MEMORANDUM FOR THE RECORD

SUBJECT: Lower Susquehanna River Watershed Assessment
Quarterly Team Meeting, 30 April 2012

1. On 30 April 2012, agency team members met to discuss ongoing and completed activities for the Lower Susquehanna River Watershed Assessment (LSRWA). The meeting was hosted by the Maryland Department of the Environment (MDE) in their Aqua Conference Room at the Montgomery Park Building in Baltimore, Maryland. The meeting started at 10:10 am and continued through 12:30 pm. The meeting attendees are listed in the table below.

Agency	Name	Email Address	Phone
Exelon Generation	Bob Matty	robert.matty@exeloncorp.com	610-765-5514
Exelon -- Gomez and Sullivan	Gary Lemay	glemay@gomezandsullivan.com	603-428-4960
Exelon -- URS Corp.	Marjorie Zeff	marjorie.zeff@urs.com	215-367-2549
Lower Susquehanna Riverkeeper	Michael Helfrich	LowSusRiver@hotmail.com	717-779-7915
MDE	Herb Sachs	hsachs@mde.state.md.us	410-537-4499
MDE	John Smith	jsmith@mde.state.md.us	410-537-4109
MDE	Tim Fox	tfox@mde.state.md.us	410-537-3958
MDNR	Bruce Michael	bmichael@dnr.state.md.us	410-260-8627
MGS	Jeff Halka	jhalka@dnr.state.md.us	410-554-5503
NOAA-NMFS	John Nichols	john.nichols@noaa.gov	410-267-5675
SRBC	David Ladd	dladd@srbc.net	717-238-0425x204
SRBC	John Balay	jbalay@srbc.net	717-238-0423 x217
TNC	Kathy Boomer	kboomer@tnc.org	
USACE	Andrea Takash	andrea.m.takash@usace.army.mil	410-962-2626
USACE	Carey Nagoda	carey.m.nagoda@usace.army.mil	410-962-6761
USACE	Chris Spaur	christopher.c.spaur@usace.army.mil	410-962-6134
USACE	Claire O'Neill	claire.d.o'neill@usace.army.mil	410-962-0876
USACE	Dan Bierly	daniel.m.bierly@usace.army.mil	410-962-6139
USGS	Mike Langland	langland@usgs.gov	717-730-6953

In addition, a number of team members listened in via the conference line; those listening were:

Agency	Name	Email Address	Phone
PADEP	Patricia Buckley	pbuckley@pa.gov	717-772-1675
PADEP	Ted Hessler		
PA DCNR	Ray Zomok	rzomok@pa.gov	
SRBC	Andrew Gavin	agavin@srbc.net	717-238-0423x107
TNC	Mark Bryer	mbryer@tnc.org	301-897-8570
USACE-ERDC	Carl Cerco	carl.f.cerco@erdc.usace.army.mil	601-634-4207
USACE-ERDC	Steve Scott	steve.h.scott@usace.army.mil	601-634-2371
USGS	Ed Koerkle	ekoerkle@usgs.gov	

The meeting agenda is provided as enclosure 1 to this memorandum.

2. Welcome and Opening Remarks – After a brief introduction of the meeting attendees, Herb Sachs welcomed the LSRWA agency group. Herb noted the low flow conditions in the Susquehanna River.

3. Review of Action Items from January 2012 Meeting – For the first meeting discussion, the team reviewed the January 2012 action items as well as the ongoing action items.

Action Items from January Meeting:

A. Bruce will integrate comments from the team to refine the LSRWA (public) website.
   Status – Completed.
B. Steve will coordinate with Bruce to obtain digitized maps of SAV data in the Susquehanna flats area.
   Status – Maps have been provided; Steve Scott still needs to download them and will do so shortly.
C. Bruce will share results of the suspended sediment sampling taken at Conowingo outfall (taken during high flow events this year) with the team. [**Update**: MDNR provided the data to Carl Cerco]
   Status – Completed.
D. Anna will update the map in the LSRWA PowerPoint presentation to remove the York Haven Dam.
   Status – Completed.
E. Bruce will send the LSRWA website link to the team.
   Status – Completed.
F. Bruce will update the LSRWA website with recommended changes from the team.
   Status – Completed.
G. The team will send Bruce documents and links that should be posted on the LSRWA website.
   Status – Ongoing; future documents and links should be sent to Bruce Michael.
H. The MDE FTP website will be utilized to share internal draft documents within the team; Matt will be the point of contact for this FTP site.
   Status – Ongoing; sharing of future documents will go through the MDE ftp website.
I. Dave will send a hyperlink to the SRBC publication 239 (the 2006 sediment analysis report) to the team. [**Update**: Link sent January 24, 2012]
   Status – Completed.
J. Claire will coordinate monthly conference calls to discuss modeling activities.
   Status – Completed.
K. Shawn will notify team when most recent Exelon study reports are released.
   Status – Recent report was sent out to team; ongoing action.
L. Claire will work with Mike Langland to execute funding for USGS for LSRWA efforts.
   Status – Paperwork is completed on the USGS end and is on its way to USACE [Update: Completed documents were delivered on April 30th.]

Ongoing Action Items

A. Anna will update PowerPoint slides after each quarterly meeting to be utilized by anyone on the team providing updates to other Chesapeake Bay groups.
B. Anna will send out an update via the large email distribution list that started with the original Sediment Task Force (includes academia, general public, federal, non-government

organization (NGO), and state and counties representatives) notifying the group of updates from the quarterly meeting.

C. Mark and Anna will coordinate to conduct a literature search providing info on best management practices around the nation and world for reservoir sedimentation.

D. Matt will keep team informed on innovative re-use committee findings to potentially incorporate ideas/innovative techniques into LSRWA strategies.

4. Communication and Coordination – Claire mentioned that USACE had sent out standard USACE study coordination letters to various Federal and state environmental resource agencies in February 2012. These letters had been coordinated with Bruce and Herb in advance. As a result of this coordination, we have added several new agency team members, some of whom attended or listened into the quarterly team meeting. In particular, we have several new representatives from Pennsylvania, as well as the National Marine Fisheries Service.

Since the last quarterly meeting, there have been no official presentations of the project PowerPoint slides. Herb mentioned that Tim Fox will be attending the 1 May 2012 meeting of the innovative re-use committee.

Herb asked about the status of the Federal funding for the watershed assessment. Claire indicated that the assessment has received funding to cover the activities through FY12, with some funds (roughly $50,000) for the first part of FY13. The project is not in the president's budget that was released in February 2012. However, for this fiscal year, the study received funds from a general pot of money and it is hoped that the same result will happen in FY13; the allocation of these funds is determined by USACE Headquarters staff. Herb and Michael Helfrich asked what they could do to help with the budget situation. Claire explained that while in the past Congressional earmarks were an avenue to funding for non-budgeted studies, earmarks are not acceptable to Congress this fiscal year [**Action** = Claire will discuss funding needs for FY13 with Herb].

Recently, there was a workshop on the short-term impacts of Tropical Storms Irene and Lee. Bob Hirsch from USGS reported on significant load of sediments and nutrients from high-flow events and that impacts will be more severe in the future. Subsequently, the window for action is closing. There will be a follow-up workshop in the fall. Bruce indicated that we will send the workshop information to the LSRWA agency group [**Note:** The link to the April 19, 2012 CBP Storm Effects Topical Meeting has been added to the LSRWA website]. Mike Langland reminded the group that Bob Hirsch will be invited to the next quarterly meeting to make a presentation on his findings [**Action** = Mike to invite Bob; update: Bob has put us on his schedule for August 7th].

5. LSRWA Technical Analyses – The various modeling leads provided updates on their technical analyses.

A. CBEMP Modeling Update and Data Report – Carl's data report was sent out for comment in early April. So far, comments have been received from SRBC and Chris Spaur (USACE). Marjorie Zeff mentioned that she would be sending a suggestion for improving the report on 30 April. Carl noted that he would need 2 weeks to finalize the report.

Carl's analysis shows that as the flow over Conowingo gets larger, the composition of the transported materials starts to resemble the reservoir bed material. His work indicates that we have sufficient data to characterize material coming over the spillway, and that it is a good dataset for water quality modeling.

B. Sediment Transport Modeling – Steve Scott updated the agency LSWRA team on his sediment transport modeling using the PowerPoint presentation in enclosure 2. Two separate models were developed, one for Conowingo and one for the Susquehanna Flats. Steve used the 2008 and 2011 bathymetric surveys of Conowingo Pond extensively in his analysis. NOAA nautical charts were used for the Susquehanna Flats area. All data was converted to NGVD (National Geodetic Vertical Datum) 1929.

To date, Steve has completed an evaluation of the importance of three-dimensional effects in Conowingo sedimentation. Three-dimensional effects can result from density-gradient currents, wind-generated currents, and reservoir discharges at multiple depths. These effects are important when the reservoir inflows are low, when flow velocities are low since turbulence and mixing are at a minimum, and when there are a high reservoir residence times. Steve's approach to the analysis was to evaluate sediment availability to the reservoir when the three-dimensional impacts may be significant. Since flows greater than 30,000 cubic feet per second (cfs) have a very low retention time (5 days or less), it can be assumed that there is sufficient mixing at these flow levels.

In addition, Steve looked at the total sediment load coming into Conowingo Pond. Of about 4.28 million tons of annual sediment inflow, only 0.22 million tons happens during flows of less than 30,000 cfs. So, the bottom line is that Conowingo Pond is exposed to only 5 percent of the total annual sediment load during low flow conditions. Steve concluded that although three-dimensional effects do occur, they are negligible. Hence, for the flow levels that we are interested in, a three-dimensional model is not warranted. Steve mentioned that the 30,000-cfs cut-off value could have been as low as 20,000 cfs.

Steve then described the development of the two-dimensional models. There are 11,432 nodes in the Conowingo Pond model with the density of nodes increasing closer to the dam. The model includes routines for the power plant operations as well as the flood gates. Flows less than 86,000 cfs are routed through the power plant, while the flood gates open at higher flows. When flows reach as high as 400,000 cfs, the power plant no longer functions for flow passage. Steve's presentation included several slides showing the 2008 bathymetry, water depths and velocities at a flow of 700,000 cfs, and velocities at two lower levels of discharge. Steve showed a short movie showing how the velocities in the reservoir change with high flow operations.

The Susquehanna Flats two-dimensional model has 8,587 nodes in it, with the density of nodes increasing as you go up the river toward the Conowingo Dam. Steve's presentation included several slides showing the model bathymetry, as well as water depth and velocity at a flow of 100,000 cfs. The submerged aquatic vegetation patch at the mouth of the river was quite evident in these slides (large roughly circular area in red, showing as deflecting flow). The SAV bed is modeled with 3 feet of grass plus 2 feet of water. Bruce Michael mentioned that the SAV area is roughly 12,000 acres in size, and is the largest contiguous SAV bed in the Chesapeake Bay. This bed has been steadily growing, although it took a hit with Tropical Storms Irene and Lee. Jeff Halka asked

whether Steve could decrease the SAV canopy height seasonally. Steve noted that yes, they can. Bruce indicated that Lee Karrh from his staff would have information on the SAV winter dieback.

Steve mentioned that the two-dimensional models can be run on a PC although he will be using a supercomputer for added speed of turnaround time. Steve also reported that the ERDC field crew returned from the sediment core sampling recently. Lots of good data were collected; Steve has started the SEDflume data analysis.

C. HEC-RAS Modeling – USGS's Mike Langland and Ed Koerkle shared the status of their HEC-RAS modeling work using the PowerPoint presentation in enclosure 3. The HEC-RAS model extends from the Marietta gage at the upstream end to Conowingo Pond at the downstream end. Within this reach, there are two major flow inputs, the Conestoga River and Pequea Creek. To date, the USGS work has focused on evaluating the sediment input data, model geometry and hydraulics, and modeling sediment transport.

Using sediment input and instantaneous discharge data, Mike developed four transport curves (Marietta, Conestoga River, Pequea Creek, and Conowingo). The curves were developed by ranking the flow values and then showing the associated sediment concentration values. The resultant curves had R^2 values ranging from 0.65 to 0.70. Mike also summarized the particle size transport data for Conowingo. This data included 391 samples of sand/fines and 16 samples of sand/silt/clays. Mike noted that he would prefer to have more particle size data for this analysis.

While there was a HEC-6 model done in the mid-1990's, it didn't perform well so USGS started the HEC-RAS model from scratch. The model uses LIDAR data from Maryland and Pennsylvania, as well as recent bathymetry data (1996 and 2008 datasets). Ed is also using some flood insurance data to fill in where bathymetry data wasn't available (the alternative would have been assuming a trapezoidal channel). In some cases, this results in "mixed" data; however, these areas are primarily in areas where Ed doesn't expect much problems. Ed tried to use some supplemental data from Gomez and Sullivan; unfortunately, there were significant elevation discrepancies with other data, so the supplemental data was not used. The only remaining area with potential issues is the Washington Borough flats. The HEC-RAS model is expected to be operational in June 2012.

D. MGS Data Collection – Jeff Halka noted that the MGS survey crew hoped to be out sampling surficial sediments for grain sizes this week. The crew is squeezing it in between two other major jobs. Consequently, if they can't make it this week, there may be a delay in collecting the samples [Update: The MGS crew made it out on 2 May and Jeff began the lab work on 3 May]. Once the samples are collected, it will take about 4 weeks to complete the follow-on analyses.

E. Exelon Activities – Gary Lemay from Gomez and Sullivan (an Exelon contractor) brought the group up to date on some recent corrections to their sediment calculations presented at the January 2012 quarterly meeting. Specific numbers that were revised are bolded below:

(1) the accumulation of **3,434** acre-feet of sediment in Conowingo Pond between fall 2008 and fall 2011 surveys;
(2) the 3,434 acre-feet is equivalent to **5.07** million tons (using an assumed density of 67.8 pounds per cubic feet);
(3) the 3,434 acre-feet is equivalent to an average of **1.69** million tons of deposition per year; and

(4) assuming Conowingo Pond's steady-state volume is 142,000 acre-feet, there is approximately **21,800** acre-feet of remaining sediment capacity.

Gary showed a longitudinal profile of the Conowingo Pond and the difference in average depth between the 2008 and 2011 (post-Lee) surveys. The profile showed some slight scouring in the upper end of the reservoir, and significant deposition in the lower 3 miles. Gary's presentation also included a graph of time versus the remaining sediment capacity. This graph indicates that the Conowingo Pond is approaching a sediment volume equilibrium value, and is acting less effectively as a sediment trap. Currently, the reservoir is in a pattern of net deposition, with periodic sediment re-suspension occurring during high flows. As the reservoir fills, re-suspension may occur at a lower flow, theoretically. Gary and Marjie noted that while there is likely less sediment being trapped than the previously suggested "linear filling" hypothesis would predict, Conowingo Pond will continue to trap this reduced amount well into the future.

As a follow-on to the Exelon presentation, there was significant discussion among the meeting attendees about the meaning of the results. One attendee postulated that meeting the TMDL (total maximum daily load) targets will become more difficult. Another suggested that prior to this analysis, scientists thought that there was 10 to 15 more years before Conowingo reached this point, but it is becoming clearer that Conowingo's time as an effective sediment trap is running out. The agency group agreed that a statement on these findings and the repercussions, needs to be developed this summer to get out a consistent message to policymakers, the public, and media [**Action** = Herb and Bruce to draft preliminary statement]. Part of this effort will include some additional checking of storm flow and scour events. One suggestion was to make a presentation at the December 2012 Susquehanna River Basin Commission meeting.

6. Review of Schedule for 2012 – Claire provided a handout of the most recent schedule for the assessment, and reviewed the activities coming up in the next 3 to 4 months. Steve Scott noted that the 2D-3D comparison report will be combined with the SEDflume data report and should be completed by 1 June. Carl Cerco expects to finalize the CBEMP data report 2 weeks ahead of schedule by 15 May. Based on the meeting discussions and follow-up conversations, all other tasks are on schedule, as noted in the project schedule dated 16 April (enclosure 5).

7. Wrap Up – Claire will draft up notes for the group's review. Following this, the notes and presentations will be posted to the project website. The next meeting will be held August 7, 2012, 10-12:30, at MDE. Bob Hirsch from USGS has been invited to make a presentation. The next modeling conference call will be on June 7, 2012, starting at 2:00 pm (EDT, 1:00 pm CDT).

Claire D. O'Neill, P.E.
Project Manager

Enclosures:
1. Meeting Agenda
2. Steve Scott Presentation
3. Mike Langland/Ed Koerkle Presentation
4. Gary Lemay Presentation
5. Project Schedule dated 16 April 2012

LOWER SUSQUEHANNA RIVER WATERSHED ASSESSMENT
QUARTERLY TEAM MEETING

MDE, Montgomery Park Building, Aqua Conference Room
April 30, 2012

Meeting Agenda

		Lead
10:00	Welcome and Opening Remarks	Sachs
10:05	Introductions	All
10:10	Review of Action Items from January Meeting	O'Neill
10:20	Communication and Coordination	
	USACE Agency Coordination Letters	O'Neill/Bierly
	PowerPoint Presentation – Feedback from Recent Meetings	All
	Project Website Update	Michael
10:30	LSRWA Technical Analyses	
(10 min)	CBEMP Modeling Update	Cerco
(5 min)	Data Report – Major Comments?	All
(30 min)	Sediment Transport Modeling Update	Scott
(20 min)	HEC-RAS Modeling Update	Langland/Koerkle
(5 min)	MGS Data Collection	Halka
(5 min)	Exelon Activities	LeMay
11:45	Review of Schedule for 2012	O'Neill
11:55	Wrap Up	O'Neill
	Action Items/Summary	
	Next Meeting	

Call-In Information: (410) 537- 4281 (no password required)

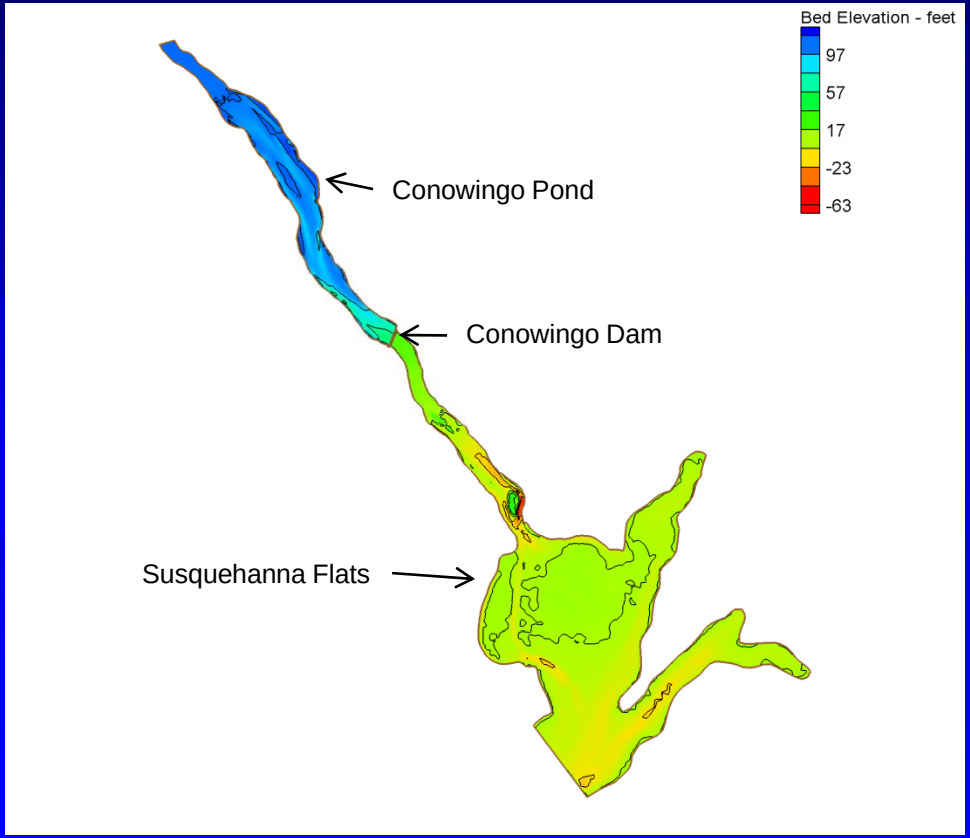
Expected Attendees:

MDE: Herb Sachs; Tim Fox, Adam Rettig
MDNR: Bruce Michael, Shawn Seaman
MGS: Jeff Halka
SRBC: John Balay, David Ladd, Andrew Gavin
USACE: Bob Blama, Carey Nagoda, Chris Spaur, Claire O'Neill, Dan Bierly
ERDC: Carl Cerco, Steve Scott
TNC: Mary Bryer, Kathy Boomer
USEPA: Gary Shenk
USGS: Mike Langland, Ed Koerkle

Exelon: Gary LeMay, Robert Matty
Lower Susquehanna Riverkeeper: Michael Helfrich
PA Agencies: Patricia Buckley, Raymond Zomok

Lower Susquehanna River Watershed Assessment

Two Dimensional Modeling Studies



Lower Susquehanna River Watershed Assessment

Progress to Date:

- **Task 1 – Evaluated Reservoir Sedimentation 3D Effects**
- **Task 2 – Built a 2D model of Conowingo Pond Including Hydrodynamic Simulations**
- **Task 3 – Built a 2D model of Susquehanna Flats Including Hydrodynamic Simulations**

Lower Susquehanna River Watershed Assessment

TASK 1 – Investigate Impacts of 3D Phenomena

What are the 3D Effects in Reservoirs?

- **Currents Generated by Density Gradients due to Temperature Stratification**
- **Currents Generated by Winds**
- **Reservoir Discharge at Depth**

Lower Susquehanna River Watershed Assessment

TASK 1 – Investigate Impacts of 3D Phenomena

When are These Effects Important?

- **Low River Discharge into Reservoir**
- **Advection (Flow Velocity) is low; Turbulence and Mixing at a Minimum**
- **High Water Residence Time in Reservoir**

Lower Susquehanna River Watershed Assessment

TASK 1 – Investigate Impacts of 3D Phenomena

The Concern:

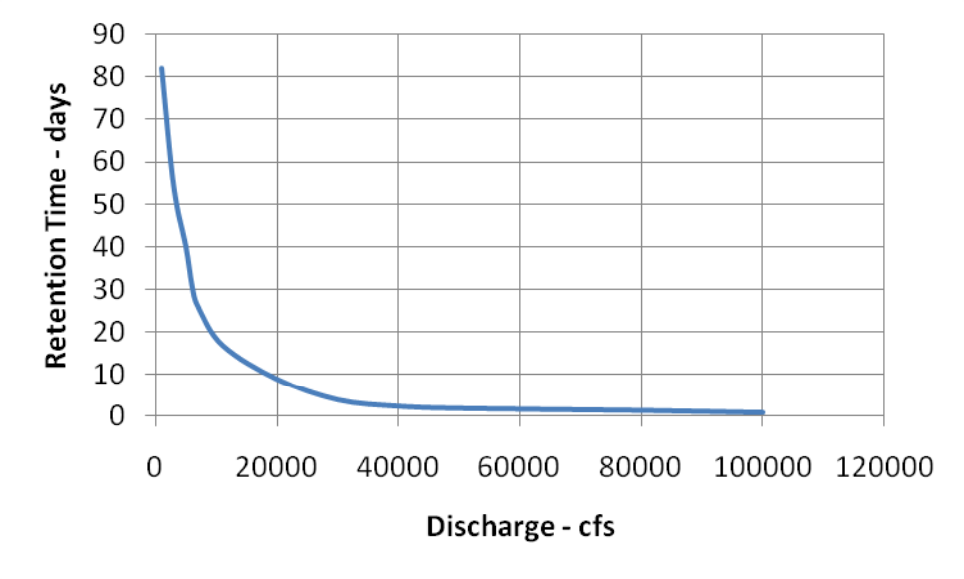
Will 3D Effects Significantly Impact 2D Sediment Transport and Fate Simulations?

The Approach:

Evaluate Sediment Availability to Reservoir When 3D Impacts May be Significant

Lower Susquehanna River Watershed Assessment

Water Retention Time In Conowingo Pond

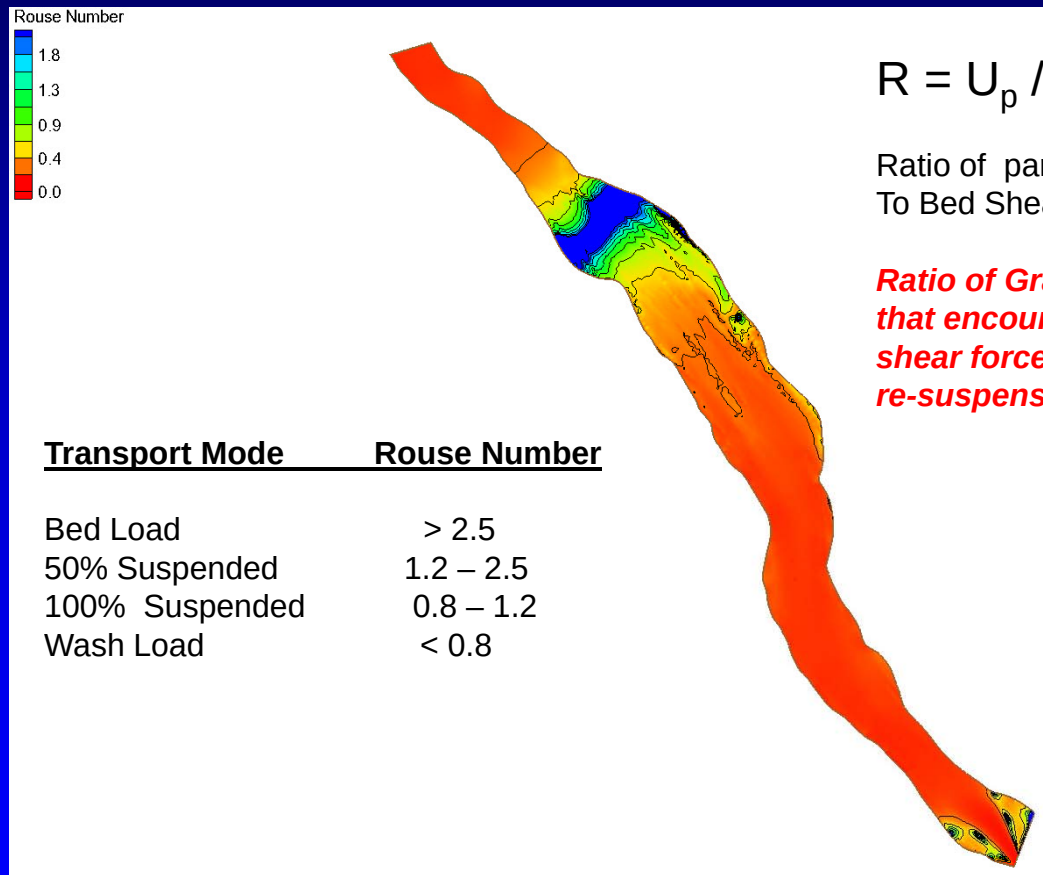


* Flows > 30,000 cfs have a retention time of 5 days or less
* ASSUME all Flows < 30,000 cfs Have Dominant 3D Effects
* ASSUME all Flows > 30,000 cfs Have Sufficient Mixing

Lower Susquehanna River Watershed Assessment

Rouse Number Calculation to Predict Mixing / Stratification

Medium Silt at 30,000 cfs



$$R = U_p / \kappa(\tau_B / \rho)^{0.5}$$

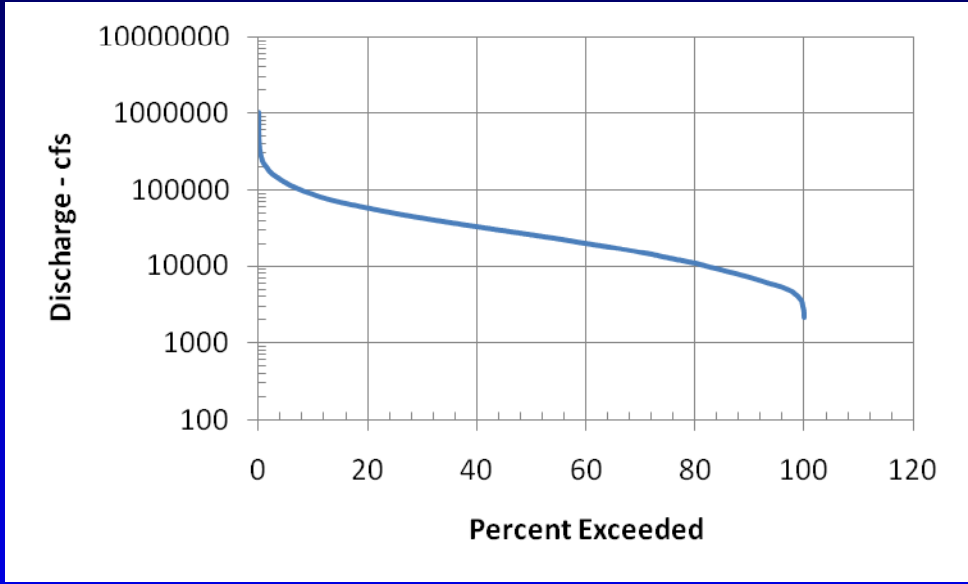
Ratio of particle fall velocity
To Bed Shear Stress

Ratio of Gravitational Force that encourages settling to bed shear forces that encourage re-suspension

Transport Mode	Rouse Number
Bed Load	> 2.5
50% Suspended	1.2 – 2.5
100% Suspended	0.8 – 1.2
Wash Load	< 0.8

Lower Susquehanna River Watershed Assessment

Flow Duration Curve for Susquehanna River

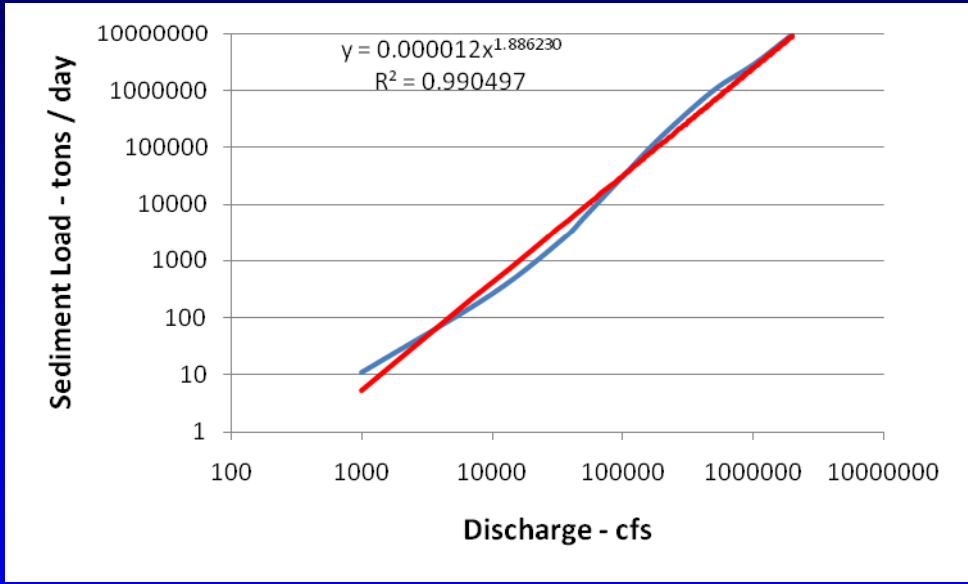


Median Flow is about 26,000 cfs

56% of Flows are Less Than 30,000 cfs

Lower Susquehanna River Watershed Assessment

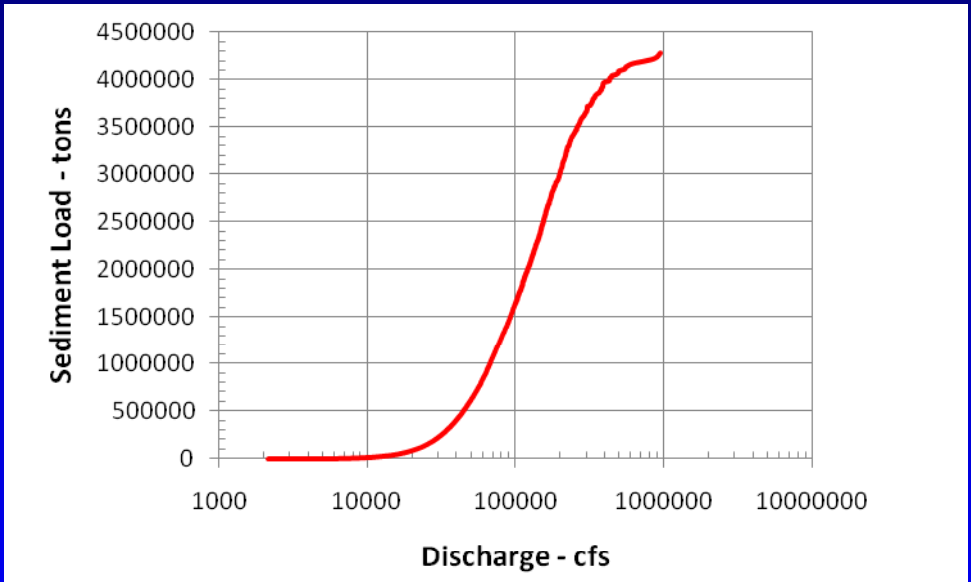
Sediment Rating Curve for Susquehanna River



Sediment Load Entering the Reservoir in Tons / Day for a Given Discharge

Lower Susquehanna River Watershed Assessment

Integration of the Flow Duration Curve and Sediment Rating Curve



Total Load / Year: 4,283,166 Tons

Total Load ≤ 30,000 cfs: 224,869 Tons

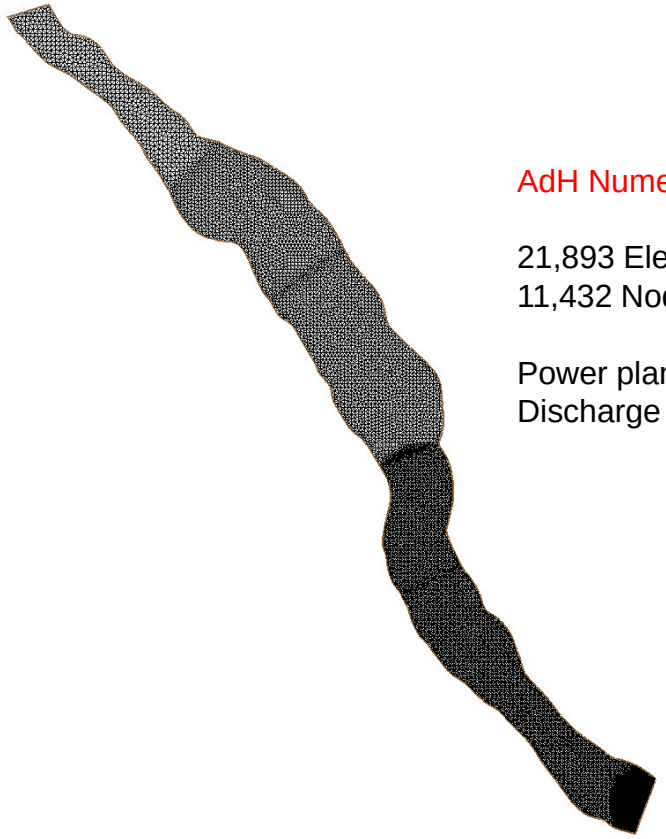
BOTTOM LINE:

Reservoir is Exposed to only 5% of Total Yearly Load During Low Flow Conditions

Although 3D Effects do Occur, They Are Negligible

Lower Susquehanna River Watershed Assessment

2D Model Development – Conowingo Pond



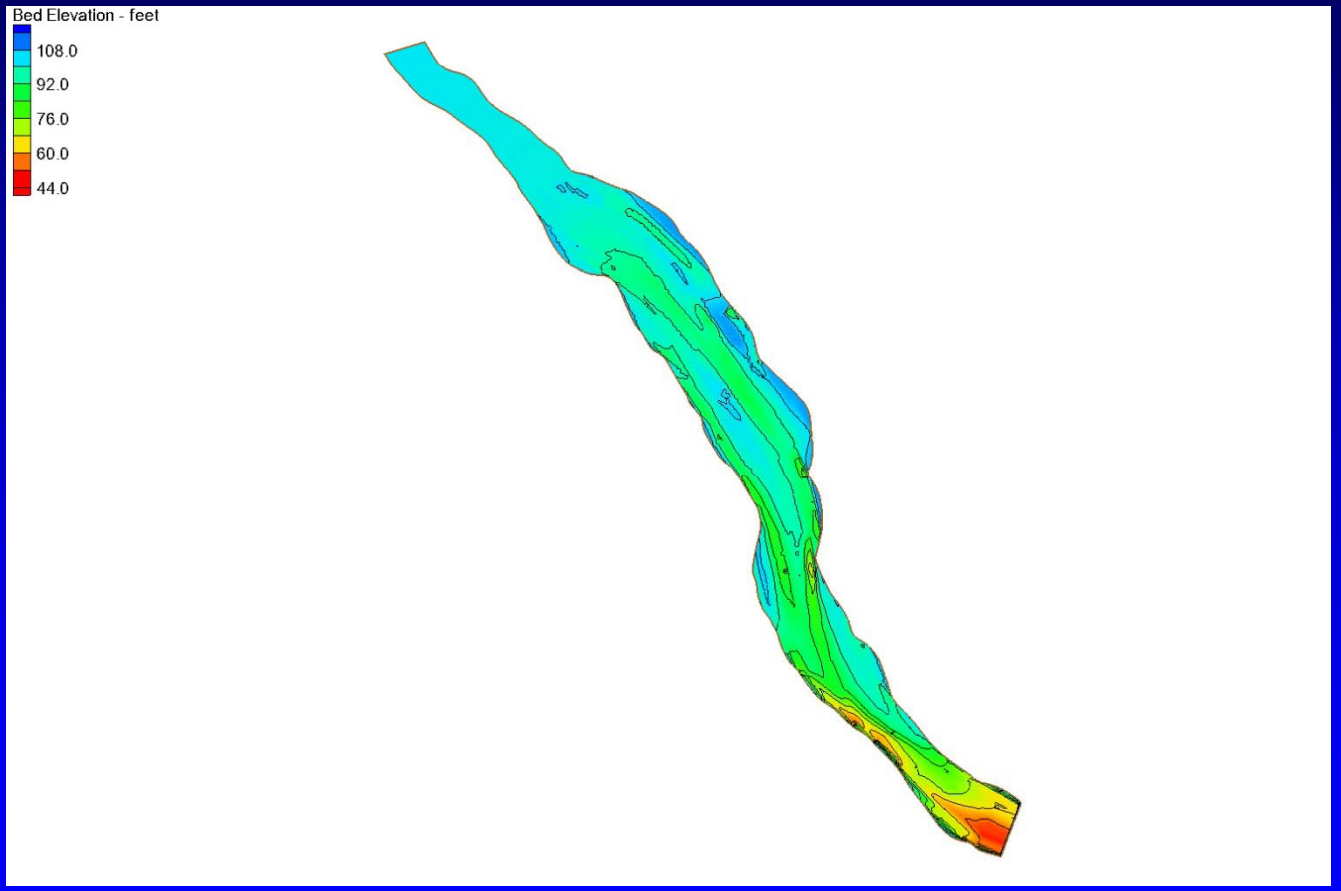
AdH Numerical Mesh Info

21,893 Elements
11,432 Nodes

Power plant and Flood Gate
Discharge Capability

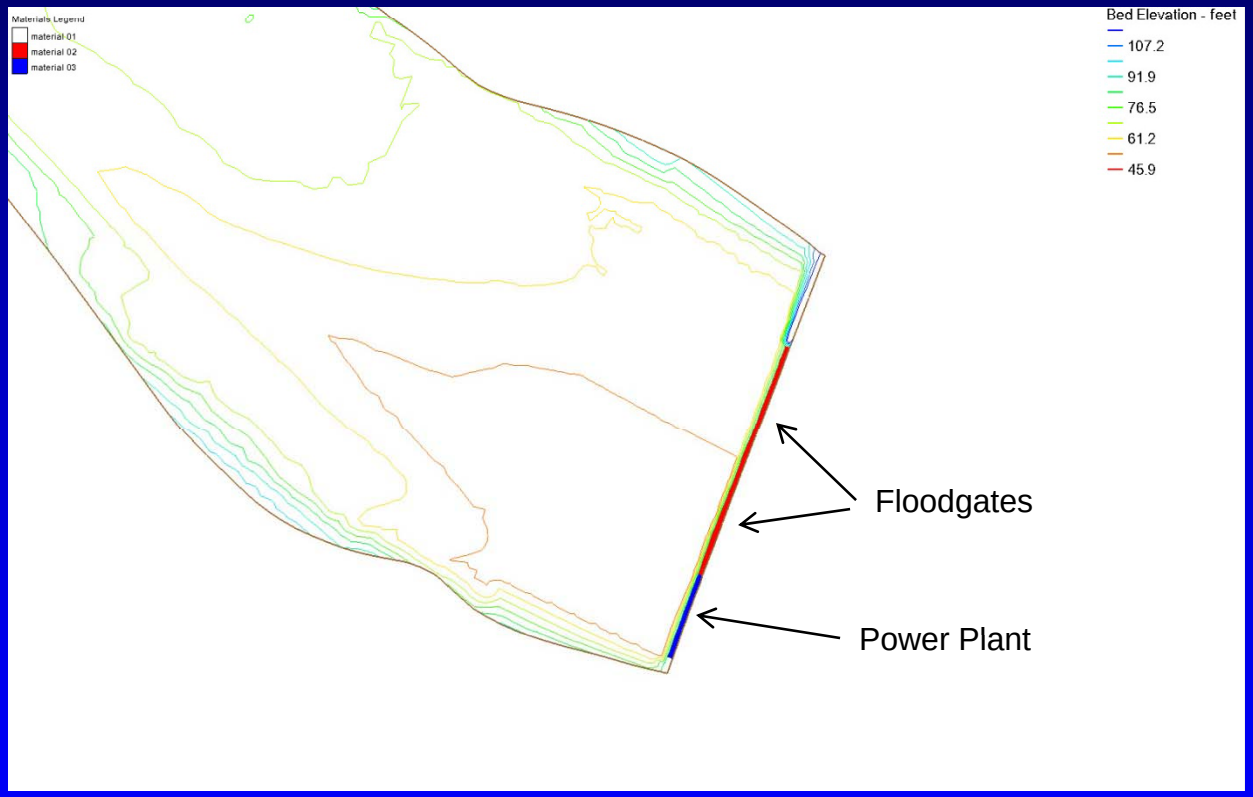
Lower Susquehanna River Watershed Assessment

2D Model Development – 2008 Bathymetry



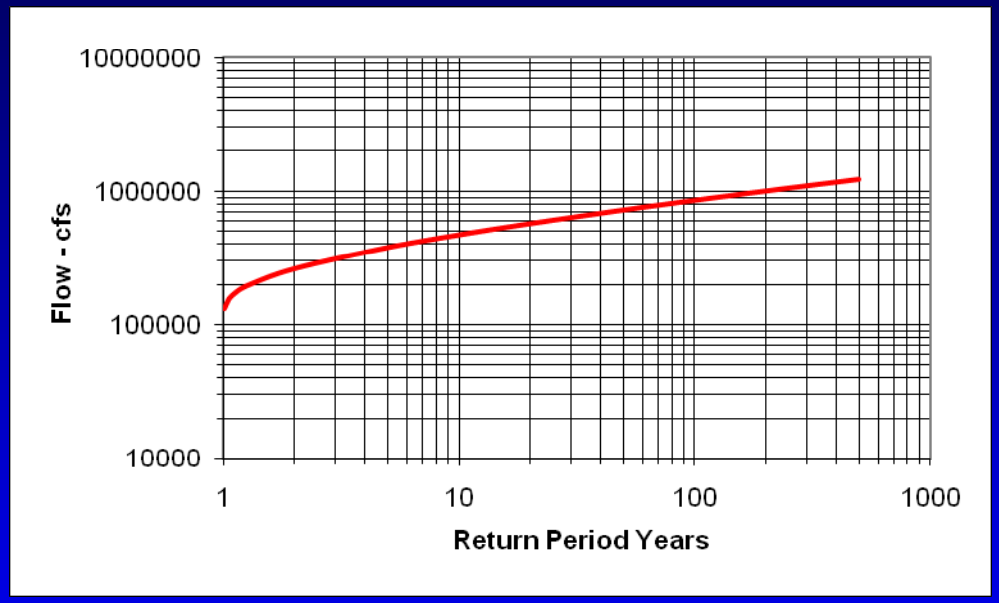
Lower Susquehanna River Watershed Assessment

2D Model Development – Power Plant and Gates



Lower Susquehanna River Watershed Assessment

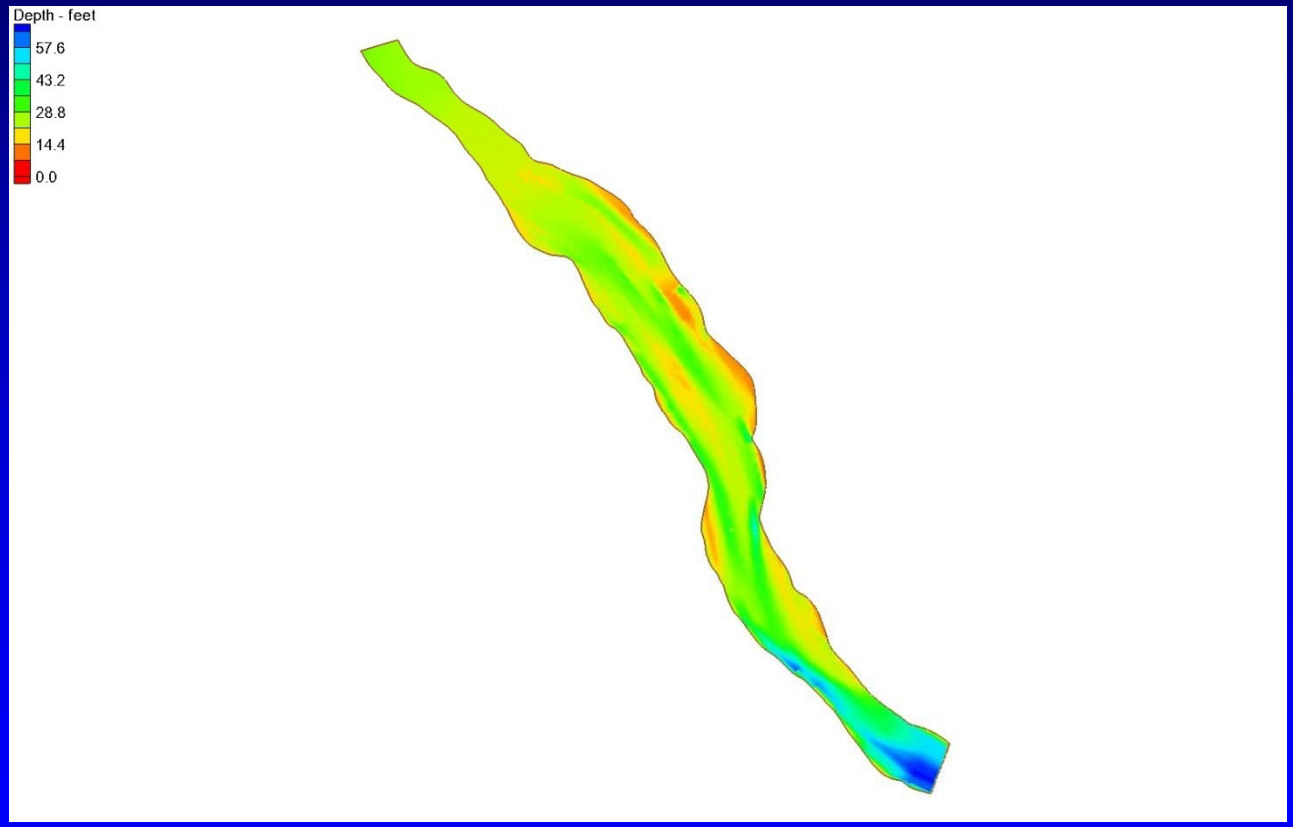
Susquehanna River Return Flood Flows



Simulated 700,000 cfs Flood ~ 40 Year Return Event

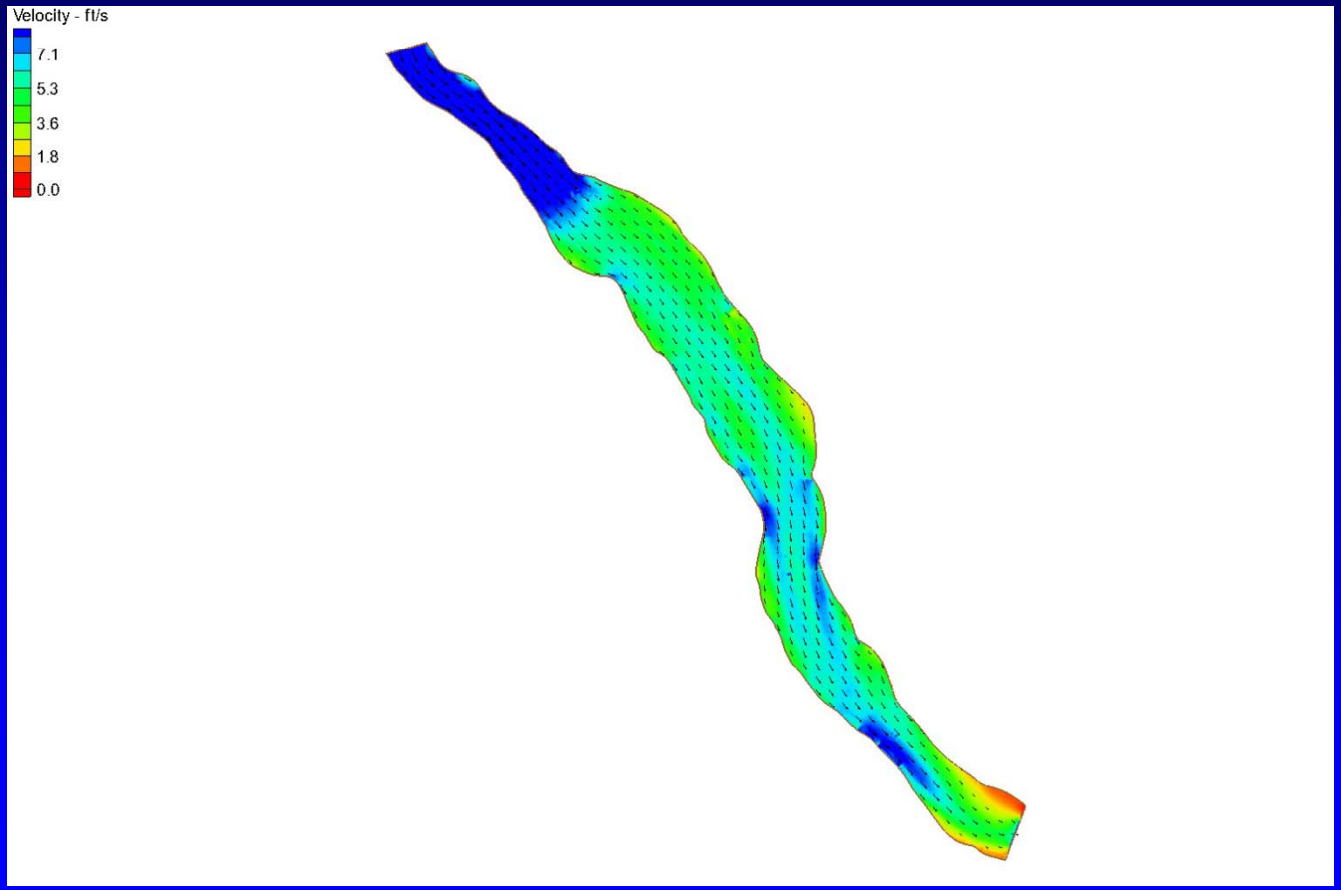
Lower Susquehanna River Watershed Assessment

Water Depth at 700,000 cfs



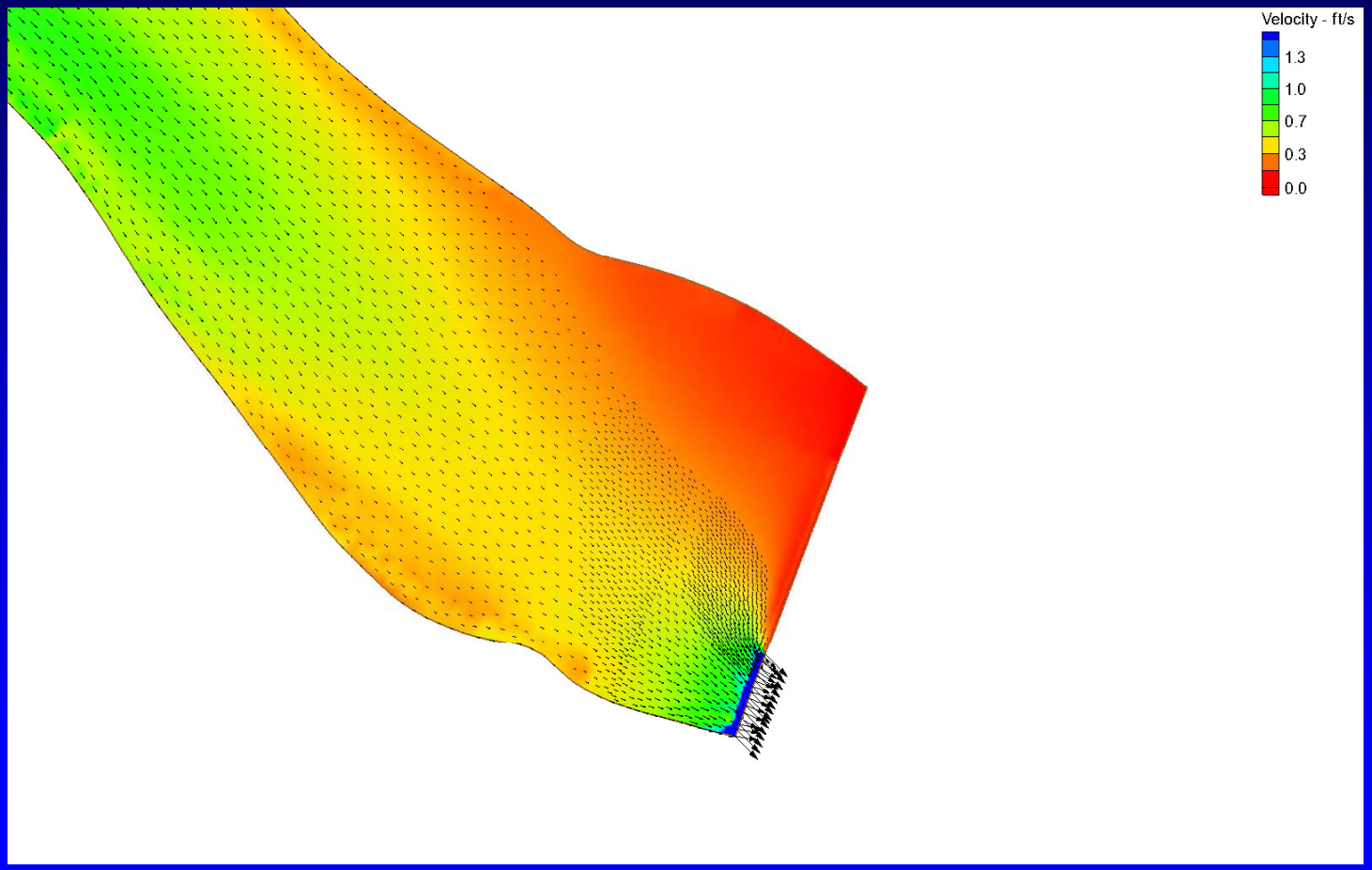
Lower Susquehanna River Watershed Assessment

Velocity at 700,000 cfs



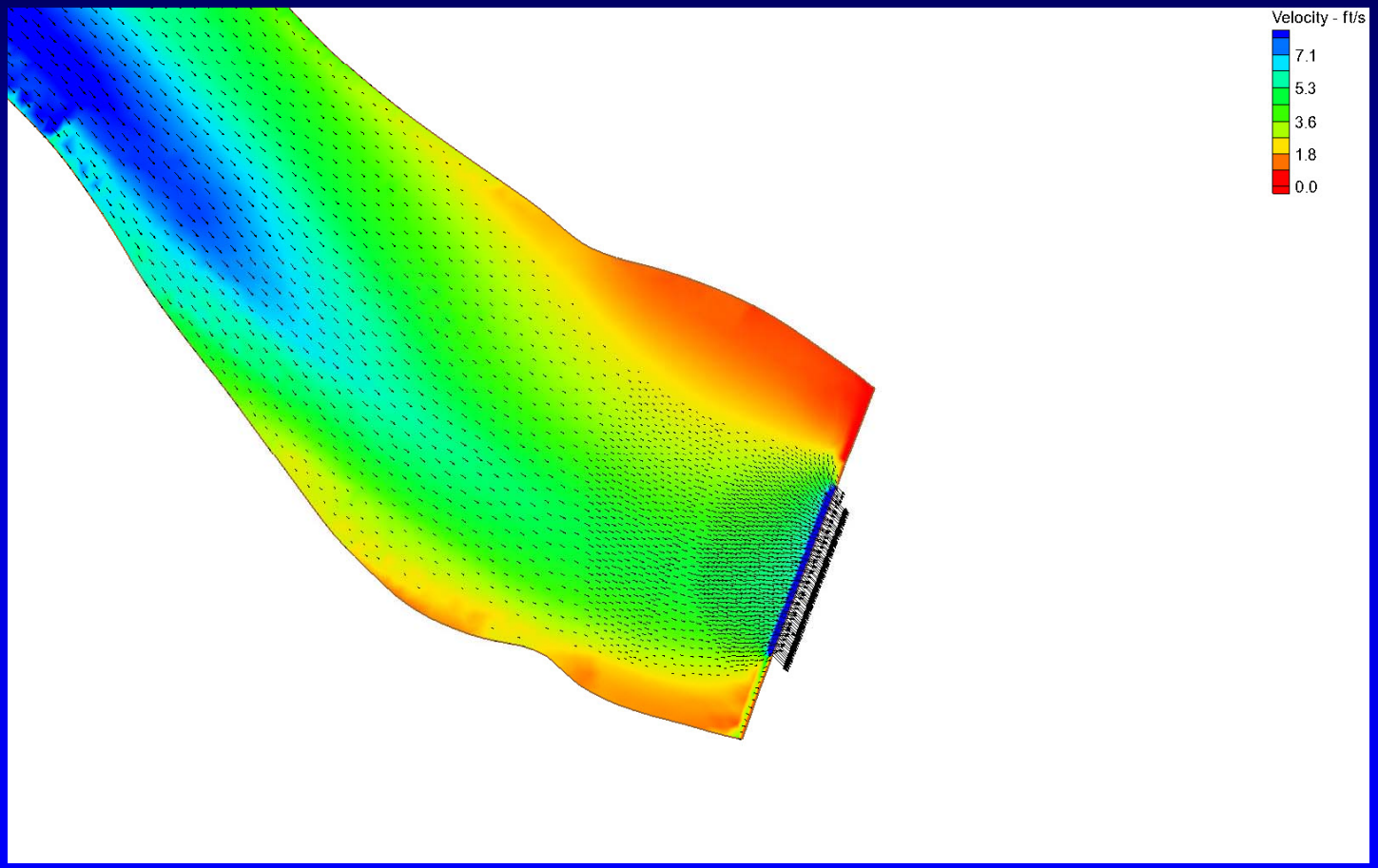
Lower Susquehanna River Watershed Assessment

Discharge Through Power Plant ≤ 86,000 cfs

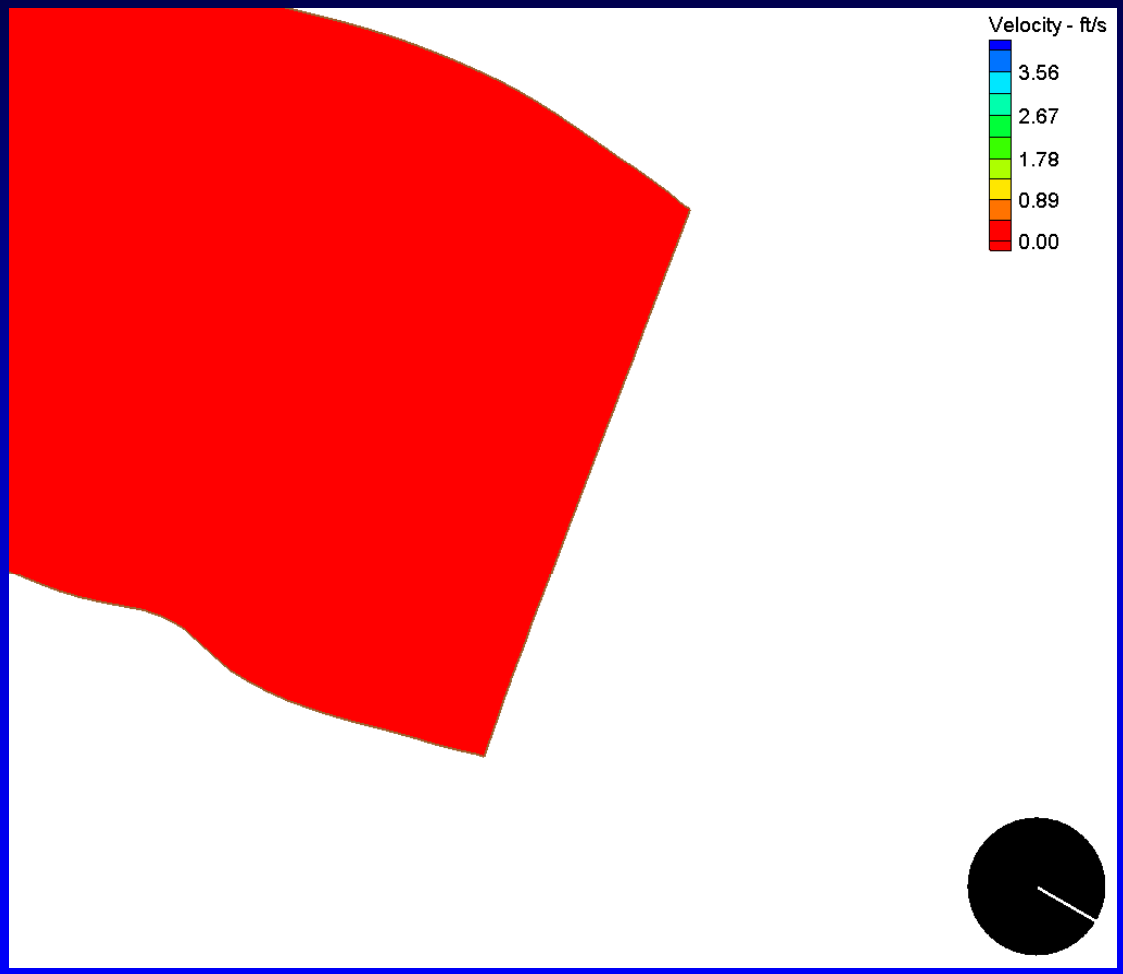


Lower Susquehanna River Watershed Assessment

Discharge Through Flood Gates ≥ 400,000 cfs

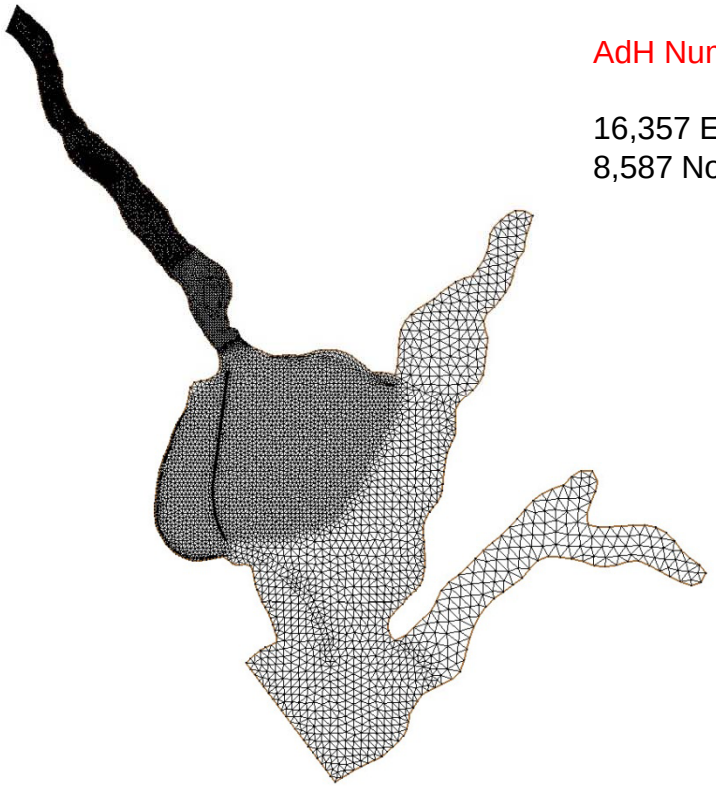


Lower Susquehanna River Watershed Assessment



Lower Susquehanna River Watershed Assessment

2D Model Development – Susquehanna River Through Susquehanna Flats

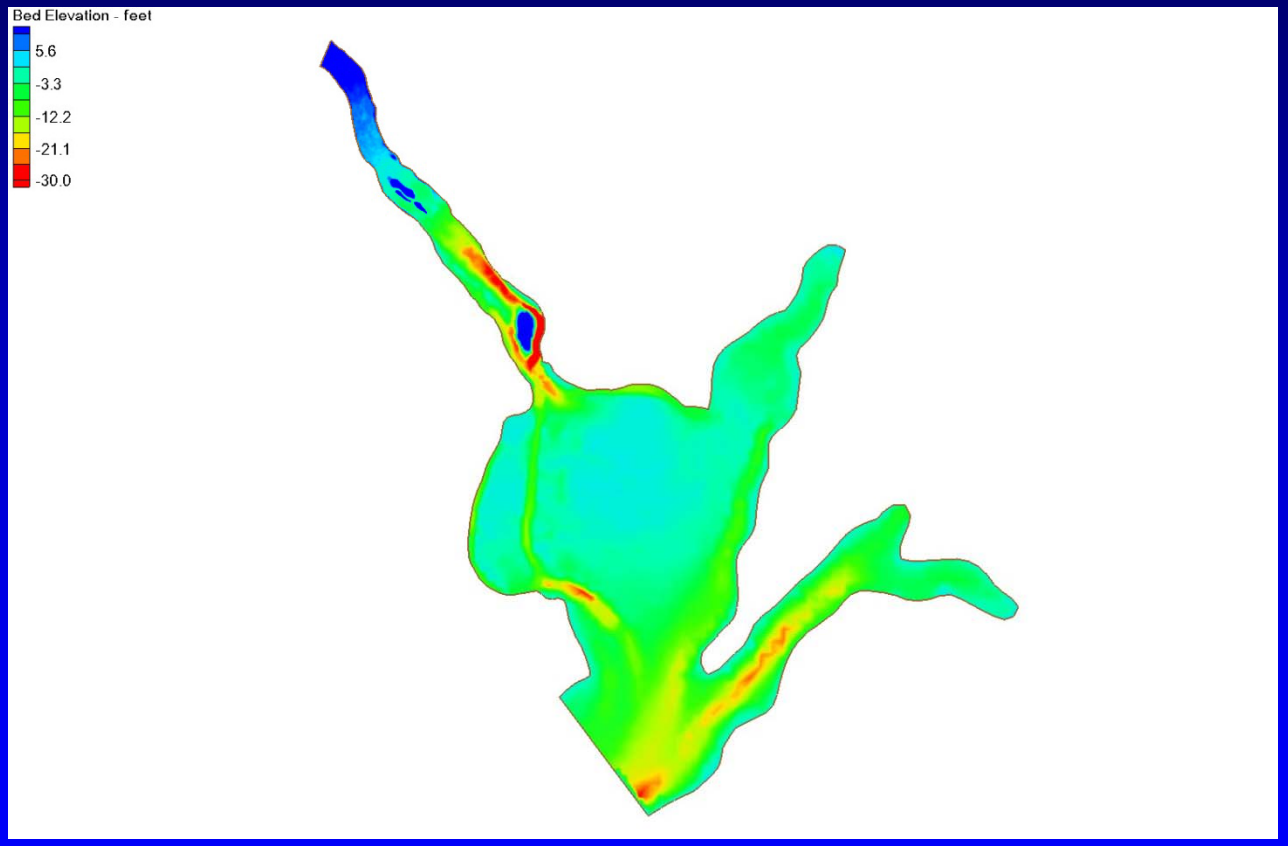


AdH Numerical Mesh Info

16,357 Elements
8,587 Nodes

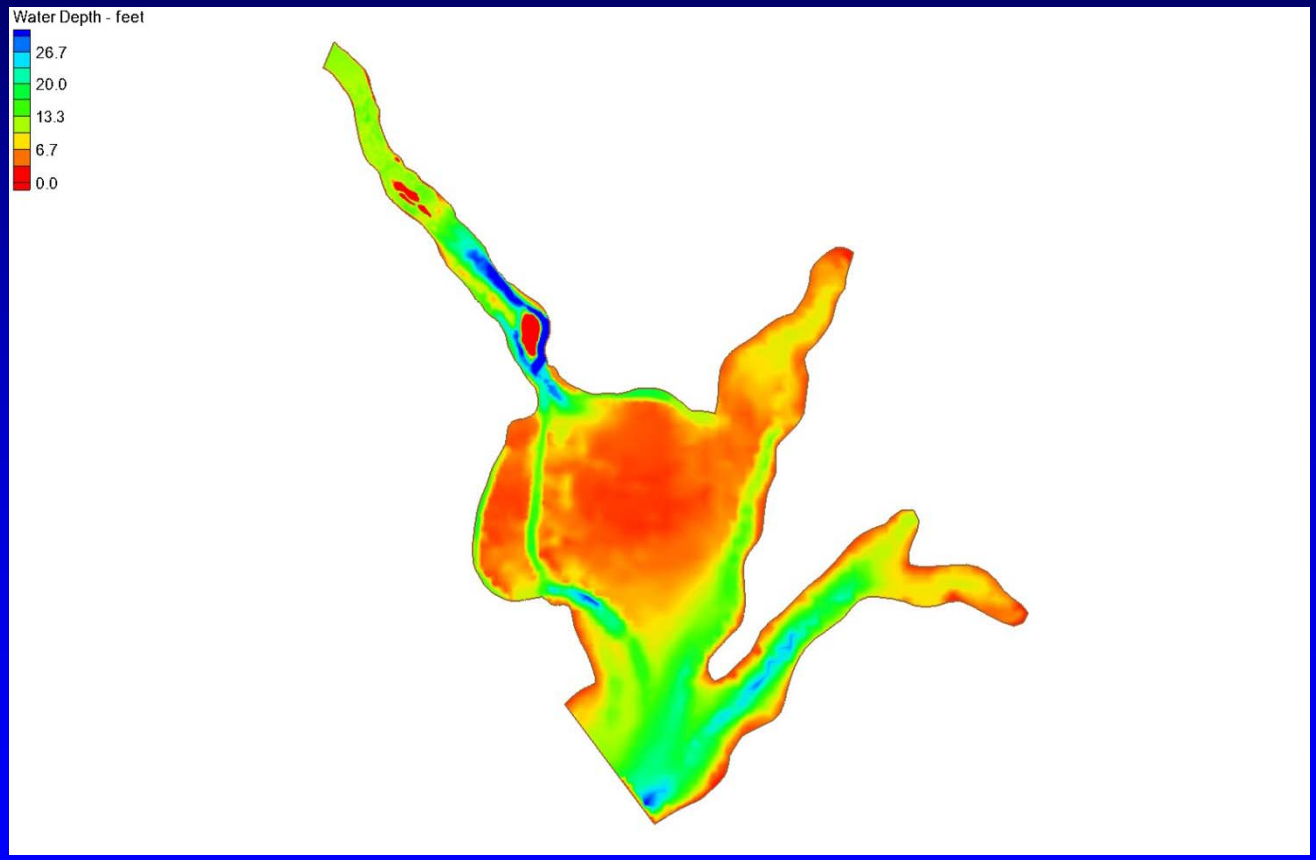
Lower Susquehanna River Watershed Assessment

2D Model Development – Model Bathymetry



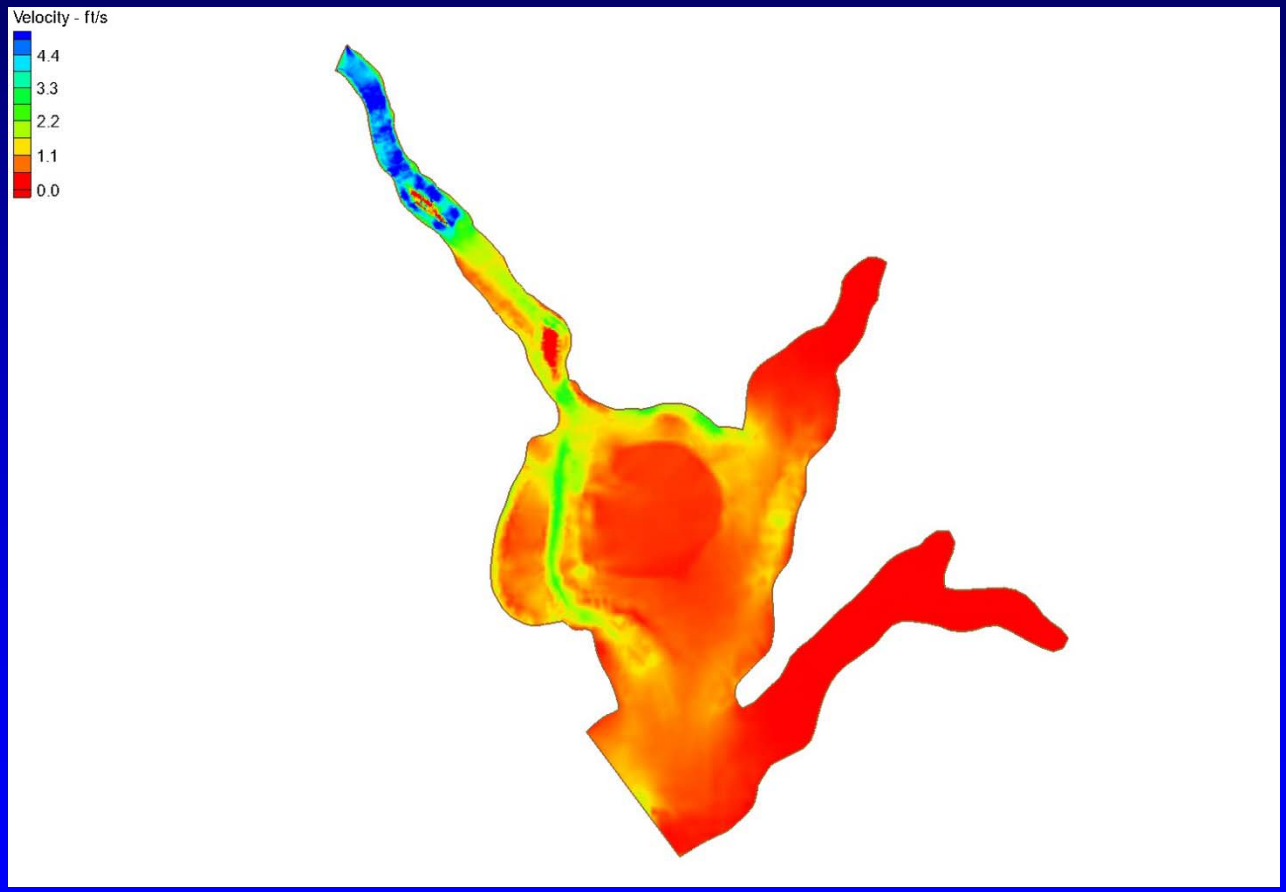
Lower Susquehanna River Watershed Assessment

Water Depth at 100,000 cfs
Mean Low Lower Water Tail Water Elevation



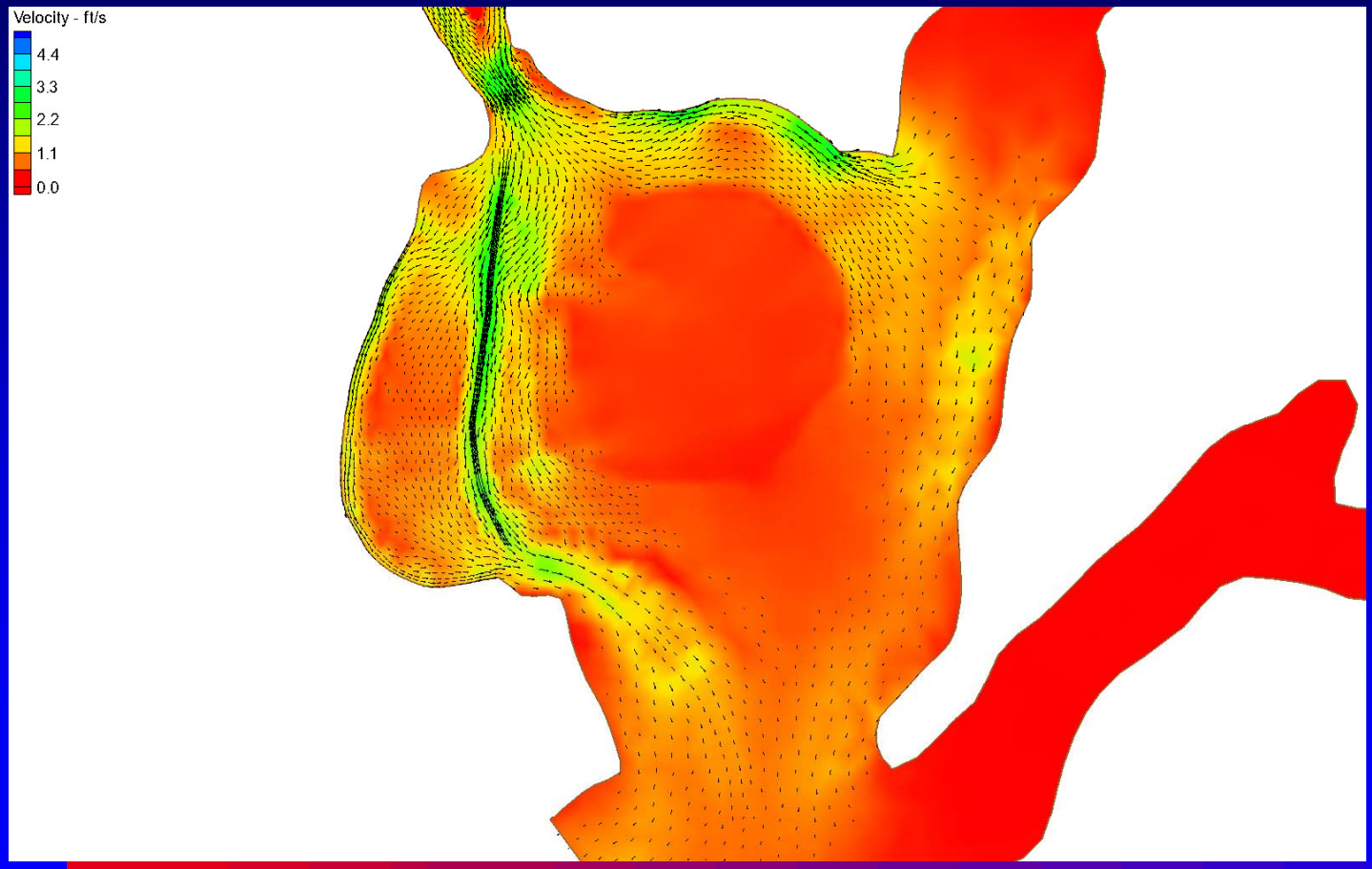
Lower Susquehanna River Watershed Assessment

Velocity at 100,000 cfs
Mean Low Lower Water Tail Water Elevation



Lower Susquehanna River Watershed Assessment

Velocity at 100,000 cfs
Flow Patterns with Submerged
Vegetation Roughness Assignment



US Army Corps
of Engineers

Coastal and Hydraulics Laboratory
Engineer Research and Development Center

Update on the HEC-RAS Reservoir Transport Simulation

Mike Langland and Ed Koerkle
03/30/2012

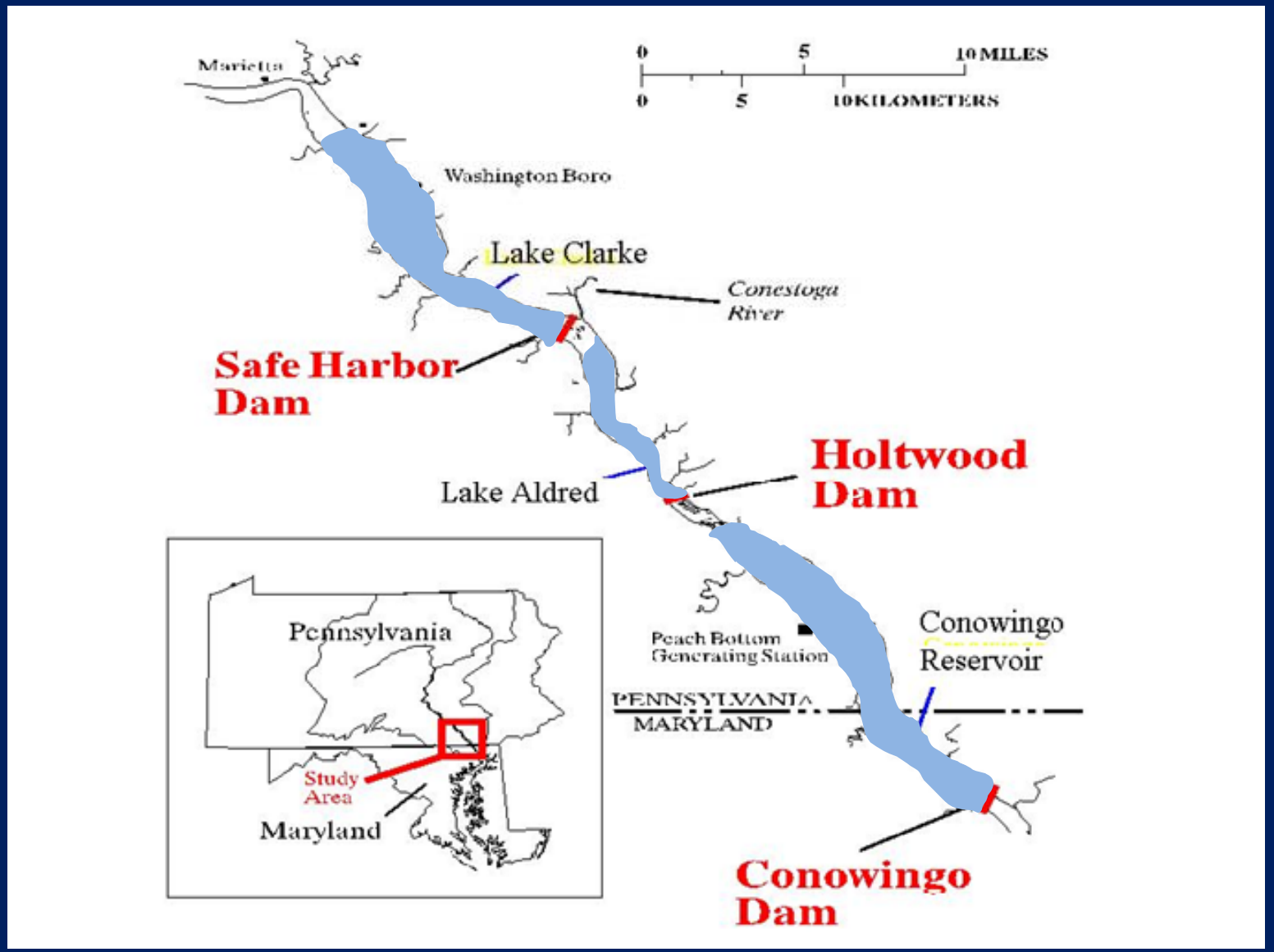
USGS

Topics

- Sediment Input Data
- Model Geometry and Hydraulics
- Model Sediment Transport

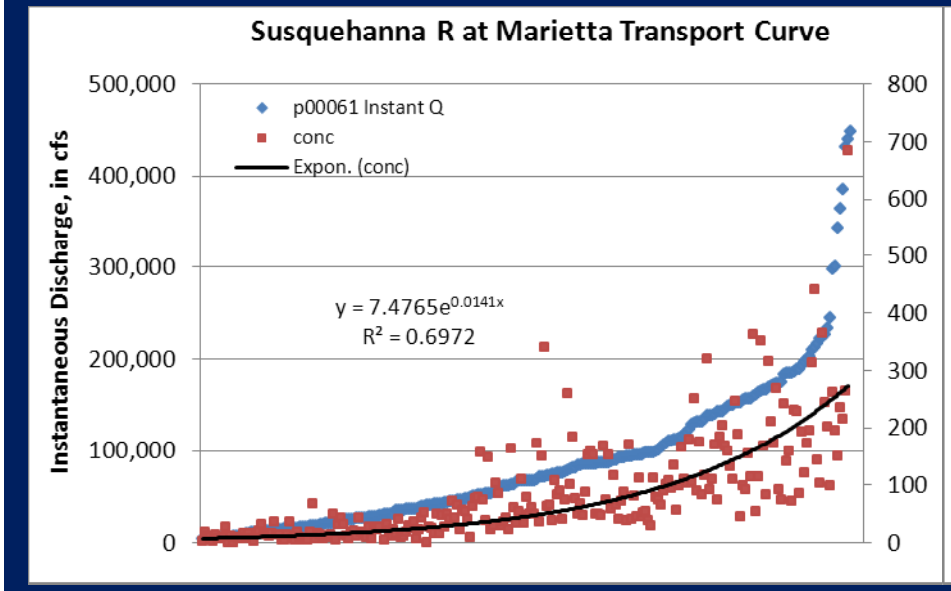
USGS

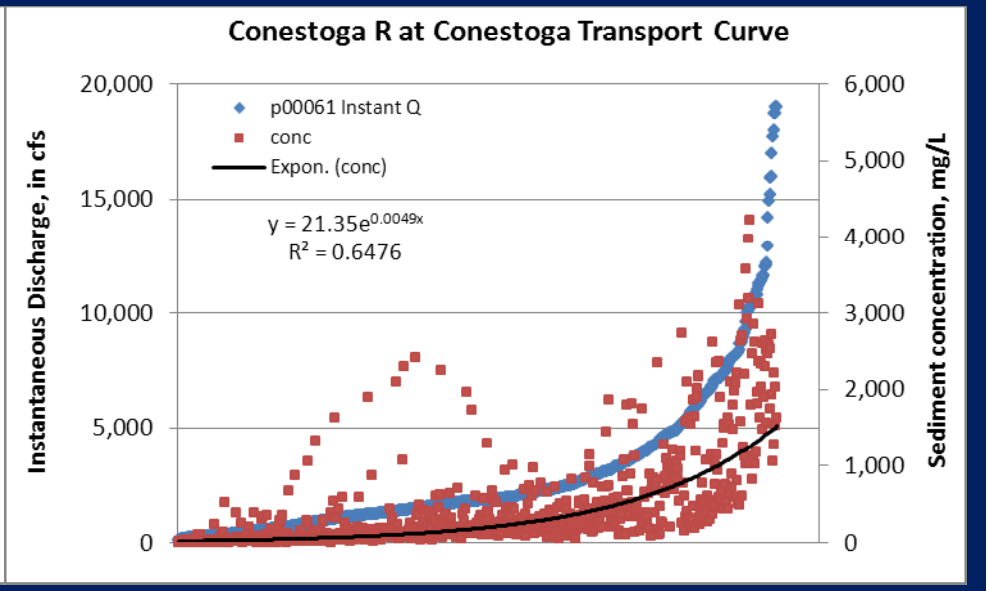
Susquehanna River Reservoirs

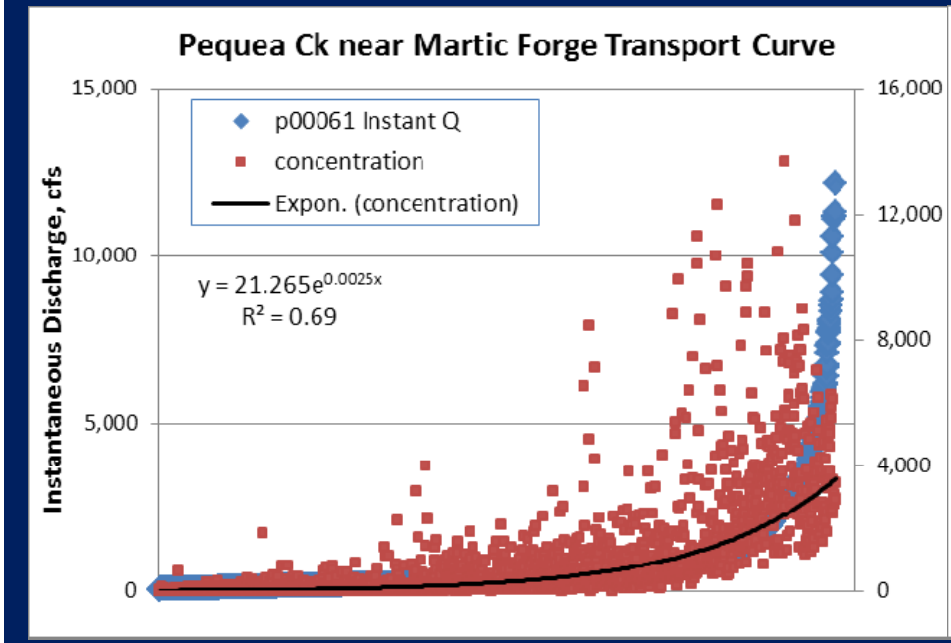


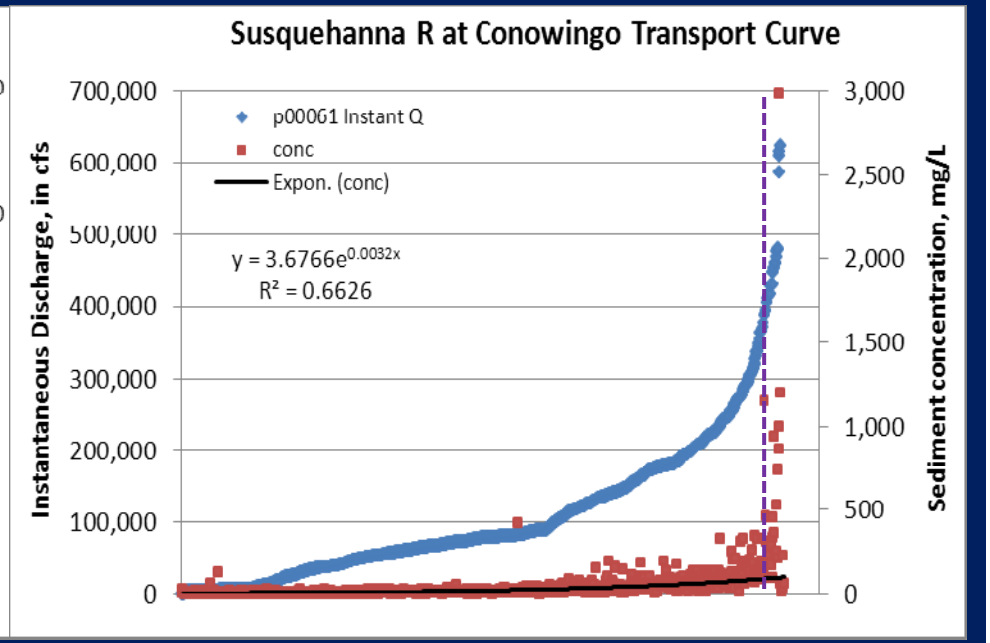
Enclosure 3
Langland/Koerkle Presentation

Transport Curves









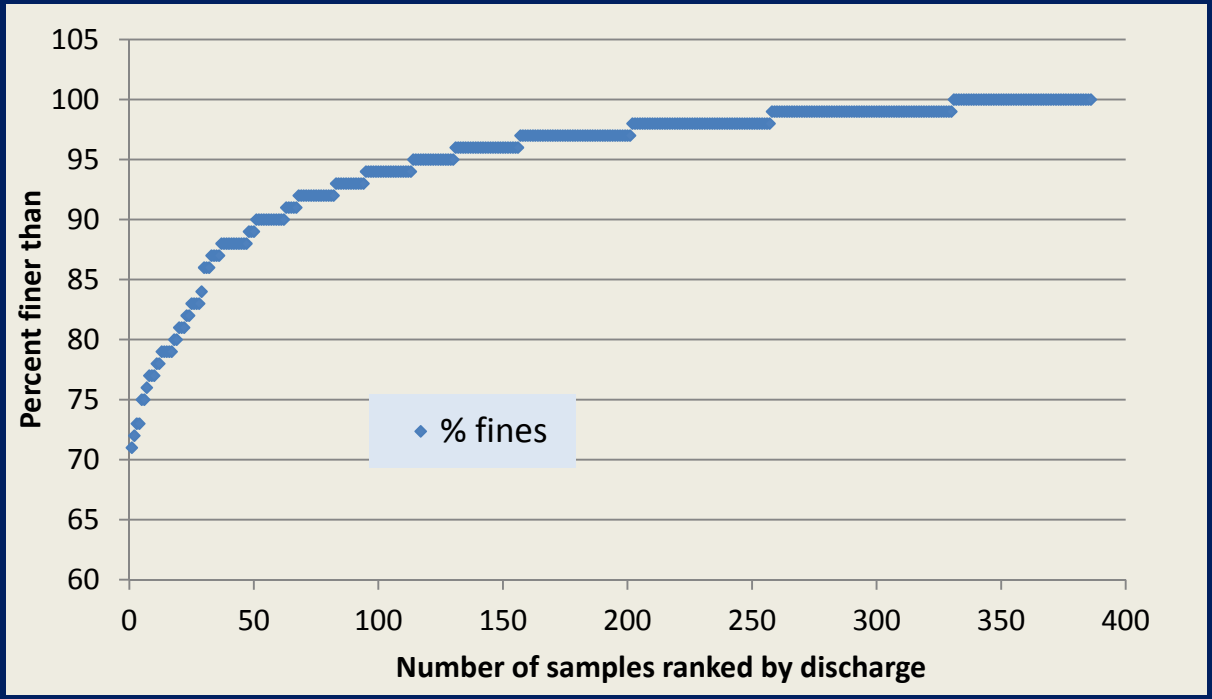
Enclosure 3
Langland/Koerkle Presentation

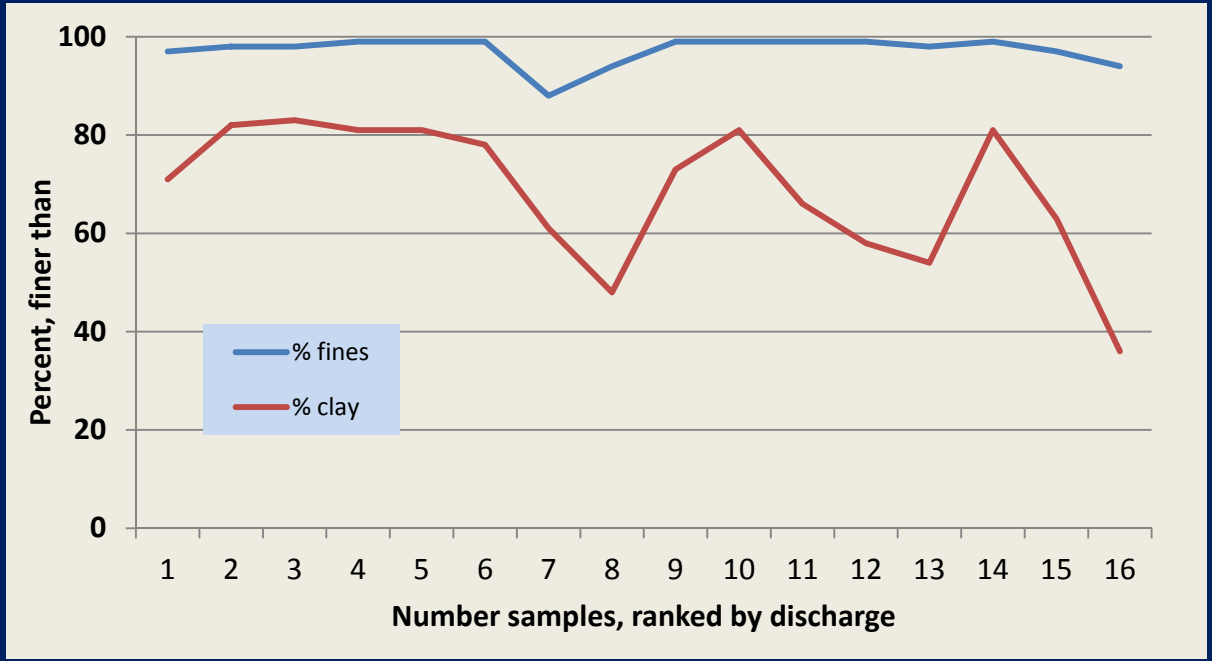
Particle Size Transport (Conowingo)

391 samples
% sand/fines

16 samples
% sand/silt/clay

Missing data ?

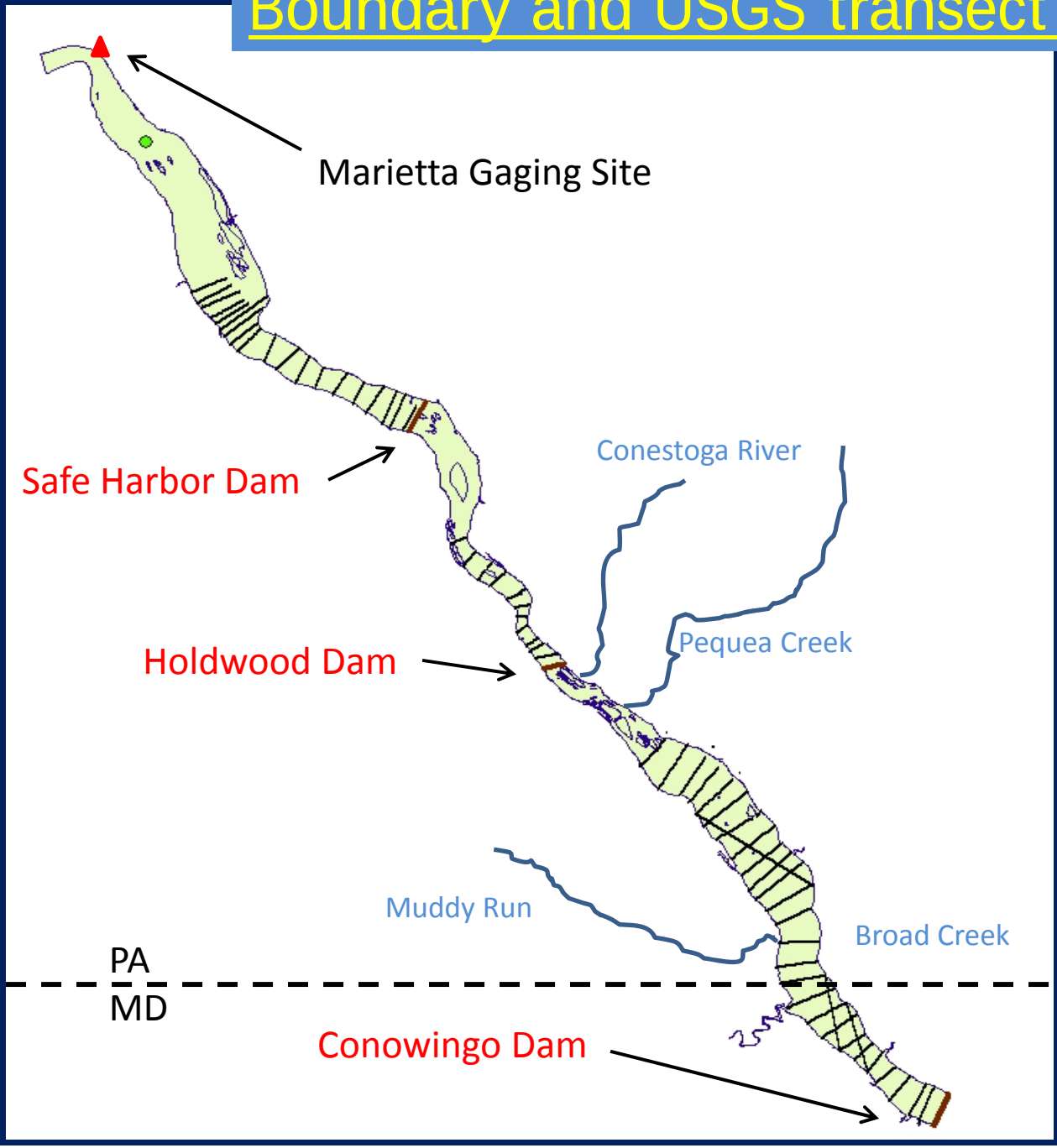




Enclosure 3
Langland/Koerkle Presentation

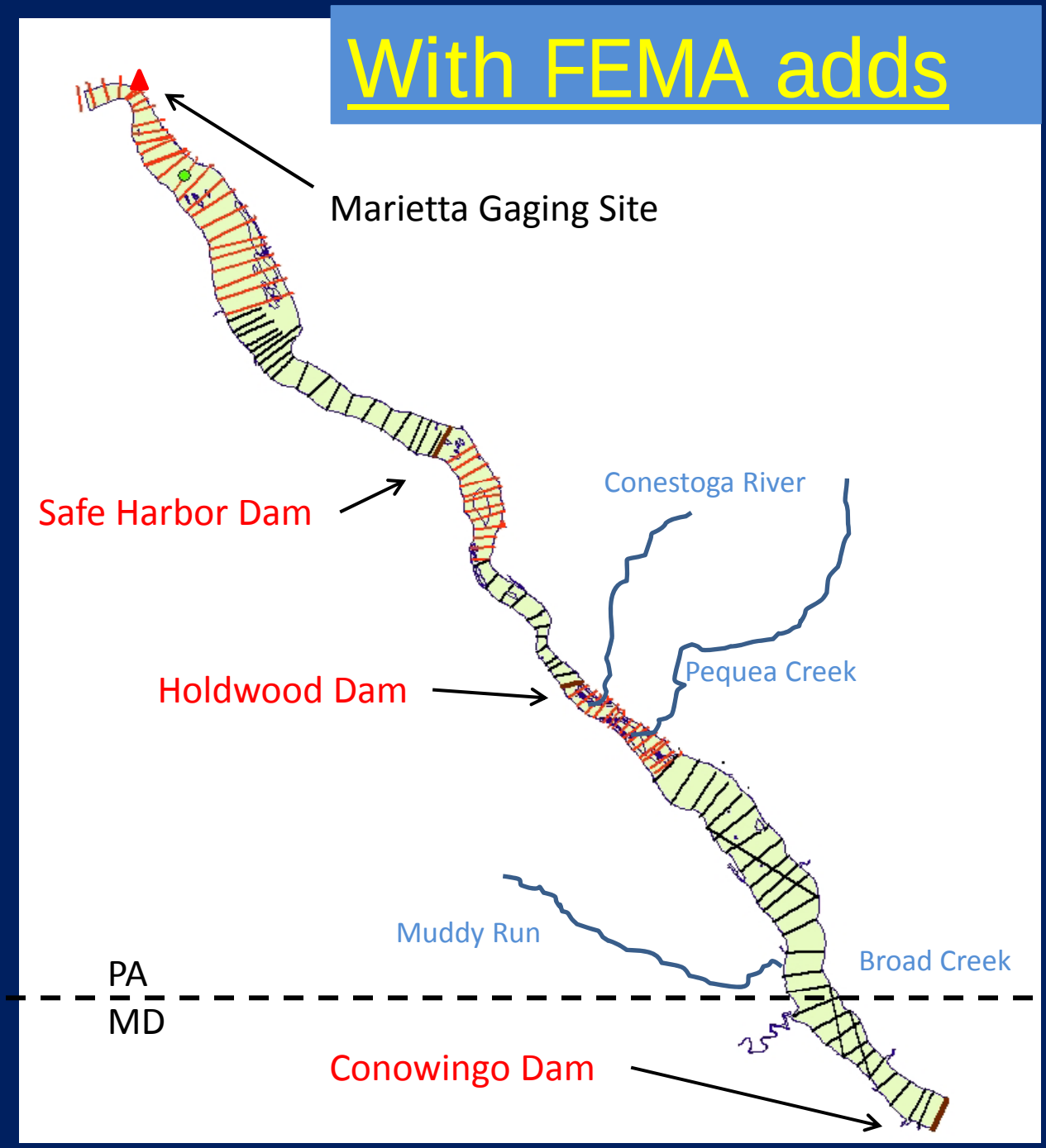
Model Geometry and Hydraulics

Boundary and USGS transect data

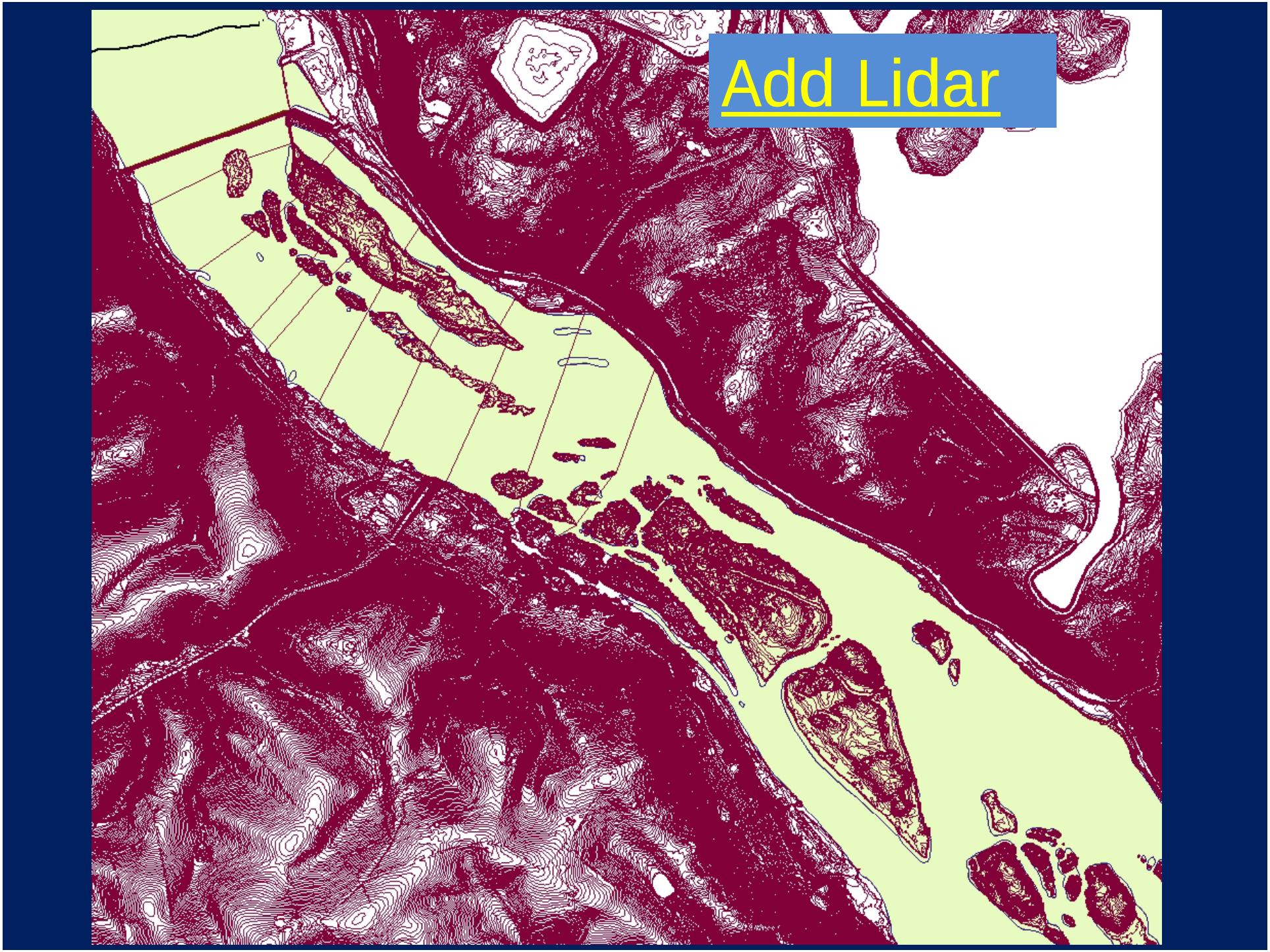


Enclosure 3
Langland/Koerkle Presentation

With FEMA adds

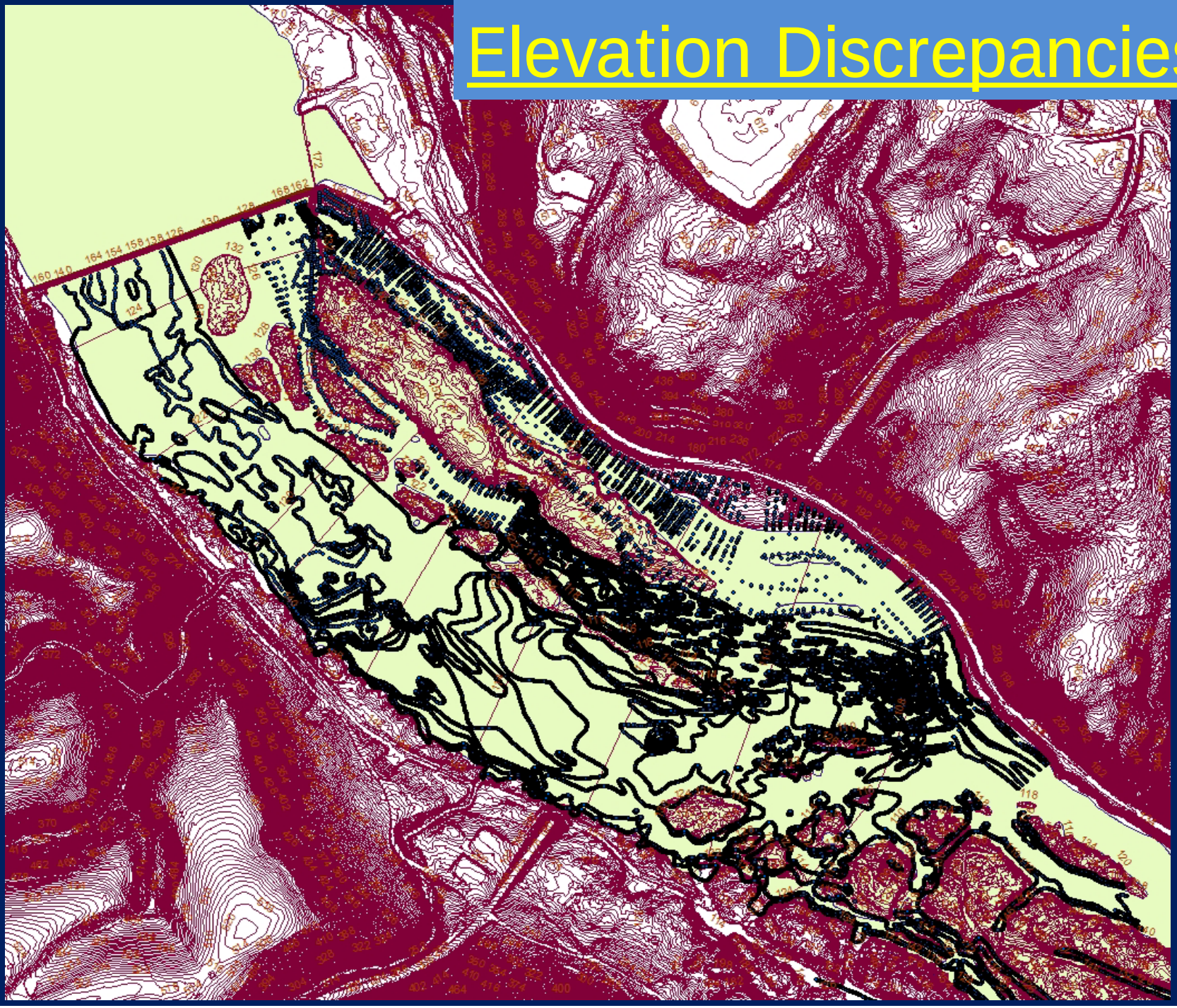


Enclosure 3
Langland/Koerkle Presentation



Enclosure 3
Langland/Koerkle Presentation

Elevation Discrepancies



Enclosure 3
Langland/Koerkle Presentation

Sediment Transport Simulation

- Progress limited
- Calibrate one “average” flow year (no scour) and a high flow event (Sept 2011)
- Bed sediment particle size distribution and shear stress

Summary

- Model Geometry and Hydraulics nearly complete
- Issue with GeoRAS resolved (max # of transect points)
- On schedule to have HEC-RAS model completed by June, 2012.

USGS

Conowingo Hydroelectric Project (FERC No. 405)
Updated 2011 Bathymetric Survey Results

Sediment Task Force Meeting
April 30, 2012

Marjorie L. Zeff, PhD., PG
Gary Lemay

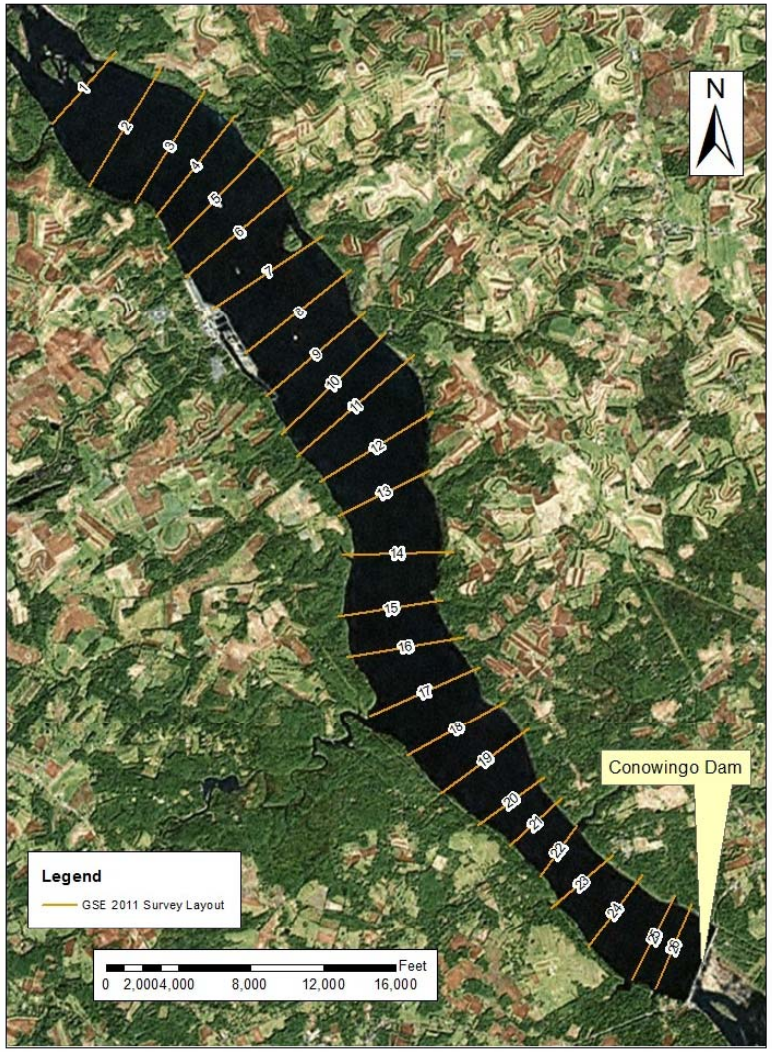
Enclosure 4
Gary Lemay Presentation

Collection and Analysis Methods

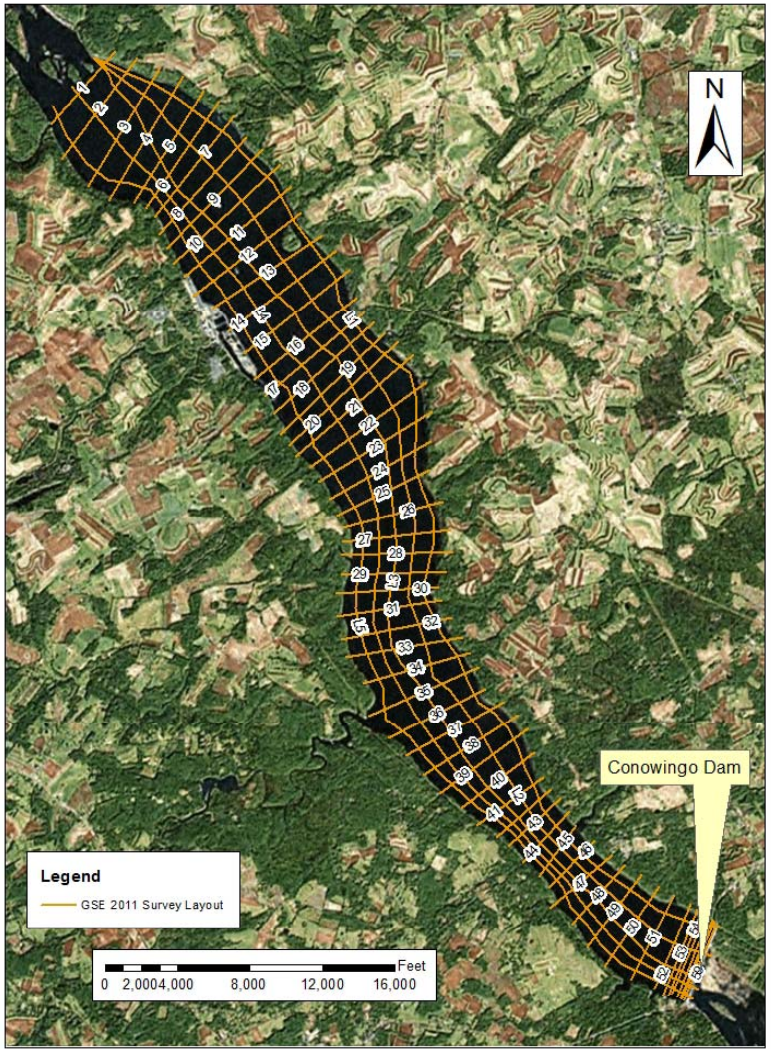
- Collected bathymetric and water velocity data in Conowingo Pond
  - Week of October 24, 2011 (~6 weeks after T. S. Lee)
  - 26 previously surveyed USGS transects, 33 additional transects, 5 longitudinal profiles
- Compared 2008 and 2011 depths, sediment volumes and weight at common transects
- Numbers revised and additional analyses conducted since January
  - A QAQC review identified uncorrected datum differences (Conowingo Datum vs. National Geodetic Vertical Datum of 1929) between the 2008 and 2011 survey
  - Overestimated some 2008 cross-section depths, which consequently overestimated deposition between 2008 and 2011

2011 Transect Layout

Historic Coverage



2011 Coverage

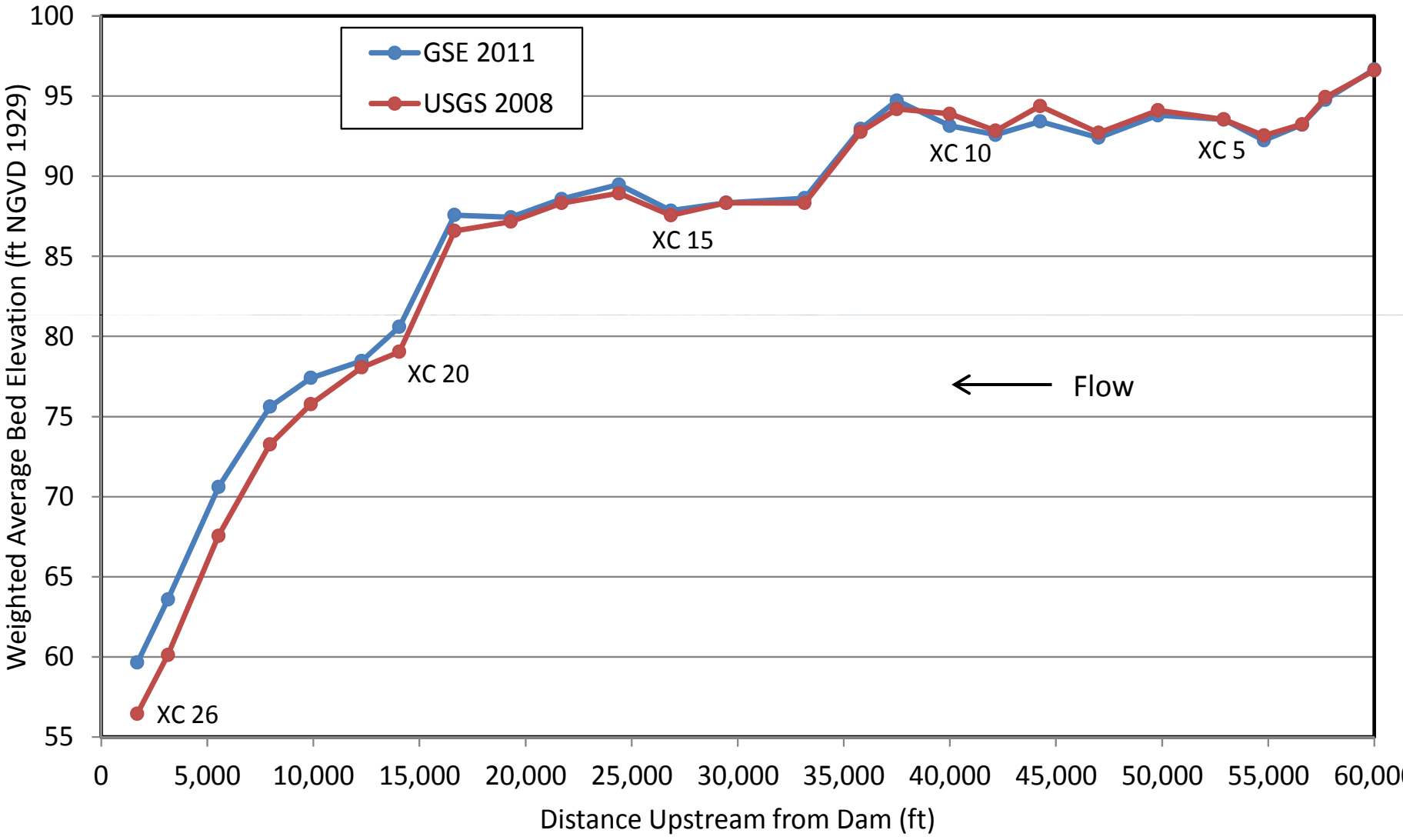


Enclosure 4
Gary Lemay Presentation

Updated Results

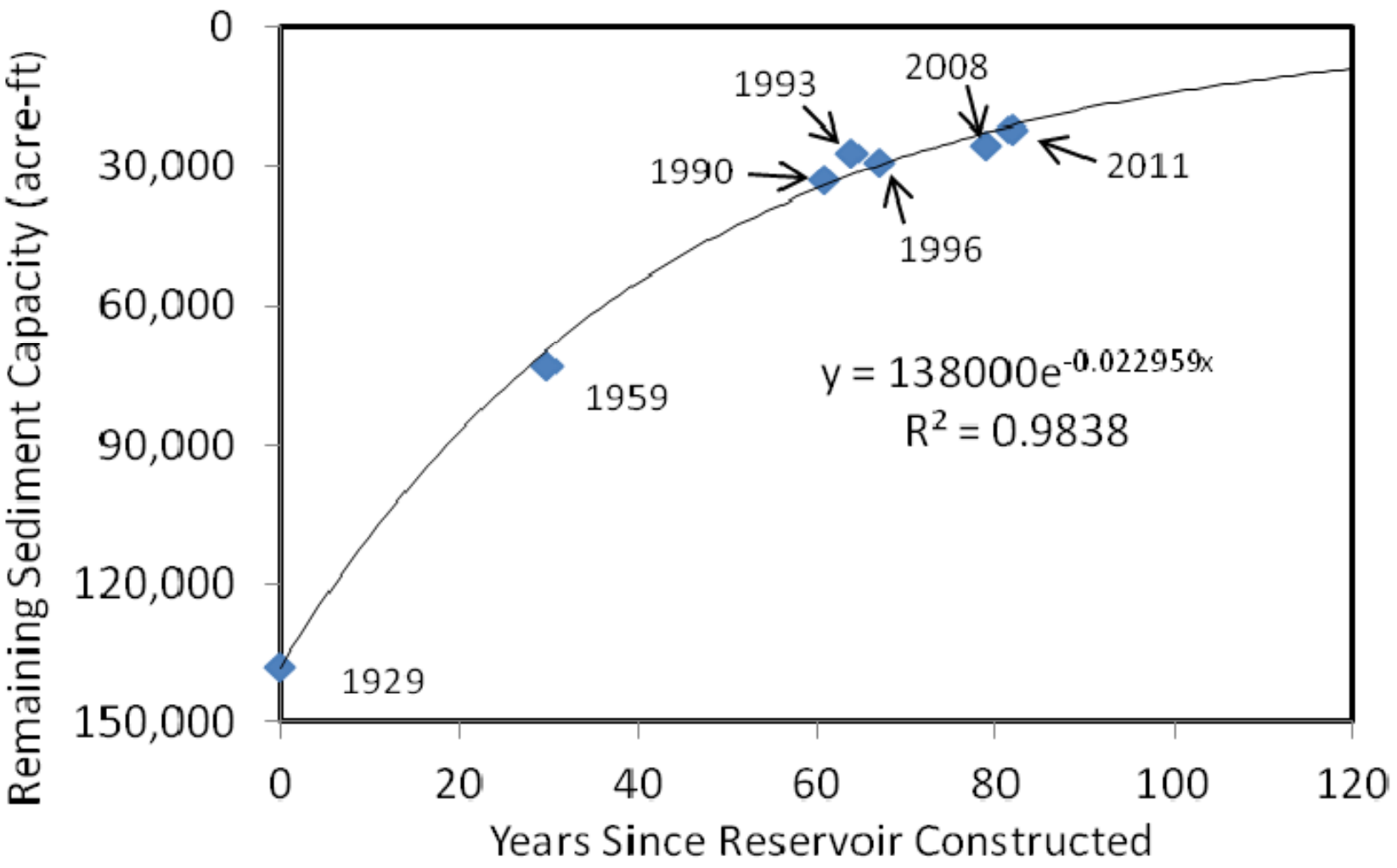
- Conowingo Pond accumulated approximately 3,434 acre-ft of sediment between the fall 2008 and fall 2011 surveys
- Assuming a sediment density of 67.8 lb/ft^3, this is approximately 5.07 million tons
  - 1.69 million tons of deposition per year
  - *Sediment core densities ranged from 35.3 to 143 lb/ft^3, from surface to depth, with most (50%) of the cores between 56 and 79 lb/ft^3*
    - *Sediment density varies with depth and along the surface*
- Historic deposition rates:
  - 3.1 million tons/yr (1929-1958)
  - 2.5 million tons/yr (1958-1993)
  - 1.5 million tons/yr (1996-2008)
- Assuming Conowingo Pond's steady state volume is 142,000 acre-ft (Langland 2009), there is approximately 21,800 acre-ft of remaining sediment capacity

Longitudinal Profile (Weighted Avg. Depth)



Enclosure 4
Gary Lemay Presentation

Capacity over Time (Fitted Curve)



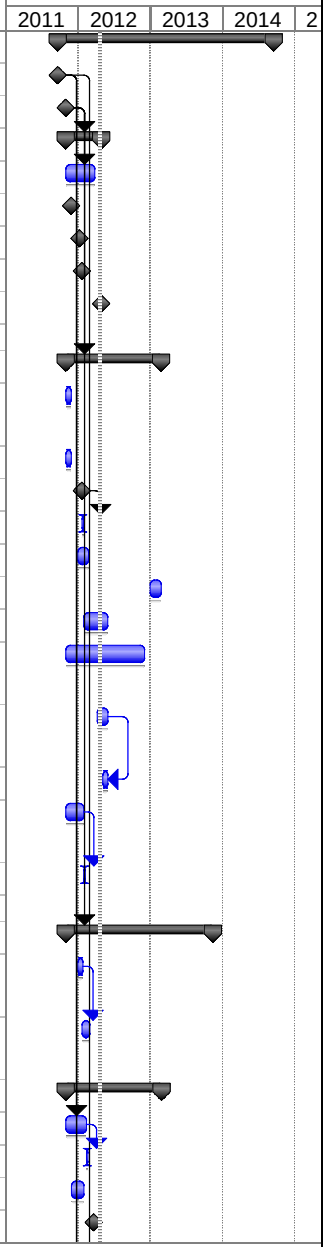
*Calculations assume the steady state reservoir water volume is 142,000 acre-ft

Questions?

Lower Susquehanna River Watershed Assessment

Schedule is dependent upon receipt of adequate funding

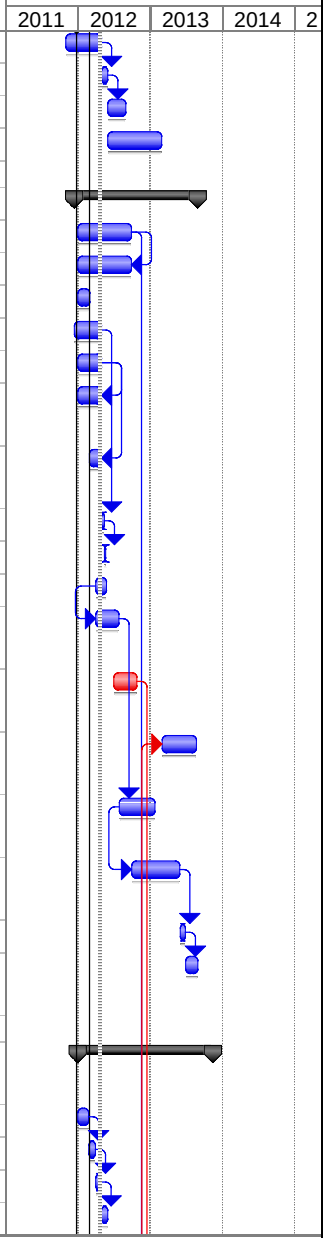
ID	Task Name	Resource Names	Duration	Start	Finish	Predecessors
1	**Lower Susquehanna River Watershed Assessment**		**156.2 wks**	**9/23/11**	**9/19/14**	
2	**Execute Assessment Cost-Sharing Agreement**		**0 wks**	**9/23/11**	**9/23/11**	
3	**Assessment Kick-Off Meeting**	**Team**	**0 wks**	**11/2/11**	**11/2/11**	
4	**Project Coordination**		**25.6 wks**	**11/2/11**	**4/30/12**	**3**
5	Develop project website	MDNR	21 wks	11/2/11	3/27/12	3
6	Presentation to CBP modeling subcommittee	MGS	0 wks	11/30/11	11/30/11	
7	Presentation to DMMP citizens advisory group	MGS	0 wks	1/11/12	1/11/12	
8	January 2012 team meeting	Team	0 wks	1/23/12	1/23/12	
9	May 2012 team meeting	Team	0 wks	4/30/12	4/30/12	
10						
11	**Data Collection**		**69 wks**	**11/2/11**	**2/26/13**	**3**
12	Provide schedule of lower Susquehanna flow recommendations	TNC	4 wks	11/2/11	11/29/11	
13	Summarize Exelon report	MDNR	4 wks	11/2/11	11/29/11	
14	Year 2 Exelon licensing report	Exelon	0 wks	1/23/12	1/23/12	
15	Licensing report -- sediment addendum	Exelon	1.2 wks	1/23/12	1/30/12	14
16	Water Year 2011 water quality report	MDNR	8 wks	1/2/12	2/24/12	
17	Water Year 2012 water quality report	MDNR	8 wks	1/2/13	2/26/13	
18	Collect sediment grab samples	MGS	17.4 wks	2/1/12	5/31/12	
19	Sampling/analysis of suspended sediments at Conowingo outflow	USGS	57 wks	11/2/11	12/4/12	
20	Collect sediment cores in Conowingo and do initial analysis with SEDflume	ERDC	8 wks	4/9/12	6/1/12	
21	Do remaining analysis with SEDflume	ERDC	4 wks	5/7/12	6/1/12	20FF
22	Complete and summarize literature search on reservoir sedimentation management	NAB	13 wks	11/2/11	1/31/12	
23	Review of literature search summary	Team	1 wk	2/1/12	2/7/12	22
24						
25	**Modeling and Documentation of Modeling**		**106.6 wks**	**11/2/11**	**11/15/13**	**3**
26	Complete literature search to compile data for boundary conditions	ERDC	4 wks	1/2/12	1/27/12	
27	Use available information to build model boundary conditions	ERDC	6 wks	1/23/12	3/2/12	26FS-1 wk
28	**Sediment Deposition and Transport Simulation**	**USGS**	**69.4 wks**	**11/2/11**	**2/28/13**	
29	Develop and process interagency agreement	USGS	15 wks	11/2/11	2/14/12	2
30	Execute interagency agreement	USGS	1 wk	2/15/12	2/21/12	29
31	Locate sediment cores	USGS	9 wks	12/1/11	2/1/12	
32	Additional bathymetry is not needed	USGS	0 wks	3/23/12	3/23/12	



Lower Susquehanna River Watershed Assessment

Schedule is dependent upon receipt of adequate funding

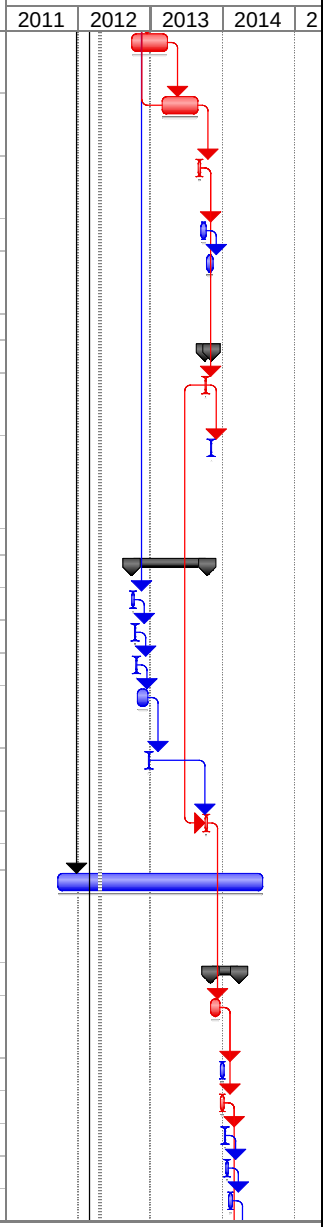
ID	Task Name	Resource Names	Duration	Start	Finish	Predecessors
33	Complete initial HEC-RAS hydraulic model	USGS	25.8 wks	11/2/11	4/30/12	2
34	Refine HEC-RAS hydraulic model	USGS-HEC	4.6 wks	5/1/12	5/31/12	33
35	Validate 1D HEC-RAS model	USGS	13.2 wks	6/1/12	8/31/12	34
36	Draft modeling report and finalize	USGS	39 wks	6/1/12	2/28/13	
37						
38	**1D/2D/3D Reservoir Model Development**	**ERDC**	**89.4 wks**	**12/15/11**	**8/30/13**	
39	Decide on initial modeling scenarios	Team	39 wks	1/2/12	9/28/12	
40	Selects management measures to be modeled	Team	39 wks	1/2/12	9/28/12	39FF
41	Gather model input data	ERDC	9 wks	1/2/12	3/2/12	
42	Prepare 2D vs. 3D model comparison draft report	ERDC	19.6 wks	12/15/11	4/30/12	
43	Construct 2D/3D reservoir numerical model	ERDC	17.2 wks	1/2/12	4/30/12	
44	Modify codes for gate release scenarios for 2D/3D reservoir numerical model	ERDC	17.2 wks	1/2/12	4/30/12	43FF
45	Develop initial 2D/3D hydrodynamic model and proofs mesh	ERDC	8.8 wks	2/29/12	4/30/12	43FF
46	Review 2D vs. 3D comparison report	Team	2 wks	5/1/12	5/14/12	42
47	Make decision on 2D vs. 3D	Team	1 wk	5/15/12	5/21/12	46
48	Validate hydrodynamics of reservoir model	ERDC	8 wks	4/2/12	5/25/12	
49	Construct sediment reservoir model and proofs mesh	ERDC	17 wks	4/2/12	7/27/12	48SS
50	Validate sediment model (model vs. SEDflume data) to assess risk	ERDC	17 wks	7/2/12	10/26/12	
51	Conduct CBEMP model simulations of scenarios and prepare draft report	ERDC-USGS	25 wks	3/4/13	8/23/13	63SS
52	Conduct sediment transport simulations to input CBEMP model	ERDC-USGS	26 wks	7/30/12	1/25/13	49
53	Conduct watershed / reservoir sediment transport simulations, prepare draft report	ERDC	35 wks	10/1/12	5/31/13	52SS+9 wks
54	Review watershed / reservoir modeling report	Team	4 wks	6/3/13	6/28/13	53
55	Technical review of watershed / reservoir modeling report	ECO-PCX	9 wks	7/1/13	8/30/13	54
56						
57	**Chesapeake Bay Environmental Model Package (CBEMP) -- Model Development**		**98 wks**	**1/2/12**	**11/15/13**	
58	Assemble data for CBEMP model	ERDC	8 wks	1/2/12	2/24/12	
59	Prepare CBEMP data report	ERDC	5 wks	2/27/12	3/30/12	58
60	Team review of CBEMP data report	ERDC	4 wks	4/2/12	4/27/12	59
61	Finalize CBEMP data report	ERDC	4.8 wks	4/30/12	5/31/12	60



Lower Susquehanna River Watershed Assessment

Schedule is dependent upon receipt of adequate funding

ID	Task Name	Resource Names	Duration	Start	Finish	Predecessors
62	CBEMP set-up; refine with sediment and water quality data; coordinate with reservoir modeling	ERDC	26 wks	10/1/12	3/29/13	50FS-4 wks
63	Conduct CBEMP model simulations of scenarios, prepare draft report	ERDC	26 wks	3/4/13	8/30/13	62FS-4 wks
64	Review draft CBEMP model simulations of scenarios report	Team	2 wks	9/2/13	9/13/13	63
65	Agency technical review of CBEMP	ECO-PCX	4 wks	9/16/13	10/11/13	64
66	Address/resolve ATR comments	Team	5 wks	10/14/13	11/15/13	65
67						
68	**Development of Recommendations**		**5 wks**	**10/7/13**	**11/8/13**	
69	Meeting to view model results and determine preliminary recommendations	Team	1 wk	10/7/13	10/11/13	64FS+3 wks
70	Agency coordination meeting to discuss model results and recommendations	Team	1 wk	11/4/13	11/8/13	69FS+3 wks
71						
72	**Dredging Placement Site Evaluation**		**55 wks**	**10/1/12**	**10/18/13**	
73	Complete dredging placement desktop site evaluation	EN-OP	2 wks	10/1/12	10/12/12	39
74	Site visit to potential placement sites	EN-OP	1 wk	10/15/12	10/19/12	73
75	Develop dredging plan and bypassing options	EN-OP	1 wk	10/22/12	10/26/12	74
76	Develop schematics and cost estimates for dredging and bypassing options	EN-OP	8 wks	10/29/12	12/21/12	75
77	Review dredging plan and bypassing options, schematics, and cost estimates	Team	1 wk	12/24/12	12/28/12	76
78	Refine schematics and cost estimates using model results	EN-OP	2 wks	10/7/13	10/18/13	77,69SS
79						
80	**Technical Integration and Coordination with Exelon, TMDLs, and WIPs**	**Team**	**148 wks**	**9/23/11**	**7/24/14**	**2**
81	**Draft Report Preparation**		**21 wks**	**11/4/13**	**3/28/14**	
82	Prepare draft report containing team's tentative recommendations	PL	7 wks	11/4/13	12/20/13	78FS+2 wks
83	Review draft report	Team	3 wks	12/23/13	1/10/14	82
84	Resolve comments and incorporate into report	Team	3 wks	12/23/13	1/10/14	82
85	Finalize draft report for upper management review	PL	1 wk	1/13/14	1/17/14	84
86	Upper management review of draft report	Team	2 wks	1/20/14	1/31/14	85
87	Finalize draft report for agency technical review	PL	3 wks	2/3/14	2/21/14	86



Lower Susquehanna River Watershed Assessment

Schedule is dependent upon receipt of adequate funding

ID	Task Name	Resource Names	Duration	Start	Finish	Predecessors
88	Agency technical review of draft report	ECO-PCX	5 wks	2/24/14	3/28/14	87
89						
90	**Quality Assurance / Quality Control Activities**		**123.2 wks**	**3/2/12**	**7/11/14**	
91	Coordinate agency technical review for initial in-progress review meeting	PL	4 wks	3/2/12	3/29/12	2FS+23 wks
92	Prepare read-ahead materials for initial in-progress review meeting	PL	8 wks	7/6/12	8/30/12	91FS+14 wks
93	Review initial in-progress review read-ahead materials	Team	2 wks	8/31/12	9/13/12	92
94	Agency technical review of read-ahead materials	ECO-PCX	4 wks	9/14/12	10/11/12	93
95	Resolve comments and incorporate into read-ahead materials	Team	5 wks	10/12/12	11/15/12	94
96	Initial in-progress review meeting with CENAD and HQUSACE	Team	1 wk	12/28/12	1/3/13	95FS+6 wks
97	Prepare read-ahead materials for final in-progress review meeting	PL	8 wks	1/13/14	3/7/14	84
98	Review final in-progress review read-ahead materials	Team	2 wks	3/10/14	3/21/14	97
99	Agency technical review of read-ahead materials	ECO-PCX	4 wks	3/24/14	4/18/14	98
100	Resolve comments and incorporate into read-ahead materials	Team	5 wks	4/21/14	5/23/14	99
101	Final in-progress review meeting with CENAD and HQUSACE	Team	1 wk	7/7/14	7/11/14	100FS+6 wks
102	Secure concurrence to release draft report with recommendations	Team	0 wks	7/11/14	7/11/14	101
103						
104	**Final Report Preparation**		**9 wks**	**7/21/14**	**9/19/14**	
105	Public review of draft final report	PL	4 wks	7/21/14	8/15/14	102FS+1 wk
106	Public meeting for draft final report	PL	1 wk	8/4/14	8/8/14	105FF-1 wk
107	Prepare final report after public review	PL	2 wks	8/18/14	8/29/14	105
108	Route to Baltimore District Engineer for signature	PM	1 wk	9/1/14	9/5/14	107
109	Transmit report to CENAD	PM	2 wks	9/8/14	9/19/14	108