Biological Surveys of Three Potomac River Mainstem Reaches
2012 Summary Report # ICP12-10
EPA Section 106 Monitoring Initiative, Grant # I-98339411.
By Jim Cummins

Objectives

The ecological conditions and status of large rivers such as the Potomac River's mainstem are not as well documented as those of wadeable streams. This project is designed to enhance the basin jurisdiction's collective understanding and documentation of the mainstem's ecological condition. It will help determine if the mainstem is meeting water quality goals and Clean Water Act objectives. The project also improves our ability to assess potential impacts such as flow modifications in the Great Falls and Little Falls sections. The project augments the statewide monitoring programs of Maryland, Virginia, West Virginia and the District of Columbia as well as MD Core (mainstem) stations and EPA's Large River Assessment sites.

Tasks Performed

Biological evaluations were conducted at three Potomac River mainstem reaches (See Appendix Figure A-1 for a map of river reach locations):

1) Knoxville, approximately 2 miles (3.2 km) downstream of the Potomac-Shenandoah confluence, near Knoxville MD.
2) Carderock, near Scotts Run and approximately 1 mile (1.6 km) upstream from the American Legion Memorial Bridge on the I-495 Washington beltway.
3) Little Falls, immediately downstream of the rubble remains of C&O Canal's Dam #1 (near the Brookmont Dam), and approximately 1 mile (1.6 km) upstream from Chain Bridge.

These reaches were selected to help fill small but critical gaps in coverage under Maryland's Core Trend Stations for the Potomac River's mainstem. Data from the Knoxville reach will improve our understanding of the mixing zones below the confluence of the Shenandoah and Potomac Rivers. The Carderock and Little Falls reaches are important for evaluation of potential compounding effects of water withdrawal during drought periods due to large Washington Metropolitan area water supply withdrawals and a hydroelectric facility which has consumptive water use due to evaporative cooling. This report summarizes activities in 2012. Analysis of the information is ongoing but not yet complete, in large part because this is the first year of the project.

Three biological indicator groups are assessed at each reach; 1) benthic macroinvertebrates, 2) submerged aquatic vegetation (SAV), and 3) freshwater mussels.

Each reach has a target of 6 benthic macroinvertebrate sites, 10 SAV sites and 36 freshwater mussel sites. Habitat was characterized at each site regarding substrate characteristics, depth, flow, degree of filamentous algae, and percentage of SAV. Reach locations are considered fixed and will be re-sampled in future years in order to help evaluate trends.

Prior to field work site selection within each reach was performed through random selection of computer generated and numbered 25m² grids imposed over digital maps of each reach (see Appendix Figure 2 showing a grid overlay for the Little Falls Reach and Appendix Figures 3-6 showing the randomly selected sample sites at each reach). A General and an Endangered Species scientific collecting permit were obtained from the Maryland Department of Natural Resources to cover our field research activities.

Field work was conducted between August 24th and October 26th, 2012, during late summer and early fall, when the Potomac River is typically near its lowest flow levels. Storms and high flows do occur during this period, as can be seen in Figure 1 below. The study protocols for appropriate flow levels during field work are that flows should be less than 1.2 x median flow. These levels of flows typically provide for excellent water clarity, shallow exposure of mussel beds, ease of prosecution, and safety.

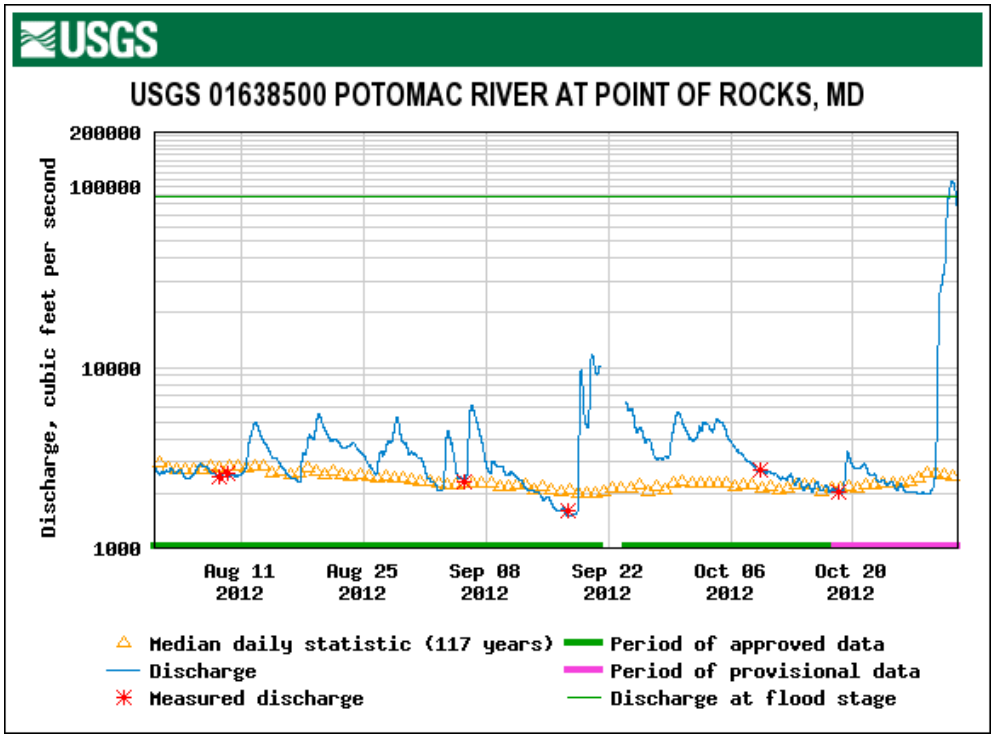

Figure 1: Flows recorded at USGS's Point of Rocks Gage, August 1 – October 31, 2012. This gage is located approximately midway between the studied reaches

During field work, canoes were used to access the river reaches and, once within each reach, to access individual sites. A handheld global positioning system, or GPS (Garmin model Etrex 20) was employed to locate the centerpoint of each site.

The methods used to sample the three biological indicator groups were as follows:

1) Benthic Macro-invertebrates: A 500 micron mesh kick net was used to collect invertebrates from six riffle/run habitat sites within each river reach, each consisting of a six-kick composite of ¼ meter² kicks (for a total surface collection area of 1½ meter² at each site). Samples were preserved in the field in 70%+ alcohol, with labels both in and on the container. Samples were transferred to storage and laboratory facilities for subsequent sorting and laboratory identification, enumeration and data entry. Each sample is subsampled by random selection of 28 grids in order to extract two - 100 organism counts (+/- 20%) and one 200 organism count (+/- 20%), making the total target count of 400 individuals/sample (+/- 20%). Laboratory identifications are performed to genus/species level of taxonomy. This sample size follows recent monitoring recommendations (Mandel et al., 2011) (C. Buchanan, 2010).

2) Freshwater Mussels: At site centerpoints, timed visual and excavation mussel searches were conducted within a ¼ m² quadrat. The quadrat area was first visually examined for mussels and then excavated to a depth of approximately 15 cm. Sand, gravel, gobble and any mussels from the excavations were placed into a ¼ m² box (with a 1 cm² (.375 in²) wire-mesh botttom), then removed from the water for examination in the canoes. Mussels encountered were kept in fresh river water until identified, measured (length, width and height), recorded (see Appendix B: 2012 Field Form for Mainstem Freshwater Mussel), and then placed back into the river in their approximate original location and orientation within the quadrat site. Digital images of the mussels were taken for the purpose of vouchers or to document any questions or anomalies. Results of the timed visual and excavation searches will be used to develop taxa richness, abundance and, when sample size permits, age classes based upon size-groupings. Habitat parameters were taken at each quadrat which included depth, flow characterizations, estimates of substrate composition, stream morphology, embeddedness, and percent coverage of SAV.

3) Submerged Aquatic Vegetation (SAV): Evaluations of SAV are conducted at two scales; 1) at 10 randomly selected 25 meter linear transects within each river reach, and 2) at each of the ¼ meter² mussel quadrats. The linear transects were used to record species and measurements of the length of line covering individual species clusters (in .1 m increments) to derive diversity and percent coverage.

At return from the field, data from field and laboratory forms were transferred to Excel® electronic spreadsheets

Results:

1. Benthic Macroinvertebrates: Each of the sixteen collections were sorted and picked into 400 organism subsamples composed of one 200 organism subsample and two 100 organism subsamples. In total, there were forty-eight subsamples consisting of thirty-two – 100 count samples and sixteen – 200 count samples. Laboratory identifications and tabulations of these subsamples have been completed. Currently we are in the process of running these results through the Cheseapeake Bay Biotic Index of Biologic Integrity (BIBI) (Buchanan et al., 2011) which was designed for non-tidal wadeable streams. This will be a first cut to help evaluate and develop a similar benthic IBI for large river environments.

2. Freshwater Mussels: Seventy-six sites were surveyed. Thirty-six were in the Knoxville reach, thirty-five at Little Falls, and five at Carderock. Carderock was the last reach surveyed and was an incomplete survey due to the interruption by high river flows due to September storm and then the subsequent seasonal break-up of SAV. Eighteen additional selected sites within the three reaches were also located and evaluated but then rejected. The primary cause for site rejection was excessive depth (i.e., exceeded 1.2 m in depth) for snorkel surveys. In two cases, sites were rejected because they were in cascade zones where strong water currents prevented evaluations due to safety and efficiency concerns. Seventeen of the rejected sites were in the Knoxville reach, one site was rejected in the Little Falls reach. We have yet to determine the full set of acceptable sites in the Carderock reach.

A total of 271 living mussels comprised of four species were documented (Table 1). The Eastern Elliptio (*Elliptio complanata*) were the most abundant and were especially abundant in the Little Falls reach. The Lampmussel (*Lampsilis sp.**) was fairly common. While uncommon, the presence of the Brook Floater (*Alasmidonta varicosa*), a Maryland endangered species, at two of the reaches is notable. One Creeper (*Strophitus undulates*) was collected at the Knoxville site.

Table 1: Freshwater mussel species and counts from three Potomac river mainstem reaches surveyed in 2012

Reach\Species	Eastern Elliptio	Lampmussel	Brook Floater*	Creeper
Knoxville	9	13	2	1
Carderock	48	2		
Little Falls	192	4	1 fresh dead	
Totals	249	19	2	1

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Figure 2: Mussels from quadrat 51 in the Little Falls reach, the most prolific quadrat in the 2012 survey. At the bottom right is a Lampmussel, all of the rest are Eastern Elliptio. Small specimens of E. Elliptio, such as the bottom four, are rarely encountered.

The Knoxville reach had the greatest diversity (4 species) but relatively low abundance. The relatively high number of Eastern Elliptio at the Little Falls reach was unexpected

because the river rapidly constricts at that location and during even moderate flooding is influenced by scouring flows. Little Falls's quadrat 51, pictured above, had the greatest number of individuals of any quadrat and was located in a very high energy location which was 50% bedrock.

The depth of all of the seventy-six sites ranged from 1.2 meter (3.9 ft)) to 0.2 meter (0.7 ft.) and averaged 0.7 meter (2.2 ft). The typical composition of samplable substrate was dominated by cobble (31.8%) and gravel (21.5%). There was substantial bedrock (16.5%) and boulders (10.6%), with less finer materials like sand (13%) and silt (4%). Other materials, like detritus and shells of bivalves, primarily Corbicula, made up the remaining 2.3 % of the substrate.

3. Submerged Aquatic Vegetation: Transect information is still being processed and evaluated.

The first year results of this survey serve as a baseline. Subsequent surveys will permit evaluations of inter-year variability and eventually trend assessments.

All results are entered into Excel spreadsheets according to biological indicator group and are available upon request.

References:

Cummins, J., & C. Buchanan, C. H.-B. (2010). *Potomac Basin Large River Environmental Flow Needs.* Rockville, MD: The Interstate Commission on the Potomac River Basin, Publication number: ICPRB 10-03.

Mandel, R., Buchanan, C., Griggs, A., Nagel, A., & Devereux, O. (2011). *Data Analysis to Support Development of Nutrient Criteria for Maryland Free-Flowing Waters.* Rockville, MD: The Interstate Commission on the Potomac River Basin, Publication number: ICPRB11-02.

Appendices

Appendix A, Figures A1-A5

Figure A-1 Map of the locations of the Potomac River mainstem reaches studied in this project.

A = Knoxville Reach, B = Carderock Reach, C = Little Falls Reach

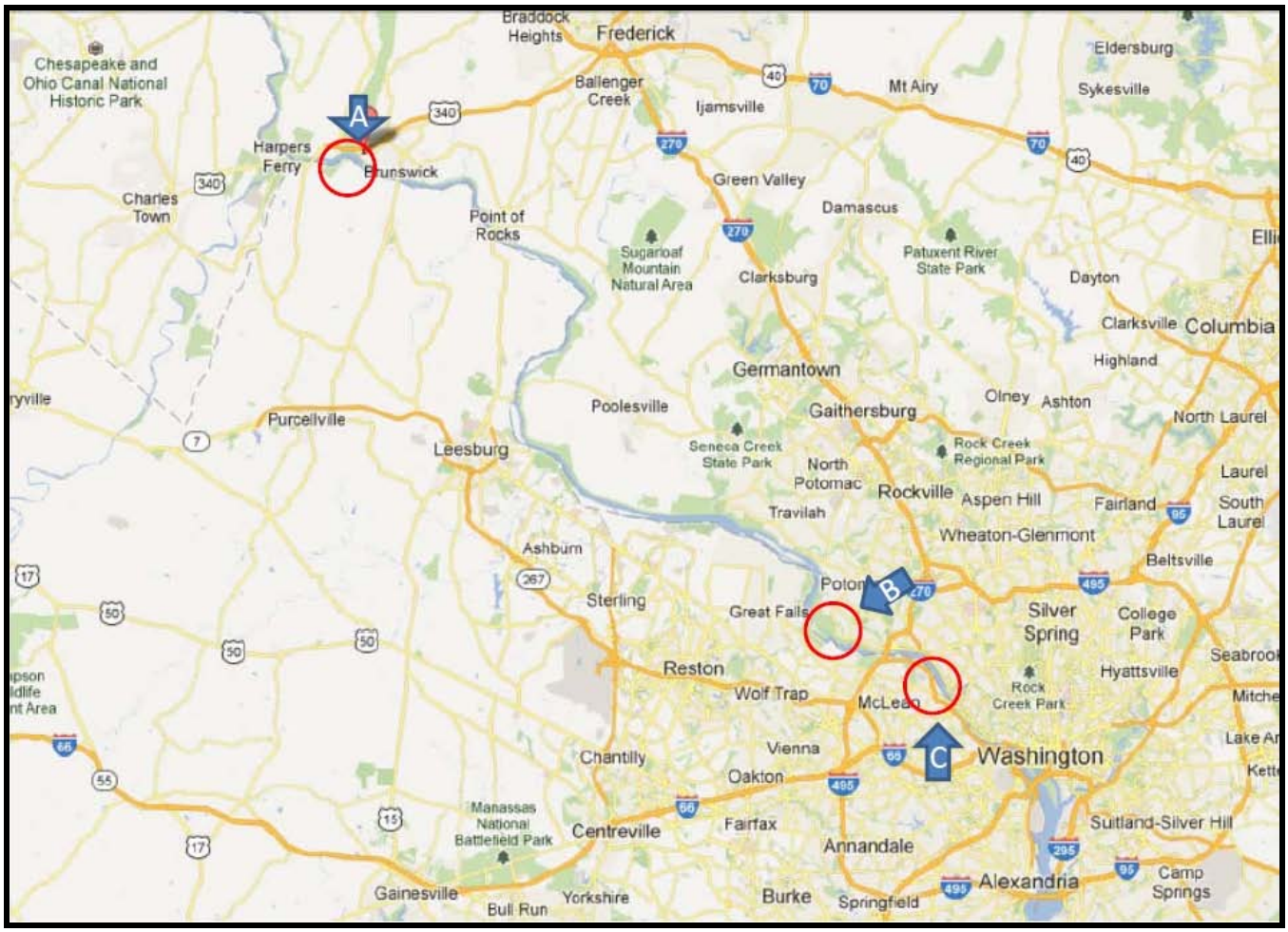


Figure A-2: Potomac River Little Falls Reach with computer grid and randomly selected sampling sites. Yellow boxes are primary sites, red boxes are primary sites where submerged aquatic vegetation transects were conducted, orange and blue sites are alternate sites.

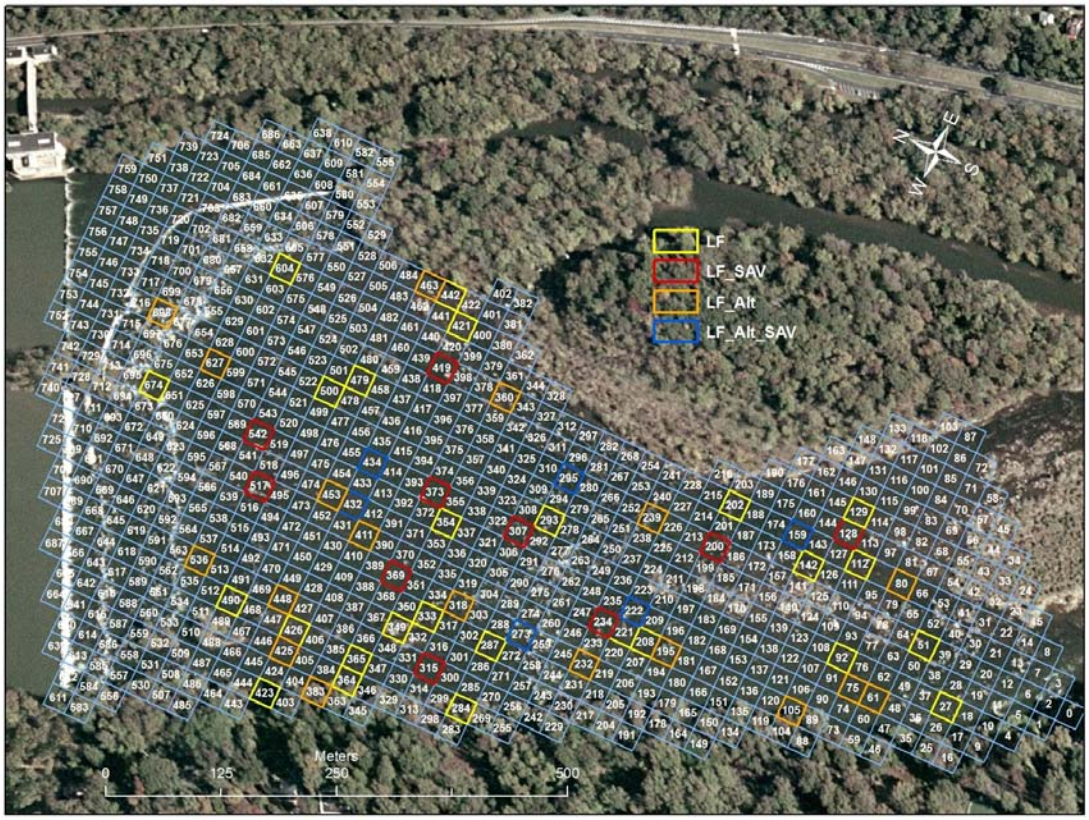


Figure A-3: Potomac River Little Falls Reach with grid removed showing randomly selected field sites.

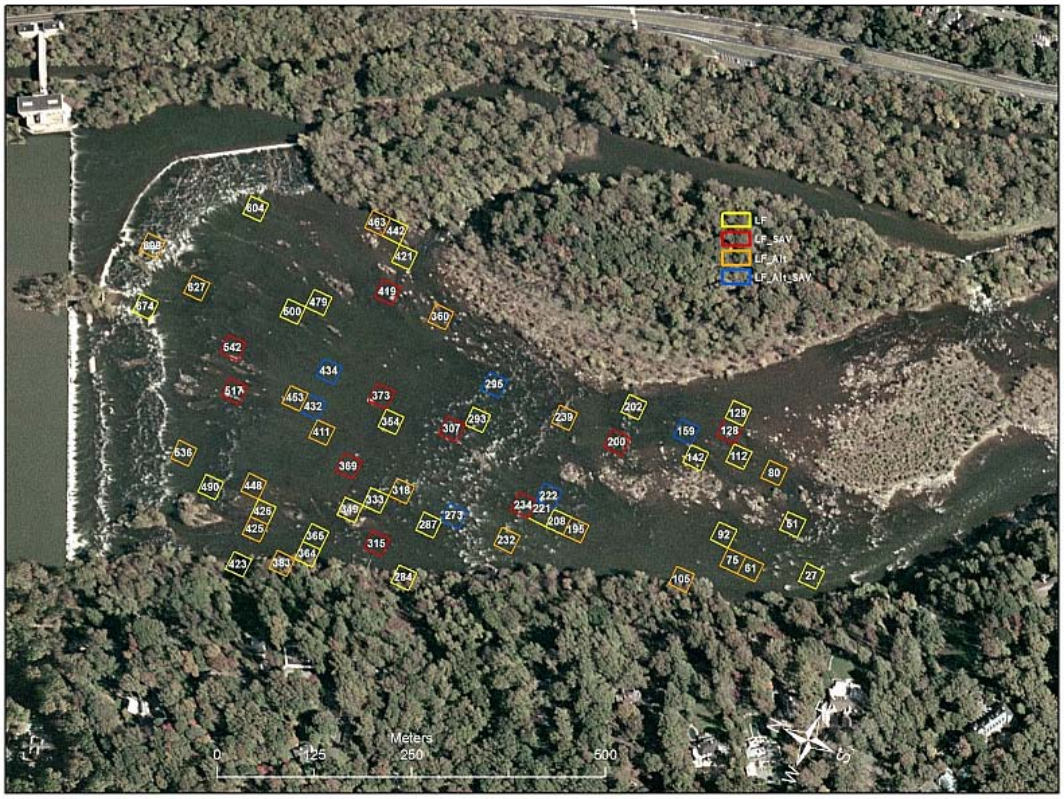
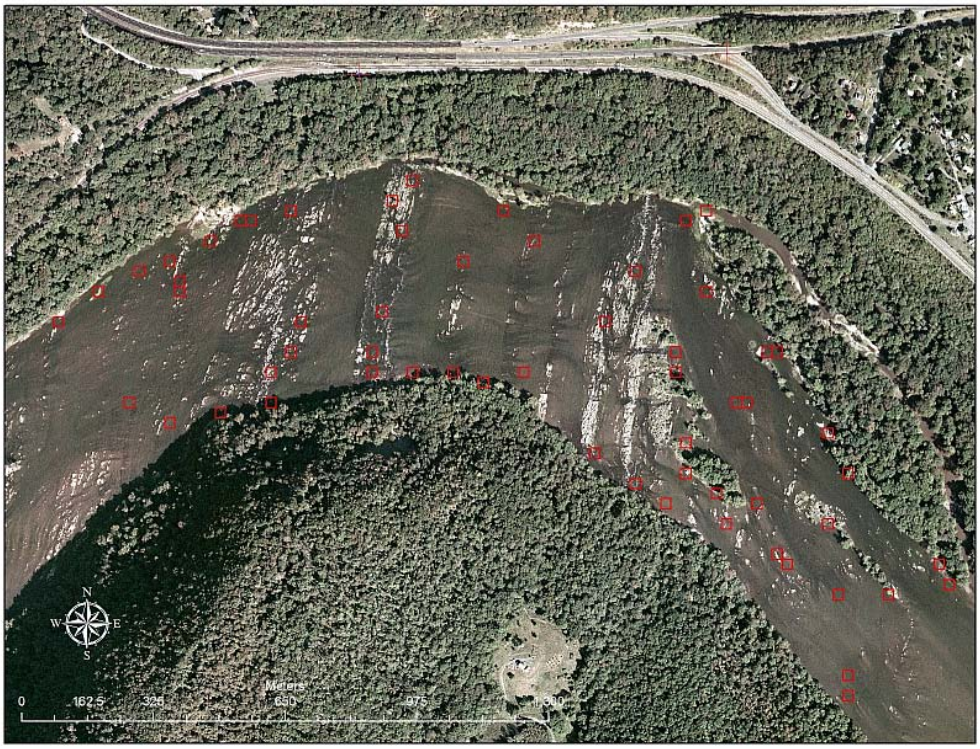


Figure A-4: Carderock Reach, Potomac River, with randomly selected field sites. Yellow boxes are primary sites, red boxes are primary sites where submerged aquatic vegetation transects were conducted, orange and blue sites are alternate sites.

Figure A-5: Knoxville Reach with randomly selected field sites (red boxes).



Appendix B: 2012 Field Form for Mainstem Freshwater Mussels

River Reach ________________________________ Section______ Date:_____/____/2012
StartTime ____:____ Air Temp _______ Water Temp ______ D.O. ____ Cond. ________ pH _____
Water Clarity (least is 25 cm, then in 0.1 meter increments) _____m Weather____________________
Surveyor(s):____

Site #	Time/quad **V**is + **E**xcavated	Water Depth. In .1 m	Substrate (Est %) Habitat Type (Circle)	Detects: Species, Sizes (in mm) and number detected Label shells as **F**resh, **D**ead, **S**ubfossil	**SAV Type % cov**	Notes
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ------------------------- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		
	Vis = ____:____ Exc = ____:____		Bed= Bol = Cob= Gra = San = Silt = Oth = ------------------------- Po Gl Ri Ra Ca Fa	Vis = Exc = Adjacent = In vicinity =		
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