

Memorandum

To	Michael Liberati, DuPont CRG Ralph Stahl, DuPont CRG	Page	1 of 2
CC	Nancy Grosso, DuPont CRG Cecilia Mancini, AECOM		
Subject	Area of Concern (AOC) 4 Short-Term Monitoring (STM) 2015 Biannual Monitoring		
From	Joshua Collins, AECOM		
Date	January 11, 2016		

In accordance with the United States Environmental Protection Agency (US EPA) Resource Conservation and Recovery Act (RCRA) Corrective Action Permit, interim measures are being implemented by E.I. du Pont de Nemours and Company (DuPont) to address mercury released to the South River from the former DuPont facility in Waynesboro, Virginia. Preliminary (Phase 1) interim measures are focused on bank stabilization, which will be implemented at Bank Management Areas (BMAs) beginning with the first two relative river miles (RRM), RRM 0 to RRM 2.0 downstream of the site (Anchor QEA, et al, 2015).

Phase 1 BMAs are divided into Primary and Secondary BMAs. Phase 1 Primary BMAs consist of banks that contribute disproportionately to THg loading between RRM 0 and RRM 2; loadings from Phase 1 Secondary BMAs contribute substantial but less than loadings from Phase 1 Primary BMAs. Phase 1 Primary and Secondary BMAs are further divided into Phase 1A and Phase 1B based on land ownership. Phase 1A BMAs include all City-owned Primary BMAs, as well as City-owned Secondary BMAs that are located immediately adjacent to City-owned Primary BMAs. The remaining City-owned Secondary BMAs and non-City-owned BMAs from RRM 0 to RRM 2 are classified as Phase 1B BMAs.

To evaluate the performance of the interim measures and proposed remedial approach, Short- and Long-Term Monitoring (STM and LTM, respectively) is being conducted. STM is intended to evaluate the effectiveness of the remedial approach over a short period of time (i.e., two to ten years) within a limited spatial extent (i.e., adjacent to a particular BMA). STM evaluates the following:

- Bank stability
- Total mercury (THg) and methylmercury (MeHg) concentrations in:
 - Sediment
 - Pore water
 - Periphyton
 - Asiatic clams (*Corbicula fluminea*)

Additional habitat assessments and public access feature surveys were also conducted in order to address stakeholder concerns. These assessments include the following:

- Riparian and aquatic habitat
- Benthic community structure
- River access / aesthetics

This technical memorandum summarizes the June and October 2015 STM events, which were conducted to assess pre-remediation (i.e., baseline) conditions. An annual STM report is being

prepared that will provide a more detailed description of 2015 STM data and will be submitted in the first quarter of 2016.

The June and October 2015 STM events focused on Short-term Monitoring Plan locations (STMP) - 01, -05, and -07 (Figure 1). Monitoring was conducted in accordance with the Final AOC 4 Short-term Monitoring Plan (URS Corporation, 2015). Table 1 provides an overview of the monitoring plan design, including performance objectives, metrics, success criteria, and adaptive management outcomes; additional detail is provided in the Monitoring Plan and associated appendices. Based on the field investigations:

- Banks at STMP-01, -05, and -07 were generally stable with localized areas of erosion based on a visual survey.
- Mercury concentrations in sediment, pore water, and periphyton were generally comparable between sampling events, but were highly variable within each BMA (Tables 2, 3, and 4).
- Asiatic clams collected during the June sampling event had higher mercury concentrations compared to the October event (Table 5).
- Mercury concentrations in periphyton and Asiatic clams collected from near bank environments were generally higher than concentrations in those collected from mid-channel environments.

The following points summarize the ancillary assessments mentioned above:

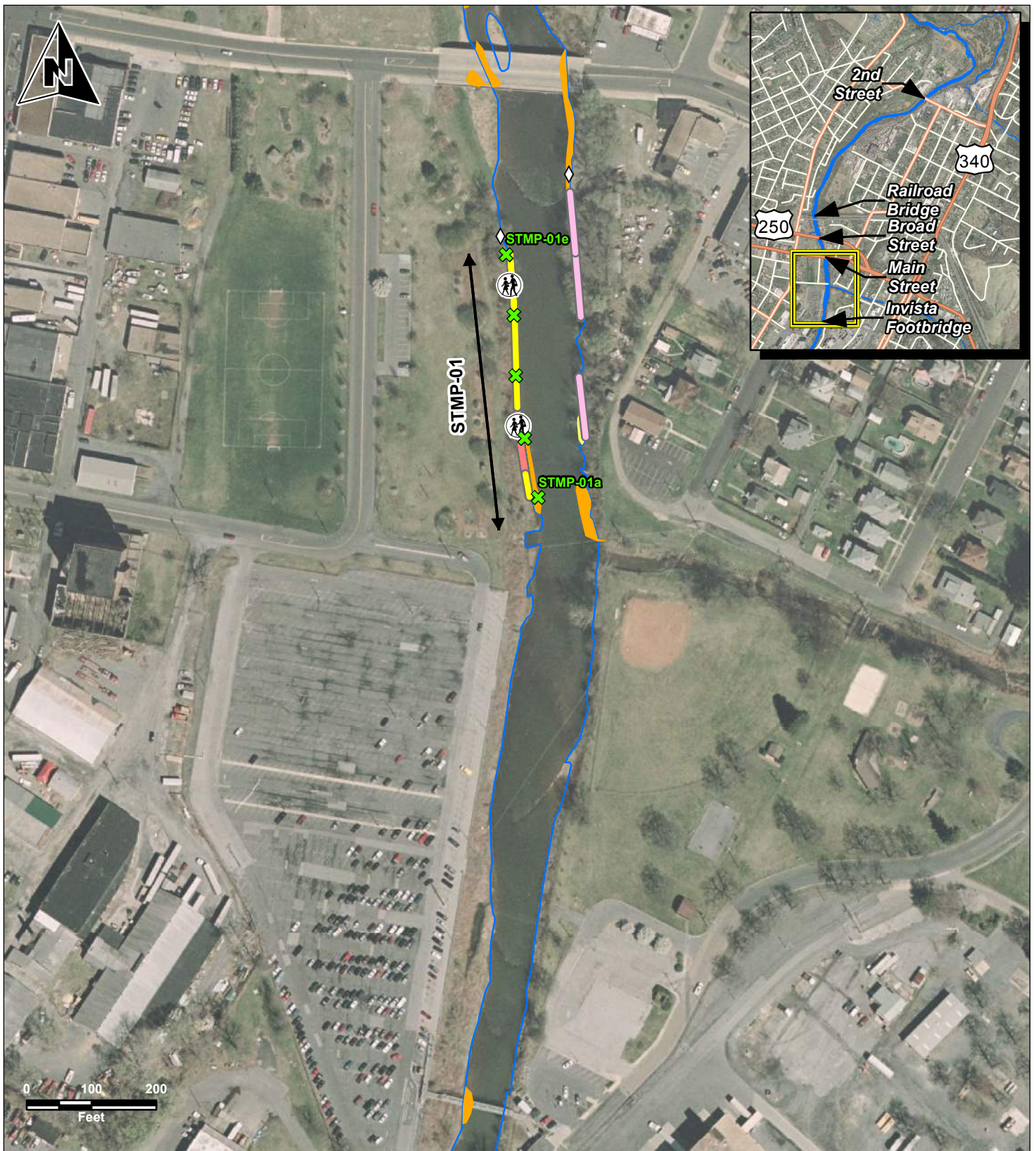
- Existing canopy cover at each STMP was limited.
- High densities of invasive species were present at STMP-01, but were not as prevalent at STMP-05 or -07.
- Sediment grain size distribution at STMP-01 and -05 was normally distributed and consisted primarily of coarse gravel and small to medium cobble, respectively. STMP-07 displayed a more even grain size distribution, with a larger proportion of smaller grain sizes.
- Results of benthic community sample analyses will be available in January 2016.
- Vegetation at STMP-01 and -05 had been cleared to provide access along foot paths, presumably for fishing (Figure 1). STMP-07 had few cleared paths likely due to its location adjacent to the City of Waynesboro wastewater treatment plant.

The annual report will provide a more detailed description of the results of the 2015 STM sampling efforts. Consistent with adaptive management principles, the annual STM report will also include suggested recommendations for corrective actions or modifications to the plan, if warranted.

REFERENCES

Anchor QEA, URS Corporation, E.I. du Pont de Nemours and Company. 2015. Final Interim Measures Design, Implementation, and Monitoring Work Plan. Phase I - South River Area of Concern 4. 471 pp.

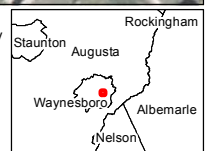
URS Corporation. 2015. Final AOC 4 Short-term Monitoring Plan - Relative River Mile 0-2 of the South River, Virginia. 28 pp.



Legend

- | | | | | | | | |
|--|---|--|-------------------------|--|-------------------|--|----------------------------|
| | Benthic Community Location | | Phase 1A Primary BMAs | | Sampling Transect | | River Access |
| | Near bank and Mid-channel Periphyton/Clam Collections | | Phase 1A Secondary BMAs | | LWD | | Shoreline |
| | Extent of Short-term Monitoring Location | | Phase 1B Primary BMAs | | | | 1.) Clay and Silt Deposits |
| | | | Phase 1B Secondary BMAs | | | | 2.) Fine Sand Deposits |

Reference:
VBMP Recent Aerial Imagery



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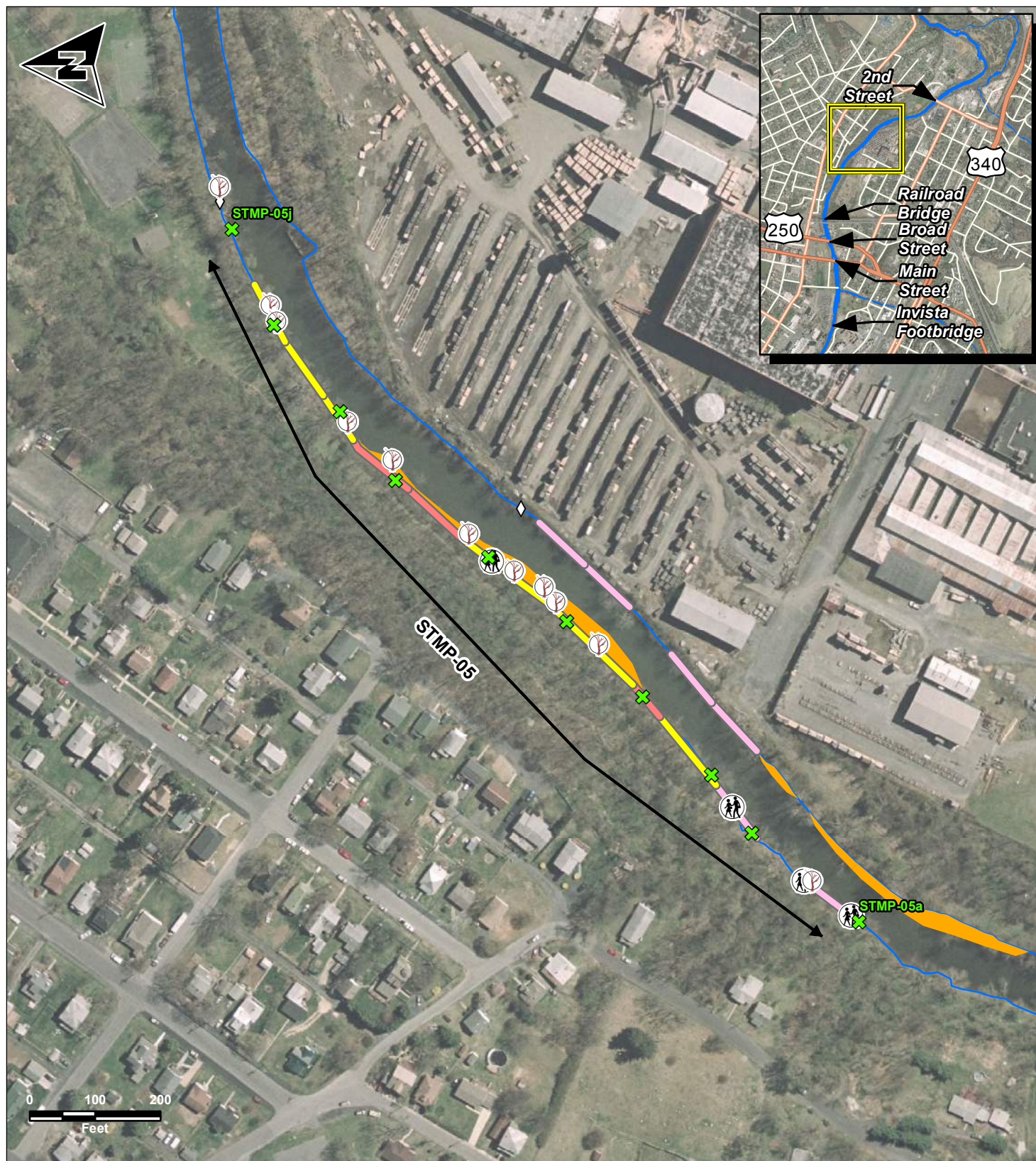
Prepared by: VP

Checked by: BR

Date: 10/28/2015

Figure 1: Sheet 1 of 3 Short-term Monitoring Locations Overview Map AOC 4 Short-Term Monitoring Plan

Former Dupont Waynesboro Plant
Waynesboro, Virginia



Legend

- | | | | | | | | |
|--|---|--|-------------------------|--|-------------------|--|----------------------------|
| | Benthic Community Location | | Phase 1A Primary BMAs | | Sampling Transect | | River Access |
| | Near bank and Mid-channel Periphyton/Clam Collections | | Phase 1A Secondary BMAs | | LWD | | Shoreline |
| | Extent of Short-term Monitoring Location | | Phase 1B Primary BMAs | | | | 1.) Clay and Silt Deposits |
| | | | Phase 1B Secondary BMAs | | | | 2.) Fine Sand Deposits |

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VBMP Recent Aerial Imagery



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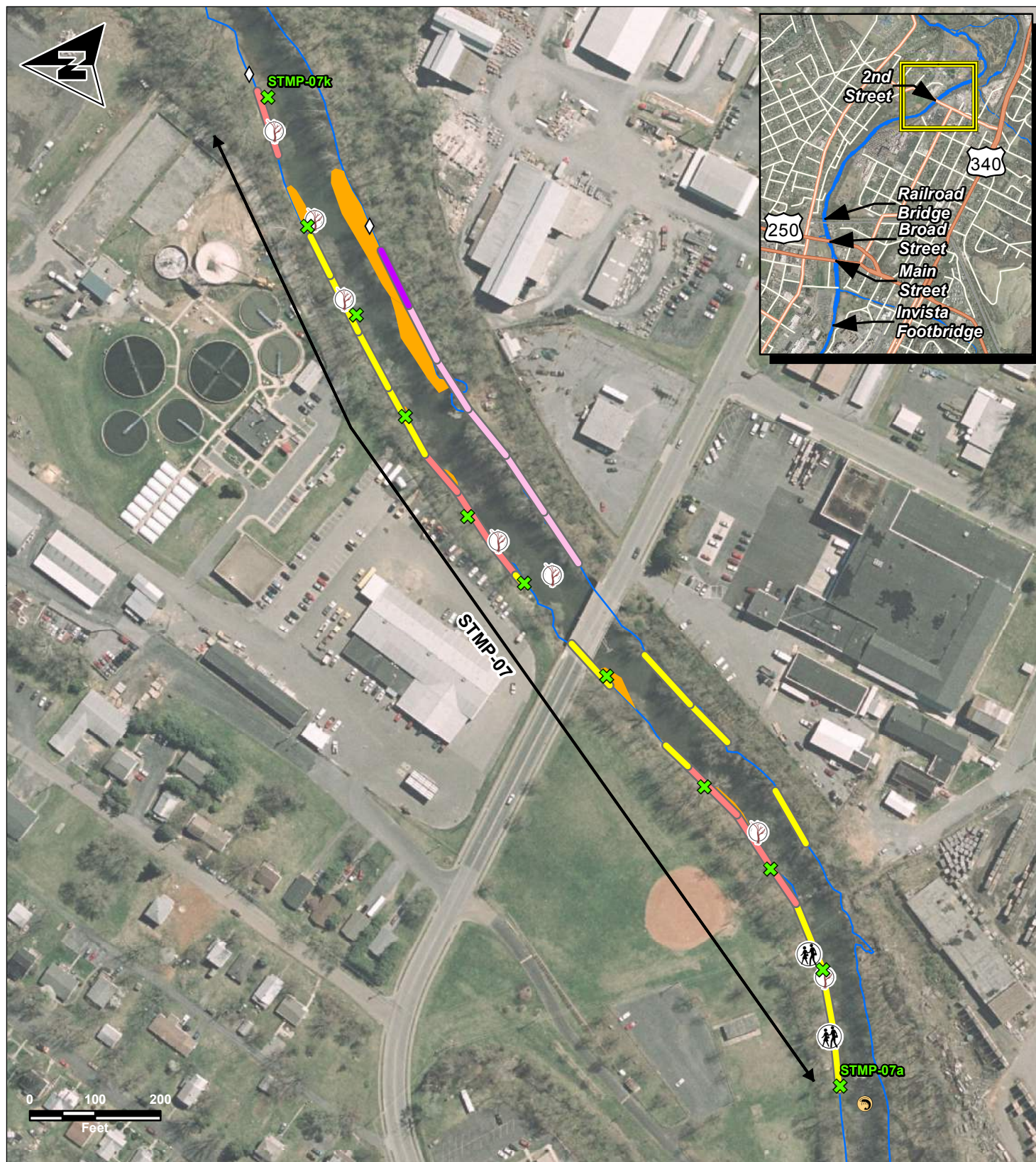
Prepared by: VP

Checked by: BR

Date: 10/28/2015

Figure 1: Sheet 2 of 3 Short-term Monitoring Locations Overview Map AOC 4 Short-Term Monitoring Plan

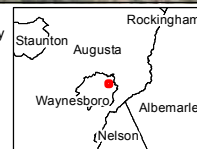
Former Dupont Waynesboro Plant
Waynesboro, Virginia



Legend

- | | | | | | | | |
|--|---|--|-------------------------|--|-------------------|--|----------------------------|
| | Benthic Community Location | | Phase 1A Primary BMAs | | Sampling Transect | | River Access |
| | Near bank and Mid-channel Periphyton/Clam Collections | | Phase 1A Secondary BMAs | | LWD | | Shoreline |
| | Extent of Short-term Monitoring Location | | Phase 1B Primary BMAs | | | | 1.) Clay and Silt Deposits |
| | | | Phase 1B Secondary BMAs | | | | 2.) Fine Sand Deposits |

Reference:
VBMP Recent Aerial Imagery



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Figure 1: Sheet 3 of 3 Short-term Monitoring Locations Overview Map AOC 4 Short-Term Monitoring Plan

Former Dupont Waynesboro Plant
Waynesboro, Virginia

Table 1

AOC-4 Short-Term Monitoring Summary

South River and a Segment of the South Fork Shenandoah River

Former DuPont, Waynesboro Plant, Virginia

Short-Term Remedial Action Objectives				Monitoring Plan Designs			Adaptive Management Outcomes	
General Objective	Performance Objective	Measurable Metric	Preliminary Success Criteria	General Station Locations	Monitoring Frequency	Analytical Parameters	Contingency Actions	Decision Analysis
Reduce Mercury Transport and Exposure	Increase in Bank Stability	Topography	Reduced Annual Erosion Rate	Shore Based LIDAR Surveys Conducted at Each BMA	Annually for First 3 Years; Post-storm	Average Annual Erosion Rate	Structural and/or Vegetative Stabilization	Refine Effectiveness Estimates
		Vegetation	>80% Cover; <10% Invasives	Vegetation Plots at Each BMA	Twice Annually for First 3 Years; Post-storm	Cover and Species Composition	Additional Vegetation Enhancement	Refine Effectiveness Estimates
		Design and Implementation	Landowner Approvals and Permits	BMA Properties	NA	NA	NA	Refine Implementation Estimates
	Reduce Mercury Loading from Bank	Surface Sediment	>75% Mercury Concentration Reduction	Transects Spaced ~100-200' at each BMA	Twice Annually for First 3 Years	IHg and MeHg Concentrations	NA	Refine Effectiveness Estimates
		Pore Water	>75% Mercury Concentration Reduction	Transects Spaced ~100-200' at each BMA	Twice Annually for First 3 Years	IHg and MeHg Concentrations	NA	Refine Effectiveness Estimates
		Periphyton	>75% Mercury Concentration Reduction	Downstream of Representative BMAs (Near-shore)	Twice Annually for First 3 Years	IHg and MeHg Concentrations	NA	Refine Effectiveness Estimates
		Asiatic Clam Sampling	>75% Mercury Concentration Reduction	Downstream of Representative BMAs (Near-shore)	Twice Annually for First 3 Years	IHg and MeHg Concentrations	NA	Refine Effectiveness Estimates
	Reduce In-Channel Mercury Exposure	Periphyton	>50% Mercury Concentration Reduction	Downstream of Representative BMAs (Channel)	Annually for First 10 Years	IHg and MeHg Concentrations	NA	Refine CSM
		Asiatic Clam Sampling	>50% Mercury Concentration Reduction	Downstream of Representative BMAs (Channel)	Annually for First 10 Years	IHg and MeHg Concentrations	NA	Refine CSM
Maintain or Improve Riparian and Aquatic Habitat	Improve Bank Vegetation	Vegetation	>80% Cover; <10% Invasives	Vegetation Plots at Each BMA	Twice Annually for First 3 Years	Cover and Species Composition	Additional Vegetation Enhancement	Refine Effectiveness Estimates
	Improve In-Stream Habitat	Rapid Bioassessment Protocols	Visual Stream Classification	Each BMA Assessed Independently	Quarterly for the First Year and Semi Annually (Q1/Q3) for years 2-10	Rapid Bioassessment Protocol Scores	NA	Refine Effectiveness Estimates
	Maintain Detrital Input/Stream Shading	Canopy Cover	Achievement of Baseline Canopy Coverage	Transects Spaced ~100-200' at each BMA	Annually for First 3 Years	Percent Canopy Coverage (Spherical Densiometer)	Additional Vegetation Enhancement	Refine Effectiveness Estimates
	Maintain Stream Substrate Condition	Wolman Pebble Counts	Maintenance / Improvement of Baseline Conditions	Transects Spaced ~100-200' at each BMA	Annually for First 3 Years	Particle Size Analysis	Structural and/or Vegetative Stabilization	Refine Effectiveness Estimates
	Maintain In-stream Habitat Features	# of In-stream Habitat Features	Maintenance / Improvement of Baseline Conditions	Each BMA Assessed Independently	Twice Annually for First 3 Years	# of In-stream Habitat Features	Structural Stabilization	Refine Effectiveness Estimates
	Habitat Function and Ecological Value	EPW & USM	Maintenance / Improvement of Baseline Conditions	Each BMA Assessed Independently	Annually for first 3 Years	USM Methodology & EPW Non-tidal Stream - Fish FCI	Structural and/or Vegetative Stabilization	Refine Effectiveness Estimates
Maintain or Improve Benthic Community	Maintenance of Benthic Community	Benthic Invertebrate Metrics	Maintenance / Improvement of Baseline Conditions	Four Locations Within the Interim Measures Area (RRM 0.5, RRM 1.0, RRM 1.5, RRM 2.0)	Twice Annually for First 3 Years	300 Organism Sub-count	NA	Refine Effectiveness Estimates
River Access / Aesthetics	Provide Stable River Access Points	Stable Access Points	Maintenance / Improvement of Baseline Conditions	Each BMA Assessed Independently	Twice Annually for First 3 Years	# of Stable and Improvised Access Points	Structural Stabilization	Refine Effectiveness Estimates

Notes:

EPW, Evaluation for Planned Wetlands

FCI, Functional Capacity Index

USM, Unified Stream Methodology

RRM, Relative River Mile

NA, Not Applicable

, Ancillary Habitat/Public Access metrics

Table 2
Sediment IHg and MeHg Monitoring Summary
Short-Term Monitoring
DuPont South River – AOC 4

Sample ID	Sediment Type	IHg June (mg/Kg dw)	IHg Oct. (mg/Kg dw)	MeHg June (µg/Kg dw)	MeHg Oct. (µg/Kg dw)
STMP-01					
A	Bulk	0.11	0.09	0.47	0.85
B		1.13	0.48	2.51	4.12
C		1.98	3.27	1.64	5.85
D		10.4	13.9	2.98	23.6
E		8.08	2.97	1.92	5.80
STMP-05					
A	Bulk	5.26	2.56	10.5	13.0
B		13.19	2.88	4.64	6.34
C		6.63	5.03	17.0	4.15
D		3.24	3.89	9.35	9.70
E		7.11	19.2	24.4	48.2
F		44.1	93.2	52.3	31.6
G		149	792	77.5	47.6
H		13.2	19.5	51.6	22.4
I		9.34	43.6	7.25	5.84
J		22.7	61.2	13.2	31.8
STMP-07					
A	Bulk	2.75	3.03	0.96	1.02
B		4.60	12.8	16.2	4.86
C		12.0	10.6	18.1	1.77
D		30.0	13.4	8.63	6.16
E		4.38	2.96	20.9	3.01
F		3.09	2.44	16.0	2.05
G		26.6	25.9	41.4	9.75
H		3.01	4.31	9.90	9.36
I		4.91	3.33	26.1	10.3
J		3.50	1.70	13.2	5.21
K		1.75	7.56	0.47	2.32

Notes:

IHg, Inorganic mercury

MeHg, Methylmercury

mg/Kg dw, Milligrams per Kilogram dry weight

Table 3
Pore Water FIHg and FMeHg Monitoring Summary
Short-Term Monitoring
DuPont South River – AOC 4

Sample ID	FIHg June (ng/L)	FIHg Oct. (ng/L)	FMeHg June (ng/L)	FMeHg Oct. (ng/L)
STMP-01				
A	2.58	3.68	0.96	1.69
B	10.7	8.36	1.17	2.52
C	5.69	4.77	0.58	0.49
D	61.4	11.0	3.37	0.79
E	14.2	10.7	2.61	2.85
STMP-05				
A	42.3	31.3	1.67	22.6
B	4.14	4.33	0.74	0.30
C	11.4	6.87	1.31	0.45
D	2.54	2.70	6.14	0.09
E	23.6	4.41	26.7	2.04
F	15.2	467	3.44	3.74
G	18.5	5.62	0.68	0.40
H	8.60	10.4	1.23	0.49
I	15.8	33.1	2.16	0.82
J	24.4	26.3	4.39	0.74
STMP-07				
A	13.7	4.69	0.94	0.04
B	3.71	4.70	0.24	0.19
C	7.47	22.3	0.02	0.19
D	2.49	14.2	0.18	0.20
E	1.29	5.06	0.96	0.18
F	5.25	2.76	4.63	0.31
G	12.3	19.0	0.40	4.46
H	14.3	4.96	4.84	0.10
I	1.68	4.91	2.36	1.36
J	1.59	4.30	2.91	0.04
K	28.8	79.6	0.29	1.99

Notes:

FIHg, Filtered inorganic mercury

FMeHg, Filtered methylmercury

ng/L, Nanograms per Liter

Table 4
Periphyton IHg and MeHg Monitoring Summary
Short-Term Monitoring
DuPont South River – AOC 4

Sample Replicate	Environment	IHg June (µg/kg ww)	IHg Oct. (µg/kg ww)	MeHg June (µg/kg ww)	MeHg Oct. (µg/kg ww)
STMP-01					
A	Mid-Channel	189.4	--	0.94	--
B		145.5	--	1.01	--
C		134.3	--	0.91	--
A	Near Bank	650.5	193.8	2.58	0.36
B		535.0	112.3	2.57	0.36
C		861.8	255.8	2.71	0.35
STMP-05					
A	Mid-Channel	45.09	--	0.89	--
B		49.78	--	0.87	--
C		37.10	--	0.78	--
A	Near Bank	2661	1591	4.55	1.09
B		2262	2135	6.95	1.01
C		2586	2016	4.92	0.94
STMP-07					
A	Mid-Channel	580.8	--	2.12	--
B		553.4	--	1.63	--
C		482.4	--	1.32	--
A	Near Bank	3045	3509	6.97	1.62
B		2043	2321	5.55	1.49
C		1963	2492	5.83	2.62

Notes:

IHg, Inorganic mercury

MeHg, Methylmercury

µg/Kg ww, Micrograms per Kilogram wet weight

-- , Not sampled

Table 5
Corbicula IHg and MeHg Monitoring Summary
Short-Term Monitoring
DuPont South River – AOC 4

Sample Replicate	Environment	IHg June (µg/kg ww)	IHg Oct. (µg/kg ww)	MeHg June (µg/kg ww)	MeHg Oct. (µg/kg ww)
STMP-01					
A	Mid-Channel Caged	19.9	--	8.69	--
B		38.1	--	12.76	--
C		16.9	--	6.10	--
A	Near Bank Caged	25.3	12.3	15.3	7.28
B		26.2	9.86	17.8	9.20
C		22.0	13.7	16.9	8.67
A	Near-Bank Seeded	36.3	15.0	41.0	10.4
B		47.0	14.3	46.1	11.0
C		34.8	17.4	52.7	12.0
STMP-05					
A	Mid-Channel Caged	23.6	--	6.47	--
B		19.7	--	8.21	--
C		34.7	--	11.8	--
A	Near Bank Caged	38.3	13.7	35.1	9.17
B		34.7	18.9	29.8	10.9
C		30.3	17.1	30.5	11.2
A	Near Bank Seeded	44.3	16.4	41.8	14.3
B		68.0	15.2	42.0	13.5
C		45.9	17.6	42.8	14.6
STMP-07					
A	Mid-Channel Caged	24.4	--	11.5	--
B		28.5	--	10.8	--
C		23.2	--	10.4	--
A	Near Bank Caged	38.4	9.37	13.9	8.02
B		49.7	18.9	18.4	12.2
C		41.9	12.4	15.9	8.46
A	Near Bank Seeded	53.5	16.6	28.0	14.1
B		65.7	13.2	32.3	14.5
C		59.4	15.8	29.9	14.9

Notes:

IHg, Inorganic mercury

MeHg, Methylmercury

µg/Kg ww, Micrograms per Kilogram wet weight

--, Not sampled