



Update on Lake Lanier Modeling and Standards Revisions

August 15, 2011

Presented by:

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Outline

- ❑ Tools and Models Used
- ❑ Updates to the Watershed Model
- ❑ Updates to the Lake Hydrodynamic and Water Quality Models
- ❑ Lake Standard Revisions
- ❑ Questions

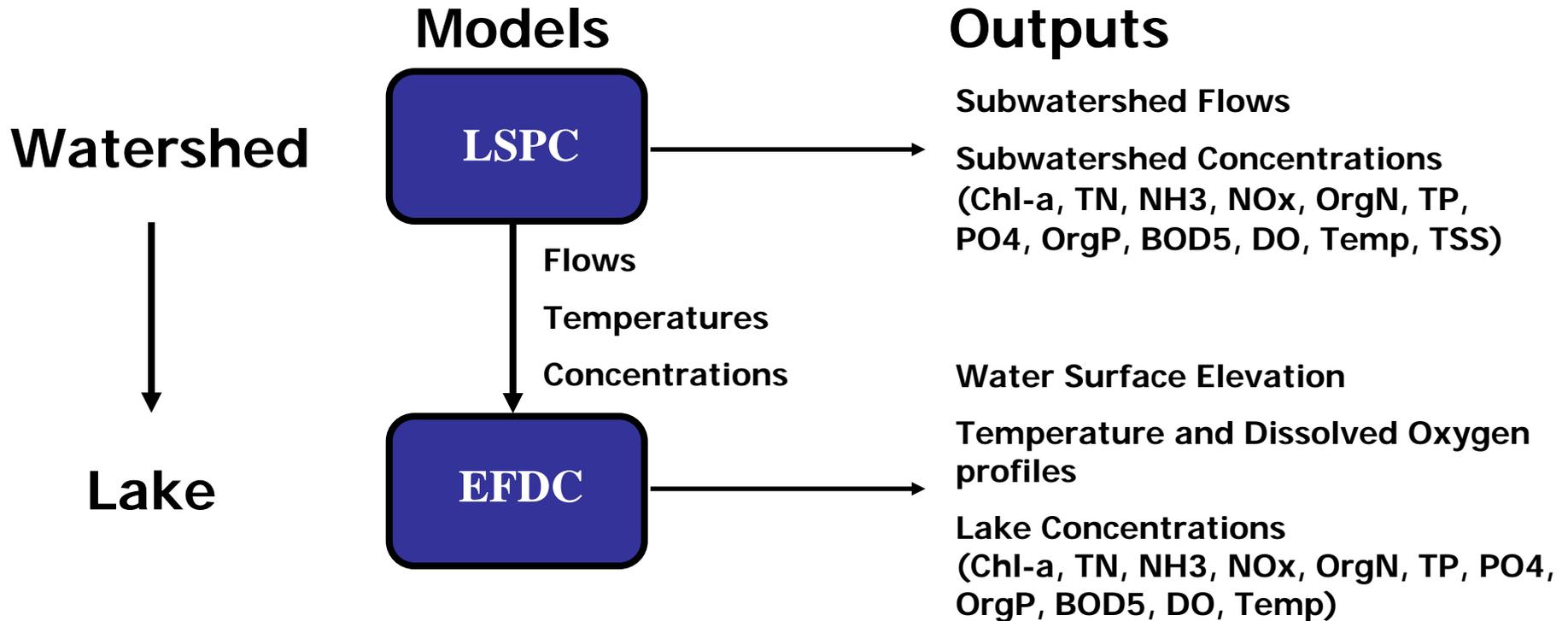
Previous Meetings

- ❑ May 21, 2009
- ❑ November 30, 2009
- ❑ July 29, 2010
- ❑ December 17, 2010

Database and Models Used

- ❑ Database Management
 - Water Resources Database (WRDB)
- ❑ Watershed Model
 - Loading Simulation Program C++ (LSPC)
- ❑ Hydrodynamic Model
 - Environmental Fluid Dynamics Code (EFDC)
- ❑ Water Quality Model
 - Environmental Fluid Dynamics Code (EFDC)

Model Linkage



Data Sources

- US Army Corps of Engineers
 - Water Surface Elevation
 - Buford Dam Flows
- Kingfisher Maps, Inc.
 - Lake Bathymetry
- US EPA Region IV
 - Sediment Oxygen Demand
 - Nutrient Fluxes
 - Algal Growth Potential Test

Data Sources

□ USGS

- Stream Flow
- Temperature
- Dissolved Oxygen

□ North Georgia College & State University

- Long-Term Water Quality Data

□ Lake Lanier Homeowner Association

- Chlorophyll-a data (46 Stations)

Data Sources

□ GA EPD

- Point Source Discharge
- Water Withdrawals
- Temperature Profiles
- Dissolved Oxygen Profiles
- River and Lake Water Quality
- GIS Coverages

□ UGA–NARSAL GA Land Use Trends (GLUT)

- 2005 Land Cover

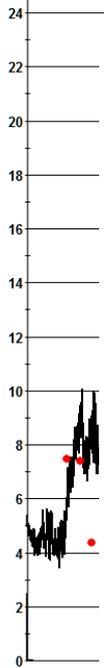


Data Sources

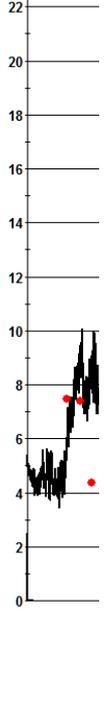
- ❑ County Health Departments
 - Septic Data
- ❑ GA Automated Environmental Monitoring Network
 - Meteorological Data
- ❑ National Climatic Data Center
 - Meteorological Data
- ❑ Google Earth
 - Chicken Houses

Final Calibrations of the Lake Chlorophyll a

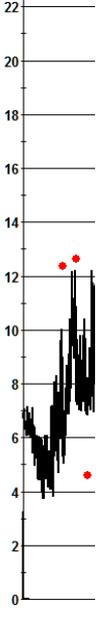
Chestatee – Bolling Bridge



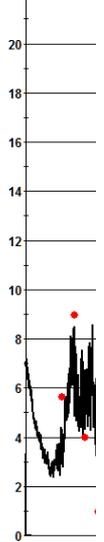
Chattahoochee – Lanier Bridge



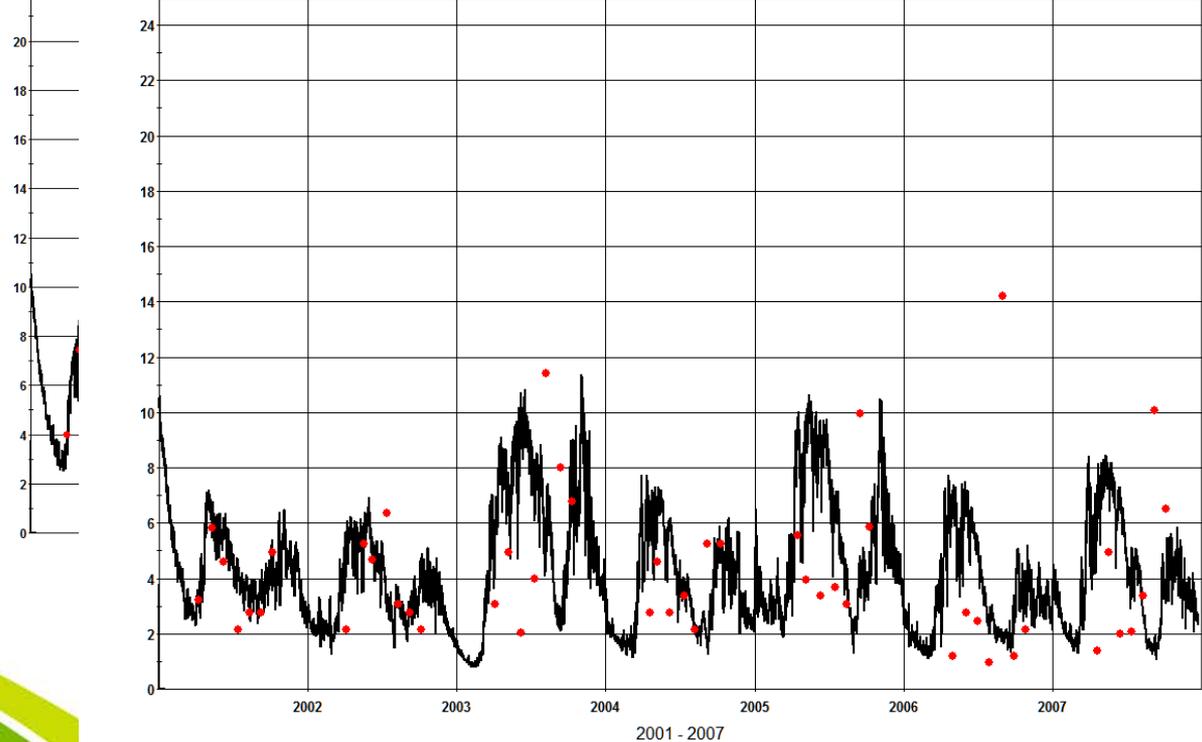
Browns Bridge



Flowery Branch



Dam Pool



— Surf Chla
• CHL_A



Growing Season Average Chlorophyll a

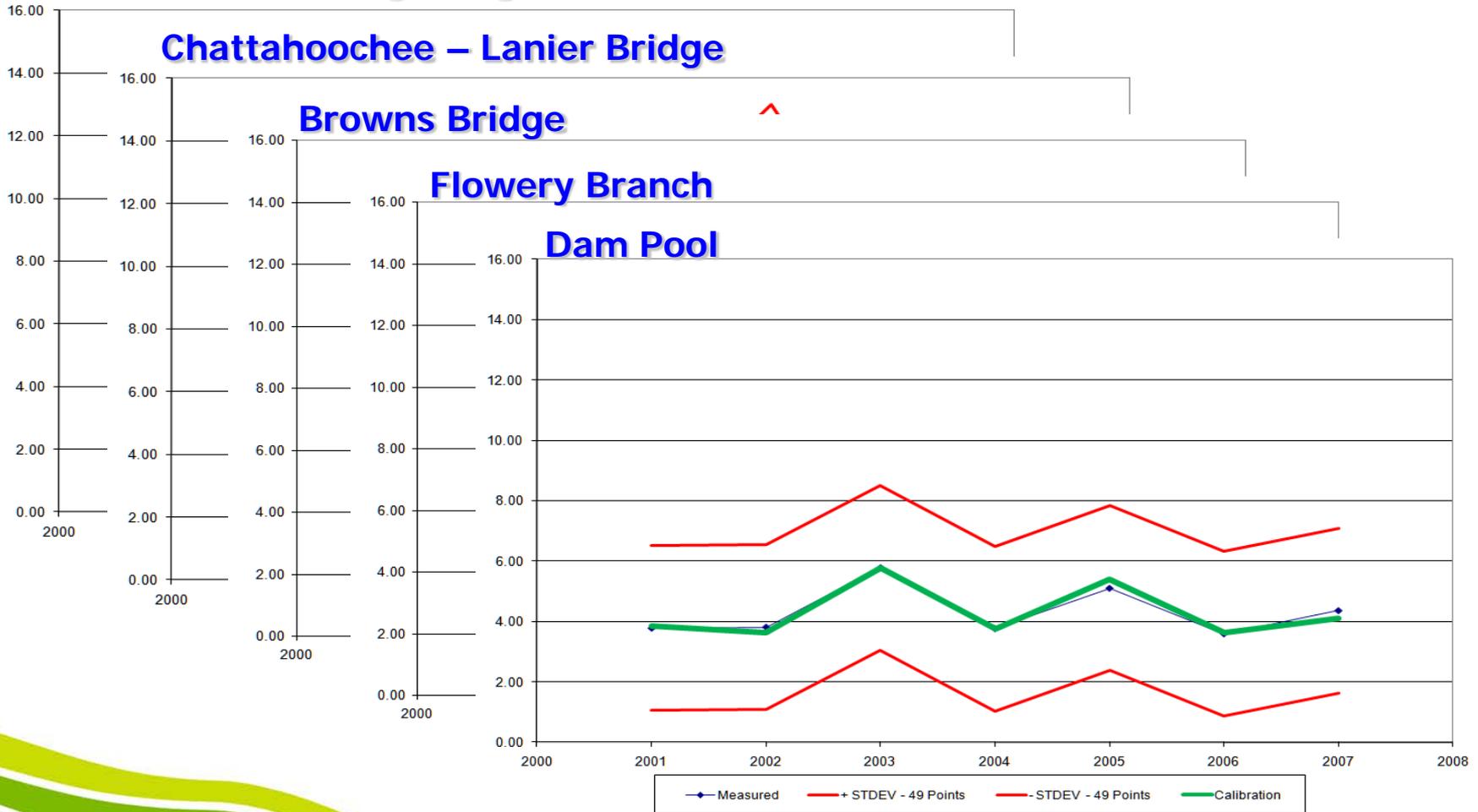
Chestatee – Bolling Bridge

Chattahoochee – Lanier Bridge

Browns Bridge

Flowery Branch

Dam Pool



Comparison of Growing Season Average Chlorophyll a

Measured Growing Season Average of Chl-a

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	3.78	3.81	5.78	3.76	5.10	3.60	4.36
12039401	5	4.70	3.77	5.75	4.03	6.06	4.34	4.37
12038001	5	4.64	5.23	7.17	4.38	7.94	4.84	4.46
12037001	10	5.15	6.86	9.02	4.97	7.66	4.18	5.72
12030201	10	9.20	9.34	10.51	7.61	11.30	5.61	8.26
12030161	--	11.35	12.90	12.70	9.51	14.14	5.59	13.21
12038651	--	8.12	8.51	8.58	6.50	8.83	4.31	5.97
12038681	--	9.60	6.07	7.74	3.96	8.03	3.55	5.24
12038801	--	4.35	4.84	6.90	3.75	7.37	3.68	4.82
12039621	--	6.79	4.17	6.64	4.39	6.17	3.64	4.89

Simulated Growing Season Average of Chl-a

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	3.84	3.64	5.78	3.77	5.40	3.62	4.11
12039401	5	4.43	4.04	6.71	4.02	5.97	4.12	4.70
12038001	5	4.46	4.98	6.84	4.23	6.74	4.12	4.71
12037001	10	6.10	7.04	9.22	5.78	8.37	5.26	5.98
12030201	10	7.08	8.04	10.58	6.70	10.99	5.90	7.65
12030161	--	9.11	10.67	13.92	8.85	14.63	6.04	9.96
12038651	--	8.74	7.76	8.58	4.92	9.07	4.22	6.04
12038681	--	7.41	6.63	7.53	4.11	7.91	3.82	5.42
12038801	--	4.48	4.76	7.05	3.87	7.27	3.75	4.98
12039621	--	6.96	4.12	6.14	4.21	6.17	3.72	5.05



Average Difference (%) Between Measured and Simulated Growing Season Average of Chl-a

Station	2001	2002	2003	2004	2005	2006	2007	Average
12040001	1%	-4%	0%	0%	6%	1%	-6%	0%
12039401	-6%	7%	17%	0%	-1%	-5%	7%	3%
12038001	-4%	-5%	-5%	-4%	-15%	-15%	6%	-6%
12037001	18%	3%	2%	16%	9%	26%	5%	11%
12030201	-23%	-14%	1%	-12%	-3%	5%	-7%	-8%
12030161	-20%	-17%	10%	-7%	3%	8%	-25%	-7%
12038651	8%	-9%	0%	-24%	3%	-2%	1%	-3%
12038681	-23%	9%	-3%	4%	-2%	7%	3%	0%
12038801	3%	-2%	2%	3%	-1%	2%	3%	1%
12039621	3%	-1%	-7%	-4%	0%	2%	3%	-1%
Avg. Compliance	-3%	-3%	3%	0%	-1%	2%	1%	0%
Avg. All	-4%	-3%	2%	-3%	0%	3%	-1%	-1%

Absolute Difference (ug/l) Between Measured and Simulated Growing Season Average of Chl-a

Station	2001	2002	2003	2004	2005	2006	2007	Average
12040001	0.06	-0.17	0.00	0.00	0.30	0.03	-0.26	-0.01
12039401	-0.28	0.27	0.96	-0.01	-0.08	-0.22	0.33	0.14
12038001	-0.18	-0.25	-0.32	-0.15	-1.20	-0.72	0.25	-0.37
12037001	0.95	0.18	0.19	0.82	0.71	1.08	0.26	0.60
12030201	-2.12	-1.31	0.07	-0.92	-0.31	0.30	-0.61	-0.70
12030161	-2.23	-2.23	1.22	-0.67	0.49	0.45	-3.25	-0.89
12038651	0.61	-0.75	0.00	-1.58	0.24	-0.09	0.06	-0.22
12038681	-2.19	0.56	-0.21	0.15	-0.12	0.27	0.18	-0.19
12038801	0.13	-0.09	0.15	0.12	-0.10	0.07	0.16	0.06
12039621	0.17	-0.06	-0.49	-0.19	0.00	0.08	0.15	-0.05
Avg. Compliance	-0.31	-0.26	0.18	-0.05	-0.12	0.09	-0.01	-0.07
Avg. All	-0.51	-0.38	0.16	-0.24	-0.01	0.12	-0.27	-0.16

Scenarios

❑ Calibration

❑ Full Permit

- All Point Sources input at Current Permitted Flows & Concentrations
- Land Use Unchanged
- Septics Unchanged
- Buford Dam Water Surface Elevation and Flows Unchanged

❑ All Forest

- Point Source and Water Withdrawals Removed
- Septics Removed
- All Land Use converted to forest
- Buford Dam Water Surface Elevation and Flows Unchanged

❑ Preliminary TMDL

Preliminary TMDL

❑ Non-Point Source Reductions

- 40% Agricultural
- 70% Urban
- Equal reduction to TP and TN
- Assumed 25% impact on subsurface loads

❑ Point Source Reductions

- Cornelia WPCP (TP = 0.5 mg/l)
- Baldwin WPCP (TP = 0.5 mg/l)

❑ Septic Systems

- 50% Failing

TMDL Chlorophyll a

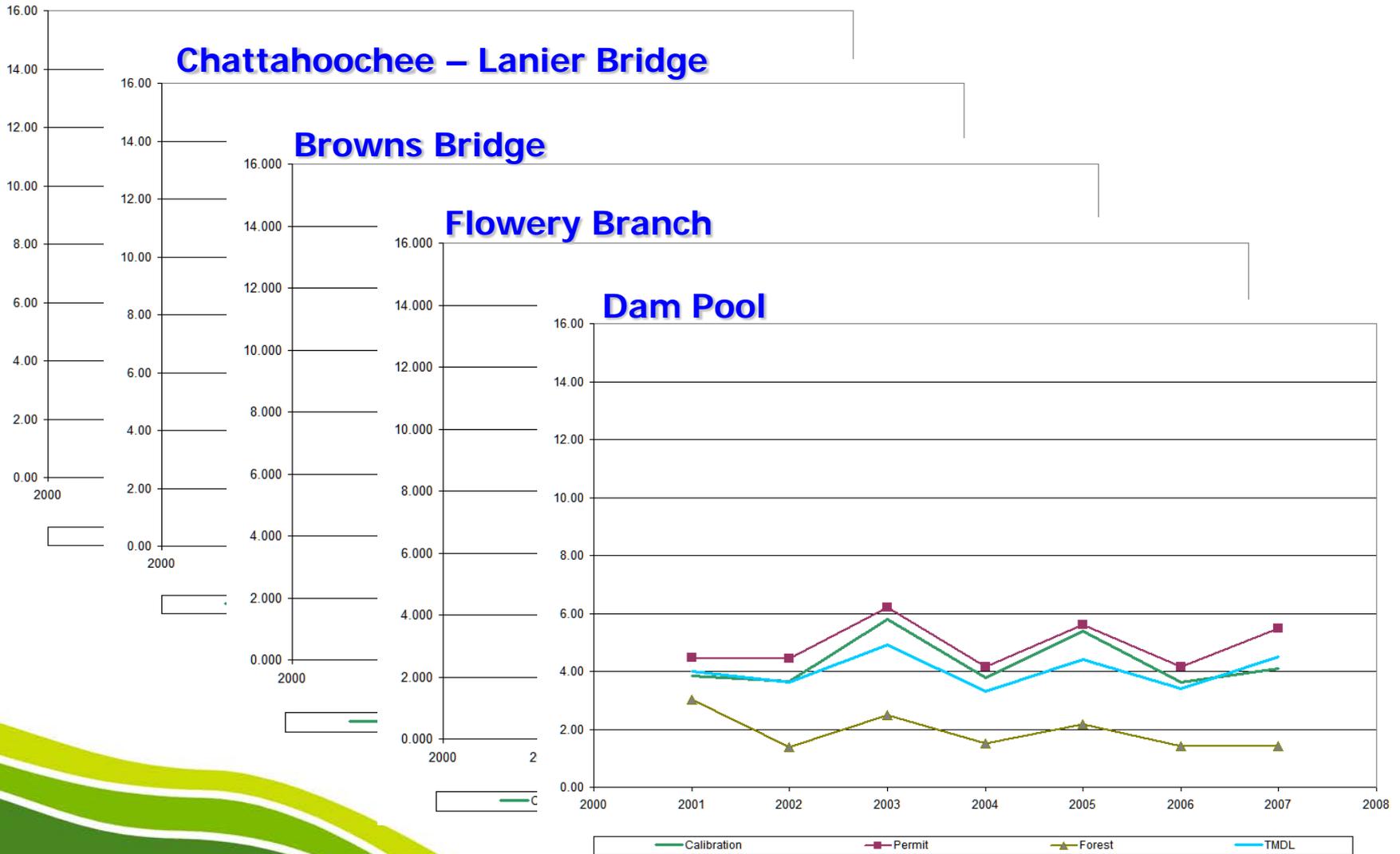
Chestatee – Bolling Bridge

Chattahoochee – Lanier Bridge

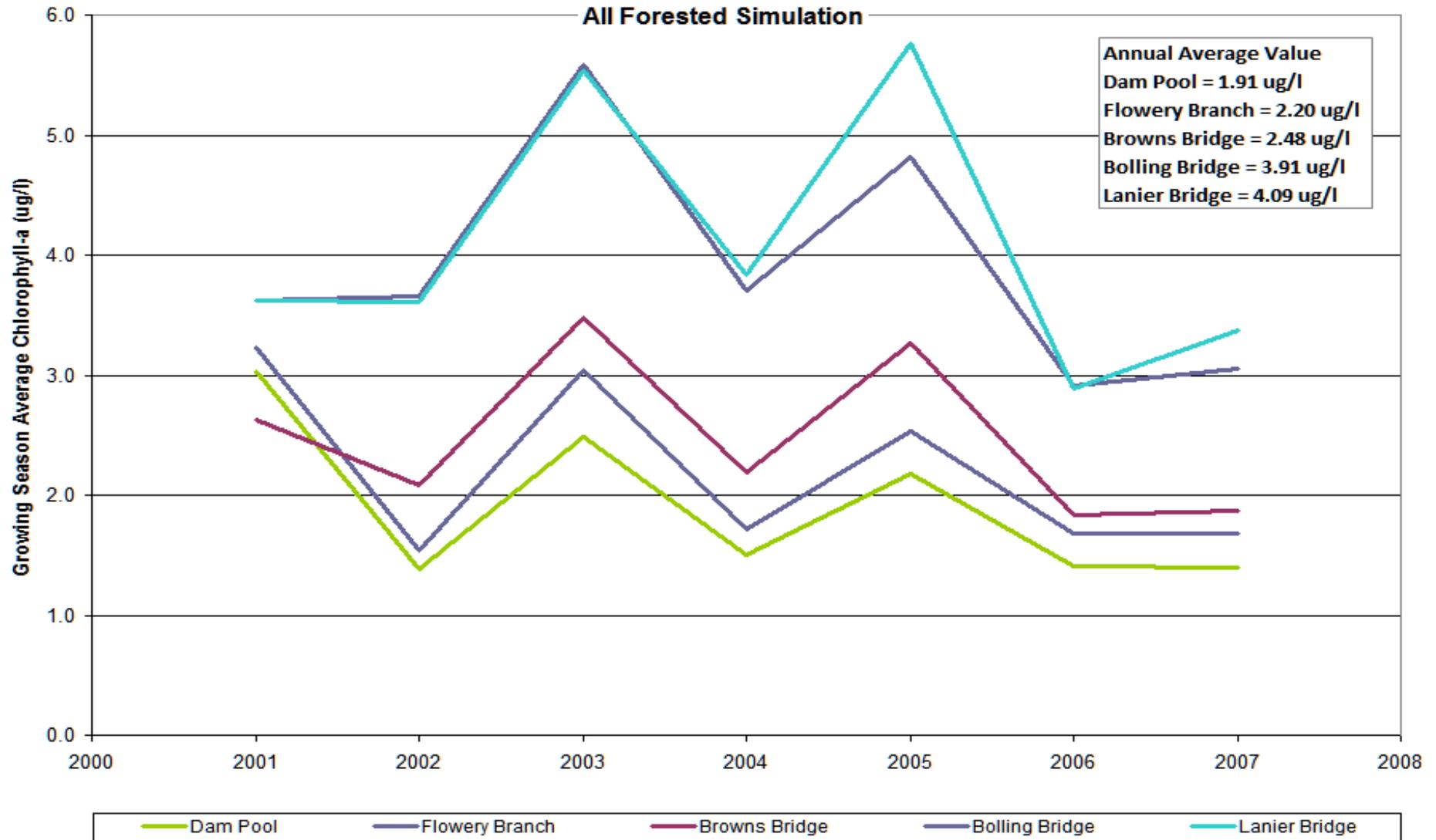
Browns Bridge

Flowery Branch

Dam Pool



Browns Bridge Chlorophyll a Criteria Evaluation



Browns Bridge Chlorophyll a Criteria Evaluation

Station	Current Chl-a Standard (ug/L)	Forest (ug/L)	Forest Percentage of Standard (%)	Average Percentage (%)
Dam Pool	5	1.91	38	41
Flowery Branch	5	2.20	44	
Browns Bridge	5	2.48	50	~40 – 6.2 Range 6 – 6.5
Boling Bridge	10	3.91	39	40
Lanier Bridge	10	4.09	41	



Revised Chlorophyll a

■ Chlorophyll a: For the months of April through October, the average of monthly mid-channel photic zone composite samples shall not exceed the chlorophyll a concentrations at the locations listed below more than once in a five-year period:

- | | |
|--|----------|
| 1. Upstream from the Buford Dam forebay | 5 ug/L |
| 2. Upstream from the Flowery Branch confluence | 5 ug/L |
| 3. At Browns Bridge (State Road 369) | 6.5 ug/L |
| 4. At Bolling Bridge (State Road 53) on Chestatee River | 10 ug/L |
| 5. At Lanier Bridge (State Road 53) pm Chattahoochee River | 10 ug/L |

Total N Lake Criteria Evaluation

Maximum Value during Growing Season

Calculated using data at all Compliance Stations for all years

Scenario	5 th %ile	25 th %ile	Mean	75 th %ile	95 th %ile
Measured	0.392	0.500	0.532	0.600	0.796
Calibration	0.484	0.538	0.589	0.657	0.764
Permit	1.261	1.337	1.394	1.456	1.540
Forest	0.226	0.238	0.283	0.312	0.337



Revised Total N Criteria

- Total Nitrogen: Not to exceed a growing season average of 1.5 mg/L as nitrogen in the photic zone.



Bonus Scenarios

- Started with Full Permit Scenario
 - ❑ Fixed Water Surface Elevation (WSE)
 - Current USACE Rule Curve
 - Summer = 1071.0 ft
 - Winter = 1070.0 ft
 - Assumed all loading unchanged
 - ❑ Alternative Water Surface Elevation (WSE)
 - Current USACE Rule Curve + 2 feet
 - Summer = 1073.0 ft
 - Winter = 1072.0 ft
 - Assumed all loading unchanged

Bonus Scenario – Fixed Water Surface Elevation

Growing Season Average Chlorophyll a

Simulated Growing Season Average of Chl-a (ug/l) - Permit

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	4.48	4.44	6.19	4.15	5.60	4.15	5.48
12039401	5	4.66	4.34	6.82	4.13	5.84	4.41	5.57
12038001	5	4.37	4.86	6.76	4.05	6.43	4.28	5.17
12037001	10	5.81	6.69	9.07	5.66	8.17	5.25	6.30
12030201	10	6.67	7.58	10.30	6.11	10.38	6.01	7.92
12030161	--	8.64	10.11	13.60	8.14	13.95	6.24	10.27
12038651	--	8.35	7.40	8.15	4.64	8.50	4.67	7.26
12038681	--	7.40	6.65	7.45	4.06	7.58	4.07	6.20
12038801	--	4.52	4.82	7.00	3.83	6.99	3.96	5.69
12039621	--	7.20	4.34	6.21	4.28	6.02	3.93	5.90

Simulated Growing Season Average of Chl-a (ug/l) - Fixed WSE

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	3.86	4.73	6.61	4.13	5.60	3.82	5.32
12039401	5	4.05	4.73	7.19	4.11	5.85	4.12	5.58
12038001	5	3.85	5.31	6.91	4.06	6.34	3.95	5.20
12037001	10	5.31	7.07	8.97	5.64	7.96	4.74	6.15
12030201	10	6.31	8.21	10.14	6.10	10.00	5.58	7.79
12030161	--	8.52	11.10	13.29	8.13	13.44	5.88	10.24
12038651	--	7.63	8.22	8.41	4.63	8.44	4.36	7.40
12038681	--	6.54	7.35	7.70	4.05	7.52	3.80	6.34
12038801	--	3.98	5.37	7.25	3.83	6.93	3.72	5.82
12039621	--	6.30	4.76	6.56	4.27	6.01	3.67	5.91



Bonus Scenario–Fixed Water Surface Elevation+2 Growing Season Average Chlorophyll a

Simulated Growing Season Average of Chl-a (ug/l) - Permit

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	4.48	4.44	6.19	4.15	5.60	4.15	5.48
12039401	5	4.66	4.34	6.82	4.13	5.84	4.41	5.57
12038001	5	4.37	4.86	6.76	4.05	6.43	4.28	5.17
12037001	10	5.81	6.69	9.07	5.66	8.17	5.25	6.30
12030201	10	6.67	7.58	10.30	6.11	10.38	6.01	7.92
12030161	--	8.64	10.11	13.60	8.14	13.95	6.24	10.27
12038651	--	8.35	7.40	8.15	4.64	8.50	4.67	7.26
12038681	--	7.40	6.65	7.45	4.06	7.58	4.07	6.20
12038801	--	4.52	4.82	7.00	3.83	6.99	3.96	5.69
12039621	--	7.20	4.34	6.21	4.28	6.02	3.93	5.90

Simulated Growing Season Average of Chl-a (ug/l) - Fixed WSE + 2 Feet

Station	Standard	2001	2002	2003	2004	2005	2006	2007
12040001	5	3.73	4.73	6.57	4.23	5.62	3.85	5.38
12039401	5	3.94	4.76	7.18	4.24	5.86	4.19	5.69
12038001	5	3.78	5.37	6.91	4.14	6.33	4.00	5.30
12037001	10	5.21	7.08	8.93	5.65	7.92	4.77	6.22
12030201	10	6.28	8.34	10.14	6.20	9.98	5.66	7.94
12030161	--	8.53	11.34	13.35	8.31	13.48	6.00	10.50
12038651	--	7.48	8.33	8.42	4.75	8.46	4.42	7.52
12038681	--	6.39	7.43	7.74	4.18	7.53	3.86	6.47
12038801	--	3.92	5.43	7.28	3.95	6.96	3.80	5.97
12039621	--	6.15	4.79	6.57	4.40	6.06	3.73	6.03



Next Steps

- Brief the DNR Board in October 2011
- Public Notice for 45 days starting late October
- Hold Public Hearing in early January 2011
- Final presentation to the DNR Board February 2012
- Send standards to EPA for approval
- Once approved, draft the TMDL





Questions?

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