

**NC HYDROLOGIC
STREAM CLASSIFICATION
USING SIMULATED
VS.
USGS FLOW DATA**

Presentation to Ecological Flows Science Advisory Board
January 18, 2011



Questions Raised During the Expert Workshop

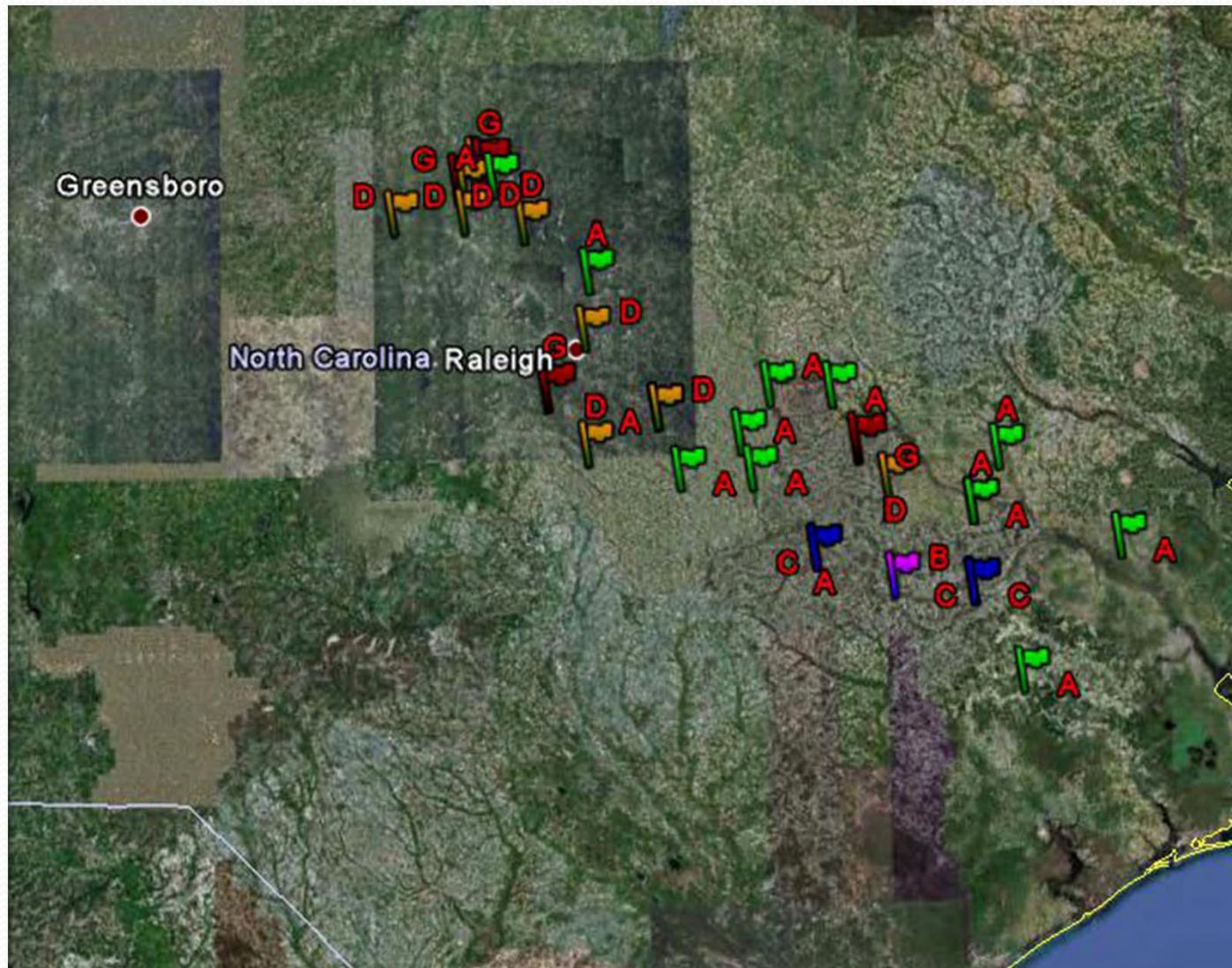
- **Are flow data simulated by the basinwide hydrologic models comparable to actual USGS recorded flows for classifying streams?**
- **Different gages have different periods of record. Does the period of record used in the analysis affect the stream classification?**
- **To address these questions, additional analyses were performed by DWR and Environmental Flow Specialists**



Neuse Basin USGS Gages

- **31 Total Unaltered and Altered flow records**
- **14 Class A – Coastal streams**
- **1 Class B – Small Stable stream**
- **3 Class C – Large Stable streams**
- **9 Class D – Small Flashy streams**
- **4 Class G – Seasonal Small streams**
- **zero Class E and F – Large Piedmont rivers & medium stable streams**

Neuse River Basin Gages



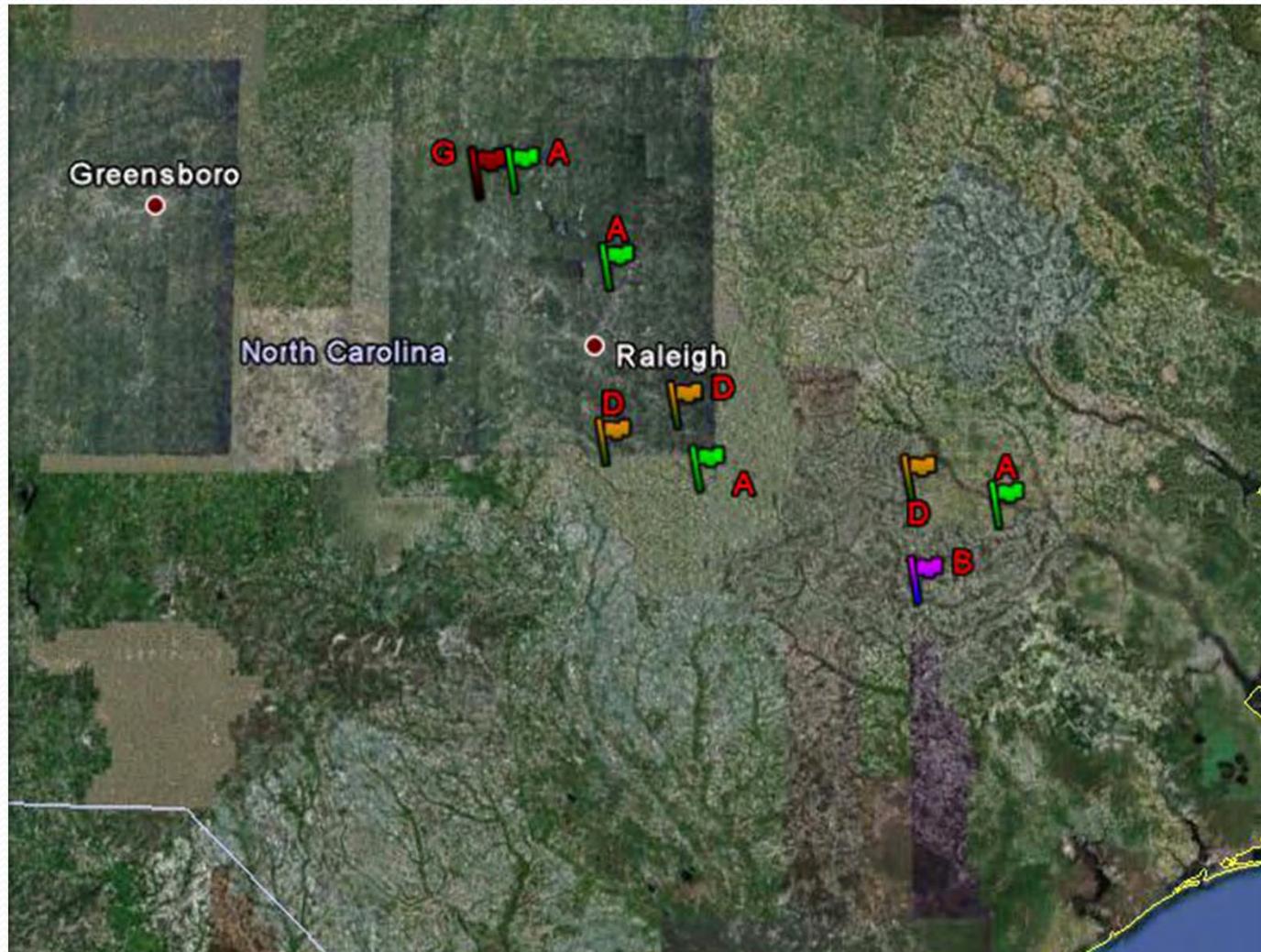
DISCREPANCIES for USGS

VS.

SIMULATION FLOWS

STATION #	GAGE NAME	Drainage Area	USGS Period of Record	USGS class	OASIS class using USGS POR	79 yr OASIS record class
02086500	FLAT RIVER AT DAM NEAR BAHAMA	168.00	1928-1964	A	D	D
02087570	NEUSE RIVER AT SMITHFIELD	1,206.00	1971-1991	A	F	F
02091500	CONTENTNEA CREEK AT HOOKERTON	733.00	1930-1975	A	F	A
0208925200	BEAR CREEK AT MAYS STORE	57.70	1988-2008	B	G	G
02087500	NEUSE RIVER NEAR CLAYTON	1,150.00	1928-1980	D	A	A
02088000	MIDDLE CREEK NEAR CLAYTON	83.50	1940-2008	D	A	A
02091000	NAHUNTA SWAMP NEAR SHINE	80.40	1955-2008	D	A	A
0208521324	LITTLE R @ SR1461 NR ORANGE FACTORY	78.20	1988-2008	G	D	D

USGS vs. Simulation Discrepancy





Explanations for Discrepancies

- **3 of 8 corrected by revisions to classification models – coefficients for Class D and zero flow criterion set at zero instead of 0.5**
 - **Flat River at Dam near Bahama**
 - **Neuse River near Clayton**
 - **Little River at SR1461 near Orange factory**
- **All are now Class D for both USGS & simulated data**



Explanations cont'd

- **Three of these 8 gages - Neuse River at Smithfield, Nahunta Swamp near Shine, and Middle Creek near Clayton - have a portion of their flow record that appears to be altered.**
- **Determined by EFS using trend analysis.**
- **The simulated flow data, on the other hand, is completely unimpaired.**



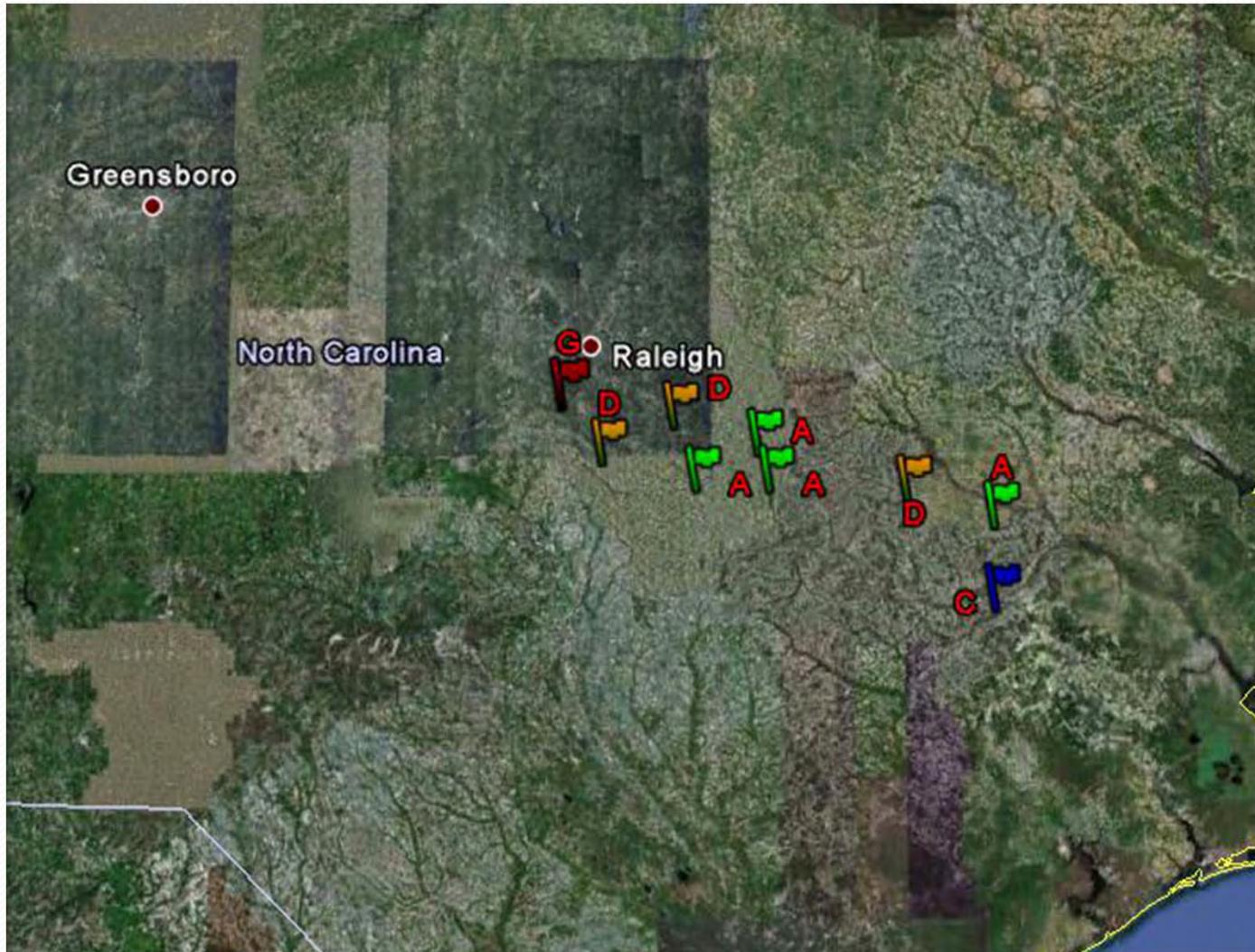
Explanations cont'd

- **Flows for 3 of these 8 stream gages - Contentnea Creek at Hookerton, Nahunta Swamp near Shine, and Bear Creek at Mays Store – were simulated based on flows at other locations, NOT from a node in the basin model at the gage location.**
- **It is therefore not unusual for simulated flows to be somewhat different than empirical measurements on a daily timestep – especially for short-term events .**

DISCREPANCIES for DIFFERENT PERIODS OF RECORD

STATION #	GAGE NAME	79 yr OASIS record class	20-yr time increments						
			1	2	3	4	5	6	7
02087500	NEUSE RIVER NEAR CLAYTON	A	D	A	D	A	A	D	B
02087570	NEUSE RIVER AT SMITHFIELD	F	D	A	D	A	A	F	B
02089500	NEUSE RIVER AT KINSTON	C	E	C	E	E	C	C	C
0208758850	SWIFT CK NEAR MCCULLARS CROSSROADS	G	A	A	A	A	G	G	G
02088000	MIDDLE CREEK NEAR CLAYTON	A	A	A	A	A	A	G	G
02088470	LITTLE RIVER NEAR KENLY	A	F	A	A	A	A	A	A
02088500	LITTLE RIVER NEAR PRINCETON	A	F	A	A	A	A	A	A
02091000	NAHUNTA SWAMP NEAR SHINE	A	F	A	A	A	A	A	A
02091500	CONTENTNEA CREEK AT HOOKERTON	A	F	A	A	A	A	F	A

Different Class for Different Period of Record





Explanations for Period of Record Discrepancies

- **Two of 9 gage discrepancies are eliminated by the revisions to the coefficients for the Class D model. (Neuse River near Clayton and at Smithfield)**
- **Four of 9 discrepancies are corrected if the first year of simulation is removed from the record. This is an artifact of modeling associated with establishing the initial conditions in the model. (Little River near Kenly and near Princeton, Nahunta Swamp near Shine, and Contentnea Creek at Hookerton)**



Explanations for Period of Record Discrepancies

- **The simulated flows for one gage – Neuse River at Kinston – are at the margin between two classes, particularly for high flows. Lengthening the interval from 20 to 30 years resolves the discrepancy.**
- **The last two gages – Swift Creek near McCullars Crossroads and Middle Creek near Clayton – have many zero simulation flows towards the end of the record that the USGS gages actually recorded as very low, but still positive flows. Extended the analysis interval from 20 to 40 years resolves the discrepancy.**



Conclusions

- **OASIS has the capability to simulate flow records for Neuse River Basin locations for up to 79 years. The longer the POR the more likely the stream will be classified correctly.**
- **The POR should be entirely unaltered or entirely altered. There should be no trend inflections or long term perturbations.**
- **Future hydrologic models should include nodes at all USGS stations to allow additional comparisons and checking of simulated versus measured flow data.**

Conclusions cont'd

- **Simulated daily flows are sometimes less comparable to measured data in the very low and low flow range, and the high and very high flow range. A significant number of simulated zero flow days can result in a seasonal stream classification. Abnormally high simulation flows should be verified, since they can sometimes result in a class change. A longer analyses interval (30 or 40 years) usually resolves this issue.**
- **The initial year in the simulation record should not be included in the classification analysis.**