

Phase I System Characterization: Year 2 Study Plans



Year I Physical and Biological Data Sets

Quarterly Storm Sampling

- Four storm events with 8 sample stations at bridges

Monthly Baseline Characterization

- 13 baseline stations in study area; 3 reference stations

Matrix/Type	March	April	May	June	July	August	September	October	November	December	January	February
Physical Media												
Surface Water	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sediment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Biological Tissue												
Filamentous Algae			✓			✓				✓		✓
Aquatic Plants						✓						
Crayfish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Corbicula			✓			✓				✓		✓
Diptera			✓			✓				✓		✓
Ephemeroptera			✓			✓				✓		✓
Trichoptera			✓			✓				✓		✓
Centrarchidae			✓			✓						
Cyprinidae (pool)			✓			✓						
Cyprinidae (riffle)			✓			✓						
Aquatic Community Assessments												
Invertebrates			✓			✓				✓		✓
Fish			✓			✓						

General Overview of South River Study Reach

RRM 0-12

Higher floodplain and channel storage capacity

- Lower gradient
- Greater FGS volume
- Greater floodplain area

Higher percentage of eroding channel banks

Predominant landuse in 5-yr floodplain includes agriculture and pasture

Closer proximity to source; highest THg and MeHg soil and sediment data sets

Highest baseline loading rates for MeHg and THg; generally positive loads during year of sampling

RRM 12-24

Greater number of island side channels (roughly 4X upper segment)

Two “standout” RRM features

- Deep pool near RRM 12.7 with substantial FGS
- floodplain area and river gradient change near confluence at RRM 22-23

Predominant landuse in 5-yr floodplain includes undeveloped forest types

Receives Hg loads from upper reach; biota tissue Hg levels generally equivalent to or higher than upper reach

Goals and Objectives of the Year 2 Study Plan

Collect and integrate data from numerous SRST activities to:

1. Characterize potential sources (i.e. physical media) of Hg to the South River System
2. Determine loading rates and the relative importance of various major potential sources of Hg to the South River system
3. Describe and rank various river and floodplain habitats (substrate types) with favorable overall conditions for methylation

Year 2 Study Plans

- Evaluating potential sources of Hg to the South River
 - Targeted sediment deposits
 - Participate in VADEQ floodplain study
- Integrated MeHg study in various river environments
- Targeted tributary and floodplain loading study between RRM 0 to 10
- Revised baseline monitoring

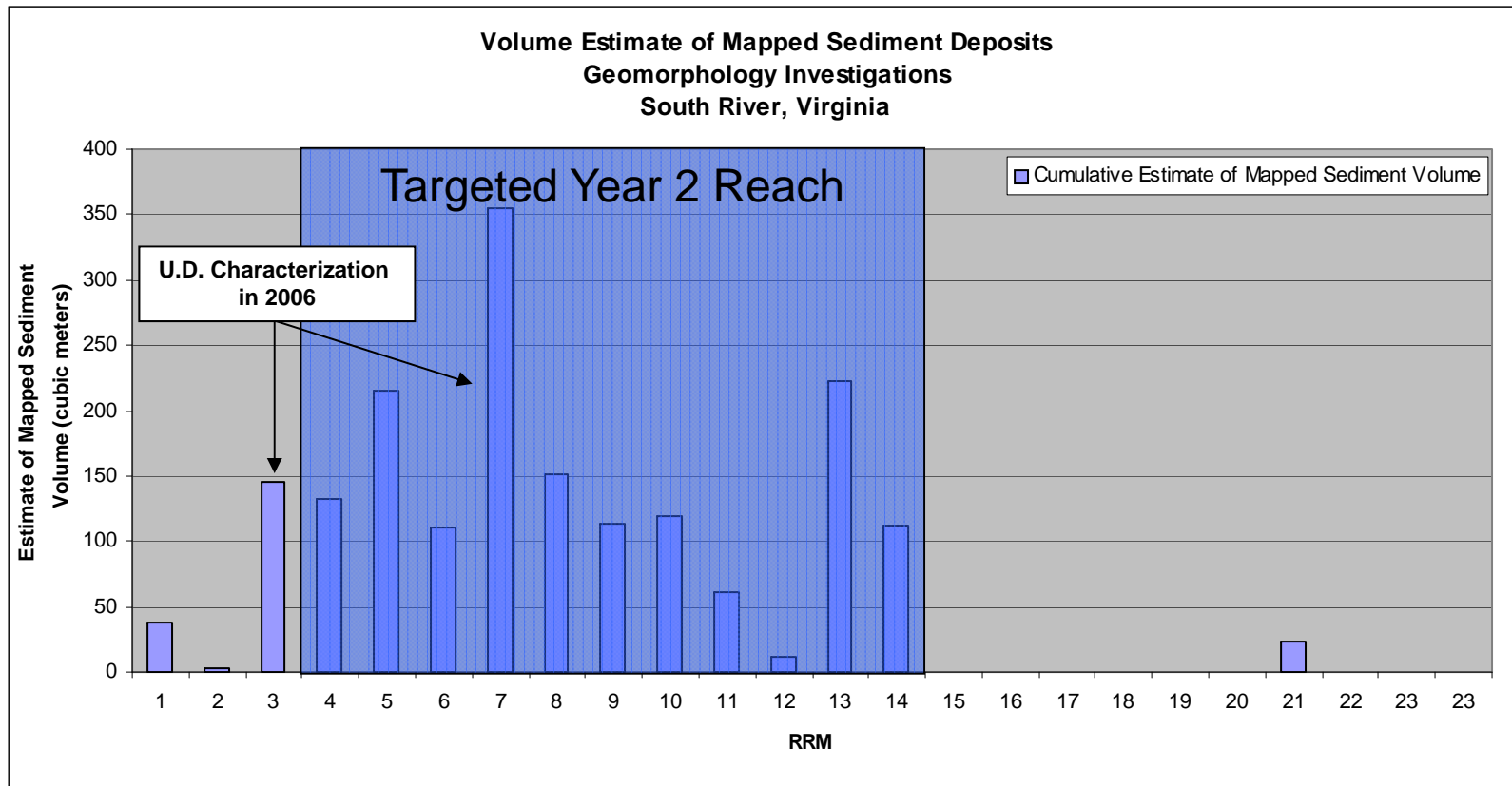
Year 2 Characterization of Depositional Features

Scope of Work

- 17 targeted features with est. volumes >30-m³
- Core sample collected at deepest sediment point
- Survey of THg using *Lumex* mercury analyzer; 10% confirmation at laboratory
- Surficial samples collected for MeHg, AVS
- Integrated with other studies; subsample collections for laboratory testing; leaching, bioavailable fraction, methylation bioassays

Deposit ID	RRM	Volume (m ³)	Deposit Category
H2B	3.0	32.7	Riffle, LWD
H4A	3.8	32.7	Riffle, LWD
H4B	3.9	32.7	Riffle, LWD
H4C	4.2	32.7	Riffle, LWD
H4D	4.6	49.3	Riffle, LWD
D1A	4.8	133.8	Pool
D1B	5.2	32.7	Riffle, LWD
D2A	5.4	55.9	Riffle, LWD
D6B	6.7	32.7	Riffle, LWD
C1D	8.2	32.7	Riffle, LWD
C2A	8.4	32.7	Riffle, LWD
C2B	8.6	32.7	Riffle, LWD
C5A	9.9	118.7	Pool
T63A	12.7	40.3	Pool
T63B	12.7	49.9	Pool
T63C	12.8	61.9	Pool
T68A	13.7	112.1	Pool

Year 2 Characterization of Depositional Features



Year 2 MeHg Studies



Integrated data collections to characterize five river environments:

- main channel pool (repeat stations from Year 1 baseline)
- main channel pool with embedded substrate
- main channel pool edge (two stations in depositional area that undergo changes in flow during year due to SAV)
- Island side channel or mill race pool
- open water wetland on 0.3-yr floodplain

Year 2 MeHg Studies

- Benthic flux chambers
 - Measure MeHg flux through diurnal cycles in DO
- Mercury bioavailability and methylation potentials study (with Rutgers University)
 - Soils and sediments from SRST studies
 - Identify which source materials have the most bioavailable mercury
 - Sequential extraction, methylation assays
 - Identify which habitat types have highest ability to methylate mercury
 - ^{203}Hg assays
- Additional characterization
 - *In situ* data logging for near bottom water conditions in four environments
 - Co-locations targeted to environments with available data
 - Data logging for ~one month during three seasons (summer, fall, spring 2008)



Year 2 Targeted Loading Study



Study Goals:

- 2 storm events
- Focus on THg loading from mainstem, tribs, and floodplain between RRM 0 to RRM 10
- Evaluate mainstem and direct floodplain runoff post storm

Year 2 Targeted Loading Study

Study Methods:

- Passive storm water samplers to evaluate:
 - floodplain direct drainages
 - evaluate contributions from tributaries above the floodplain and at the confluence
- Acoustic Doppler Profiler (ADP) to evaluate trib. discharges
- Direct samples from bridges on South River over hydrograph
- Direct grab samples post storm at safely accessible direct drainages on the floodplain
- Rising limb samples collected for unfiltered THg, TSS
- Post storm samples on floodplain collected for filtered and unfiltered THg and MeHg, TSS, TOC, DOC

Methods - ADP Technology

Provides:

- Depth profile for channel cross section
- Velocity profiles at varying depths
- Real time discharge estimate
- Check on South River discharge estimates

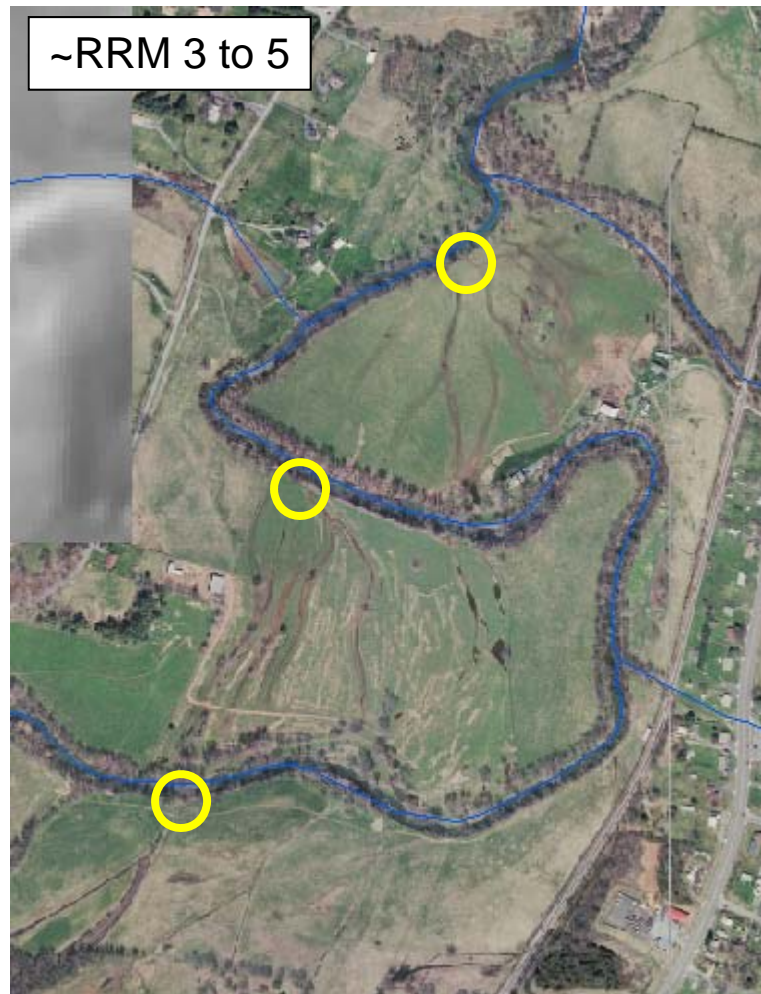


Major Tributaries between RRM 0 and 10

Shaded tributaries to be evaluated in loading study

RRM Confluence	Common Name	Total Drainage Area (KM ²)	Tributary Drainage Area in Flood Plain (KM ²)			
			100-yr	5-yr	2-yr	0.3-yr
0.1 to 0.2	Rockfish Run	14.5	0.148	0.057	0.003	0.0014
1.5 to 1.6	Steele Run	12.7	0.199	0.115	0.021	0.0021
2.5 to 2.6		7.6	0.063	0.034	0.017	0.0048
3.7 to 3.8		1.7	0.006	0.002	0.0007	0.0004
4.5 to 4.6		2.5	0.002	0.001	0.0007	0.0004
4.7 to 4.8	Sawmill Run	26.1	0.067	0.011	0.002	0.0004
5.6 to 5.7		4.7	0.129	0.039	0.026	0.014
6.0 to 6.1		4.1	0.057	0.004	0.0008	0.0003
6.7 to 6.8		4.6	0.164	0.106	0.029	0.011
7.2 to 7.3	Porterfield Run	15.0	0.178	0.079	0.015	0.0093
7.9 to 8.0		0.9	0.009	0.007	0.005	0.0028
8.1 to 8.2		0.5	0.004	0.001	0.0006	0.0004
8.4 to 8.5		4.1	0.006	0.001	0.0004	0.0001
8.6 to 8.7	Mine Branch	10.8	0.009	0.0005	0.0002	0.0001

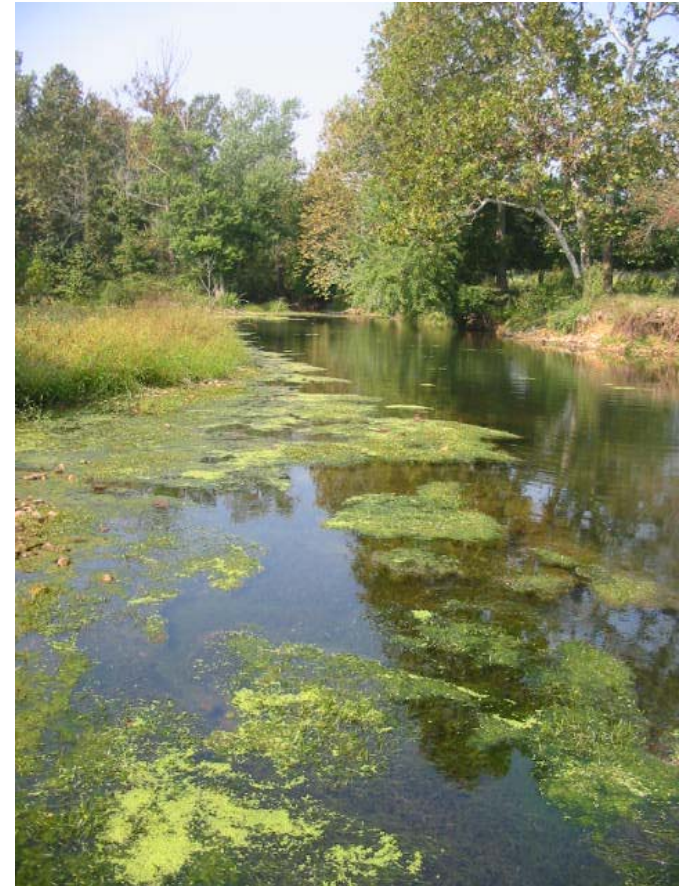
Potential Stations for Floodplain Direct Runoff



Year 2 - Baseline Monitoring Program

Program revisions along South River:

- Surface water stations moved to bridges on South River
- Sediment sampling revised to MeHg in various riverine/wetland environments on South River
- Additional SW and SED characterization for Middle River station
- No biota monitoring in Year 2



Collaborative Efforts to Evaluate THg Sources

Various studies will allow us to:

- Characterize potential sources of THg
- Develop spatially integrated THg concentration data for various floodplain soils and sediment types
- Evaluate loading rates and relative contributions for various sources along the river
- Revise the soil and sediment budgets for the floodplain and river

Phase II studies will focus on Hg releasing mechanisms and river particulate transfer processes at targeted study areas

Collaborative Efforts to Evaluate MeHg

Various studies will allow us to:

- Evaluate loading rates
- Identify and rank environments with favorable overall conditions for methylation
- Spatially describe these environments along the river

Phase II will focus on how MeHg is produced in targeted habitats

- Dominant microbial processes
 - Sulfate reduction, iron reduction
- Seasonal controls on methylation
 - Changes in bioavailability or patterns of carbon mineralization

Scheduled Activities

- Meet with NRDC on July 26th
- Year 2 field data collections starting in August
- Development of Year 1 Data Report