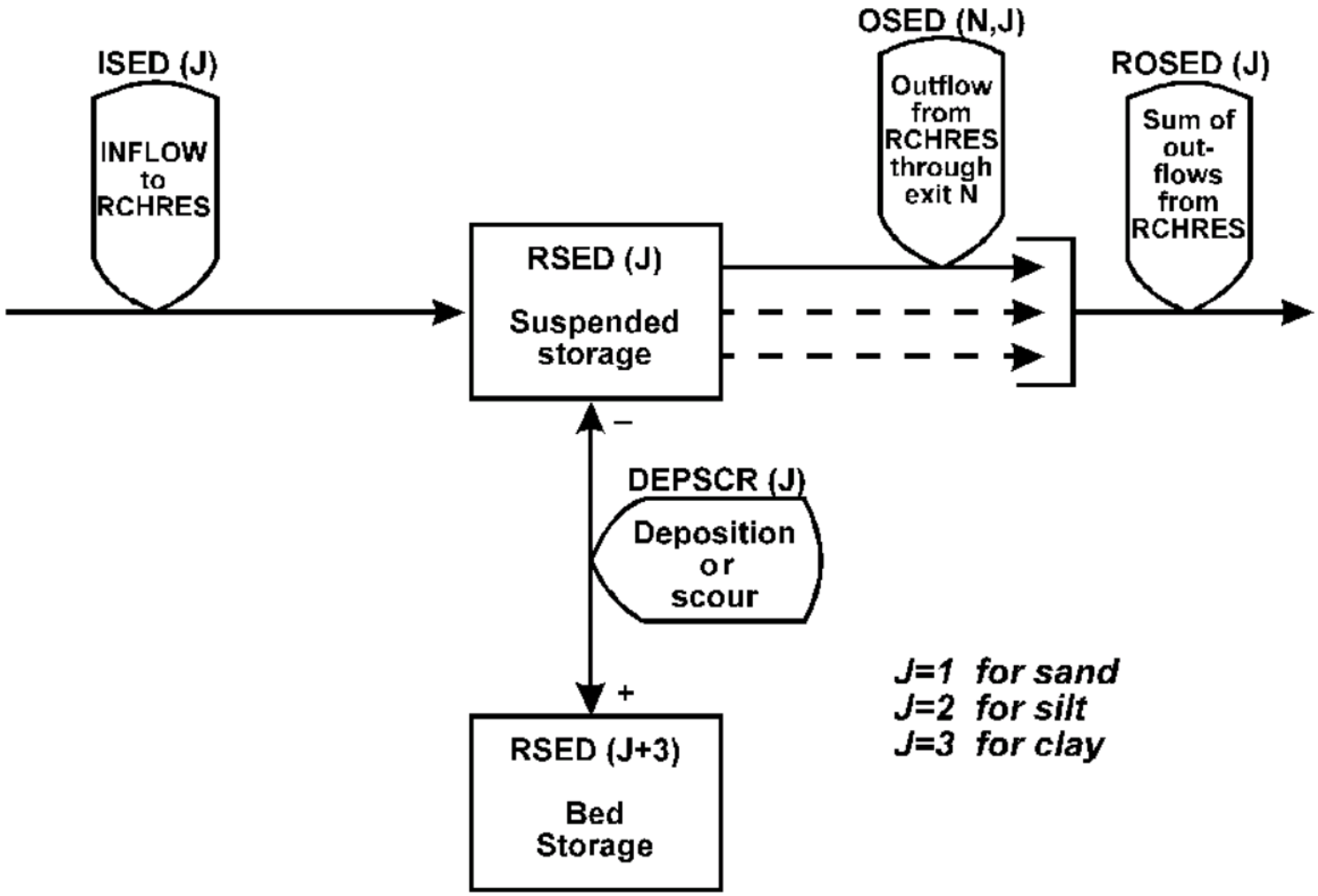


CBP WSM

Phase 6 Prototypes

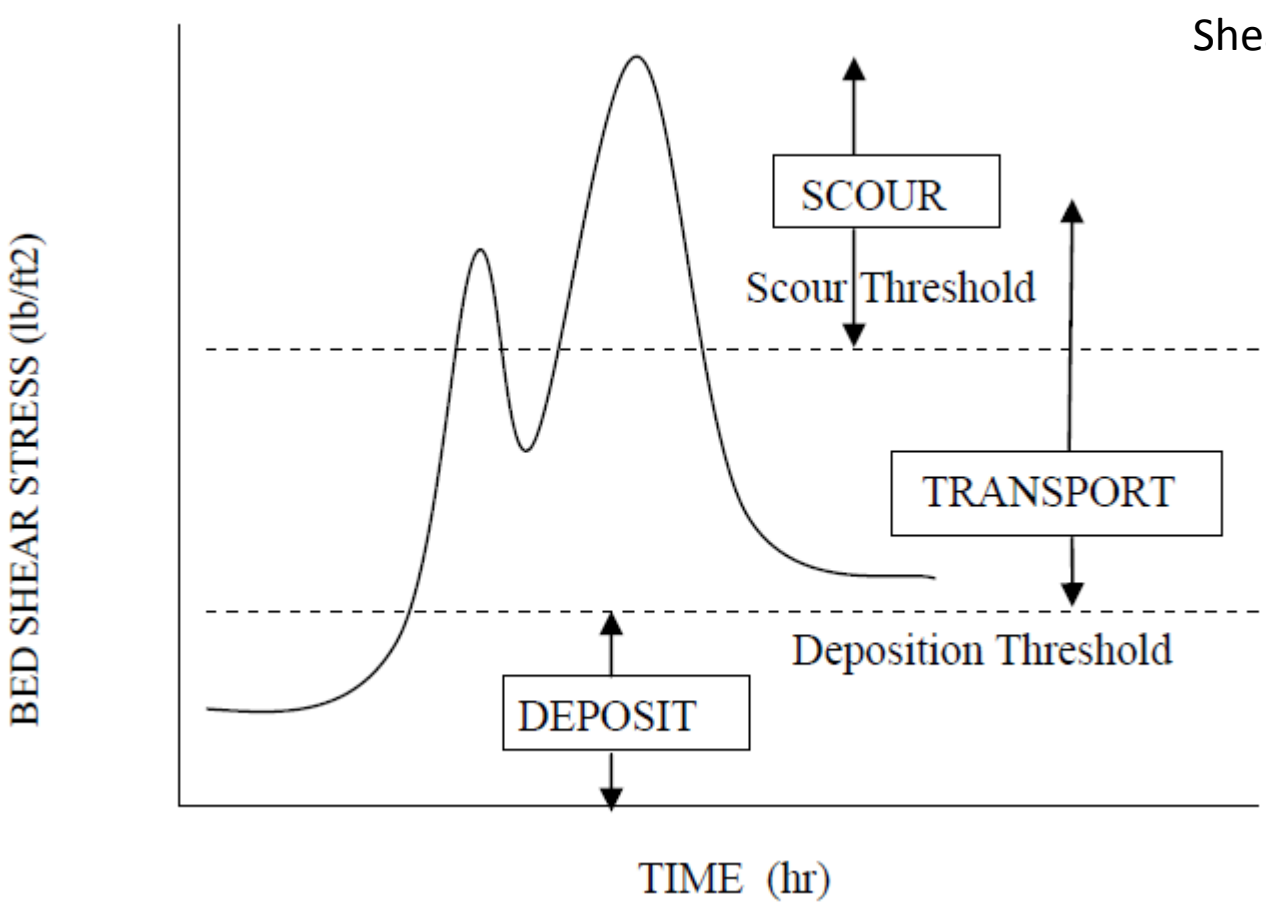
- ***Refine HSPF calibration based on available data.***
- ***Refine HSPF calibration based on the findings from HEC-RAS simulation of Safe Harbor & Holtwood, and Conowingo Pool Mass Balance Model (CPMBM).***

HSPF Sediment Transport



HSPF User Manual

HSPF SEDTRN simulation



Shear Stress

Erodibility

$(Tau/Tau_{CS}-1) * M$

Settling Velocity

$(1-Tau/Tau_{CD}) * W/d$

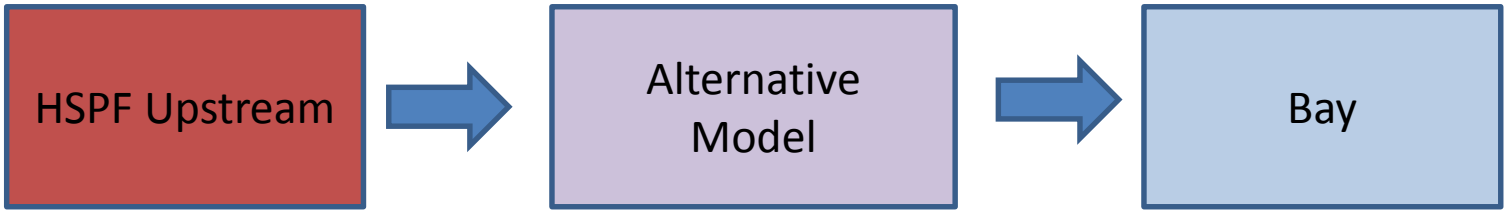
Actual equation expressed as exponential for concentration change

Depth

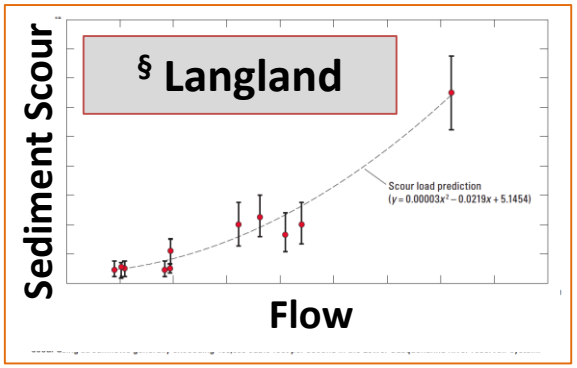
***Tau_{CD}*, *Tau_{CS}*, *Erodibility*, and *Settling Velocity* are all changeable through time.**

HSPF User Manual

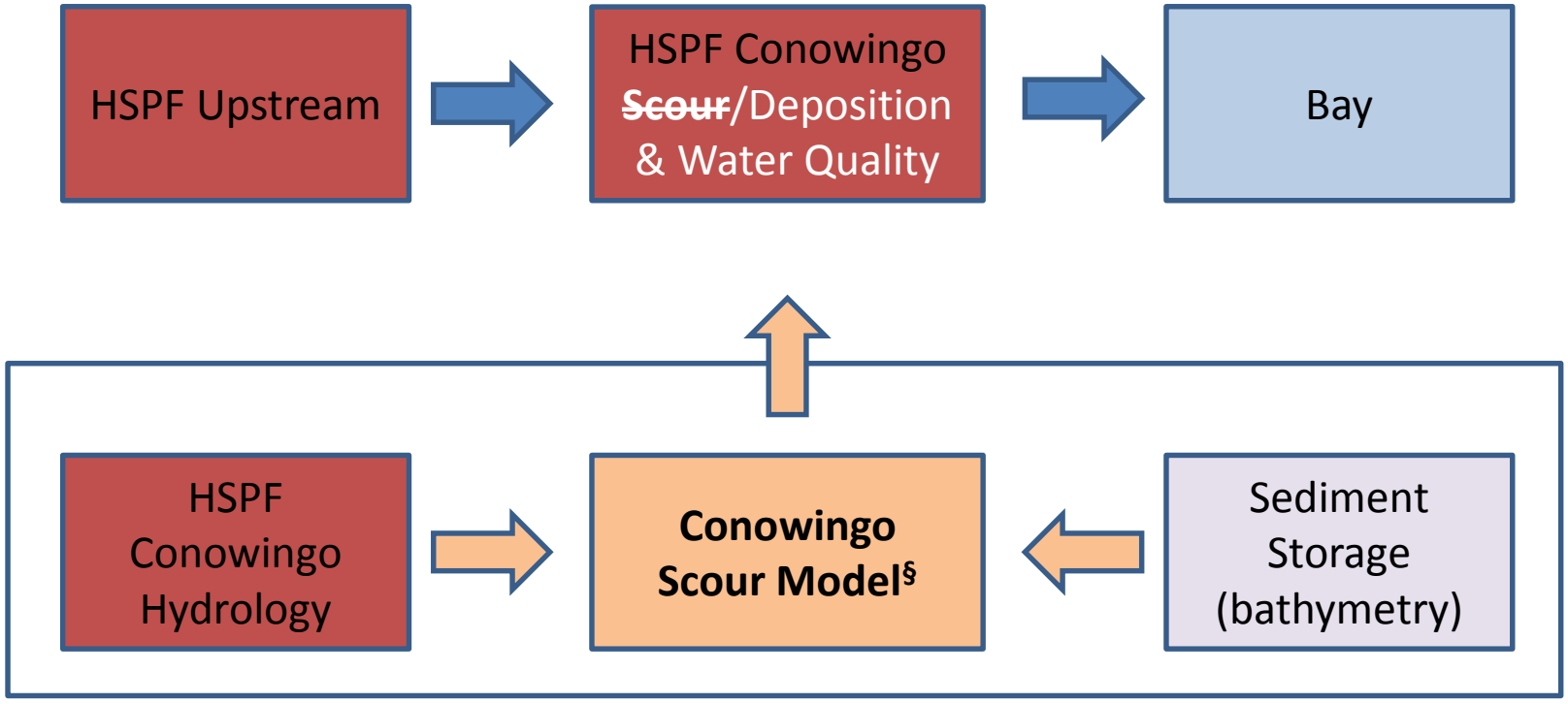
Alternative to HSPF (post 2017 Mid-Point Assessment)



Alternative to HSPF Scour



§ CPMBM



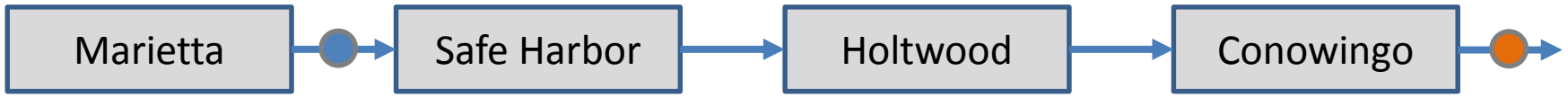
Summary

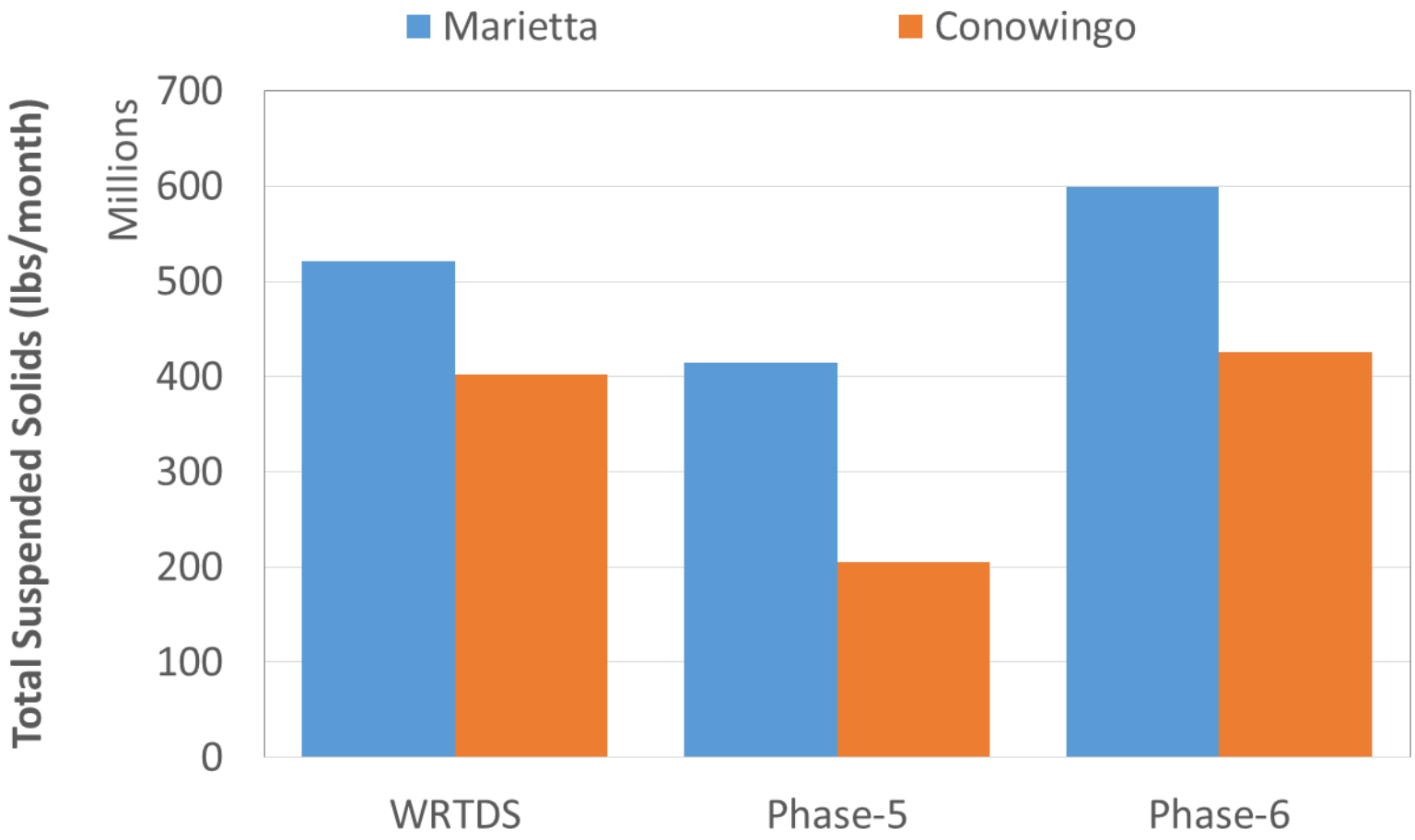
- The CBP has flexible methods to implement models of the Conowingo
- Need mathematical descriptions of scour and deposition as a function of flow and bathymetry
- The CBP Partnership would be interested in the recommendations from this workshop

Key information needs

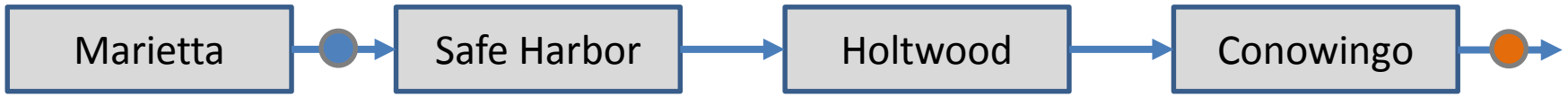
- Phase-6 has potential to simulate scour at the Conowingo for the six extreme storms between 1985-2014.
  - How does scour change with the bathymetry? Is there an agreement that its representation in Phase-6 important?
  - How does deposition change with the bathymetry? Is there an agreement that its representation in Phase-6 important?
- Are there any other reservoir infill processes that should be considered in Phase-6 simulation?

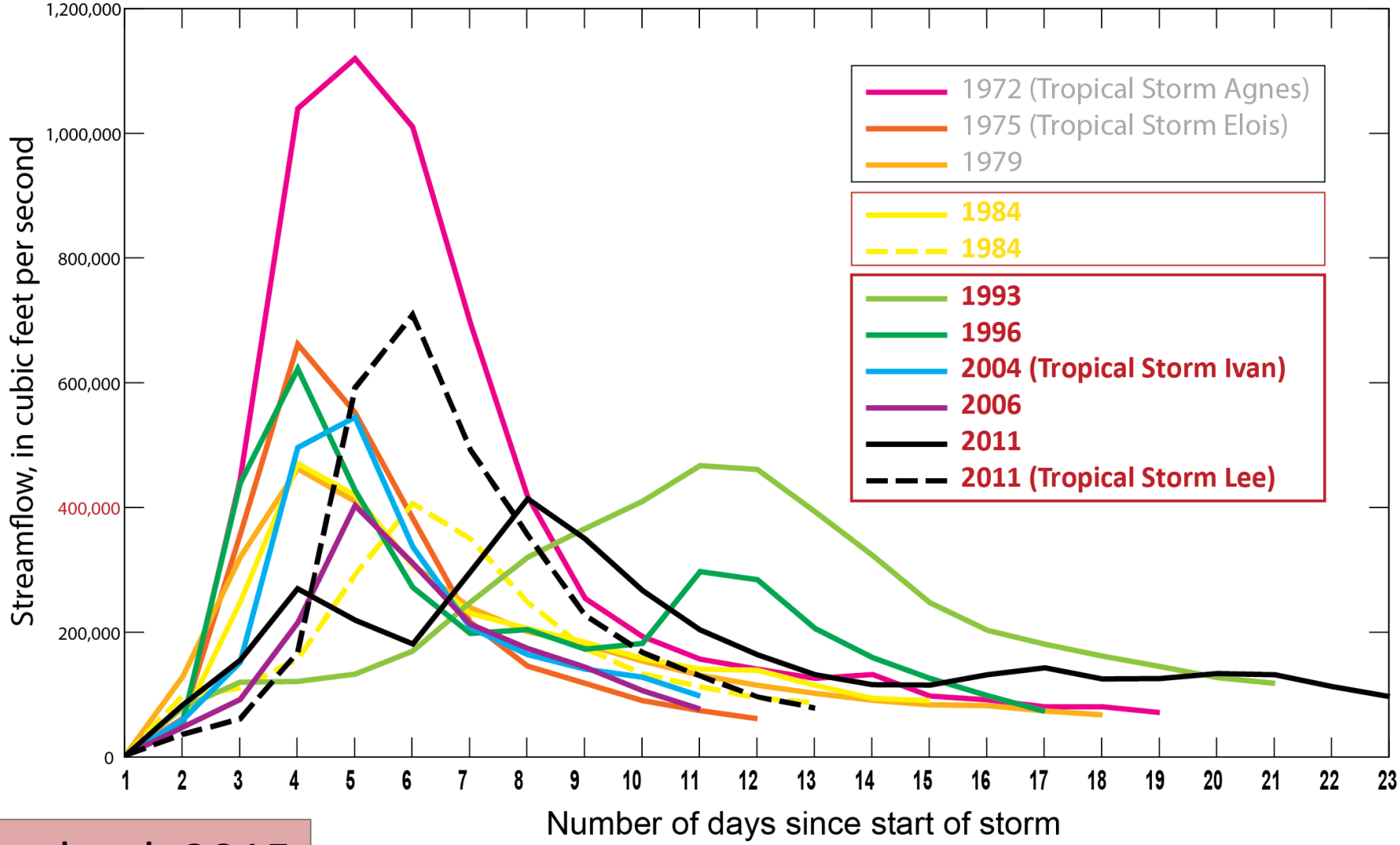
A mass-balance between Marietta & Conowingo





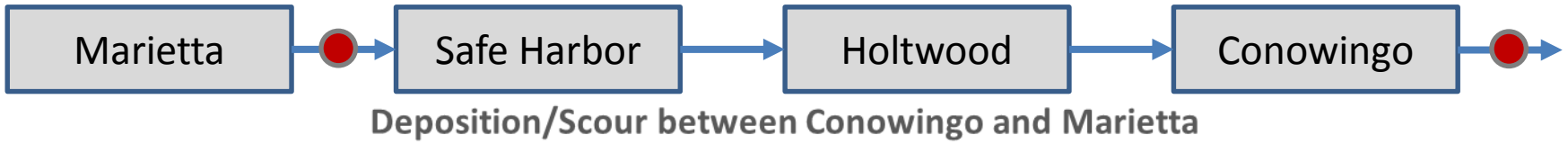
A mass-balance between Marietta & Conowingo

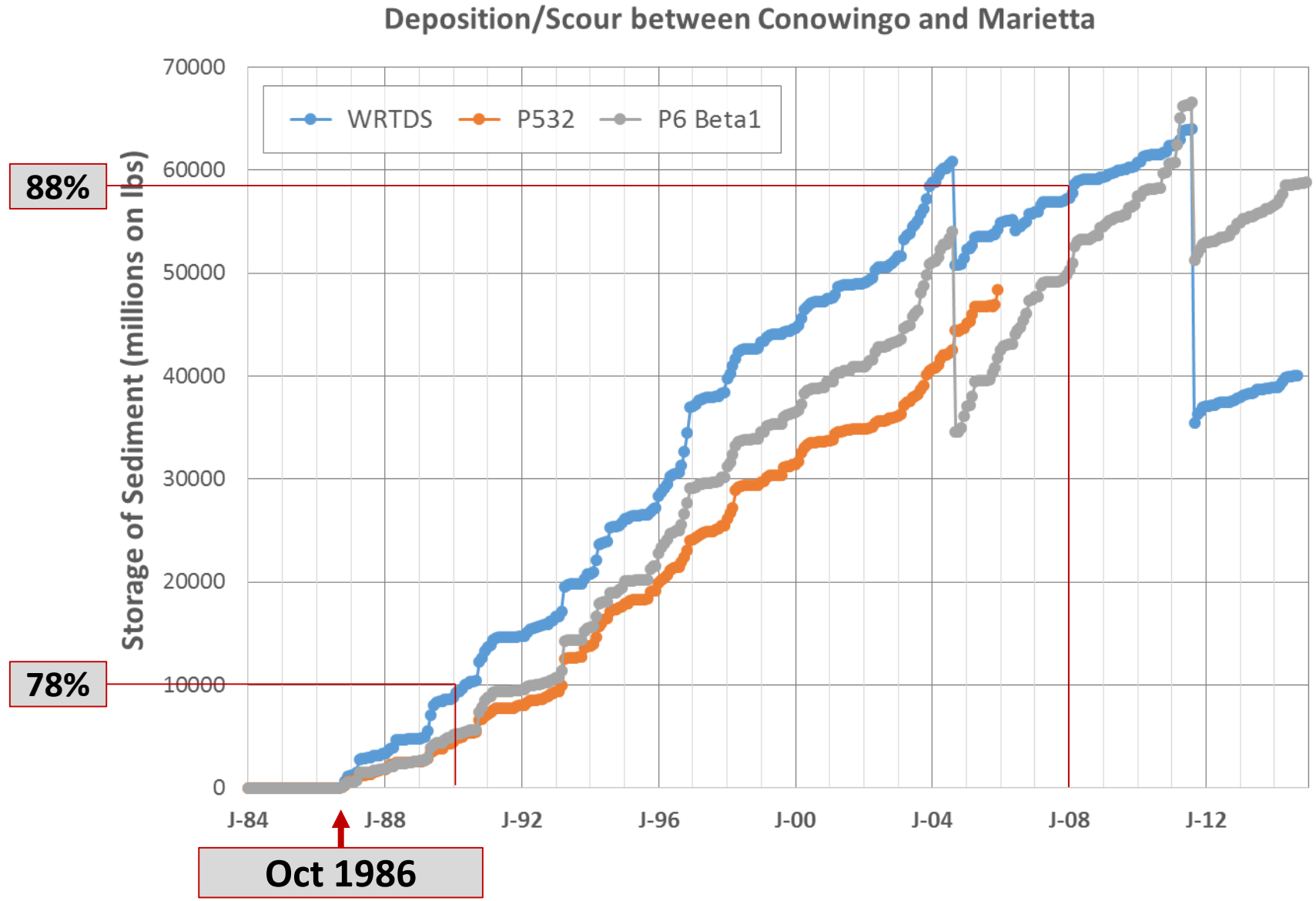


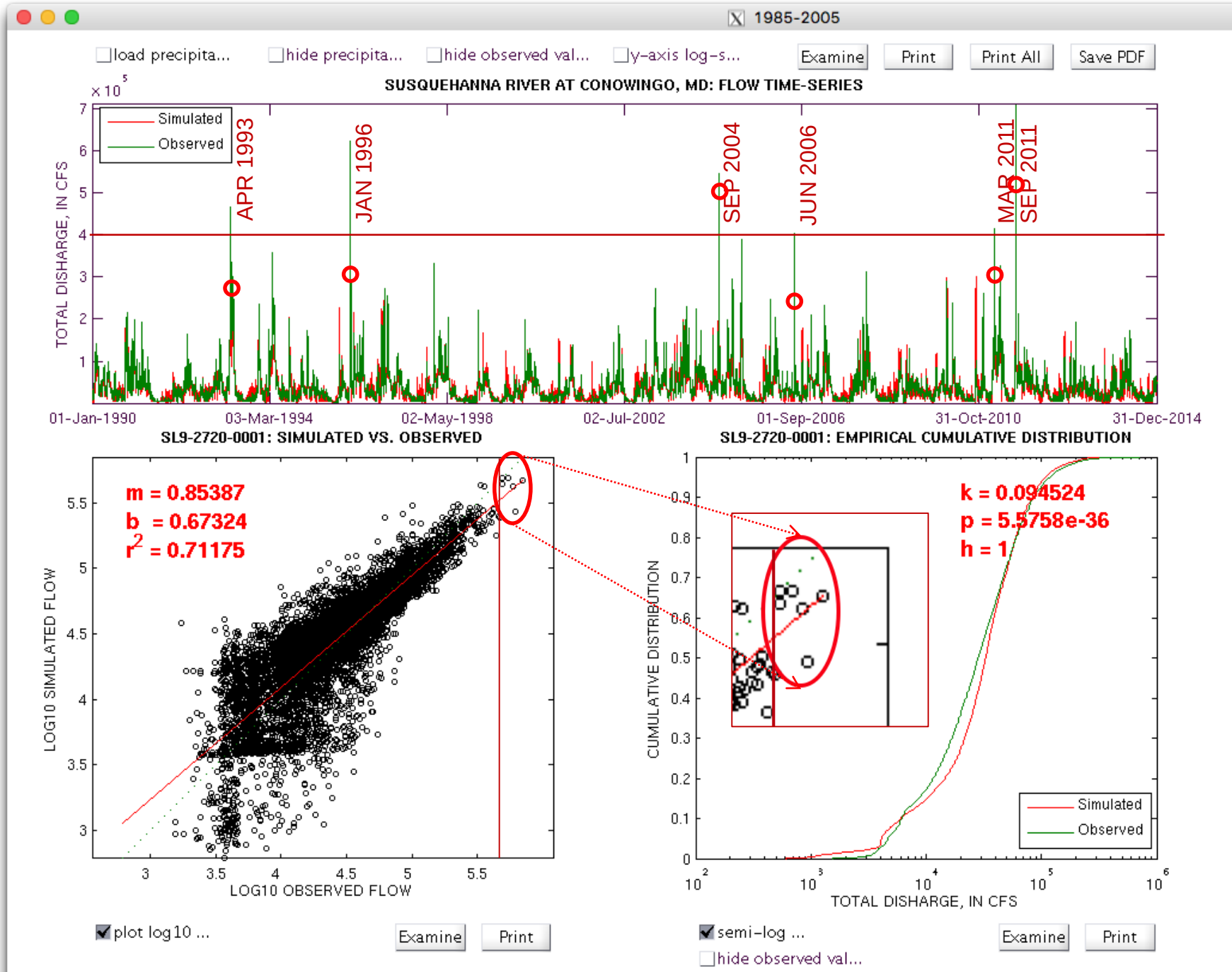


Langland, 2015

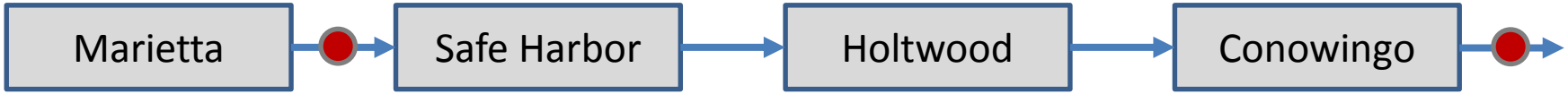
A mass-balance between Marietta & Conowingo






1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
SUSQUEHANNA RIVER AT CONOWINGO, MD: FLOW TIME-SERIES
x 10^5
TOTAL DISHARGE, IN CFS
Simulated
Observed
APR 1993
JAN 1996
SEP 2004
JUN 2006
MAR 2011
SEP 2011
01-Jan-1990
03-Mar-1994
02-May-1998
02-Jul-2002
01-Sep-2006
31-Oct-2010
31-Dec-2014
SL9-2720-0001: SIMULATED VS. OBSERVED
m = 0.85387
b = 0.67324
r^2 = 0.71175
LOG10 SIMULATED FLOW
LOG10 OBSERVED FLOW
plot log10 ...
Examine
Print
SL9-2720-0001: EMPIRICAL CUMULATIVE DISTRIBUTION
k = 0.094524
p = 5.5758e-36
h = 1
CUMULATIVE DISTRIBUTION
TOTAL DISHARGE, IN CFS
Simulated
Observed
semi-log ...
hide observed val...
Examine
Print

A mass-balance between Marietta & Conowingo



PHASE-6 (1985-2014)	Safe Harbor	Holtwood	Conowingo
Sand	0.00	0.00	0.00
Silt	0.99	0.99	0.33
Clay	0.98	0.98	0.79