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Memorandum

To	Michael Liberati, Corteva CRG	Page	1 of 4
CC	Nancy Grosso, Corteva CRG		
Subject	2019 Short-term Monitoring Field Summary Memo Former DuPont Waynesboro Site, Area of Concern 4		
From	Andrew Miano, AECOM Joshua Collins, AECOM		
Date	March 27, 2020		

This technical memorandum summarizes the Spring and Fall 2019 Short-term Monitoring (STM) sampling efforts for Area of Concern (AOC) 4 of the former DuPont Waynesboro site. STM data will be used to evaluate the effectiveness of the remedy over a short, two to ten year period, within a limited spatial extent, adjacent to a particular Bank Management Area (BMA). Additional attachments to this memorandum include:

- Table 1 – Plan Summary
- Tables 2-7 – Data Summaries
- Figure 1 – Station Overview Map
- Figure 2 – Sediment Grain Size Distribution

APPROACH

The Spring and Fall 2019 STM field efforts were conducted in accordance with the Final AOC 4 Short-term Monitoring Plan (URS Corporation, 2015) and modifications (AECOM, 2015 and 2016). Table 1 provides an overview of the monitoring plan design, including performance objectives, metrics, success criteria, and adaptive management outcomes; additional details are provided in the Monitoring Plan and associated appendices (URS Corporation, 2015).

The Spring and Fall 2019 STM program included assessment of baseline, pre-remediation, and post remediation conditions as identified below and shown in Figure 1.

BMA	Station	Baseline Dataset	Remediation Complete
Bank Stabilization Pilot Study	--	2008	November 2009
Constitution Park	STM-01	2015-2016	February 2017
City Shops	STM-07	2015-2016	February 2018
Allied Ready Mix	STM-08	2016-2017	November 2018
Shiloh Baptist Church	STM-03	2017	August 2019
North Park	STM-05	2015-2018	TBD

The Shiloh Baptist Church BMA (STM-03) was not sampled in the spring due to on-going remediation. The Shiloh Baptist Church BMA remediation was completed in August 2019 and was included in the fall monitoring activities.

SCOPE

The following activities were conducted as part of the 2019 STM program (Table 1):

- Bulk sediment and pore water were collected for Total Mercury (THg) and Methylmercury (MeHg) analysis (EPA Method 1631 & Method 1630) at the BMAs as described above during the weeks of May 20th, May 27th, and October 14th. The fall pore water samples needed to be recollected the week of November 18th, due to a sample processing error at the analytical laboratory
- Spring seeded and caged *Corbicula fluminea (*Asiatic clam, *Corbicula)* were deployed the week of April 29th and retrieved following a 5-week exposure period during the week of June 3rd. Fall transplanted Corbicula were deployed the week of September 2nd and retrieved the week of October 7th. *Cobicula* samples were analyzed for THg and MeHg analysis by EPA Methods 1631 and 1630 respectively.
- Riparian vegetation plots were monitored at all sites except the Shiloh Baptist Church BMA; aquatic and riparian habitats were also assessed using a modified Rapid Bio-assessment protocol at all BMAs (RBP; Barbour et al., 1999).
- Epilithic periphyton samples were collected for THg and MeHg analysis (EPA Method 1631 & Method 1630) during the week of May 27th and October 7th.
- Benthic community samples were collected at RRMs 0.5, 1.0, 1.5, and 2.0 the week of May 27th and October 7th.
- Areas of improvised river access and large woody debris (LWD) features were documented at each BMA during the Spring & Fall 2019 field activities (Figure 1).

DATA SUMMARY

This section provides a brief summary of data collected during the Spring and Fall 2019 STM events. Mercury concentrations differed spatially and temporally among the media sampled but were consistent with established trends. A summary of key observations from the 2019 STM efforts is provided below; complete data summary tables are presented by media type in Tables 2 through 7.

Sediment

- Sediment concentrations for IHg were generally higher in the spring compared to the fall except for STM-01, which had higher sediment IHg concentrations in the fall (Table 2).
- Sediment MeHg concentrations were generally lower in the fall compared to the spring (Table 2).
- Near-bank sediments at non-remediated BMAs continue to be influenced by elevated THg concentrations in adjacent bank soil.

Filtered Pore Water

- Filtered IHg pore water concentrations for were generally similar between the spring and fall seasons collected at remediated and non-remediated BMAs (Table 3).
- Filtered pore water MeHg concentrations were generally higher in the spring compared to the fall (Table 3).
- Filtered pore water IHg concentrations at the North Park BMAs (non-remediated) were generally higher compared to concentrations at remediated BMAs (Table 3).

Periphyton

- Concentrations of IHg were generally higher in the fall than the spring at each remediated BMA, while concentrations of MeHg were more variable across seasons and BMAs (Table 4).

Transplanted Corbicula

- Near-bank caged clams at the Allied Ready Mix BMA (STM-08) were lost due to the cage being removed from the water and placed on the bank by unknown parties.
- IHg and MeHg concentrations in transplanted *Corbicula* were generally similar among samples collected at each BMA in 2019.
- IHg and MeHg tissue concentrations were generally higher in near-bank samples compared to mid channel, transplanted *Corbicula* (Table 5).

Riparian Vegetation

- Riparian vegetation species in all strata, at the Constitution Park, North Park, City Shops, and Allied ready mix BMAs were similar in the spring and fall.
- Vegetation plots at STM-03 were not monitored in 2019 due to ongoing remediation in the spring and incomplete vegetation restoration at the time of monitoring in the fall.
- Invasive plant species including Japanese Knotweed (*Fallopia japonica)* and multiflora rose (*Rosa multiflora*) were present at all STM stations (Table 6).
- Japanese knotweed cover at the Constitution Park BMA continued to be reduced from 35-40% in the spring of 2018 to 5-15% cover in 2019 (AECOM, 2019). Herbicide applications will continue in 2020 with the goal of further reducing the knotweed population to allow planting of native vegetation.

Ancillary Habitat/Public Access Assessments:

- Average stream canopy cover was generally limited at all stations, ranging from a mean of 18% to 50%, which is consistent with previous inspections (Table 7).
- Sediment grain size distribution for most stations was similar, and consisted primarily of sand/fines, coarse gravel, and small to medium cobble (Figure 2).
- Benthic community samples are being processed; once available, data will be included in the 2019 Annual STM Report.
- Improvised access and LWD features were generally stable and consistent with 2018 observations with the exception of a new improvised access pathways at the Allied Ready Mix BMA which resulted in limited areas of torn erosion control fabric and intentionally moved stone toe rock (AECOM, 2020).
- Currently, the two pieces of installed LWD that were displaced from the City Shops BMA in 2018 continue to remain stable; they will continue to be monitored and corrective actions will be implemented if warranted.

PATH FORWARD

The 2019 Annual STM Report is currently in development; it will provide a data evaluation and summary of findings of the 2019 STM program. An assessment of the effectiveness of the completed Constitution Park, City Shops, Allied Ready Mix, and Shiloh Baptist Church BMA interim measures in the context of the established success criteria will also be provided, as well as a comparison with the framework of the Pilot Bank Study.

Consistent with the adaptive management framework for AOC 4, the elements of the STM may be revised based on documented progress towards the achievement of success criteria, contingency actions, and emerging decision analysis options (URS, 2015). More specifically, monitoring data that do not contribute to remedial decision-making may be reduced or eliminated from the STM program with the concurrence of the VDEQ.

REFERENCES

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URS Corporation. 2015. Final AOC 4 Short-term Monitoring Plan - Relative River Mile 0-2 of the South River, Virginia. DuPont Former Waynesboro Site, Area of Concern 4.

Tables

Table 1
Short-term Monitoring Plan Summary
2019 Short-Term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

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 (post construction)**	**Analytical Parameters**	**Contingency Actions**	**Decision Analysis**
Reduce Mercury Transport and Exposure	Increase in Bank Stability	Topography	Maintenance of Post-Construction Bank Condition	BMA Evaluated Holistically	Twice Annually for First 3 Years; Post-storm	Continuous Bank Angle / Grade	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[1]	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
IHg, Inorganic mercury
MeHg, Methylmercury
CSM, Conceptual Site Model
BMA, Bank Management Area
Ancillary habitat/ public access metrics
1, baseline (pre-construction) monitoring will occur semi annually

Table 2
Bulk Sediment Data Summary
2019 Short-term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Sample Replicate[1]	IHg (mg/kg, dw)		MeHg (µg/kg, dw)	
	Spring	Fall	Spring	Fall
Constitution Park (STM-01)				
A	0.55	1.44	1.50	4.01
B	0.05	0.14	2.62	1.04
C	0.78	0.81	4.24	5.44
D	0.99	59.39	2.54	14.30
E	0.16	0.22	2.11	0.72
Shiloh Baptist Church (STM-03)				
A	--	0.46	--	1.47
B	--	1.03	--	3.76
C	--	0.91	--	5.43
D	--	3.60	--	10.60
E	--	1.88	--	5.83
F	--	0.60	--	0.92
G	--	1.65	--	8.58
H	--	0.16	--	1.88
I	--	2.54	--	8.63
J	--	3.14	--	6.67
North Park (STM-05)				
A	6.13	3.46	19.70	7.49
B	19.20	11.19	4.62	7.73
C	15.08	7.19	17.60	12.10
D	1.63	1.50	9.21	6.06
E	26.26	4.86	41.50	7.44
F	55.40	21.69	95.20	8.43
G	69.56	22.30	38.30	4.65
H	18.19	30.89	13.60	7.02
I	13.58	32.50	24.50	3.98
J	76.87	18.50	31.60	2.17
City Shops (STM-07)				
A	4.06	4.03	3.45	3.58
B	3.09	2.47	10.40	8.91
C	9.66	4.58	1.48	1.80
D	29.68	10.90	15.70	3.91
E	5.68	5.40	14.30	5.09
F	11.09	2.09	12.30	10.90
G	3.56	3.39	15.00	16.50
H	2.38	1.63	9.32	5.69
I	2.45	2.61	36.70	9.35
J	1.10	0.92	5.24	1.45
K	2.95	1.64	23.30	6.74
Allied Ready Mix (STM-08)				
A	16.08	12.39	16.20	9.01
B	1.62	2.61	5.20	7.00
C	1.56	4.62	7.56	3.67
D	9.76	0.52	6.88	2.31
E	0.84	0.88	6.12	1.45
F	0.55	0.41	3.39	0.46
G	0.66	1.41	5.45	5.43
H	2.72	3.25	5.84	3.67
I	1.93	2.27	4.56	4.97
J	0.11	0.52	2.08	2.24

Notes:

1, Per STM station, sample replicates increase alphabetically with distance downstream
IHg, Inorganic mercury
MeHg, Methylmercury
dw, Dry weight
--, Not sampled

Table 3
Filtered Pore Water Data Summary
2019 Short-term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Sample Replicate[1]	FIHg (ng/L)		FMeHg (ng/L)	
	Spring	Fall	Spring	Fall
Constitution Park (STM-01)				
A	4.45	0.94	1.53	0.56
B	11.94	9.00	1.06	1.60
C	3.55	1.29	2.70	1.32
D	33.18	31.89	8.02	1.61
E	4.33	2.77	2.55	0.33
Shiloh Baptist Church (STM-03)				
A	--	2.09	--	0.13
B	--	2.01	--	3.88
C	--	7.46	--	4.94
D	--	10.91	--	4.29
E	--	24.75	--	5.15
F	--	2.37	--	0.51
G	--	1.41	--	0.30
H	--	9.83	--	0.97
I	--	3.16	--	0.33
J	--	9.03	--	0.10
North Park (STM-05)				
A	17.87	3.80	0.93	0.51
B	2.48	28.05	0.28	0.85
C	6.34	18.32	5.06	1.18
D	2.73	1.44	0.56	0.11
E	2.36	3.63	0.42	0.36
F	20.01	12.40	5.29	11.20
G	88.89	11.96	2.91	0.44
H	4.86	8.86	0.88	0.28
I	11.31	16.88	1.19	3.62
J	33.23	42.43	7.27	0.47
City Shops (STM-07)				
A	6.05	37.82	6.35	0.19
B	5.29	2.15	2.34	5.32
C	2.09	2.86	0.06	0.06
D	7.84	1.60	0.19	0.10
E	19.30	18.16	10.60	6.14
F	8.03	5.67	3.27	4.24
G	21.60	2.54	13.30	2.52
H	5.80	6.13	10.30	0.71
I	5.41	2.62	7.09	1.34
J	1.26	1.17	2.02	0.25
K	2.71	2.70	5.59	2.42
Allied Ready Mix (STM-08)				
A	12.63	6.23	6.07	0.13
B	3.15	10.19	0.05	0.21
C	2.09	7.52	0.46	0.32
D	7.19	4.79	7.31	3.74
E	11.00	17.09	13.30	5.41
F	2.20	3.48	7.47	3.17
G	8.19	6.95	8.51	7.85
H	2.18	2.86	0.12	0.06
I	5.78	4.05	0.50	0.29
J	7.60	1.20	44.80	0.05

Notes:
1, Per STM station, sample replicates increase alphabetically with distance downstream
FIHg, Inorganic mercury (filtered fraction)
FMeHg, Methylmercury (filtered fraction)

Table 4
Periphyton Data Summary
2019 Short-term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Sample Replicate	Sample Environment	IHg (µg/kg, ww)		MeHg (µg/kg, ww)	
		Spring	Fall	Spring	Fall
Constitution Park (STM-01)					
A	Mid-Channel	2444.9	—	5.1	—
B		86.8	—	1.9	—
C		139.0	—	2.0	—
A	Near Bank	148.1	37.7	1.9	2.5
B		559.8	36.0	0.2	1.9
C		95.2	27.9	1.5	1.6
Shiloh Baptist Church (STM-03) [1]					
A	Mid-Channel	—	—	—	—
B		—	—	—	—
C		—	—	—	—
A	Near Bank	—	97.4	—	3.6
B		—	67.6	—	3.5
C		—	90.4	—	2.8
North Park (STM-05)					
A	Mid-Channel	546.7	—	4.3	—
B		302.4	—	4.6	—
C		804.7	—	5.3	—
A	Near Bank	402.0	156.5	6.0	22.5
B		426.7	4880.4	8.3	29.6
C		331.4	231.4	5.6	20.6
City Shops (STM-07)					
A	Mid-Channel	347.6	—	7.4	—
B		346.3	—	11.7	—
C		403.5	—	8.5	—
A	Near Bank	524.3	54.7	8.7	2.3
B		581.2	64.5	8.8	2.8
C		634.8	51.9	11.2	2.9
Allied Ready Mix (STM-08)					
A	Mid-Channel	688.0	--	8.0	--
B		1233.7	--	6.3	--
C		708.1	--	5.9	--
A	Near Bank	456.6	63.0	18.4	4.8
B		427.0	128.3	18.0	5.7
C		612.1	61.9	19.9	5.2

Notes:

1, STM-03 was not sampled in the spring of 2019 due to ongoing construction.

IHg, Inorganic mercury

MeHg, Methylmercury

ww, Wet weight

--, Not sampled

Table 5
Transplanted *Corbicula* Data Summary
2019 Short-term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Sample Replicate	Sample Environment	IHg (µg/kg, ww)		MeHg (µg/kg, ww)	
		Spring	Fall	Spring	Fall
Constitution Park (STM-01)					
A	Mid-Channel Caged	18.1	--	7.5	--
B		21.7	--	9.3	--
C		21.0	--	8.4	--
A	Near Bank Caged	13.2	15.0	12.3	18.3
B		20.5	21.1	15.1	18.5
C		10.4	22.1	14.9	19.5
A	Near-Bank Seeded	19.5	19.1	17.6	21.6
B		16.3	21.8	17.7	19.5
C		17.4	21.9	17.0	22.6
Shiloh Baptist Church (STM-03) [1]					
A	Mid-Channel Caged	--	--	--	--
B		--	--	--	--
C		--	--	--	--
A	Near Bank Caged	--	26.9	--	16.0
B		--	14.9	--	15.7
C		--	13.9	--	14.2
A	Near Bank Seeded	--	14.9	--	25.1
B		--	15.2	--	25.9
C		--	17.9	--	23.5
North Park (STM-05)					
A	Mid-Channel Caged	14.8	--	8.5	--
B		25.5	--	10.0	--
C		27.7	--	9.1	--
A	Near Bank Caged	38.8	24.0	25.7	22.5
B		38.1	20.7	28.9	21.2
C		43.1	30.5	25.8	25.0
A	Near Bank Seeded	39.4	46.4	26.8	32.6
B		24.8	56.6	30.3	37.4
C		47.8	35.7	39.9	32.3
City Shops (STM-07)					
A	Mid-Channel Caged	33.7	--	15.0	--
B		19.5	--	11.6	--
C		33.8	--	16.2	--
A	Near Bank Caged	30.3	16.8	25.3	23.6
B		27.7	21.4	33.4	20.1
C		27.1	16.5	35.2	17.8
A	Near Bank Seeded	26.7	23.7	40.8	25.2
B		19.6	27.6	31.3	27.4
C		37.4	18.4	35.0	25.6
Allied Ready Mix (STM-08)					
A	Mid-Channel Caged	19.8	--	10.4	--
B		16.7	--	12.9	--
C		10.8	--	14.8	--
A	Near Bank Caged	14.6	NR	46.9	NR
B		28.4	NR	56.3	NR
C		5.7	NR	59.1	NR
A	Near Bank Seeded	35.5	15.6	52.5	49.3
B		20.1	14.9	53.6	42.9
C		21.9	21.9	53.6	45.2

Notes:
1, STM-03 was not sampled in the spring of 2019 due to ongoing construction.
IHg, Inorganic mercury
MeHg, Methylmercury
ww, Wet weight
--, Not sampled
NR, Not recovered

Table 6
Riparian Vegetation Plot Data Summary
2019 Short-Term Monitoring Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Vegetative Species		Absolute % Cover[1]	Absolute % Cover[1]
Scientific Name	**Common Name**	**Spring**	**Fall**
Constitution Park (STM-01)			
Tree/Vine Stratum			
Robinia pseudoacacia	Black Locust	0-30	0-45
Acer rubrum	Red Maple	0-15	0-20
Convolvulus arvensis	Field Bindweed	0-2	0
Sapling/Shrub Stratum			
Acer rubrum	Red Maple	0-30	0-10
Platanus occidentalis	Sycamore	0-15	0-15
Ailanthus altissima	Tree of Heaven	0-2	0
Physocarpus opulifolius	Atlantic Ninebark	0-15	2-15
Herbaceous Stratum			
Reynoutria japonica	Japanese Knotweed	10-15	5-15
Convolvulus arvensis	Field Bindweed	0-10	0
Festuca rubra	Red Fescue	0-2	0-10
Phytolacca americana	Pokeweed	0-2	0-15
Lactuca serriola	Prickly Lettuce	0-2	0-2
Arctium minus	Lesser burdock	0-2	0-2
Trofolium pratense	Red clover	0-1	0-1
Andropogon gerardi	Big Bluestem	0-15	0-5
Schizachyrium scoparium	Little bluestem	0-10	0-10
Catalpa speciosa	Northern Catalpa	0-10	0-2
Tridens flavus	Purpletop Tridens	0	0-5
Senna merilandica	Maryland Senna	0	0-2
Cyperus esculentus	Yellow Nutsedge	0-2	2
Shiloh Baptist Church (STM-03) [2]			
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North Park (STM-05)			
Tree/Vine Stratum			
Juglans nigra	Black Walnut	45-60	45-60
Quercus montana	Chestnut Oak	0-25	0-35
Robinia pseudoacacia	Black Locust	0-30	30
Platanus occidentalis	American Sycamore	0-10	0-10
Cercis Canadensis	Eastern redbud	0-25	20
Catalpa speciosa	Northern Catalpa	0-20	30
Parthenocissus quinquefolia	Virginia Creeper	0-10	0-5
Ampelopsis brevipedunculata	porcelain berry	5	5
Toxicodendron radicans	Poison Ivy	5-35	5-35
Clematis terniflora	Sweet Autumn Virginsbower	0-10	0-10
Sapling/Shrub Stratum			
Lonicera tatarica	Tartarian Honeysuckle	70-90	70-90
Ailanthus altissima	Tree of Heaven	0	0-20
Rosa multiflora	Multiflora Rose	5-10	1-5
Lindera benzoin	Spicebush	0-10	5-15
Juglans nigra	Black Walnut	0-25	0-25
Herbaceous Stratum			
Lindera benzoin	Northern Spicebush	0-10	0
Glechoma hederacea	Ground Ivy	0-10	10
Parthenocissus quinquefolia	Virginia Creeper	0-5	5
Microstegium vimineum	Japanese stiltgrass	0	0-20
Toxicodendron radicans	Poison Ivy	0-5	5
Rubus idaeus	Red Raspberry	0-5	5
Lonicera tatarica	Tartarian Honeysuckle	0-3	5

Table 6
Riparian Vegetation Plot Data Summary
2019 Short-Term Monitoring Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Vegetative Species		Absolute % Cover[1]	Absolute % Cover[1]
Scientific Name	**Common Name**	**Spring**	**Fall**
goldenrod sp.	Goldenrod	0-3	3
Acer platanoides	Norway Maple	0-2	0-5
Elaeagnus umbellata	Autumn olive	0	0-15
Albizia julibrissin	Mimosa Tree	0	0-2
Verbesina alternifolia	Wingstem	0	0-15
Cyperus esculentus	Yellow Nutsedge	0-2	0-2
City Shops (STM-07)			
Tree/Vine Stratum			
Juglans nigra	Black Walnut	0-15	0-10
Acer negundo	Box Elder Maple	0-70	0-70
Vitis vulpina	Frost Grape	0-10	0-10
Celastrus orbiculatus	Oriental Bittersweet	0-60	0-60
Sapling/Shrub Stratum			
Lonicera tatarica	Tartarian Honeysuckle	0-70	0-70
Elaeagnus umbellata	Autumn Olive	0-2	0
Betula nigra	River Birch	0-2	0-2
Fothergilla gardenii	Dwarf Fothergilla	0-10	0-10
Platanus occidentalis	American Sycamore	0	0-2
Physocarpus opulifolius	Atlantic Ninebark	0-10	0-5
Senna merilandica	Maryland Senna	0	0-25
Rhus typhina	Staghorn Sumac	0-15	0-15
Herbaceous Stratum			
Reynoutria japonica	Japanese Knotweed	0-20	10
Senna marilandica	Maryland Senna	0-40	0-35
Acer negundo	Box Elder	0-2	0
Andropogon gerardi	Big Bluestem	0-30	0-20
Agrostis sp.	Bentgrass	0-25	0-5
Coreopsis sp.	tickseed species	0	0-2
oats sp.	oat species	0	0-2
Cyperus esculentus	Yellow Nutsedge	0-5	0-5
Brassica kaber	Field mustard	0-2	0-2
Galium sp.	galium species	0	0-2
Convolvulus arvensis	Field Bindweed	0	0-2
Lonicera tatarica	Tartarian Honeysuckle	0-30	30
Carex sp.	sedge species	0	2
Elymus riparius	Riverbank Wildrye	0-5	0-25
Allied Ready Mix (STM-08)			
Tree/Vine Stratum			
Acer saccharinum	Silver Maple	20-35	30-40
Celastrus orbiculatus	Oriental bittersweet	0-15	0-15
Toxicodendron radicans	Poison Ivy	0-10	0-10
Lonicera japonica	Japanese honeysuckle	0-5	0-5
Parthenocissus quinquefolia	Virginia creeper	0-20	0
Sapling/Shrub Stratum			
Lonicera tatarica	Tatarian honeysuckle	0-40	45
Cornus alba	White dogwood	0	0-10
Alnus incana	Grey alder	0	0-10
Ailanthus altissima	Tree of heaven	0-5	0
Acer rubrum	Red Maple	0-15	0
Prunus sp.	Cherry sp.	0-2	0
Betula nigra	River birch	0-2	0
Salix sp.	Willow sp.	0-2	0

Table 6
Riparian Vegetation Plot Data Summary
2019 Short-Term Monitoring Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

Vegetative Species		Absolute % Cover[1]	Absolute % Cover[1]
Scientific Name	**Common Name**	**Spring**	**Fall**
Herbaceous Stratum			
Galium aparine	Bedstraw	0	40-50
Salix spp. (live stakes)	Willow sp.	0	1-15
Senna marilandica	Maryland Senna	0	0-10
Arctium minus	Lesser burdock	0	1-10
Amaranthus spinosus	Spiny Amaranth	0	0-5
Lactuca serriola	Prickly Lettuce	0	0-2
Acer rubrum	Red Maple	0-5	0-2
Panicum virgatum	Switchgrass	0	0-1
Cirsium spp.	Thistle sp.	0	0-1
Persicaria pensylvanica	Pennsylvania Smartweed	0	1-25
Solidago spp.	Goldenrod sp.	0	1
Aster spp.	Aster sp.	0	0-1
Coreopsis lanceolata	Lance-leaved coreopsis	0	0-20
Platanus occidentalis	American Sycamore	0-2	0-10
Verbascum thapsus	Great mullein	0	0-5
Reynoutria japonica	Japanese Knotweed	2-10	0-5
Phytolacca americana	American pokeweed	0	0-1
Verbesina alternifolia	Wingstem	0	0-1
Lepidium campestre	Field Pepperweed	0	0-1
Lespedeza spp.	Lespedesa sp.	0	0-1
Elymus riparius	Riverbank Wildrye	35	0
Alliaria petiolata	Garlic mustard	0-5	0
Rosa multiflora	Multiflora Rose	5	0
Trifolium repens	White Clover	0-10	0
Impatiens capensis	Common Jewelweed	0-2	0

Notes:

1, Represents the range observed between two riparian vegetative survey plots per Short-term Monitoring station.

2, Vegetation plots at STM-03 were not monitored in 2019 due to ongoing remediation and incomplete vegetation restoration at the time of monitoring.

NA, Not applicable

--, Not sampled

Table 7
Canopy Cover Data Summary
2019 Short-term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4

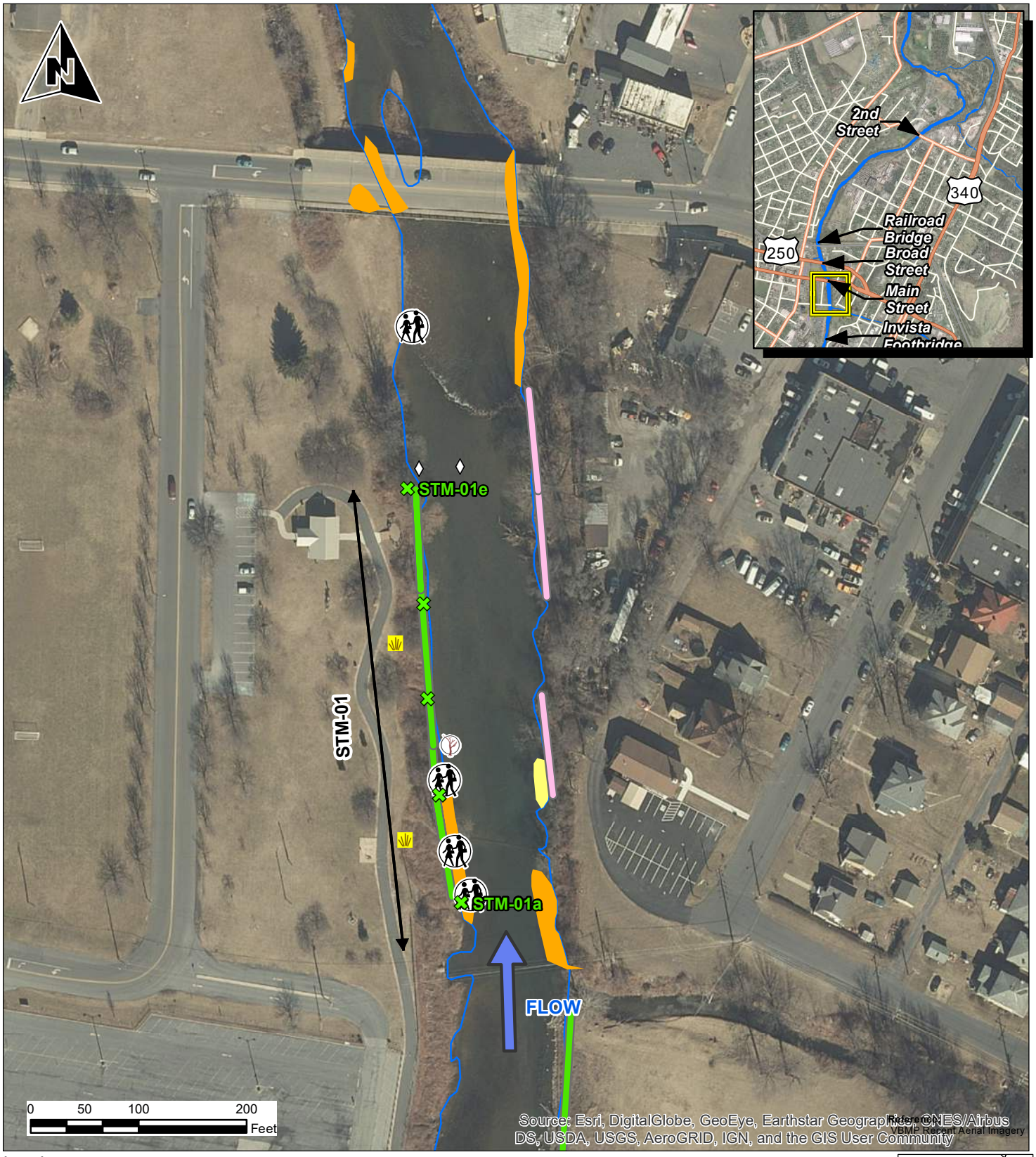
Transect ID	Mean Densiometer Reading[1]	Mean Open Sky (%)	Overall Mean Open Sky (%)	Overall Mean Canopy Cover (%)
Constitution Park (STM-01)				
A	85.0	88.5	82	18
B	92.0	95.8		
C	75.5	78.6		
D	81.5	84.9		
E	59.5	62.0		
Shiloh Baptist Church (STM-03)[2]				
--	--	--	--	--
North Park (STM-05)				
A	36.8	38.3	50	50
B	44.5	46.4		
C	48.5	50.5		
D	37.5	39.1		
E	43.5	45.3		
F	69.5	72.4		
G	56.0	58.3		
H	46.5	48.4		
I	53.0	55.2		
J	47.0	49.0		
City Shops (STM-07)				
A	43.0	44.8	55	45
B	34.5	35.9		
C	46.0	47.9		
D	32.0	33.3		
E	69.5	72.4		
F	91.0	94.8		
G	94.0	97.9		
H	40.0	41.7		
I	44.0	45.8		
J	46.0	47.9		
K	42.5	44.3		
Allied Ready Mix (STM-08)				
A	47.8	49.7	52	48
B	14.5	15.1		
C	48.3	50.3		
D	90.3	94.0		
E	87.5	91.1		
F	44.5	46.4		
G	46.0	47.9		
H	43.5	45.3		
I	22.0	22.9		
J	51.0	53.1		

Notes:

1, Canopy cover is only sampled in the spring.

2, STM-03 was not sampled in the spring of 2019 due to ongoing construction.

Figures

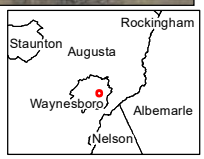


Legend

- Periphyton/Clam
- Benthic Community
- Vegetative Plots
- Sediment/PoreWater/ Canopy/Pebble Count
- Large Woody Debris
- River Access
- Extent of Short-term Monitoring Location
- Clay and Silt Deposits
- Fine Sand Deposits
- Shoreline

Bank Management Area

- Interim Measures Complete
- Non-Use BMAs
- Phase 1A Primary BMAs
- Phase 1A Secondary BMAs
- Phase 1B Primary BMAs
- Phase 1B Secondary BMAs



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Prepared by: CDW	
Checked by: AM	
Date: 1/2/2020	

Figure 1: Sheet 1 of 4
Short-Term Monitoring Stations Overview Map
2019 Short-Term Monitoring Annual Field Summary Memo
Former Dupont Waynesboro Site, Area of Concern 4
Waynesboro, Virginia

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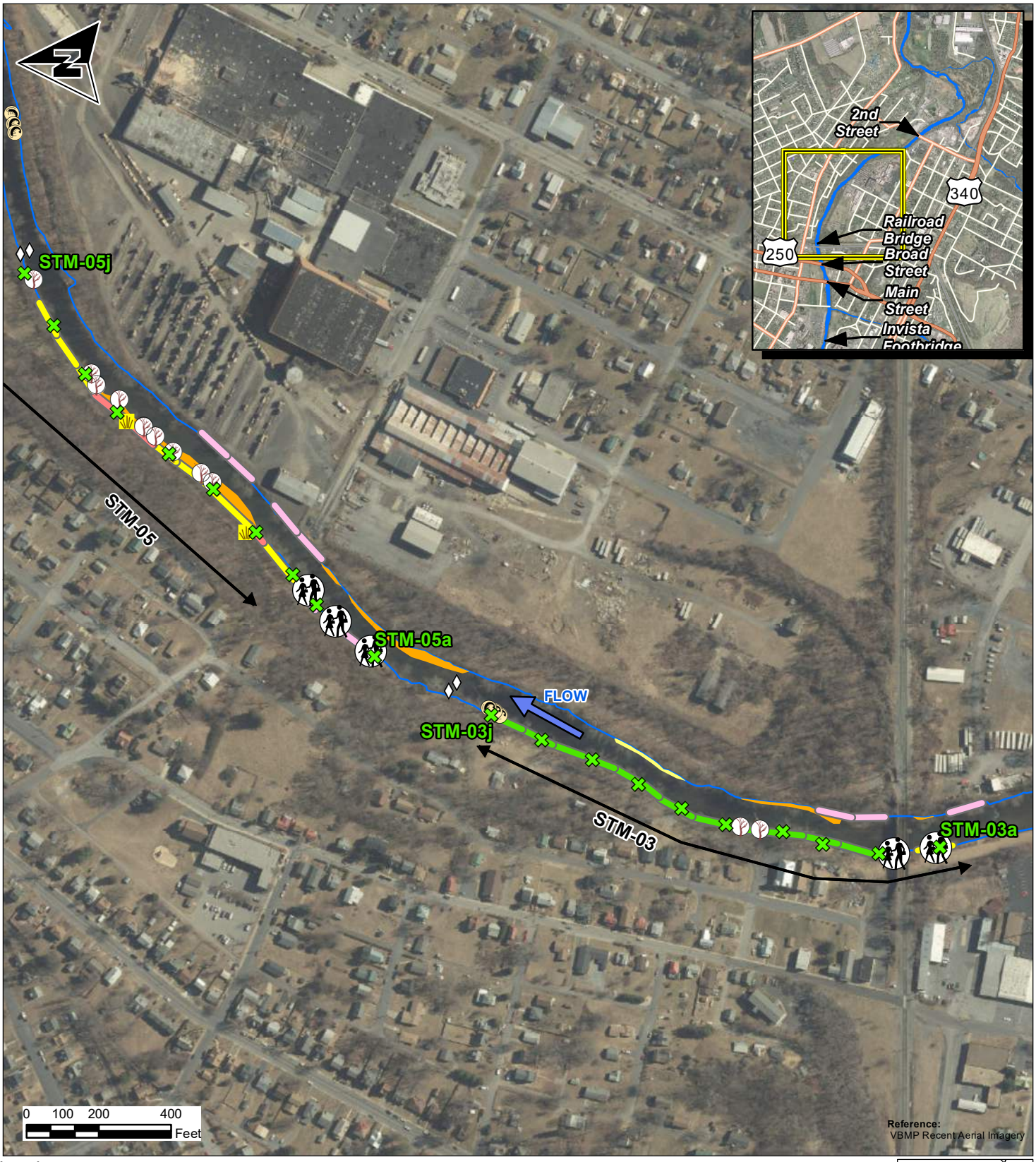

Legend

- Periphyton/Clam
- Benthic Community
- Vegetative Plots
- Sediment/PoreWater/ Canopy/Pebble Count
- Large Woody Debris
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- Extent of Short-term Monitoring Location
- Clay and Silt Deposits
- Fine Sand Deposits
- Shoreline

Bank Management Area

- Interim Measures Complete
- Non-Use BMAs
- Phase 1A Primary BMAs
- Phase 1A Secondary BMAs
- Phase 1B Primary BMAs
- Phase 1B Secondary BMAs

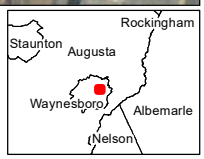

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Figure 1: Sheet 2 of 4
Short-Term Monitoring Stations Overview Map
2019 Short-Term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4
Waynesboro, Virginia

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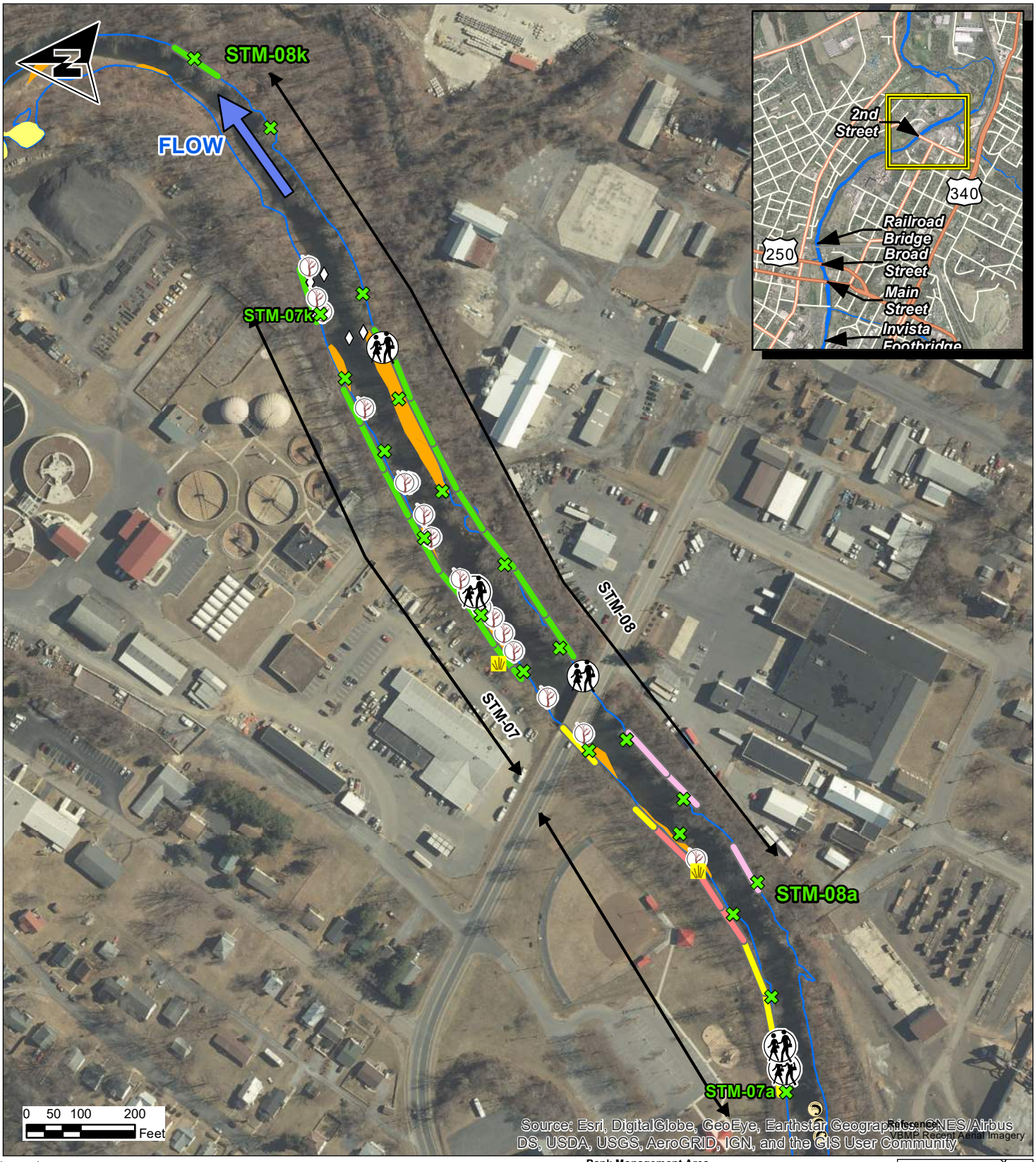

Legend

- Periphyton/Clam
- Benthic Community
- Vegetative Plots
- Sediment/PoreWater/ Canopy/Pebble Count
- Large Woody Debris
- River Access
- Extent of Short-term Monitoring Location
- Clay and Silt Deposits
- Fine Sand Deposits
- Shoreline

Bank Management Area

- Interim Measures Complete
- Non-Use BMAs
- Phase 1A Primary BMAs
- Phase 1A Secondary BMAs
- Phase 1B Primary BMAs
- Phase 1B Secondary BMAs

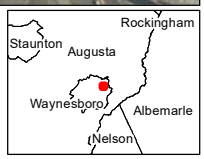

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Figure 1: Sheet 3 of 4
Short-Term Monitoring Stations Overview Map
2019 Short-Term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4
Waynesboro, Virginia

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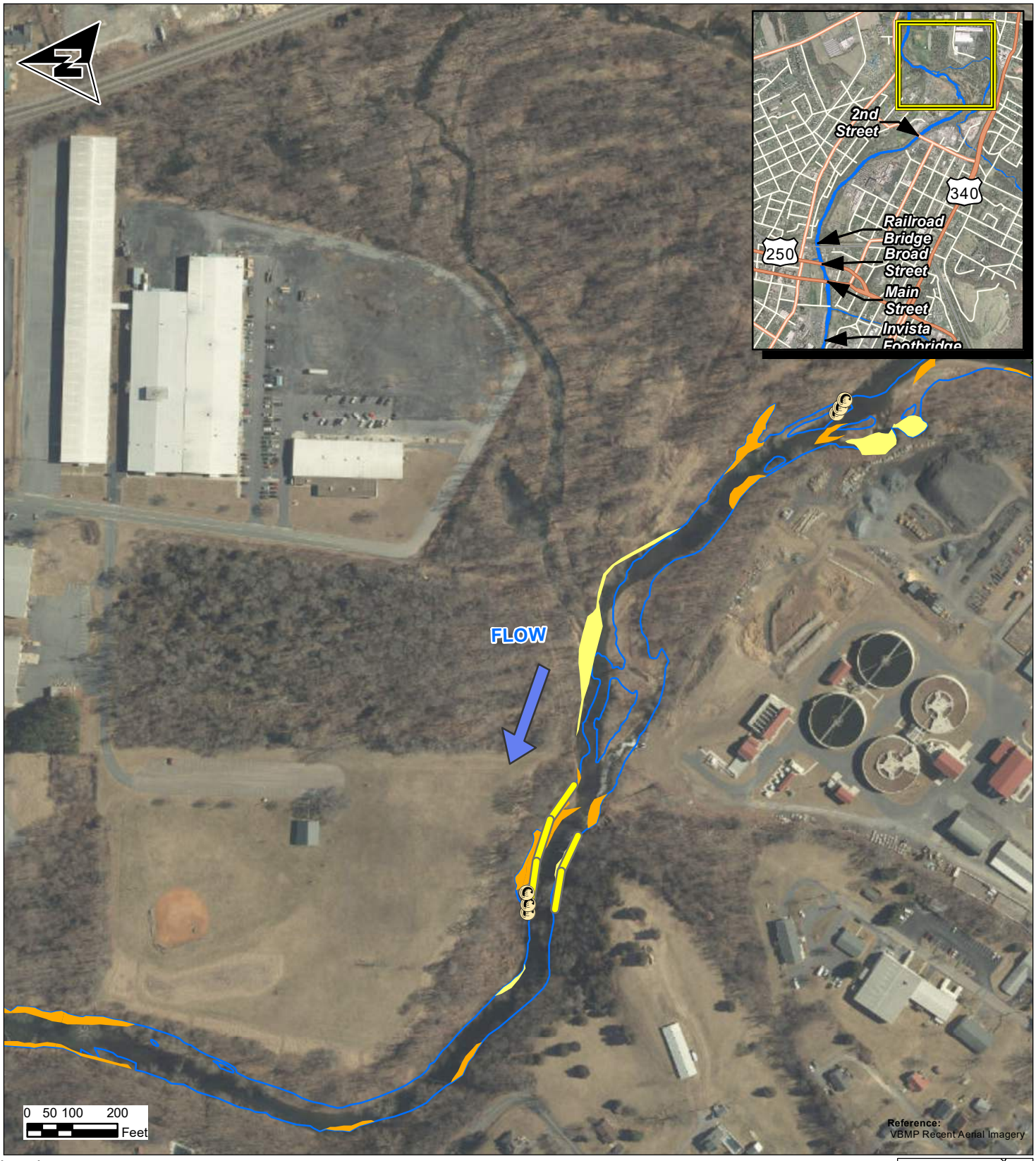

Legend

- Periphyton/Clam
- Benthic Community
- Vegetative Plots
- Sediment/PoreWater/ Canopy/Pebble Count
- Large Woody Debris
- River Access
- Extent of Short-term Monitoring Location
- Clay and Silt Deposits
- Fine Sand Deposits
- Shoreline

Bank Management Area

- Non-Use BMAs
- Phase 1A Primary BMAs
- Phase 1A Secondary BMAs
- Phase 1B Primary BMAs
- Phase 1B Secondary BMAs

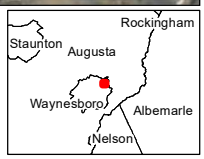

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Figure 1: Sheet 4 of 4
Short-Term Monitoring Stations Overview Map
2019 Short-Term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4
Waynesboro, Virginia

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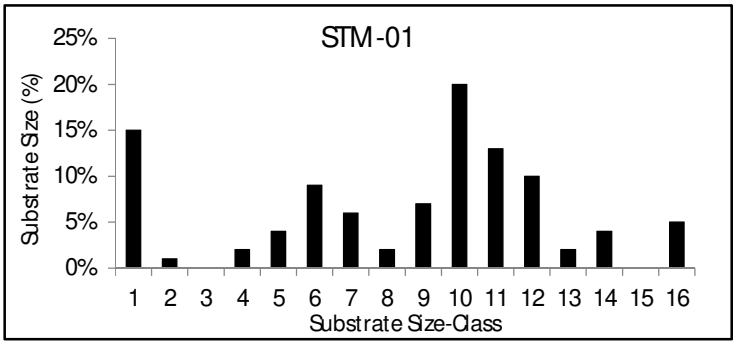
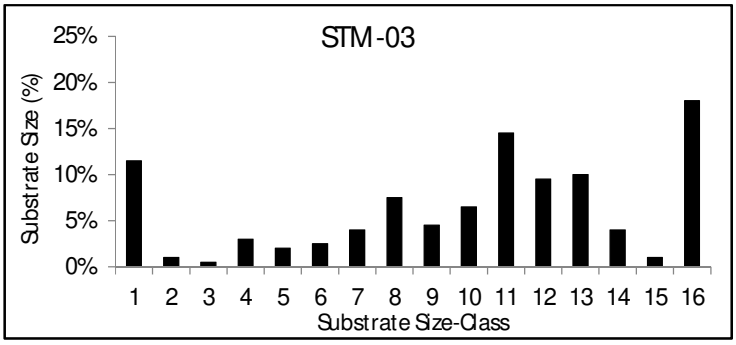
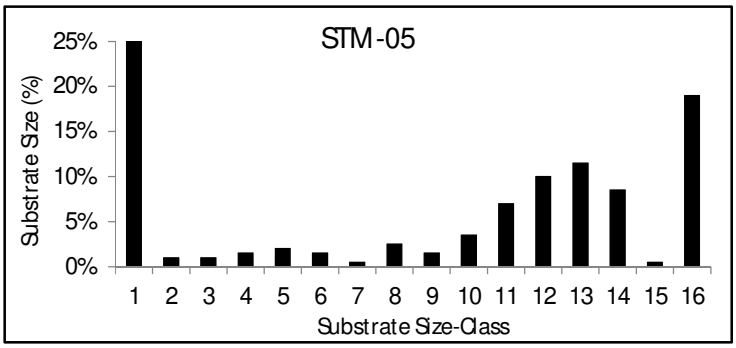
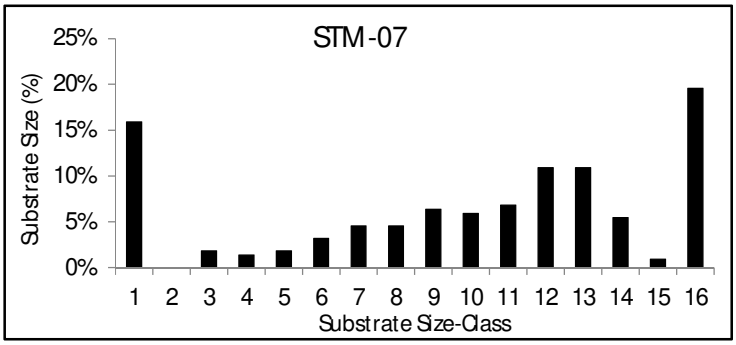
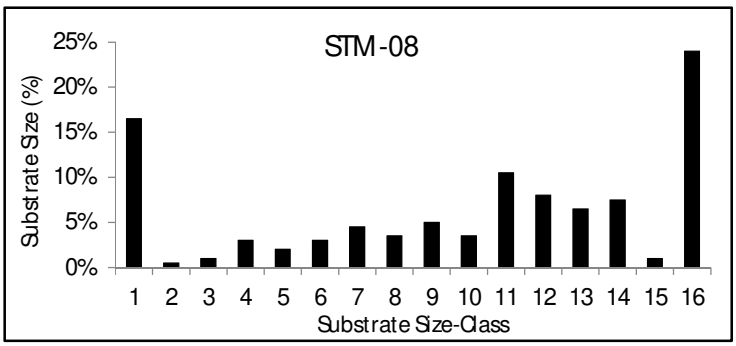
Figure 2
Sediment Grain Size Distribution
2019 Short-Term Monitoring Annual Field Summary Memo
Former DuPont Waynesboro Site, Area of Concern 4











Substrate Size Class Descriptions		
Substrate Size-Class	Size Range (mm)	Description
1	0 - 2.0	Sand/Fines
2	2.0 - 2.8	Very Fine Gravel
3	2.8 - 4.0	Very Fine Gravel
4	4 - 5.6	Fine Gravel
5	5.6 - 8.0	Fine Gravel
6	8 - 11.0	Medium Gravel
7	11 - 16	Medium Gravel
8	16 - 22.6	Coarse Gravel
9	22.6 - 32	Coarse Gravel
10	32 - 45	Very Coarse Gravel
11	45 - 64	Very Coarse Gravel
12	64 - 90	Small Cobble
13	90 - 128	Medium Cobble
14	128 - 180	Large Cobble
15	180 - 300	Very Large Cobble
16	>300	Boulder/Bedrock