Department of Defense
Legacy Resource Management Program

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An Analysis of Forest Riparian Buffer Zones on Military Installations in the Chesapeake Bay Watershed

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Appendix 1: List of site GPS coordinates

Installation	State	Site Name	Latitude	Longitude	Ability to Sample	Physiographic Region
Year 1						
Fort Detrick	MD	Carroll Creek 1	39 25.523 N	77 29.153 W	High	Piedmont
	MD	Carroll Creek 2	39 25.609 N	77 27.792 W	High	Piedmont
Indian Head NSWC	MD	Indian Head 1	38 34.807 N	77 11.414 W	High	Coastal Plain
	MD	Indian Head 2	38 35 32.49 N	77 10 46.83 W	High	Coastal Plain
Fort A.P. Hill	VA	Mill Creek Tributary	38 07 24 N	77 17 37 W	High	Coastal Plain
NIOC Sugar Grove	WV	S. Fork S. Branch Potomac	38 34.404 N	79 16.505 W	High	Ridge & Valley
NAB Little Creek	VA	Boone Clinic	36 54 30 N	76 9 22 W	High	Coastal Plain
	VA	Tidal Ditch			Low	Coastal Plain
Langely AFB	VA	Pine Ditch			Low	Coastal Plain
	VA	Unknown			Low	Coastal Plain
NMC Portsmouth	VA	Tidal Creek	36 50 49.40N	76 18 49.35W	Low	Coastal Plain
NRL Chesapeake	MD	Ditch			High	Coastal Plain
NSWC Carderock	MD	Ball Field Upstream Tributary	38 58 31.24	77 11 17.53	High	Piedmont
	MD	Bill Morgan Creek	38 58 36.46 N	77 11 58.23W	High	Piedmont
	MD	Ball Field			Low	Piedmont
	MD	Paved over parking lot			Low	Piedmont
Year 2						
Carlisle Barracks	PA	CB 1	40 12.721 N	77 10.520 W	High	Piedmont
	PA	CB 2	40 12.757 N	77 10.683 W	High	Piedmont
NWS Yorktown	VA	YT 1	37 13.537 N	76 34.988 W	High	Coastal Plain
	VA	YT 2	17 13.368 N	76 35.706 W	High	Coastal Plain
	VA	YT 3	37 14.601 N	76 34.796 W	High	Coastal Plain
Norfolk Naval Ship Yard - St. Julien's Creek Annex	VA	SJ 2	36 47.630 N	76 18.951 W	Medium	Coastal Plain
	VA	SJ 3	36 47 28.44 N	76 18 45.30 W	Medium	Coastal Plain
	VA	SJ 4	36 47 27.07	76 18 23.97 W	Medium	Coastal Plain
*Norfolk Naval Ship Yard – New Gosport	VA	NG 1	36 48 39.60 N	76 19 26.64 W	Low	Coastal Plain
Fort Meade	MD	FM 1	39 05 31.24 N	76 44 21.92 W	High	Coastal Plain
	MD	FM 2	39 05 50.01 N	76 44 39.22 W	High	Coastal Plain
	MD	FM 3	39 05 21.91 N	76 44 19.36 W	High	Coastal Plain
*Craney Island Fuel Depot	VA	CI 1	36 53 10.81 N	76 21 53.05 W	Low	Coastal Plain

Table 1: List of sites with GPS coordinates

* Sites do not functionally exist

Appendix 2: Water Quality Data

Site	Temp	SPC	DO (mg/l)	DO %	Salinity	NO3	NH4	SRP	TP	TSS
				Year 1						
Mill Creek Tributary	17.6	30.7	5.92	62.1	0.1	0.0353	0.013	0.0021	0.0274	3.8
Indian Head 1	14.7	222.7	5.91	59.2	0.1	0.1710	0.004	0.0421	0.1973	11.6
Indian Head 2	14.8	407.7	7.83	79.1	0.1	1.0600	0.003	0.4459	0.4627	12.3
Bill Morgan Creek	14.3	0.9	7.69	75.1	0.011	0.2080	0.013	0.0031	0.0107	3.2
S. Fork S. Branch Potomac	14.1	100.6	9.5	92.2	0.1	0.2260	0.003	0.0028	0.0060	2.4
Ball Field Upstream Tributary	13.7	381.6	4.21	43.1	0.2	0.4580	0.032	0.0025	0.0163	12.5
Boone Clinic	18.9	21.22	6.57	76.6	12.8	0.7530	0.066	0.0174	0.0543	14.0
NRL Ditch	21.2	12.2	6.05	55.4	0.1	0.7530	0.048	0.0037	0.0624	11.4
Carroll Creek 1	15.6	276.1	10.1	106.1	0.1	1.8200	0.016	0.0087	0.0151	2.4
Carroll Creek 2	15.5	215.4	6.99	70.2	0.1	4.5900	0.025	0.0068	0.0460	12.3
				Year 2						
Carlisle Barracks 1	14.1	534	11.2	111.8	0.3	6.43	0.027	0.0029	0.0095	5.3
Carlisle Barracks 2	14.4	546	11.25	110.1	0.3	6.14	0.007	0.0016	0.0089	4.2
NWS Yorktown 1	16.6	203.6	7.92	80.1	0	0.225	0.05	0.0022	0.0209	9.0
YT 2	22	279.6	5.2	59.2	0	0.0289	0.037	0.005	N/A	6.5
YT 3	19.2	459.1	7.7	83.6	0.2	0.133	0.053	0.0022	0.0319	13.5
Norfolk Naval Ship Yard - St. Julien's Creek Annex 2	30.3	15.9	3.85	57.5	9.3	0.061	0.515	0.0328	0.2274	70.7
SJ 3	27	23.17	8.9	120	14	0.204	0.302	0.0077	0.0805	42.0
SJ 4	24.1	23.44	7.6	98.2	14.1	0.247	0.223	0.008	0.0602	33.3
Fort Meade 1	21.1	350.1	9.54	106.7	0.1	0.796	0.057	0.0035	0.0443	4.3
FM 2	19.1	268.3	11.35	116.6	0.1	1.573	0.028	0.0027	0.0079	2.4
FM 3	20.5	301.1	11.6	118.5	0.1	1.278	0.038	0.0021	0.0172	3.1

Table 3: Water Quality Data *N/A = laboratory accident, no data

Appendix 3: All reported benthic macroinvertebrate data

Site	Total Taxa	% EPT	% Plec	% Ephem	% Trich	No. intol	% Tolerance	% Dominance	FBI
				Year 1					
Indian Head 2	10	2.326	0	0	2.326	0	62.326	36.279	6.29
Bill Morgan Creek	10	14.103	0	0	14.103	1	65.385	48.606	6.61
S. Fork S. Branch Potomac	21	38.785	6.075	29.907	2.804	63	49.065	30.374	5.51
Ft. Detrick 1	4	0	0	0	0	0	72.889	58.667	6.62
Mill Creek Tributary	17	6.612	0.413	3.306	2.894	10	60.331	47.107	6.39
Indian Head 1	10	11.275	10.294	0	0.980	24	55.392	28.431	6.75
Boone Clinic	6	0	0	0	0	0	98.049	59.314	8.78
Ft. Detrick 2	13	5.911	0	0.985	4.926	0	99.015	59.606	8.78
Ball Field Upstream Tributary	10	0	0	0	0	0	92.233	71.845	9.077
NRL Chesapeake	6	0	0	0	0	0	68.908	31.092	7.22
				Year 2					
Fort Meade 1	7	0	0	0	0	0	36.036	54.054	6.514
Fort Meade 2	8	0.763	0	0.763	0	1	80.916	75.573	6.809
Fort Meade 3	8	0.775	0	0.775	0	2	68.217	64.341	6.14
Yorktown 1	6	0.901	0	0	0.901	1	21.621	77.477	6.27
Yorktown 2	9	0	0	0	0	0	84.545	65.455	7.182
Yorktown 3	6	0	0	0	0	0	67.901	65.432	6.704
Carlisle Barracks 1	8	1.550	0	1.550	0	1	7.751	72.093	6.008
Carlisle Barracks 2	10	1.399	0	0.699	0.699	0	36.364	33.566	6.259

Table 5: Benthic macroinvertebrate results

Appendix 4: All reported total habitat scores

Site Name	Total Score
Year 1	
Carroll Creek 1	115
Carroll Creek 2	121
Indian Head 1	116
Indian Head 1	105
Mill Creek Tributary	141
S. Fork S. Branch Potomac	186
Boone Clinic	99
NRL Ditch	115
Bill Morgan Creek	124
Ball Field Upstream Tributary	121
Year 2	
Fort Meade 1	133
Fort Meade 2	130
Fort Meade 3	170
SJ 2	N/A
SJ 3	112
SJ 4	107
Yorktown 1	152
Yorktown 2	169
Yorktown 3	162
Carlisle Barracks 1	113
Carlisle Barracks 2	132

Table 7: Habitat Scores

Appendix 5: Habitat Assessment Sheet Example (High Gradient Stream)

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____