ANACOSTIA TRASH TMDL-RELATED BASELINE CONDITIONS MONITORING IN MONTGOMERY AND PRINCE GEORGE'S COUNTY

Prepared by
Jan Ducnuigeen
Interstate Commission on the Potomac River Basin

for

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Cover photo: Dense stream trash in Watts Branch at Bugler Street
Contributions: Many thanks to George Meyers (USGS, Beltsville Agricultural Research Center) for providing Rainfall data

Introduction

In cooperation with the Metropolitan Washington Council of Governments (MWCOG), the Interstate Commission on the Potomac River Basin (ICPRB) completed a year long Anacostia watershed baseline conditions trash monitoring. These baseline conditions data will be used by the Maryland Department of the Environment (MDE) in the development of a trash total maximum daily load (TMDL) for the Maryland portion of the Anacostia River watershed. Thirty sites were monitored four times between the spring of 2008 and the spring of 2009, and trash items enumerated into 27 different categories. Monitoring data was collected and submitted to MWCOG, and this report summarizes the results.

Project Scope

An Anacostia watershed baseline conditions trash monitoring was conducted in four seasons (Spring 2008, Summer 2008, Winter 2008/2009, Spring 2009), at 15 stream sites in Montgomery County and 15 stream sites Prince George's County Maryland. The purpose was to help characterize both generic types of trash and associated subwatershed loading and delivery rates to aid the MDE in it's development of a trash TMDL for the Maryland portion of the Anacostia watershed. Individual pieces of trash were counted in the same 500 foot long reaches at each site throughout the study, and sites were visited by either teams of between one and five people counting trash items individually. Attempts were made to visit sites sometime after rain events, but also after enough time had passed to allow water clarity to improve to provide as much visual observation of trash in the water column as possible. In addition to counts of trash by category, observations about general stream conditions were noted and photographs of stream conditions were made.

Methodology

Training

A training session of ICPRB staff with MWCOG instructors was completed in early June 2008. The session consisted of instruction on the typical types of trash encountered, the sizes of trash to be counted, methods of measuring and tagging site survey length, enumeration of broken parts of certain types of trash, and instruction on notion on paper data sheets. Up to 5 surveyors were used in a QA/QC component of the training to help standardize the methods of enumeration.

Site Selection

An initial list of 15 survey sites in Montgomery County and 15 sites in Prince George's County with GPS location information was provided in advance of the field surveys, as shown in Figure 1. and the names of the sites and the county in which they are located are shown in Table 1.

Table 1. GPS coordinates of upper and lower trash survey sites.

Site ID	Lower Limit Latitude	Lower Limit Longitude	Upper Limit Latitude	Upper Limit Longitude	Watershed	Site Name	Tributary name or mainstem	County
05-001	38.98940	-76.93430	38.98843	-76.93302	Paint Branch/Northeast Branch	Route 1	mainstem	P.G. Co.
05-004	39.00195	-76.93399	39.00341	-76.93382	Paint Branch/Northeast Branch	University Blvd	Mainstem	P.G. Co.
07-008B	39.00372	-76.91305	39.00416	-76.91459	Indian Creek	Greenbelt Metro	Mainstem	P.G. Co.
07-033	39.04736	-76.89604	39.04876	-76.89570	Indian Creek	Ammendale Road	Mainstem	P.G. Co.
07-038	39.02756	-76.90395	39.02859	-76.90319	Indian Creek	Beaverdam Road	Mainstem	P.G. Co.
09-006	38.95307	-76.96860	38.95369	-76.97006	Northwest Branch	Hyattsville Metro	Mainstem	P.G. Co.
14-001	38.97165	-76.98090	38.97193	-76.98264	Sligo Creek/Northwest Branch	Parklawn Park	Mainstem	P.G. Co.
14-002A	38.97188	-76.98930	38.97125	-76.99085	Sligo Creek/Northwest Branch	Takoma Branch	Takoma Branch	P.G. Co.
15-006	38.96420	-76.92187	38.96562	-76.92182	Northeast Branch	Riverdale Park	Mainstem	P.G. Co.
19-003	38.91637	-76.93466	38.91617	-76.93330	Lower Beaverdam Creek	Route 50	Mainstem	P.G. Co.
19-020A	38.88226	-76.89347	-38.88102	-76.89365	Lower Beaverdam Creek	Cabin Branch	Cabin Branch	P.G. Co.
19-040A	38.94354	-76.87536	38.94348	-76.87352	Lower Beaverdam Creek	New Carrollton Metro	Mainstem	P.G. Co.
20-004	38.94513	-76.94106	38.94589	-76.93963	Northeast Branch	Route 1 Alternate	Mainstem	P.G. Co.
22-003	38.88769	-76.90913	38.88669	-76.90912	Watts Branch	Bugler Street	Mainstem	P.G. Co.
22-004	38.88790	-76.91323	38.88658	-76.91373	Watts Branch	Faye Street	Mainstem	P.G. Co.
LPLP109	39.09433	-76.92721	39.09500	-76.92861	Little Paint Branch	Fairland Park (north)	Mainstem	Mont. Co.
LPLP202	39.06693	-76.93770	39.06753	-76.93883	Little Paint Branch	Briggs Chaney Rd	Tanglewood Trib	Mont. Co.
LPLP205	39.07293	-76.92865	39.07397	-76.92945	Little Paint Branch	South Greencastle Rd	Mainstem	Mont. Co.
LPLP301A	39.08073	-76.92575	39.08213	-76.92628	Little Paint Branch	Fairland Park (central)	Mainstem	Mont. Co.
NWBF301	39.11961	-77.04552	39.11946	-77.04710	Northwest Branch	Batchellors Run	Batchellors Run	Mont. Co.
NWBP205	39.07257	-77.04231	39.07292	-77.04378	Northwest Branch	Bel Pre Creek	Bel Pre Creek	Mont. Co.
NWNW206A	39.11999	-77.01021	39.11997	-77.00866	Northwest Branch	Nursery Run	Bryants Nursery Run	Mont. Co.
NWNW402	39.10174	-77.03660	39.10034	-77.03678	Northwest Branch	Layhill Park	Mainstem	Mont. Co.
NWNW407D	39.06138	-77.02411	39.06236	-77.02497	Northwest Branch	Kemp Mill Rd	Mainstem	Mont. Co.
PBHB210	39.05636	-76.97846	39.05724	-76.97938	Paint Branch/Northeast Branch	Hollywood Branch	Hollywood Branch	Mont. Co.
PBPB308	39.06000	-76.97959	39.06100	-76.98076	Paint Branch/Northeast Branch	Valley Mill Park	Mainstem	Mont. Co.
SCLB101	38.98840	-76.99679	38.98945	-76.99760	Sligo Creek/Northwest Branch	Long Branch	Long Branch	Mont. Co.
SCSC204	39.03176	-77.02986	39.03292	-77.02970	Sligo Creek/Northwest Branch	University Blvd	Mainstem	Mont. Co.
SCSC301	39.01798	-77.03314	39.01946	-77.03308	Sligo Creek/Northwest Branch	Forest Glen Rd	Mainstem	Mont. Co.
SCSC314	38.98249	-76.99918	38.98355	-77.00050	Sligo Creek/Northwest Branch	Carroll Ave	Mainstem	Mont. Co.

The GPS coordinates were used in conjunction with aerial photographs to gain information on site access points and to coordinate the order in which sites were visited. Most sites were visited in an order which would reduce travel time between stations and maximize the options for parking near each site. Initial site visits would began with an assessment of the best location for the 500 foot length survey reach. Efforts were made to place the center of the proposed GPS sites in the middle of the 500 foot survey reach. At many sites, the GPS coordinates for the center of the proposed site proved to be less favorable for accessibility reasons, and as a result some of the 500 foot survey reaches were shifted up or downstream of the proposed GPS locations to improve access. All of the final 500 foot reaches were less than one tenth of a mile from their original proposed locations. Once an appropriate upstream or downstream limit of the reach was determined, 500 feet was measured from one limit to another by using a string towed behind a surveyor and measured using a Haglof hip chain, while following the wetted channel curves throughout the reach. Orange flag markers on the stream banks were used to identify the upper and lower limits and to facilitate identification of the same survey reaches in subsequent seasons.

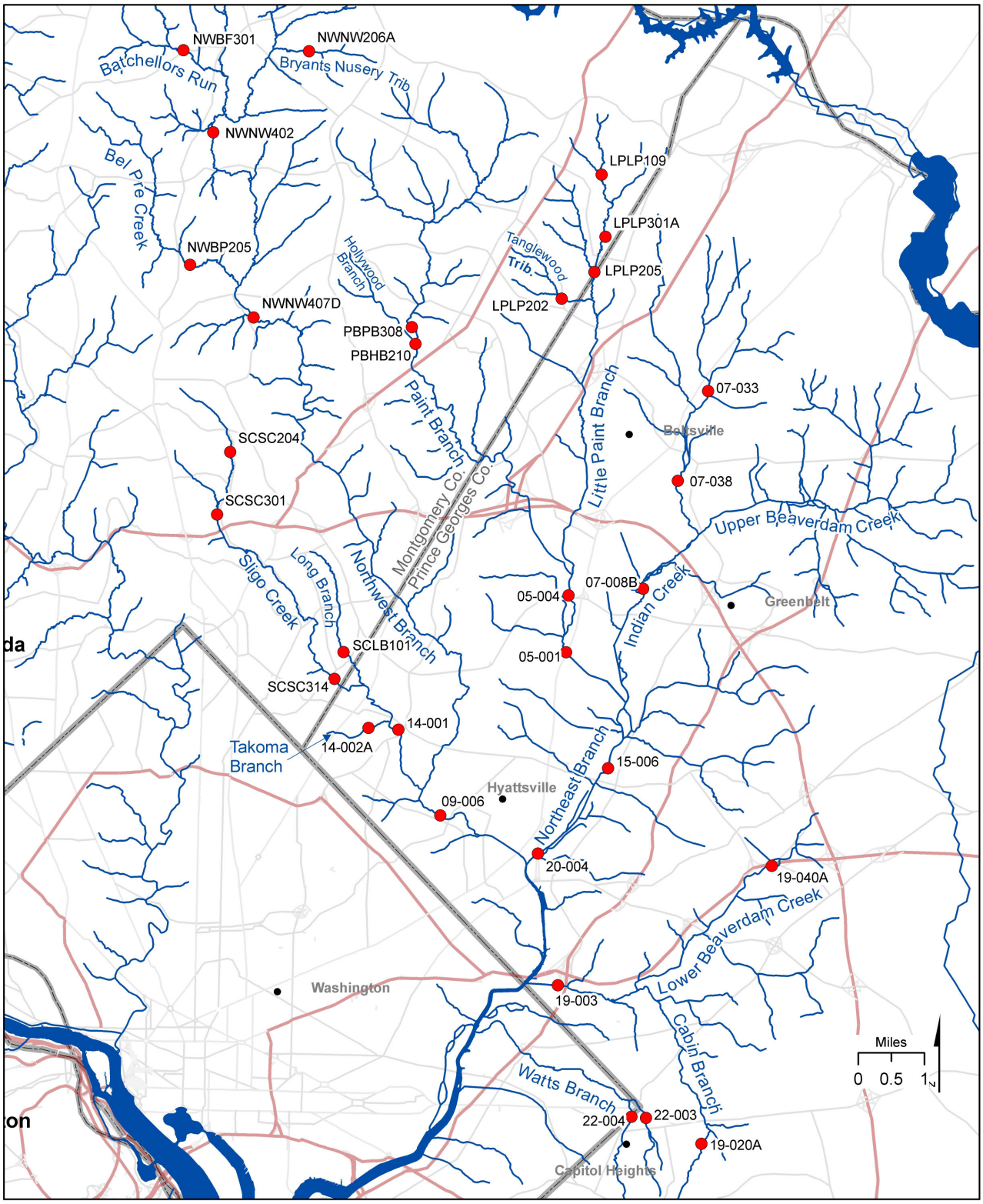


Figure 1. Trash baseline monitoring sites in the Anacostia watershed.

Some survey reach start or end points were selected based on the proximity of tributary confluences, and road or pedestrian bridges. Appendix A contains photos and site descriptions of each of the 30 sites used in this survey. Once 500 foot survey reaches were measured and established in the field, GPS measurements were made on the upper and lower limits of each reach, and the geographic location recorded.

Site visit procedures

Each of the 30 sites were surveyed 4 times between June 2, 2008 and April 10, 2009, and survey events occurred during roughly seasonal periods representing spring, summer, fall/winter, and again the following spring. As much as possible, surveys in a single season were conducted at all 30 sites within a 30 day period of each other, and site visits were attempted after rainfall events but after the water clarity or turbidity had improved to facilitate observation of trash items in the deeper pools.

Starting at either the lower or upper limit of each survey reach, individual trash items located within the bank-full sections of the stream were enumerated and recorded in one of 27 different categories of trash. Items were only counted if they were larger than a bottle cap, and a hand tally clicker was used to enumerate some of the most commonly encountered trash items. A list of the 27 different categories of trash are shown below:

Plastic Bags
Plastic Bottles
Glass Bottles
Aluminum Cans
Styrofoam (cups, packaging etc.)
Paper (newspapers, magazines, etc.)
Cardboard
Cloth/Clothing/Carpeting
Construction Debris: Bricks (>1/2 brick)
Construction Debris: Lumber
Appliances
Metal (Drums, Cans, Pipes, bars, cable)
Toiletries/Drug Containers
Miscellaneous
Food Packaging
Oil Quart Containers
Oil Filters
Antifreeze Containers
Auto Body Parts (Large: >1 ft^2)
Auto Body Parts (Small: <1 ft^2)
Car Batteries
Tires
Construction Debris: Concrete
Construction Debris: Misc. (drywall, etc.)
Wooden Pallets
Shopping Carts
Sports Equipment/Toys

While enumerating trash items through the survey reach, the number of "strainers" was recorded. Figure 2 shows an example of a strainer in a stream. A strainer was defined as any in-stream

Figure 2. An example of a stream strainer, or in-stream obstruction which traps pieces of trash.

obstruction that would cause the trapping of trash items, and usually consisting of fallen trees, branches

or other large objects.

Survey start and end times, date, survey reach station name and number were also recorded. General comments about survey site conditions, as well as photographs, were noted. Estimates of whole items, which appeared in the survey area, were recorded. For example, a count of one glass bottle was recorded if several pieces of glass could be found which together amounted to a whole bottle. Any item that could not be identified as being in any established category was recorded as a miscellaneous item. Typically a single surveyor visited the sites, but in more difficult reaches, due to the volume of trash and safety issues, at least two surveyors visited a site. At sites where there were multiple surveyors, the average number of pieces for each of the 27 categories was recorded as the number of items for that station.

Results

Thirty sites were surveyed four times between June 2, 2008 and April 10, 2009. Survey periods were as follows:

Spring 2008: 30 sites surveyed between June 2, 2008 and July 2, 2008.
Summer 2008: 30 sites surveyed between August 1, 2008 and August 21, 2008
Winter 2008/2009: 30 sites surveyed between December 29, 2008 and January 30, 2009.
Spring 2009: 30 sites surveyed between March 23, 2009 and April 10, 2009.

Surveys were not conducted between October and mid December 2008 due to the high volume of fallen leaves inundating the stream channels and obscuring the enumeration of trash items. Figure 3 provides an example of the conditions during those times impacted by fallen leaf cover.

Figure 3. Leaf cover in November obscuring stream bottom and impacting trash enumeration.

Over the entire course of the survey a total of 35,913 pieces of trash were counted at all sites, with the six most common types of trash amounting to a total of 26,358 pieces, or 73% of the total. The six most common types of trash in descending order of frequency were plastic bags, food packaging, styrofoam, plastic bottles, aluminum cans, and glass bottles. Table 2 shows summary trash totals by season and trash type. Plastic bags accounted for 45% of the six most common types of trash, while food packaging accounted for 16% of the six most common types. The spring 2008 site surveys had the

highest trash totals counted, while the spring of 2009 site surveys had the least.

Table 2. Summary of Baseline Stream Trash Survey and Six of the Most Common Types

Type of Trash	Spring 2008	Summer 2008	Winter 08/09	Spring 2009	Total
Plastic Bags	4,301	3,148	2,396	2,127	11,972
Food Packaging	942	1,249	917	1,034	4,142
Styrofoam	978	543	870	871	3,262
Plastic Bottles	883	664	721	835	3,103
Aluminum Cans	632	511	824	576	2,543
Glass Bottles	372	293	317	354	1,336
All other categories combined	2,591	2,262	2,337	2,365	9,555
Totals	10,699	8,670	8,382	8,162	35,913

Table 3 shows the average number of pieces of trash through the four seasons of the survey calculated per 100 ft of stream in either Montgomery or Prince George's County, and Figure 4 shows the average trash items per 100 feet of stream geographically in a map of the survey sites. The upper reaches of the Northwest Branch, Sligo Creek and Little Paint Branch had relatively low trash counts, while Indian Creek, the lower reaches of the Northwest and Northeast Branches, Beaverdam Creek and Watts Branch had much higher trash counts. Three survey sites on either Indian Creek, Beaverdam Creek, or Watts Branch had the highest amounts of trash, with an average of over 130 pieces of trash per 100 feet. A detailed site by site view can be seen in Appendix A. Rain fall amounts in Table 3 are an average rainfall in inches obtained from two rain gauges monitored by the Beltsville Agricultural Research Center in Beltsville, Maryland. The rainfall amounts shown in the table represent accumulated total inches for the period up to the previous seasons' site visit. For the spring 2008 survey site visits, the totals represent all rainfall prior to the site visit but after April 1, 2008

Appendix B shows graphs of average number of pieces of trash per 100 ft for each station during each season. Appendix C shows a single graph of the average number of pieces of trash per 100 ft for each station over all seasons.

Discussion

Monitoring of the baseline conditions of trash in the Anacostia watershed shows generally higher levels of trash in Prince George's County than Montgomery County. Many of the sites in Prince George's county are located near more densely populated and industrial areas and this likely contributes to the differences in the amounts of trash seen between the two counties. Indian Creek and Beaverdam Creek flow through larger industrial and transportation centers, with the Indian Creek site at Beaverdam Road (07-038) and the Beaverdam Creek site at Route 50 (19-003) showing signs of heavy inflows of industrial trash such as tires, construction debris and car parts. Beaverdam Creek at the New Carrollton Metro site (19-040A) seems to show the trash influence from transportation centers such as the metro parking lots, industrial truck parks, and the close proximity to Route 50. High numbers of trash bags, food packaging, styrofoam, bottles, and cans contribute significantly to the streams in the high density residential areas near the Watts Branch site at Bugler Street (22-003), Takoma Branch/Sligo Creek site (14-002A), Sligo Creek at the Parklawn Park site (14-001), the Northwest Branch at the Hyattsville Metro site (09-006), and the Northeast Branch at Riverdale Park site (15-006). On two separate visits to the Paint Branch site at Route 1, deliberate dumping of large numbers of beer cans and newspapers on the banks of the stream contributed to the large number of trash counts there (figure 4). The Watts

Table 3. Pieces of trash per 100 ft of stream and rainfall prior to site visit at each survey site in Montgomery and Prince George's County.

	Spring 2008		Summer 2008		Winter 08/09		Spring 2009		Average Pieces of trash per 100 ft
	Trash per 100 ft	Rainfall (inches) prior to site visit	Trash per 100 ft	Rainfall (inches) prior to site visit	Trash per 100 ft	Rainfall (inches) prior to site visit	Trash per 100 ft	Rainfall (inches) prior to site visit	
Survey Sites: Montgomery County									
Upper Northwest Branch									
NWNW206A	1.0	11.5	0.0	5.3	0.4	9.1	0.6	3.1	0.5
NWBF301	7.8	11.5	4.0	5.3	3.2	9.1	3.2	3.1	5
NWNW402	5.2	11.5	1.6	5.3	2.6	9.1	2.4	3.1	3
NWBP205	29.6	11.5	31.8	5.3	37.2	9.1	26.0	3.1	31
NWNW407D	33.2	11.5	19.4	5.3	28.4	9.1	19.8	3.1	25
Sligo Creek								3.1	
SCSC204	18.6	8.8	16.0	5.2	5.6	9.1	5.0	3.1	11
SCSC301	11.2	8.8	5.2	5.2	7.2	9.1	4.2	3.1	7
SCSC314	35.8	11.5	27.4	5.3	25.6	9.1	29.8	4.2	30
SCLB101	13.2	11.8	26.8	5.3	12.6	8.9	6.8	3.1	15
Paint Branch									
PBPB308	7.4	12.0	8.0	5.4	11.8	10.7	5.2	2.4	8
PBHB210	68.4	12.0	58.2	5.4	61.6	10.7	40.8	2.4	57
Little Paint Branch									
LPLP109	16.6	12.6	18.2	5.4	9.0	10.7	7.6	2.5	13
LPLP301A	10.0	12.6	10.4	5.4	19.2	10.7	9.4	2.5	12
LPLP205	20.8	12.0	15.4	5.4	14.0	10.7	8.2	2.4	15
LPLP202	8.0	12.0	7.0	5.4	2.2	10.7	2.6	2.8	5
Survey Sites: Prince George's County									
Paint Branch									
05-004	51.4	12.0	37.4	5.4	14.6	8.9	10.6	4.2	29
05-001	38.6	11.1	37.6	4.9	94.0	8.9	54.6	4.2	56
Indian Creek									
07-033	22.4	8.6	21.2	4.6	28.4	10.7	21.0	2.8	23
07-038	159.4	8.6	125.4	4.6	125.2	10.7	108.4	2.8	130
07-008B	31.6	8.6	18.0	4.6	30.2	10.7	33.0	2.8	28
Northeast Branch									
15-006	82.2	11.1	57.8	5.3	72.0	8.9	43.8	4.3	64
20-004	55.4	5.2	37.6	3.6	55.6	8.9	36.8	4.2	46
Sligo Creek									
14-002A	122.2	11.7	96.2	5.4	81.2	8.9	86.0	4.2	96
14-001	62.0	11.1	57.0	5.4	76.2	8.9	92.6	4.2	72
Lower Northwest Branch									
09-006	67.8	11.6	65.4	5.3	53.8	8.9	51.0	4.2	60
Beaverdam Creek									
19-020A	87.4	10.5	66.6	6.5	13.4	11.8	20.2	2.7	47
19-040A	170.8	7.8	142.4	4.4	101.2	11.8	133.2	2.7	137
19-003	157.8	7.8	111.4	4.4	104.6	11.8	97.2	2.7	118
Watts Branch									
22-003	223.4	10.5	164.4	6.5	86.4	11.8	180.8	2.7	164
22-004	2.4	11.0	1.8	6.5	6.6	11.8	36.8	2.7	12

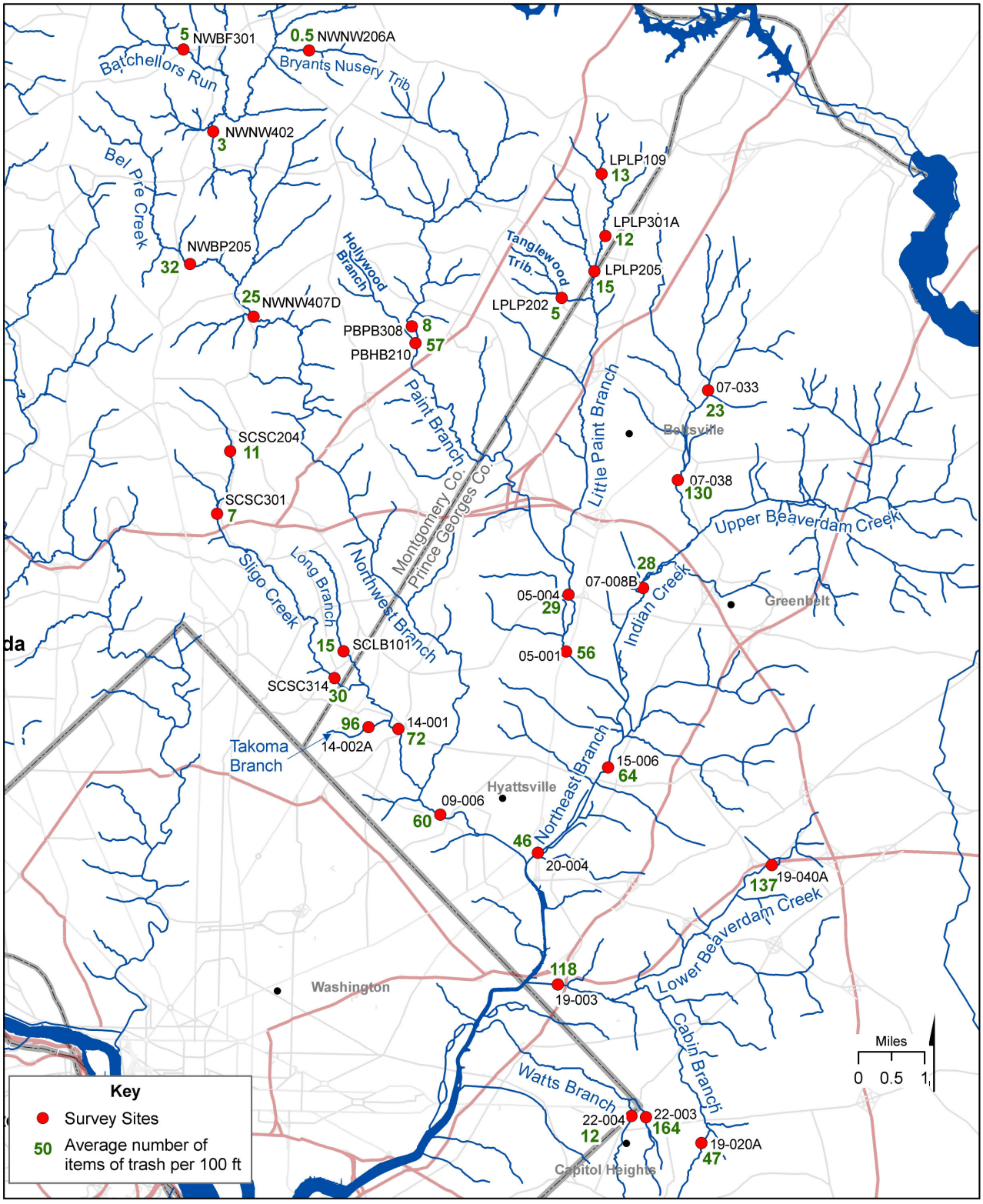


Figure 4. Map of survey sites with the average number of trash items counted per 100 feet of stream.

Figure 4. Evidence of deliberate dumping of cans and newspapers on Paint Branch at Route 1 (05-001).

Branch site at Faye Street (22-004) is situated in a concrete channelized stream bed. The smooth surfaces of these channels likely contributed to the lower trash counts at this somewhat high density residential area. The Watts Branch at Bugler street site (22-003) showed significant changes between 2008 and 2009, with complete stream channel regrading using heavy earth moving equipment and removal of stream riparian vegetation. While this site had high volumes of trash in 2008 (Figure 5), the changes made at this site seemed to affect the volumes counted in 2009 by possibly increasing the surface exposure of existing buried trash (Figure 6).

Figure 5. Large volumes of trash on Watts Branch at Bugler Street (22-003) in spring 2008 before changes were made to the riparian corridor. The foreground gravel bar has significant broken glass pieces.

Figure 6. Large volumes of trash on Watts Branch at Bugler Street (22-003) in spring 2009 after changes were made to the riparian corridor.

Beaverdam Creek at the New Carrollton metro site also showed significant changes between 2008 and 2009. In the spring of 2008 much of the stream survey reach existed as a shallow 6-9 foot wide, less than 1 foot deep channel. In the latter portion of 2008 and into 2009, beaver activity increased, trees were felled, and several beaver dams were created in the stream. In addition, clear cutting of trees by the railroad maintenance crews on the riparian area next to the neighboring train tracks led to increased numbers of tree debris in the stream channel. Both of these activities increased the depth and width of the stream (Figure 7). Turbidity of the water remained high, even weeks after the last major rainfall. As a result, less trash could be observed and thus enumerated in the deep portions of the stream channel in 2009.

Figure 7. Deep portion of Beaverdam Creek at the New Carrollton metro (19-040A) after Beaver activity and railroad right-of-way tree clear cutting.

Many of the survey sites in Montogomery county were in less densely populated and sometimes entirely forested areas, with large park buffers around the stream channels and fewer road crossings. Eight of the 15 sites in Montgomery County exist within these areas, and this likely contributed to the lower trash totals found in the county. In addition, the upper portions of Sligo Creek has been the focus of several watershed groups who periodically work to clean up this tributary and this would also reduce the amount of trash observed and recorded in this baseline survey.

This baseline trash survey of the Anacostia watershed revealed plastic bags representing the single most dominant type of trash in nearly all stream reaches. Plastic bags are often found attached to "strainers", over-hanging trees or other objects in the water (Figure 8). Survey sites containing fewer strainers also seemed to trap fewer plastic bags. During times of high water flow, these plastic bags are often deposited in over hanging trees and limbs, producing a very trash scarred river bank landscape after the water levels drop.

Figure 8. Example of plastic bags hanging on strainers and other objects caught at higher water levels.

Figure 9. View of small white pieces of styrofoam trash commonly found in streams

Another one of the most common types of trash was styrofoam. This type of trash is most commonly found in the form of cups, fast food serving containers, or food coolers. Within the stream, these styrofoam trash items are usually in very small pieces, rather than whole cups, containers or coolers (Figure 9), due to the fragile nature of this type of material. Counts of individual pieces of styrofoam can therefore be very high within a site survey. The lightweight and buoyant nature of the styrofoam also causes this type of trash to be carried long distances downstream during storms.

***Conclusions and Recommendations*:**

This baseline conditions survey of stream trash conditions in the Anacostia watershed showed plastic bags, food packaging, styrofoam, plastic bottles, aluminum cans, and glass bottles were the six most common types of trash counted, with plastic bags the most dominant. Higher levels of stream trash occurs in areas in close proximity to commercial, industrial, transportation or moderate to high intensity residential areas. Future monitoring of stream trash levels should not be conducted between the months of October and December due to the high volume of fallen leaves in the stream.

Efforts to reduce the use of the six most common types of trash could significantly reduce the volume of trash found in the Anacostia watershed. Reduction in use programs, bag fees or bottle bills should be considered in any trash reduction strategy.

Appendix A: Survey Site Descriptions

22-004: Watts Branch at Faye Street

This concrete channelized stream begins at the overpass at Faye Street and ends just south of the intersection of Dole Street and Capital Heights Blvd.

22-004: Stream channel looking south from Faye St.

22-003: Watts Branch at Bugler Street

This site begins just to the northwest of the end of Bugler Street, south of East Capitol Street and extends southward past a small play area within this unnamed neighborhood park.

22-003: Stream channel before riparian changes

22-003: Stream channel during riparian reconstruction

22-003: Stream channel after riparian reconstruction

19-020A: Beaverdam Creek at Cabin Branch

The northern end of the site starts at a small bridge crossing the stream about 500 feet south of St. Margarets Dr., and extends to a point 500 ft southward marked by flagging, but north of Wilburn Drive.

19-020A: Looking north (downstream) from the middle of the survey reach.

19-020A: View downstream from upper survey reach limit

19-020A: View upstream from lower survey reach limit at small bridge.

19-040A: Beaverdam Creek at New Carrollton Metro

This site begins at a concrete overpass over the stream (an abandoned exit ramp) and continues downstream 500 feet to a flagged marker.

19-040A: View of upstream limit at concrete overpass

19-040A: View looking downstream in middle of survey reach

19-040A: Evidence of beaverdam construction in the lower section of survey reach.

19-003: Beaverdam Creek at Route 50

Upstream limit of survey reach begins at flagged area just downstream of Route 295 overpass and continues 500 feet downstream to flagged marker.

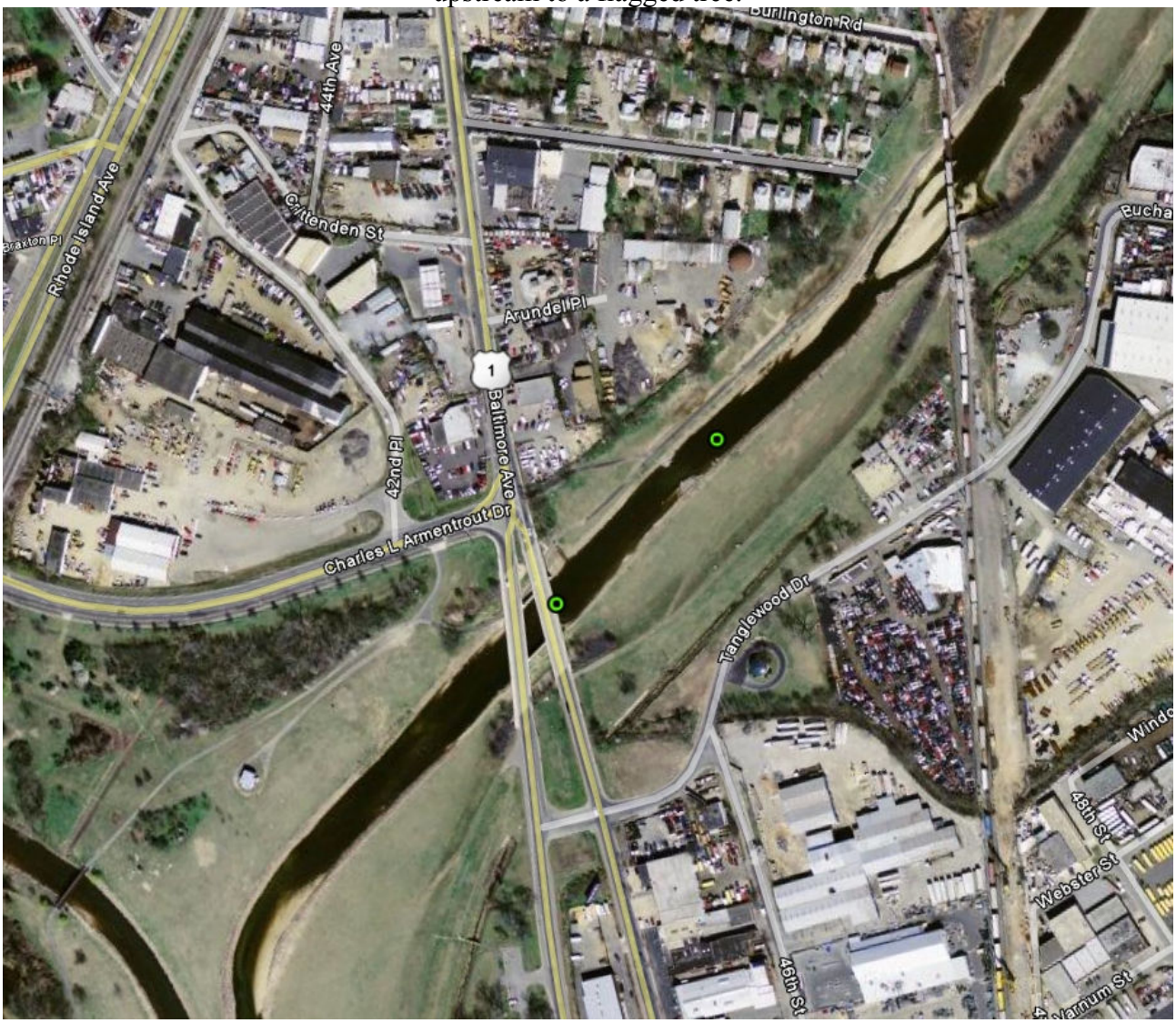
19-003: Looking upstream from lower portion of survey reach

19-003: Looking downstream from just below the Route 295 overpass.

19-003: View looking downstream at submerged tires, car parts and car seats and cloth.

20-004: Northeast Branch at Route 1 Alternate

The lower limit of this survey reach starts at the northbound Route 1 alternate bridge and extends upstream to a flagged tree.



20-004: Looking downstream from upper reach limit.

20-004: Looking downstream from top of rock wing deflector.

20-004: Discarded pesticide sprayer in the water

15-006: Northeast Branch at Riverdale Park

The upper limit of this survey reach starts at a flagged marker just below a rock riffle area south of River Road, and ends 500 feet downstream at a flagged marker.

15-006: View looking downstream from upper survey reach limit

15-006: View of trash strainer

15-006: View of plastic bags trapped on trees during high water flows

07-008B: Indian Creek at Greenbelt Metro

This site is accessed by walking downstream from the Greenbelt Metro parking lot. The upper limit of this survey reach starts at a large bend in the stream channel and continues 500 feet downstream to a flagged marker.

07-008B: View looking upstream from middle of survey reach

07-008B: View looking at trash on bank in middle of survey reach

07-008B: View looking upstream from lower survey reach limit

07-038: Indian Creek at Beaverdam Road

Site is accessed from Edmonston Road. Upper reach limit starts at a large flagged tree at a bend in the stream and continues downstream 500 feet to a marked flag on the bank.

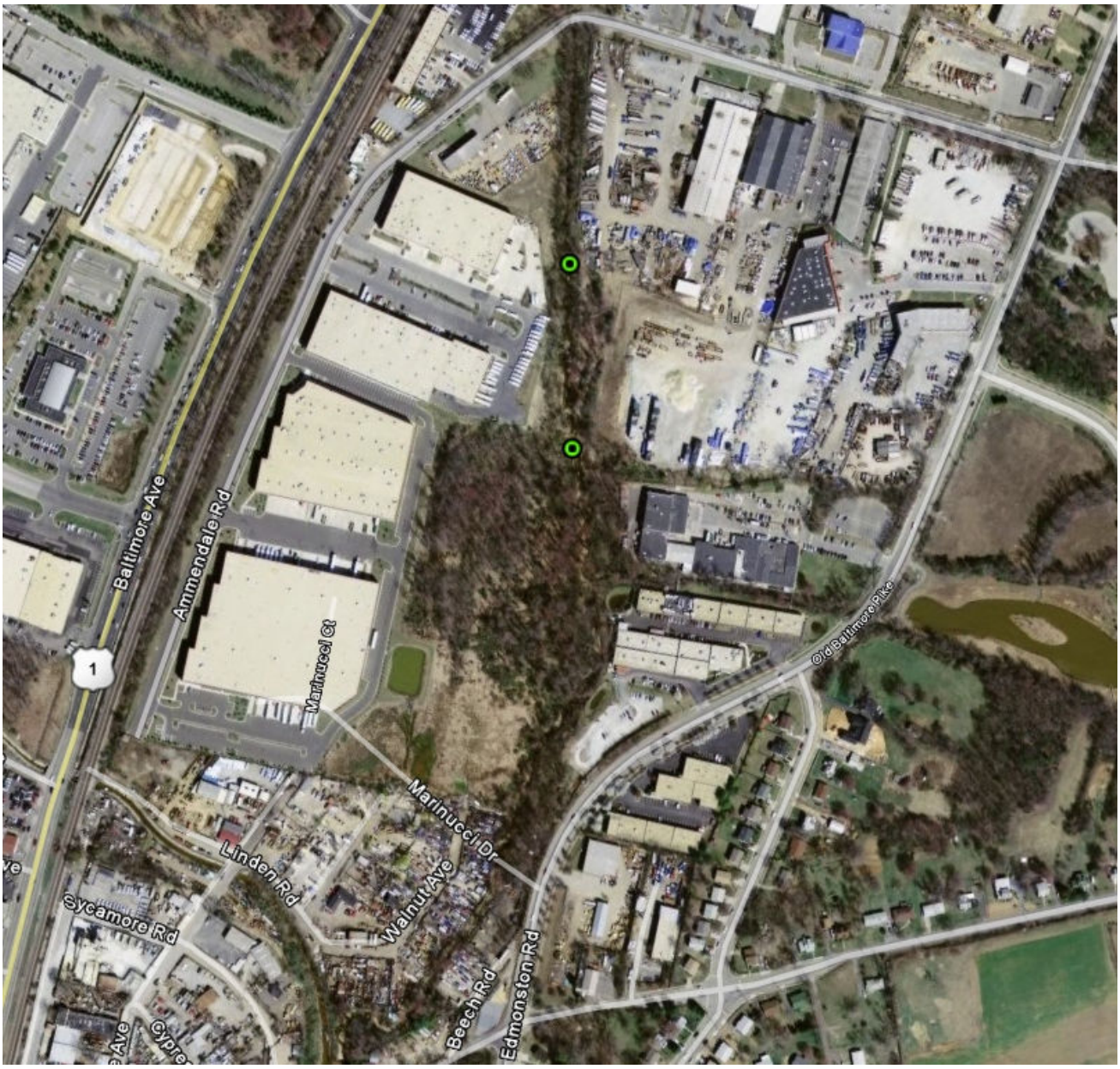
07-038: Log jam of trash and bank trash deposits looking upstream toward upper survey limit

07-038: Trash accumulating in strainer in the middle portion of the survey reach.

07-038: Large truck tires spread out within the survey reach

07-033: Indian Creek at Ammendale Road

Survey reach is accessed from a parking lot on the west side of the stream channel. Upper reach starts at a flagged tree and continues 500 feet downstream to a flagged tree.



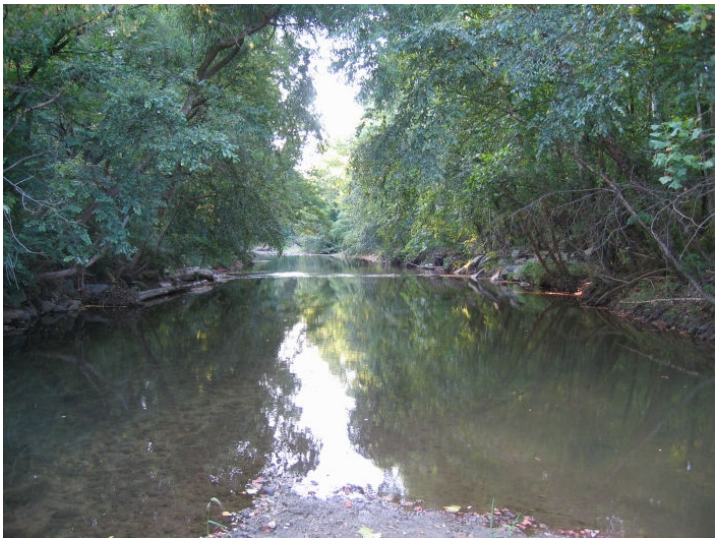
07-033: View looking downstream from upper survey reach limit

07-033: View of trash strainer in the middle of the survey reach

07-033: View of side channel tributary which appears to provide large amounts of trash into the main stream channel.

05-001: Paint Branch at Route 1

This site is accessed from a school parking lot on Pierce Avenue. The upper limit of the survey reach starts at the Route 1 bridge and extends 500 ft downstream to a flagged tree.



05-001: View downstream from upper survey limit at Route 1 bridge.

05-001: View of spring ‘09 deliberate dumping of beer cans.

05-001: View of winter ‘08/’09 dumping of beer cans and newspapers

05-004: Paint Branch at University Blvd

Site is accessed from park parking lot at the playing fields on Metzerott Rd. Lower reach of survey site begins at marked tree at stream bend just upstream of University Blvd and extends 500 feet upstream to a marked tree.

05-004: View looking upstream from lower survey reach limit

05-004: View of large strainer looking downstream from middle of survey reach limit

05-004: View of large strainer looking downstream

09-006: Northwest Branch at Hyattsville Metro

Site is accessed from parking lot at the Hyattsville Metro. Upper survey reach limit begins at pedestrian bridge and continues 500 feet downstream to marked tree.

09-006: View looking down stream from middle of survey reach

09-006: View of trash strainers

09-006: View looking upstream at up upper limit of survey reach

14-001: Sligo Creek at Parklawn Park

Site is accessed from Parklawn Park south of East West Highway. Upper limit of survey reach begins just below small tributary entering the main channel from the south. Survey reach extends 500 feet downstream until marked trees upstream of the Riggs Road bridge.

14-001: View looking upstream at trash debris in upper portion of survey reach

14-001: View looking downstream from upper reach limit

14-001: View of cloth and plastic bag trash deposited during high flows

14-002A: Sligo Creek at Takoma Branch

Site access is from the corner of Red Top Road and Burketon Rd. Lower limit of survey reach begins at pedestrian bridge on Red Top Road and survey reach extends 500 feet upstream to upper limit flagged at a large tree.

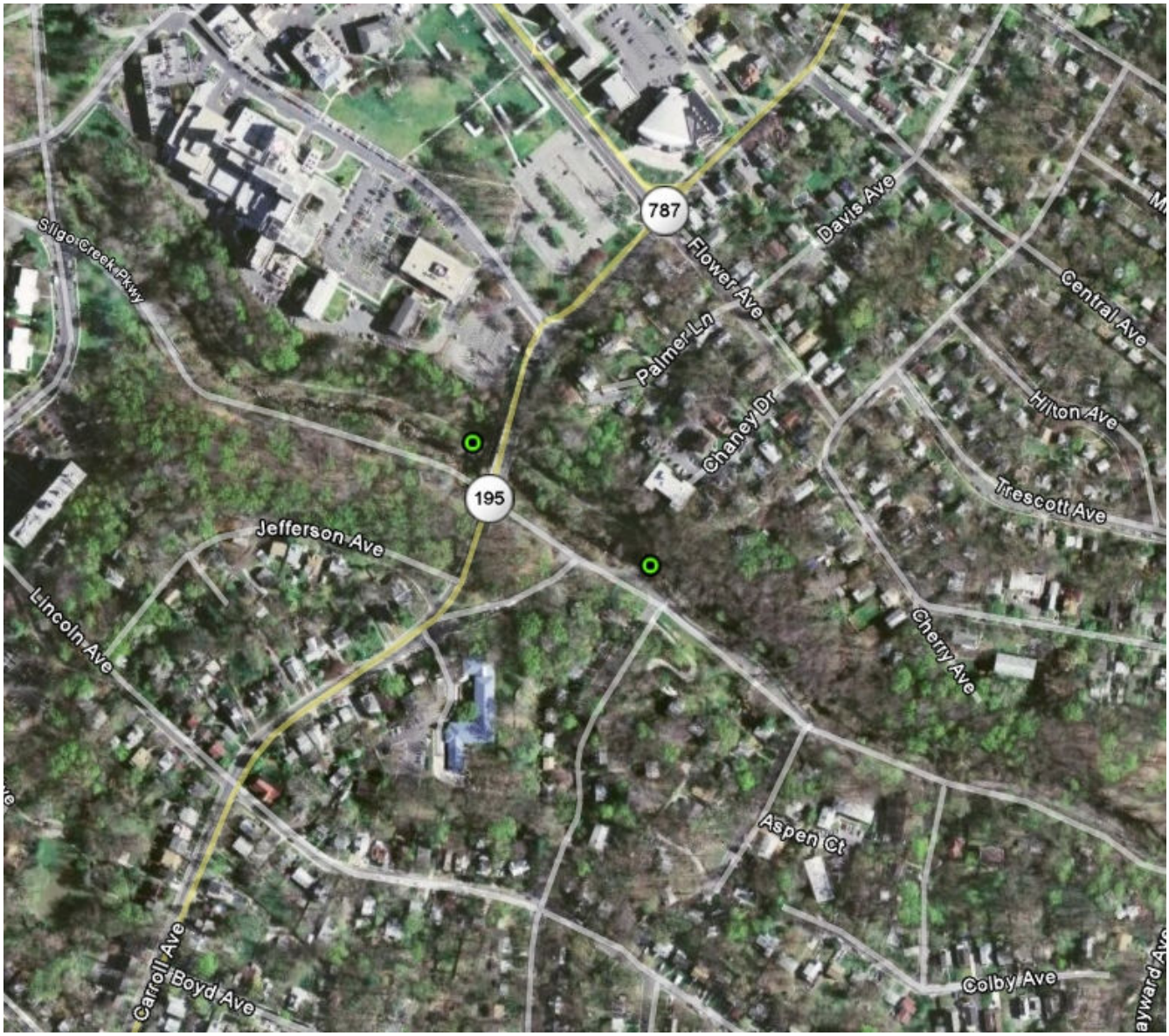
14-002A: View looking upstream near upper survey reach limit. Small tributary inters from the right supplies additional trash to the main channel.

14-002A: View of lower limit of the survey reach at the pedestrian bridge. Considerable trash is deposited from the bridge above.

14-002A: View looking down stream at trash on trees and exposed pipe crossing stream

SCSC314: Sligo Creek at Carroll Avenue

Access to site is from pedestrian bridge downstream of Carroll Avenue. Lower survey reach limit begins at this pedestrian bridge over the creek and extends 500 feet upstream to a large flagged tree just upstream of the Carroll Avenue bridge.



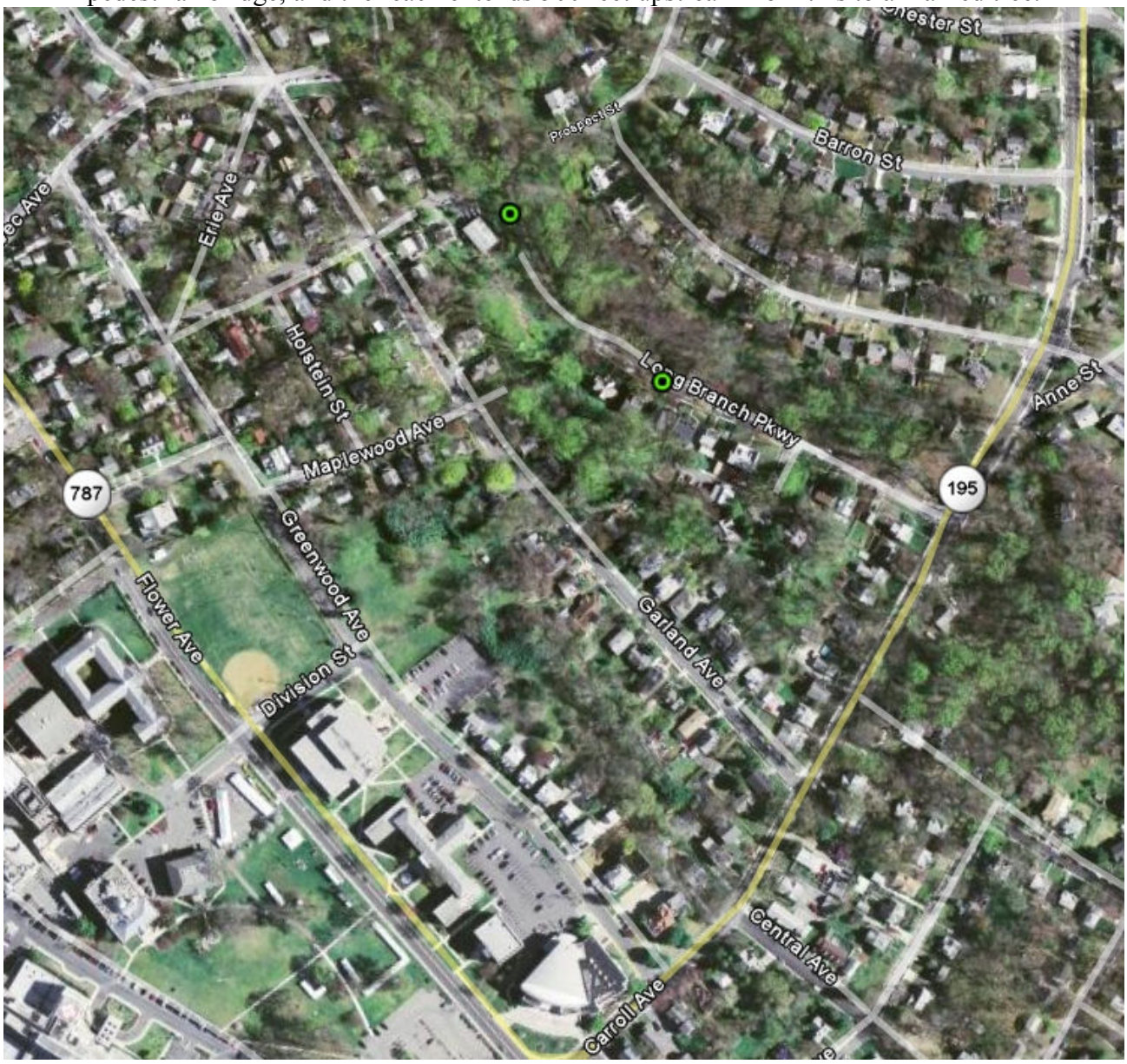
SCSC314: Looking downstream from upper survey reach limit flagging

SCSC314: Looking downstream at the lower survey reach limit at pedestrian bridge.

SCSC314: Looking downstream at trash strainer in middle of survey reach

SCLB101: Sligo Creek at Long Branch

This site is accessed from Long Branch Parkway. The lower limit of the survey reach begins at a pedestrian bridge, and the reach extends 500 feet upstream from this to a marked tree.



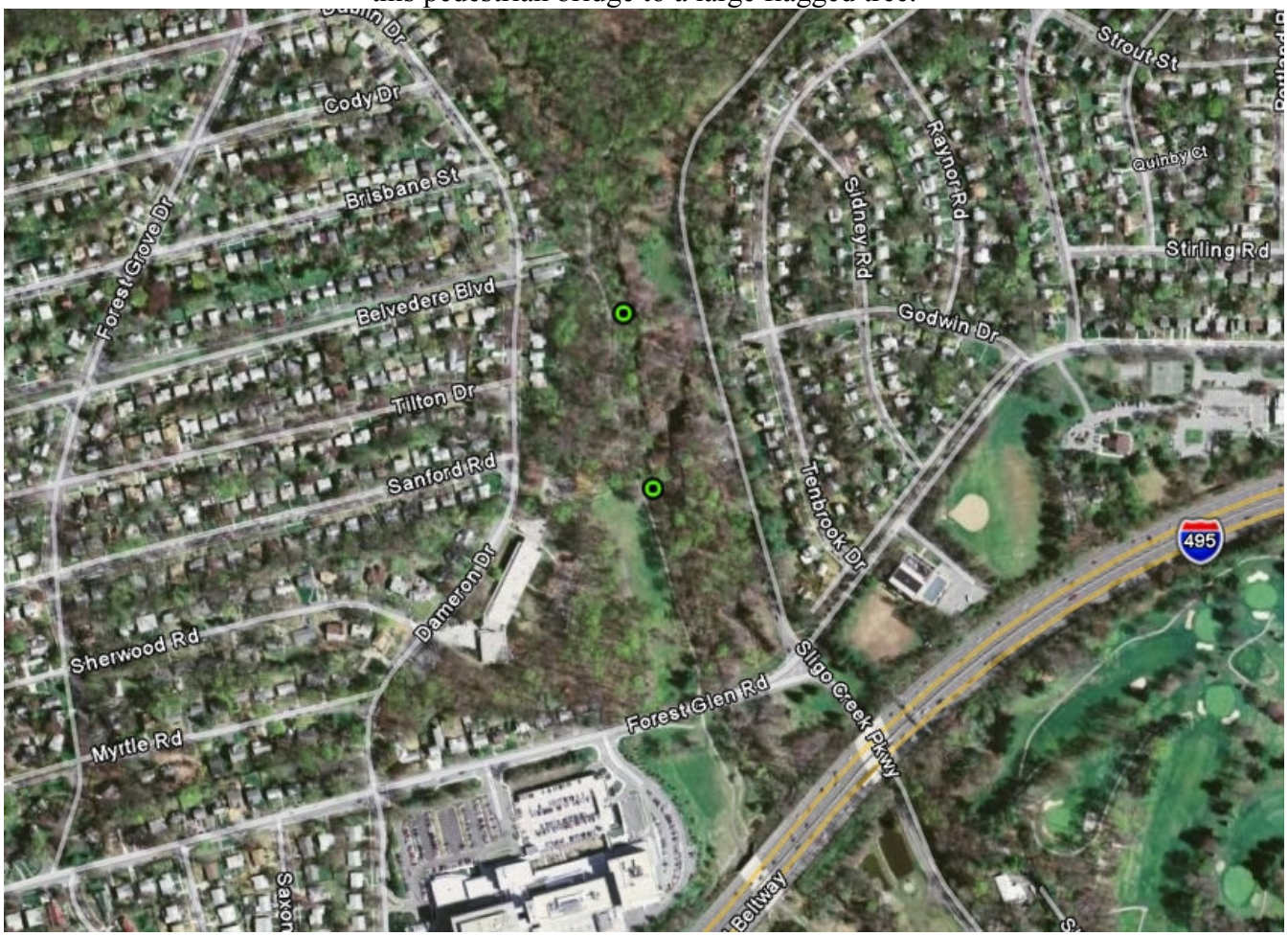
SCLB101: View looking upstream from middle of survey reach. Street culvert enters stream channel on the left, a point of trash entry to the main stem of Long Branch.

SCLB101: View looking upstream from the lower limit of the survey reach near the pedestrian bridge.

SCLB101: View looking downstream from the middle of the survey reach

SCSC301: Sligo Creek at Forest Glen Road

Access to this site is from a small parking area on Sligo Creek Parkway. Lower limit of the survey reach begins at a pedestrian bridge north of Forest Glen Road. The survey reach extends 500 feet upstream of this pedestrian bridge to a large flagged tree.



SCSC301: View looking downstream from upper survey reach limit. A large pipe draining the roadway enters the stream on left in this photo

SCSC301: View looking upstream from pedestrian bridge at lower limit of survey reach. A small tributary draining a residential area enters from the left in the photo.

SCSC301: View looking upstream from rock stream wing deflector, which has trapped some styrofoam trash.

SCSC204: Sligo Creek at University Blvd

Access to this site is from a small parking area on Sligo Creek Parkway north of a pedestrian bridge. Upper limit of survey reach begins at a pedestrian bridge crossing the stream, and the survey reach extends downstream 500 feet to flagged trees.

SCSC204: View of up and downstream portions of survey reach

SCSC204: View looking downstream at trash strainer and Styrofoam from middle of survey reach.

SCSC204: View looking upstream at area next to road pull-off area on Sligo Creek Parkway. Orange oil filter can be seen in right portion of photo, likely tossed from pull-off area.

PBHB210: Paint Branch at Hollywood Branch

Site is accessed from hiker/biker trail starting at the east end of Jackson Rd, north of Columbia Pike. Lower limit of survey reach starts at hiker/biker bridge upstream of confluence with Paint Branch mainstem. Survey reach extends upstream 500 feet from this bridge to flagged trees.

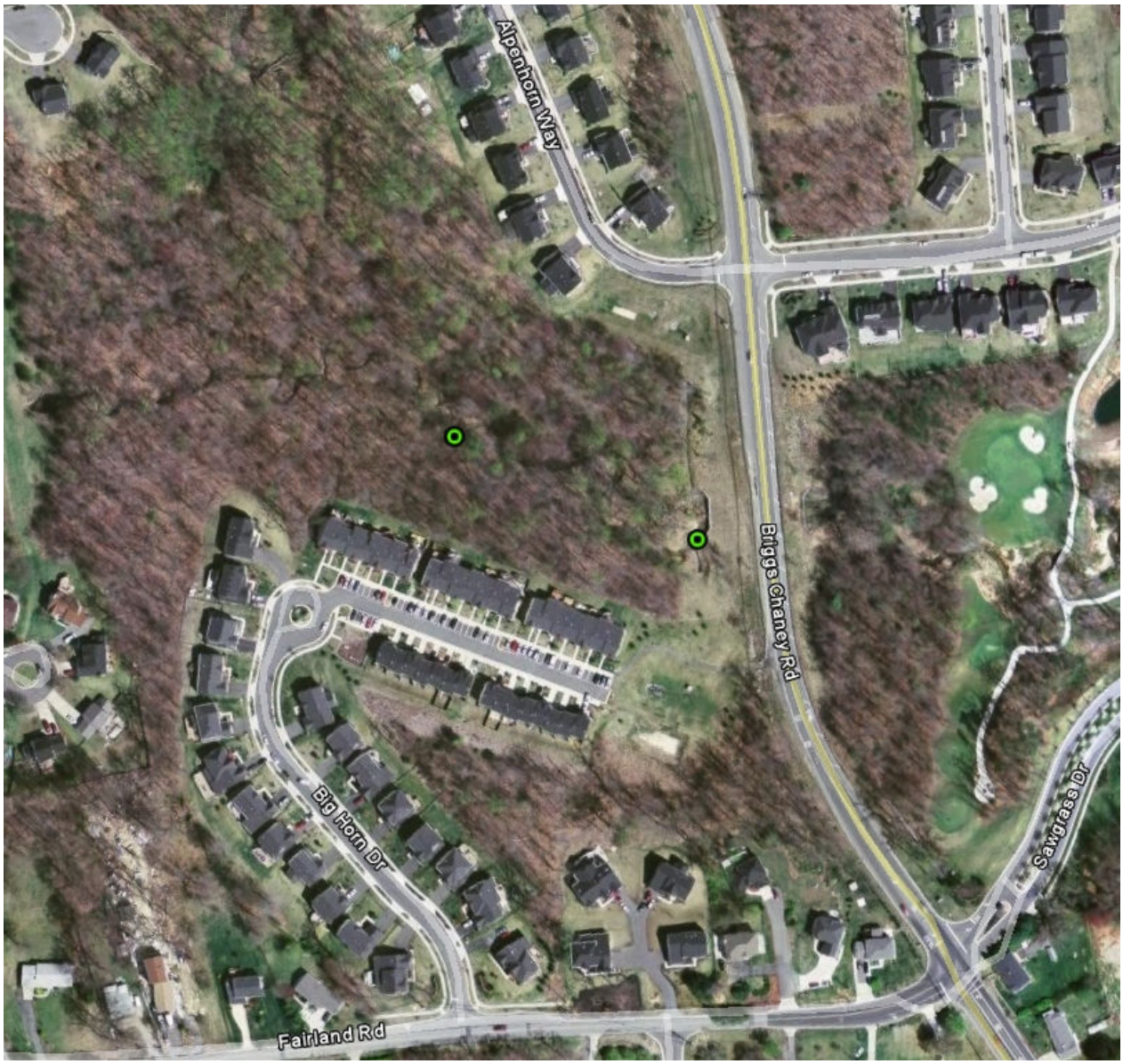
PBHB210: View looking downstream at hiker/biker bridge at lower limit of survey reach.

PBHB210: View looking downstream at trash strainer and bank trash deposits

PBHB210: View looking upstream at trash strainer

LPLP202: Little Paint Branch at Briggs Chaney Road

Access to the site is from Alpenhorn Way. Lower limit of survey reach begins at fence at concrete culvert under Briggs Chaney Road. Survey reach extends 500 feet upstream to marked tree.



LPLP202: View looking upstream at upper survey reach limit.

LPLP202: View of trash debris embedded into the stream bank

LPLP202: View of trash strainer, and tire pile (not included in trash count due to it's location above bank full level).

LPLP205: Little Paint Branch South of Greencastle Road

Survey site access is from park parking lot off of Old Gunpowder Road and hiker/biker path. This site is actually located on an unnamed tributary to Little Paint Branch, and the tributary drains the neighborhoods east of Columbia Pike. The lower limit of the survey reach begins at the confluence of this tributary and the main stem of Little Paint Branch. The survey reach extends upstream on the tributary 500 feet to a marked tree.

LPLP205: View looking downstream from upper reach limit. Water quality monitoring station can be seen in the background-right.

LPLP205: View looking downstream at trash strainers at the lower limit of the survey reach (orange flag on tree) and confluence of the tributary surveyed and the mainstem Little Paint Branch (far left). Another stream monitoring station can be seen on the bank (center).

LPLP205: View looking downstream from the middle of the survey reach. Orange fencing from private landowner appears to be in preparation for land clearing along and through the stream.

LPLP301A: Little Paint Branch at Fairland Park (central)

Site is accessed from a Fairland Park parking lot at the south end of the park off of Greencastle Road. Survey reach upper limit begins south of a small trail crossing. Survey extends south (downstream) from this limit 500 feet to a marked tree.

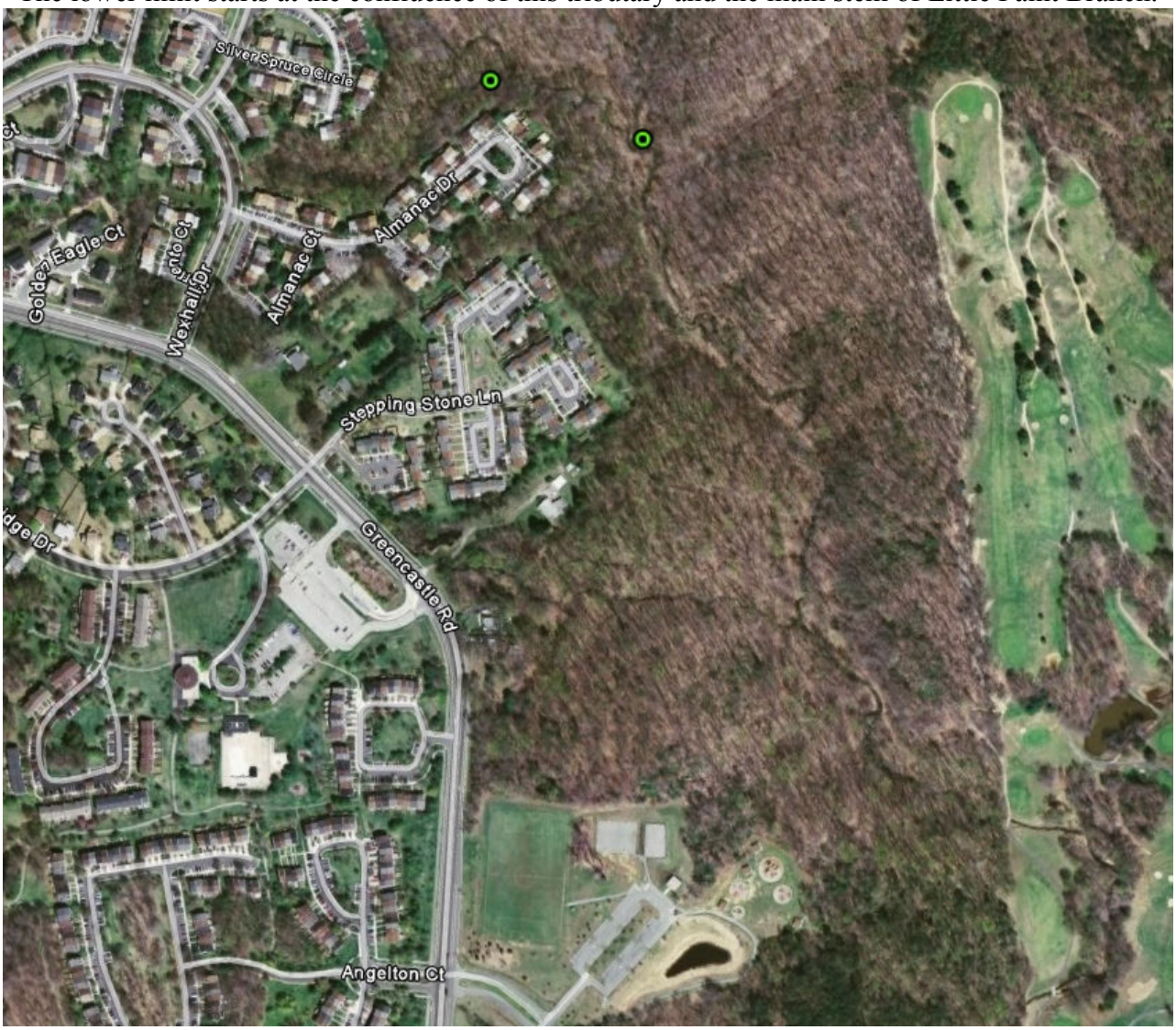
LPLP301A: View looking downstream from upper limit of survey reach.

LPLP301A: View of trash strainer in middle of survey reach

LPLP301A: View looking upstream from lower limit if survey reach.

LPLP109: Little Paint Branch at Fairland Park (north)

Site access is from a Fairland Park parking lot off of Greencastle Road near a playground and from a hiking path which starts there and travels north. This survey site is on a tributary entering from the west. The lower limit starts at the confluence of this tributary and the main stem of Little Paint Branch.



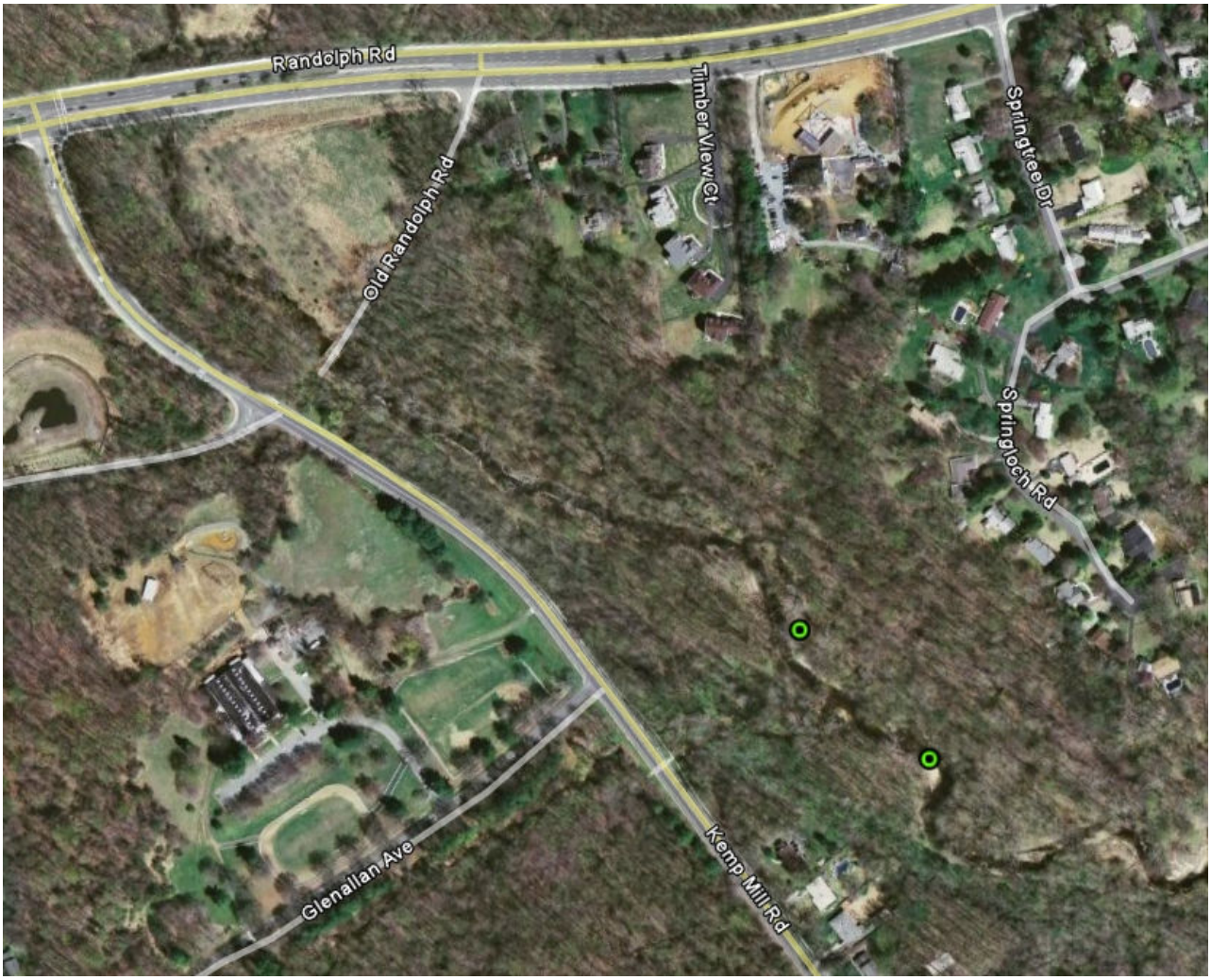
LPLP109: View looking downstream of residential home renovation trash

LPLP109: View looking upstream at residential homes whose owners have dumped household trash over fences and down to stream banks (black trash bag) in distance.

LPLP109: View of household trash thrown over residential fences (top of photo) approx 30ft from stream banks.

NWNW407D: Northwest Branch at Kemp Mill Road

Access to site is from small parking area at the intersection of Glanallen Avenue and Kemp Mill Road, then via a hiking path to the east of Kemp Mill Road. Lower limit of survey reach starts at marked tree to the north of hiking path, and survey reach extends 500 feet upstream (north) to marked tree near large fallen tree trash strainer.



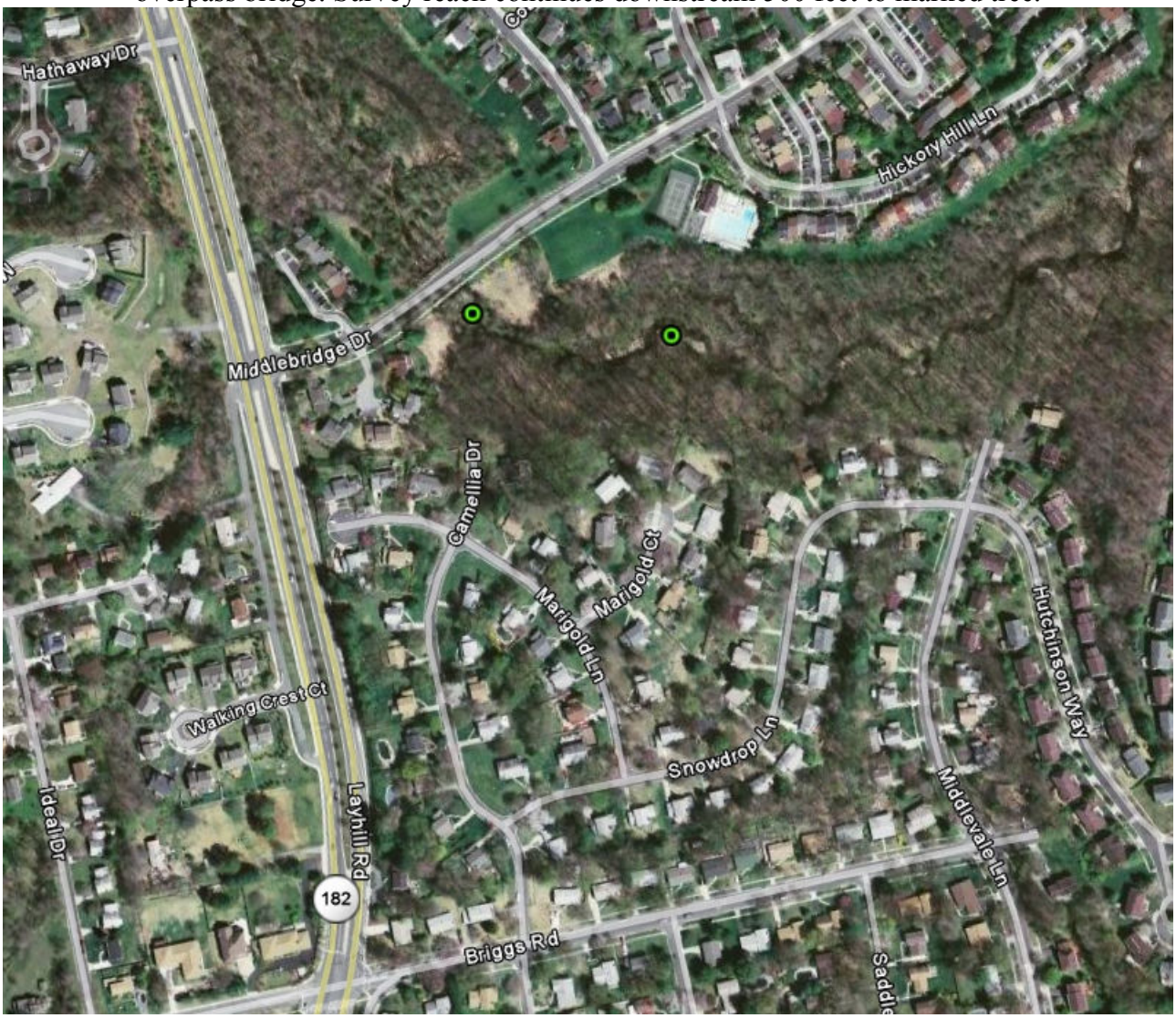
NWNW407D: View looking downstream at upper survey reach limit and large trash strainer

NWNW407D: View looking downstream at large trash strainer

NWNW407D: View looking downstream at trash strainer

NWBP205: Northwest Branch at Bel Pre Creek

Access to the site is from Middlebridge Drive. Upper limit of survey reach starts at Middlebridge overpass bridge. Survey reach continues downstream 500 feet to marked tree.



NWBP205: View looking upstream toward upper limit of survey reach

NWBP205: View of trash strainer and trash debris

NWBP205: View of orange oil filter in stream channel

NWNW402: Northwest Branch at Layhill Park

Access is from east of ball fields in Layhill Park. Lower limit of survey reach start at large tree in left field of the southern most ballfield. Survey reach extends 500 feet upstream (north) to a marked tree.

NWNW402: View looking upstream from lower limit if survey reach

NWNW402: View looking downstream in middle of survey reach

NWNW402: View looking downstream from upper limit of survey reach

NWBP301: Northwest Branch at Batchellors Run

Access to site is from intersection of Woods Center Road and Norbeck Rd. Lower limit of survey reach is at Norbeck Road bridge. Upper limit is a marked tree 500 feet upstream and west of Norbeck Road bridge.

NWBF301: View looking upstream from lower limit of survey reach

NWBP301: View looking downstream at trash and landfill construction debris

NWBP301: View looking upstream at trash and landfill debris

NWNW206A: Northwest Branch at Nursery Run

Site is accessed from Bryants Nursery Road, which is south of Norbeck Road. Upper limit of survey reach is at marked tree near reforestation project. Lower limit of survey reach is at large marked tree.

NWNW206A: View looking downstream at upper limit of survey reach

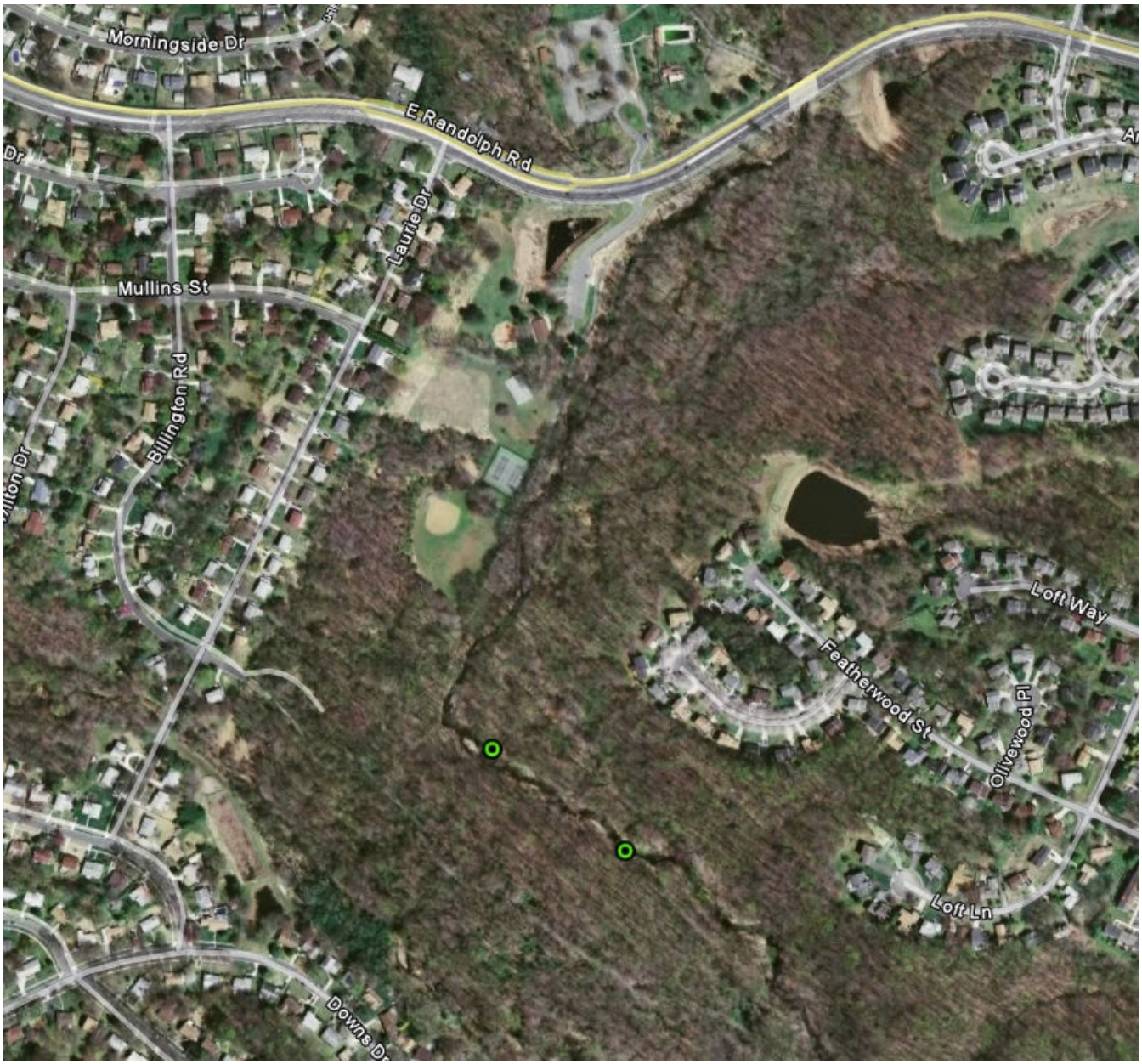
NWNW206A: View looking downstream in middle of survey reach

NWNW206A: View looking downstream at unstable bank structure

PBPB308: Paint Branch at Valley Mill Park

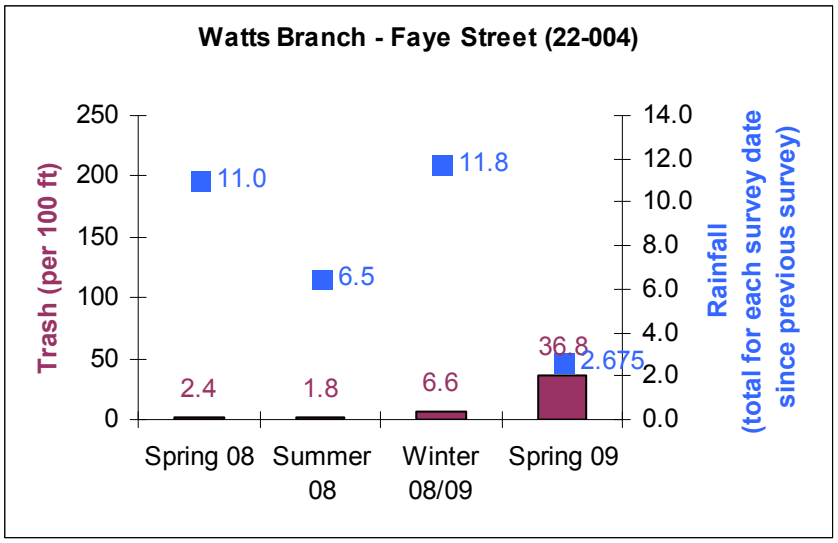
Site is accessed by Valley Mill Park parking lot south of East Randolph Road.

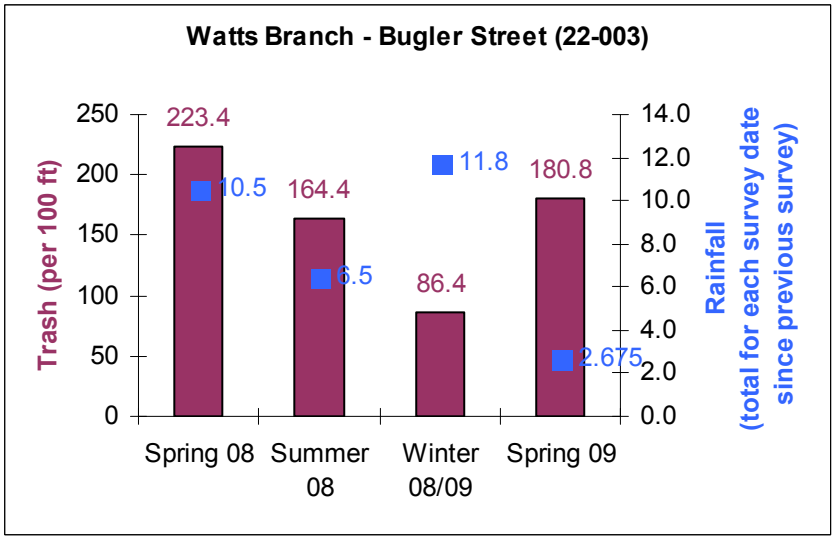
Upper survey reach limit begins at a large marked tree south of a park baseball field. Survey reach extends downstream (south) to a second marked tree.

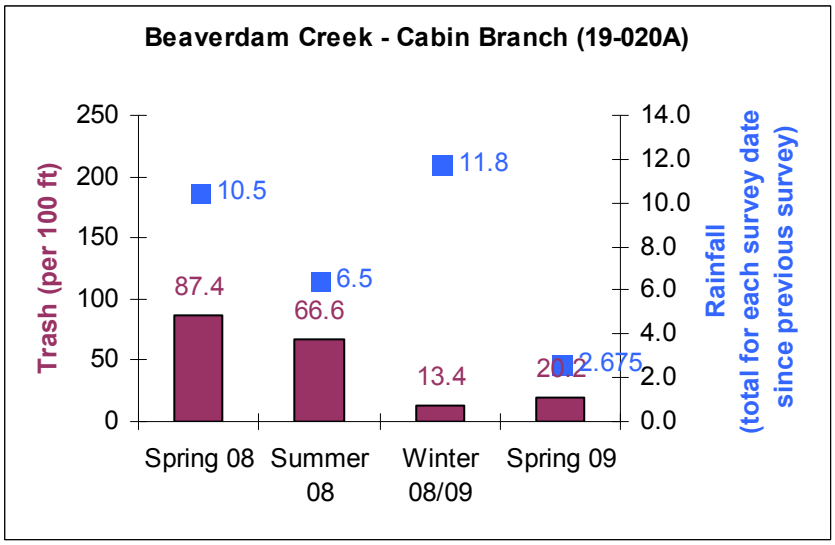


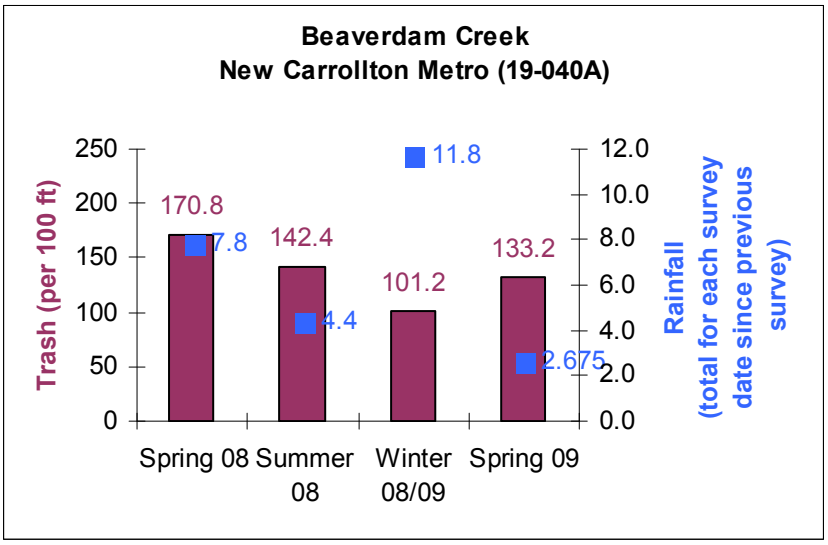
Appendix B

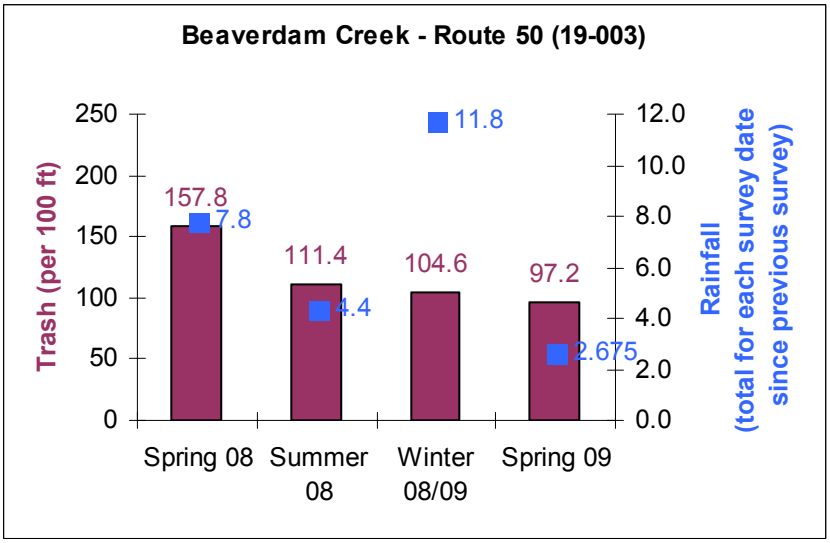
Graphs of average pieces trash per 100 feet of stream reach at each site with total inches of rainfall for each survey date since previous survey

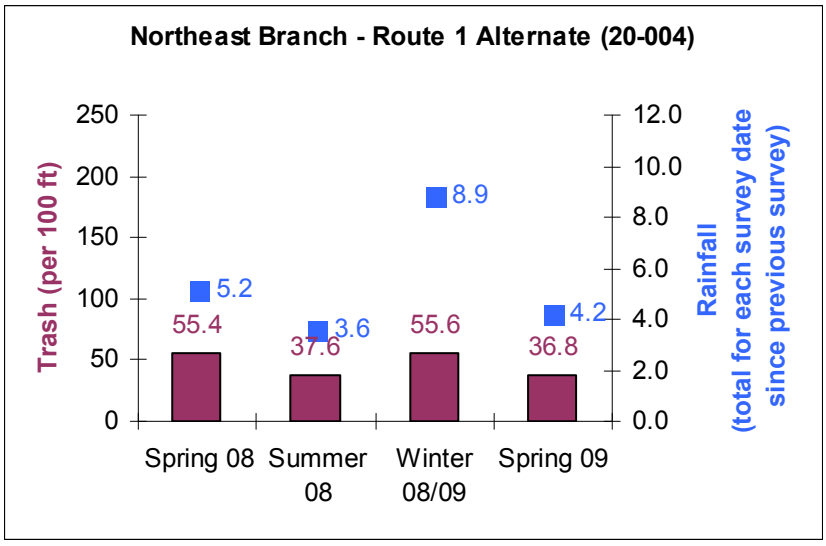


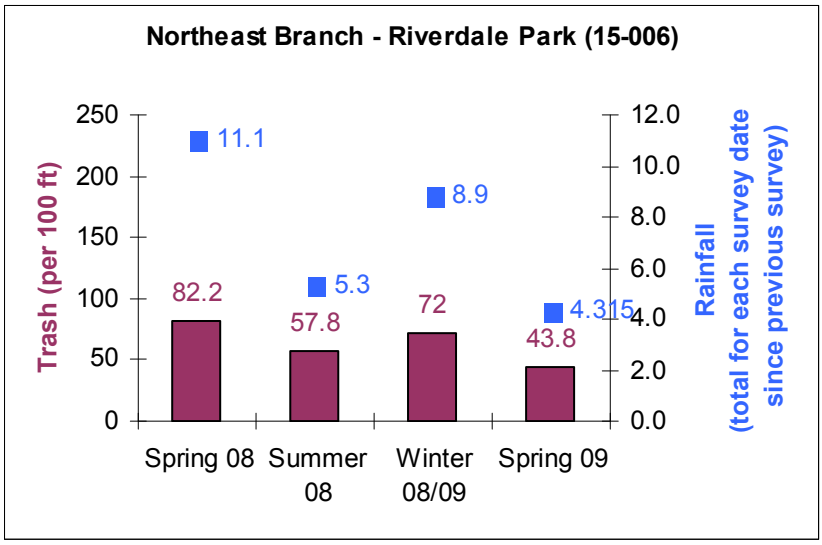


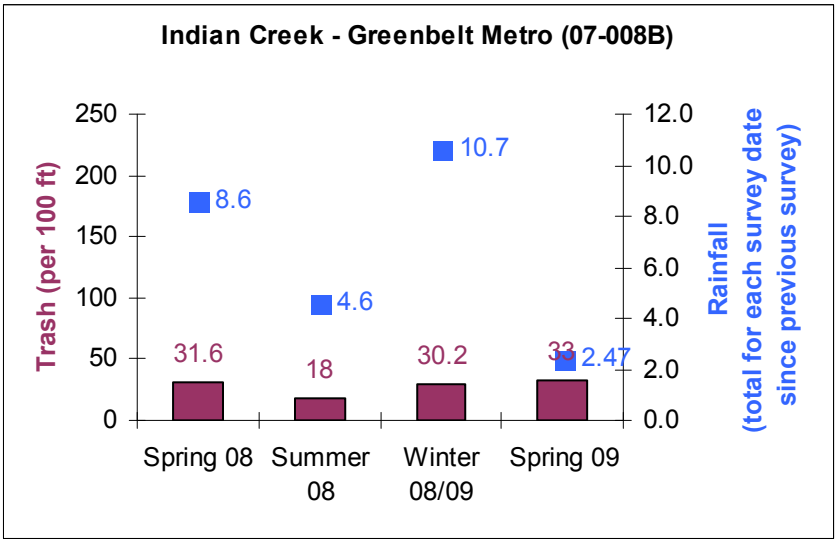


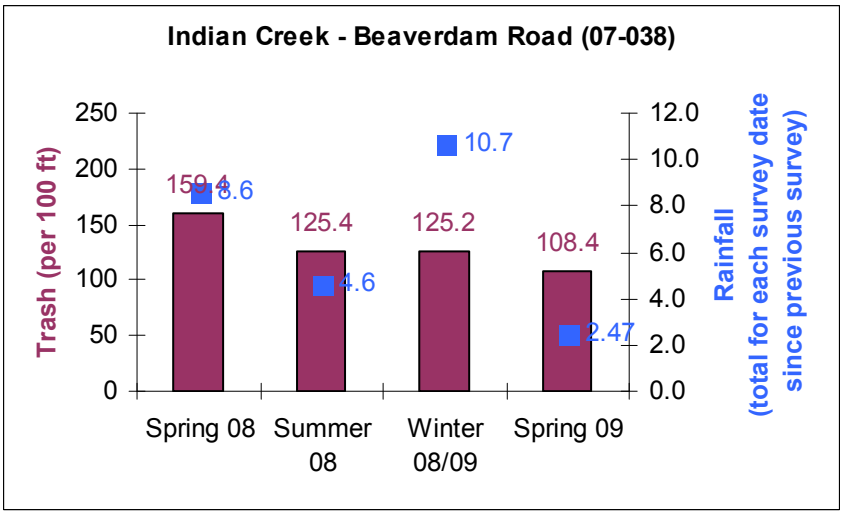

Beaverdam Creek
New Carrollton Metro (19-040A)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
170.8
142.4
101.2
133.2
7.8
4.4
11.8
2.675
Spring 08
Summer 08
Winter 08/09
Spring 09

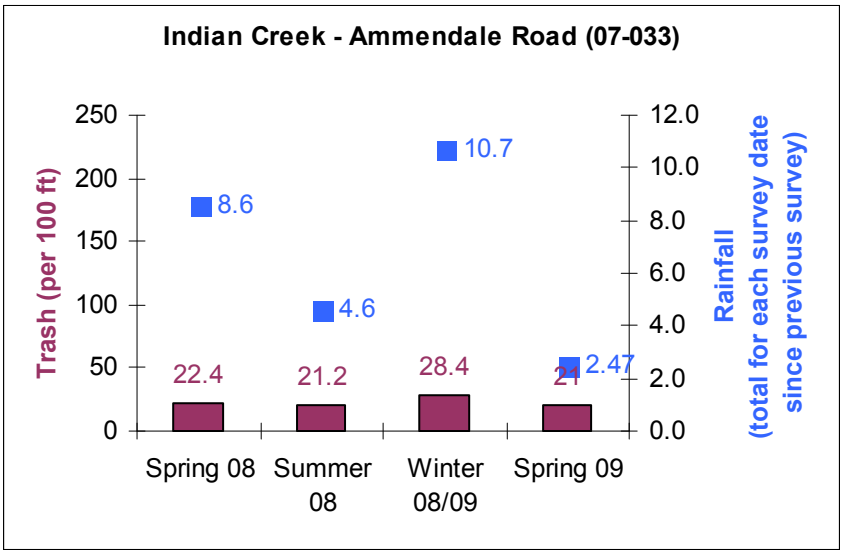

Beaverdam Creek - Route 50 (19-003)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
157.8
111.4
104.6
97.2
7.8
4.4
11.8
2.675
Spring 08
Summer 08
Winter 08/09
Spring 09

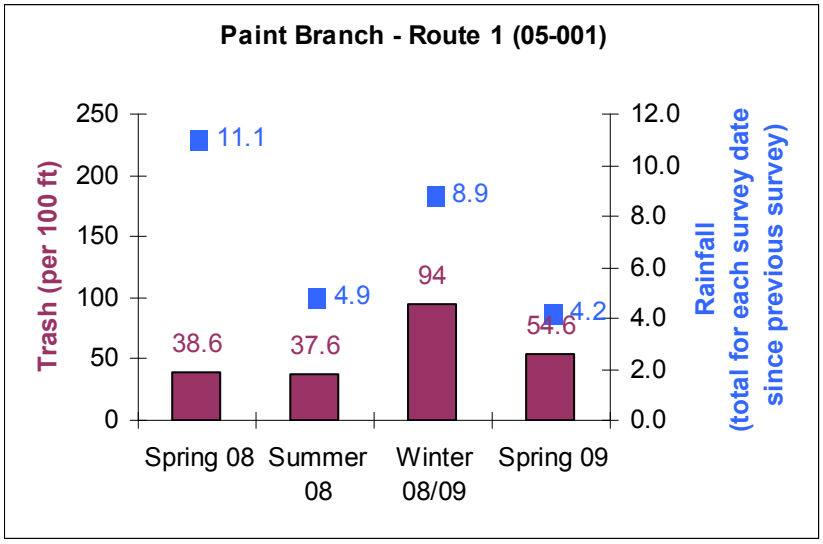

Northeast Branch - Route 1 Alternate (20-004)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
55.4
37.6
55.6
36.8
5.2
3.6
8.9
4.2
Spring 08
Summer 08
Winter 08/09
Spring 09

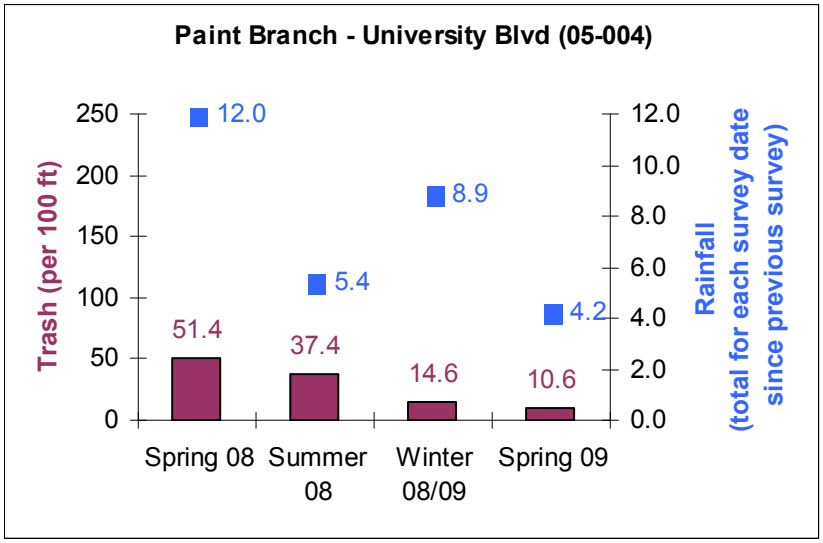

Northeast Branch - Riverdale Park (15-006)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.1
8.9
5.3
4.315
82.2
57.8
72
43.8
Spring 08
Summer 08
Winter 08/09
Spring 09

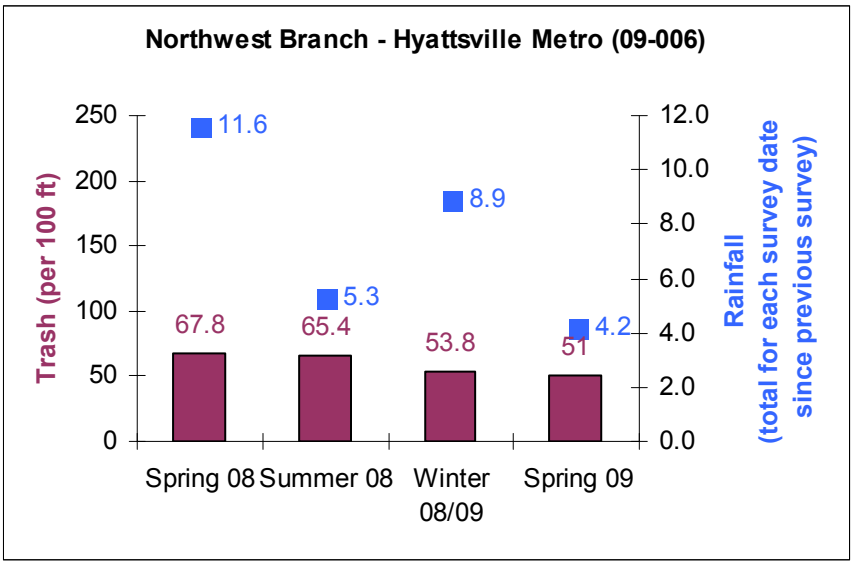

Indian Creek - Greenbelt Metro (07-008B)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
8.6
10.7
4.6
2.47
31.6
18
30.2
33
Spring 08
Summer 08
Winter 08/09
Spring 09

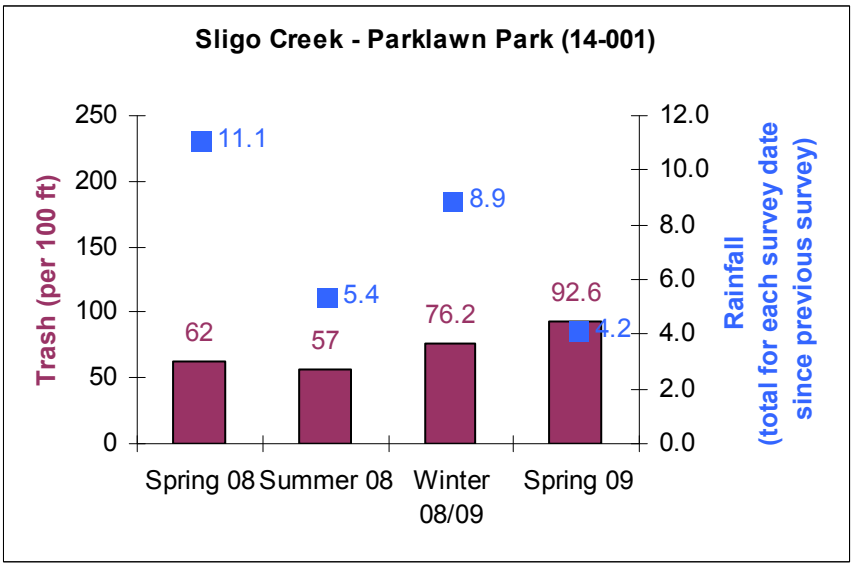

Indian Creek - Beaverdam Road (07-038)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
8.6
10.7
4.6
2.47
159.4
125.4
125.2
108.4
Spring 08
Summer 08
Winter 08/09
Spring 09

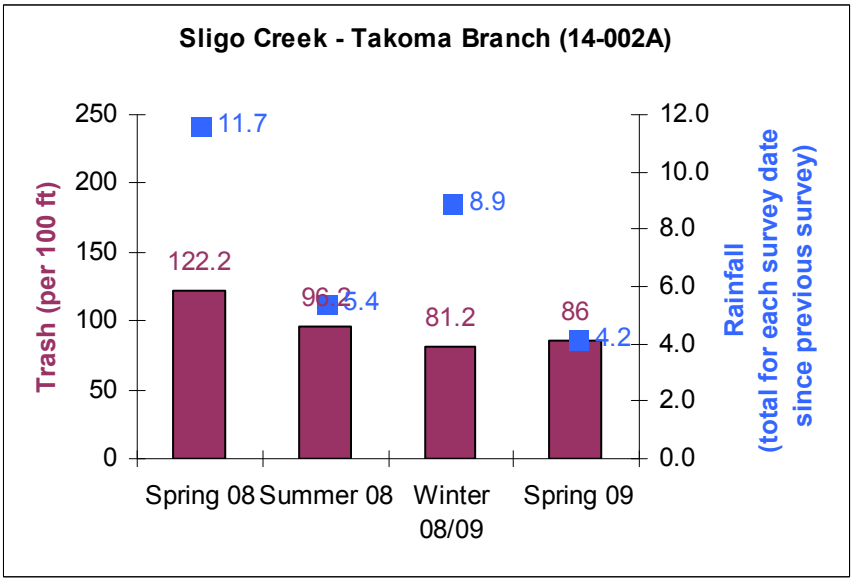

Indian Creek - Ammendale Road (07-033)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
8.6
4.6
10.7
2.47
22.4
21.2
28.4
21
Spring 08
Summer 08
Winter 08/09
Spring 09

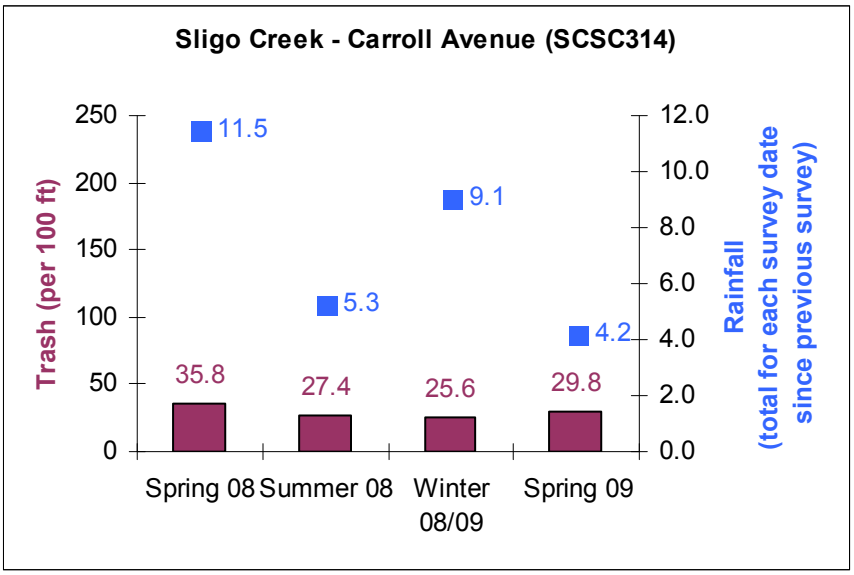

Paint Branch - Route 1 (05-001)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.1
4.9
8.9
4.2
38.6
37.6
94
54.6
Spring 08
Summer 08
Winter 08/09
Spring 09

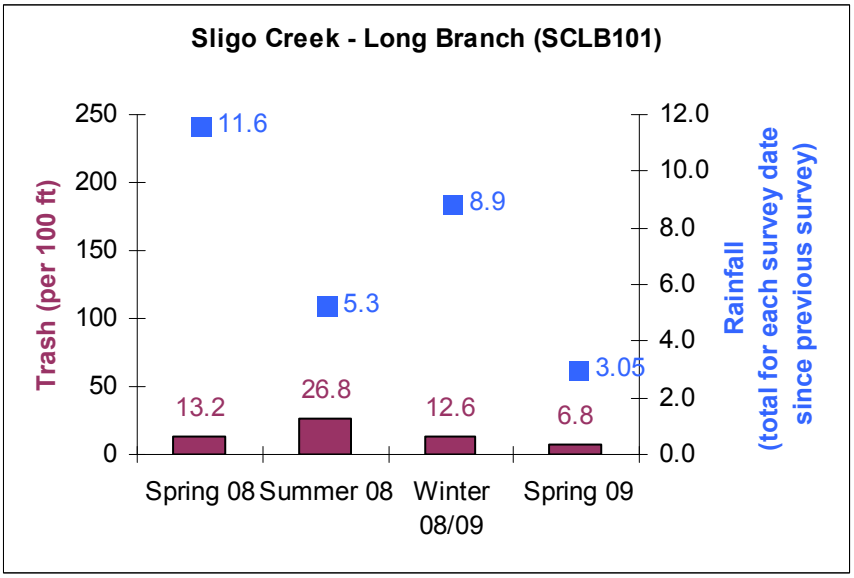

Paint Branch - University Blvd (05-004)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.0
5.4
8.9
4.2
51.4
37.4
14.6
10.6
Spring 08
Summer 08
Winter 08/09
Spring 09

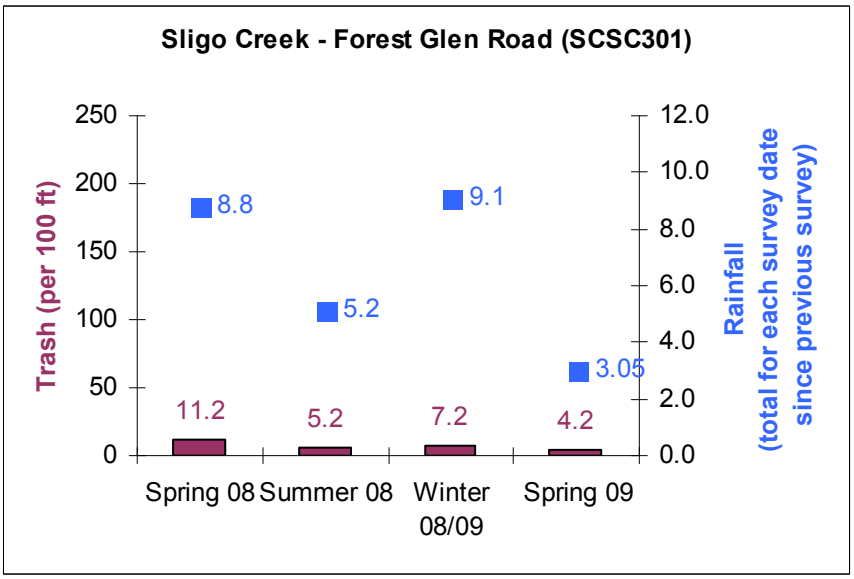

Northwest Branch - Hyattsville Metro (09-006)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.6
5.3
8.9
4.2
67.8
65.4
53.8
51
Spring 08
Summer 08
Winter 08/09
Spring 09

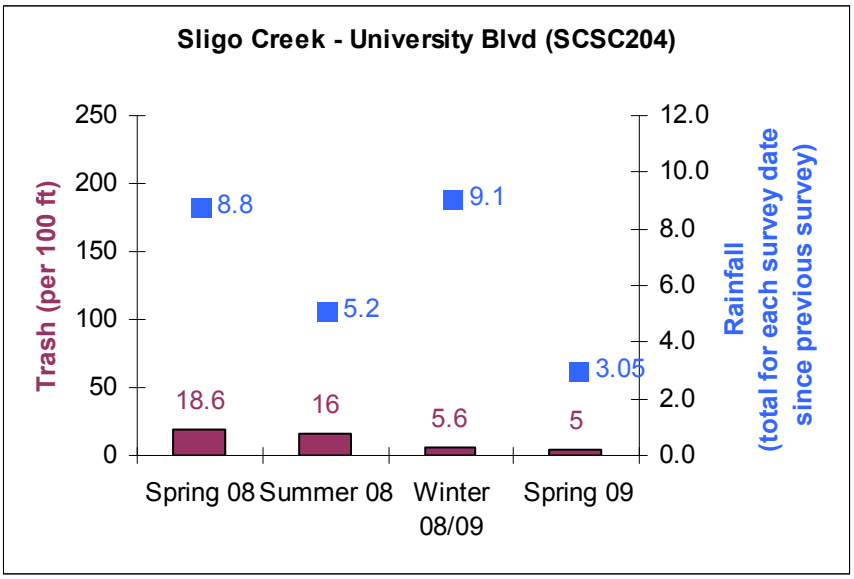

Sligo Creek - Parklawn Park (14-001)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.1
5.4
8.9
4.2
62
57
76.2
92.6
Spring 08
Summer 08
Winter 08/09
Spring 09

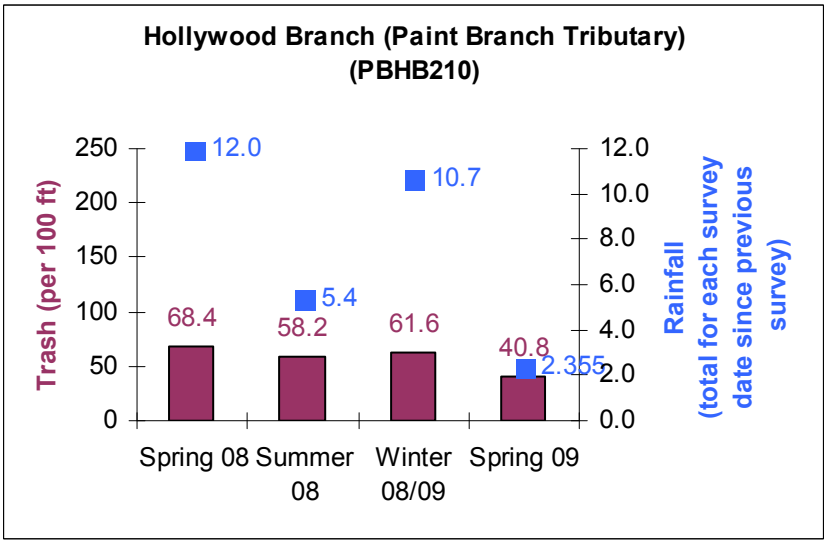

Sligo Creek - Takoma Branch (14-002A)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.7
5.4
8.9
4.2
122.2
96.2
81.2
86
Spring 08
Summer 08
Winter 08/09
Spring 09

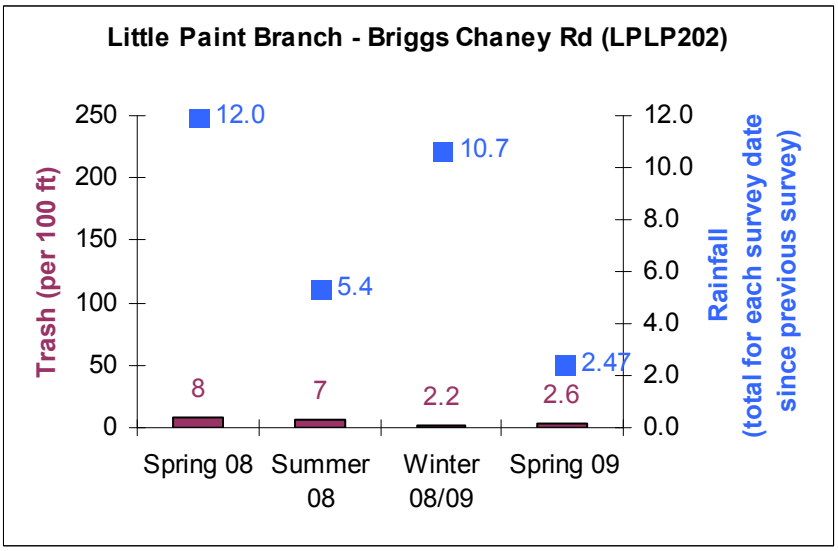

Sligo Creek - Carroll Avenue (SCSC314)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
4.2
35.8
27.4
25.6
29.8
Spring 08
Summer 08
Winter 08/09
Spring 09

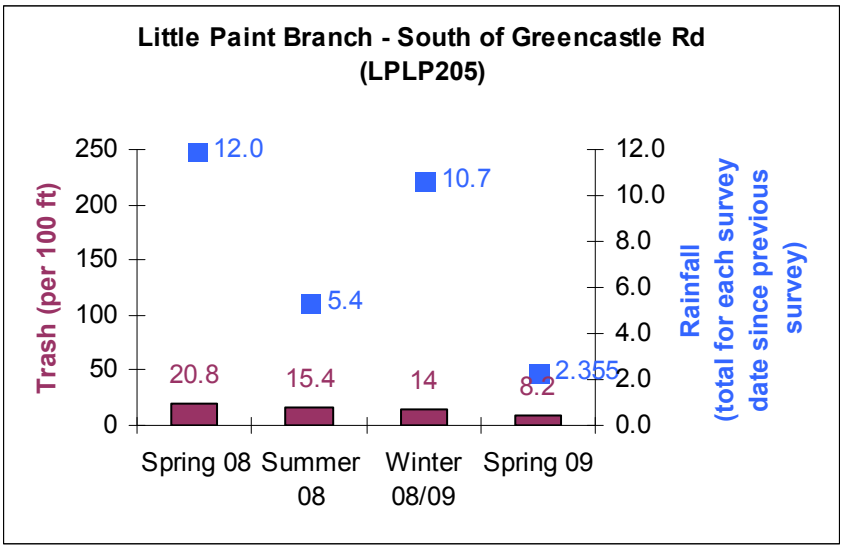

Sligo Creek - Long Branch (SCLB101)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.6
5.3
8.9
3.05
13.2
26.8
12.6
6.8
Spring 08
Summer 08
Winter 08/09
Spring 09

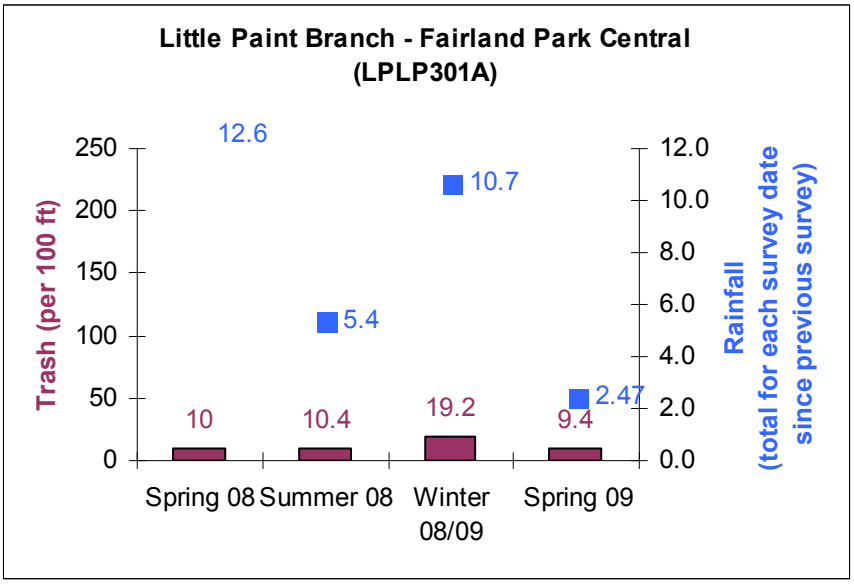

Sligo Creek - Forest Glen Road (SCSC301)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
8.8
5.2
9.1
3.05
11.2
5.2
7.2
4.2
Spring 08
Summer 08
Winter 08/09
Spring 09

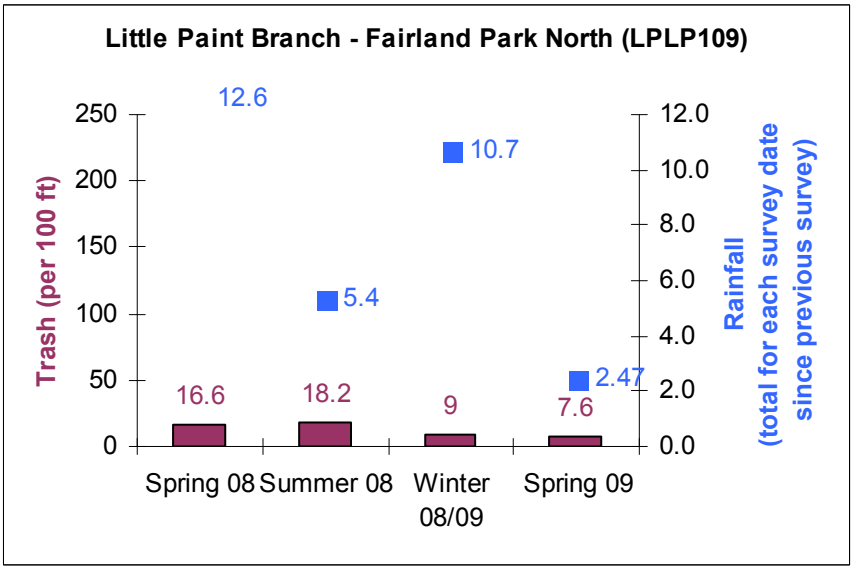

Sligo Creek - University Blvd (SCSC204)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
8.8
5.2
9.1
3.05
18.6
16
5.6
5
Spring 08
Summer 08
Winter 08/09
Spring 09

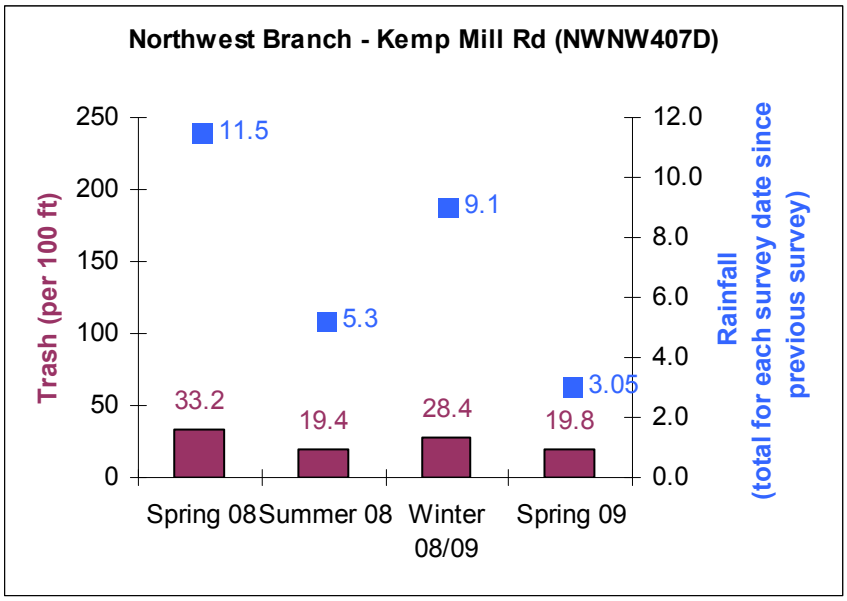

Hollywood Branch (Paint Branch Tributary) (PBHB210)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.0
10.7
5.4
2.355
68.4
58.2
61.6
40.8
Spring 08
Summer 08
Winter 08/09
Spring 09

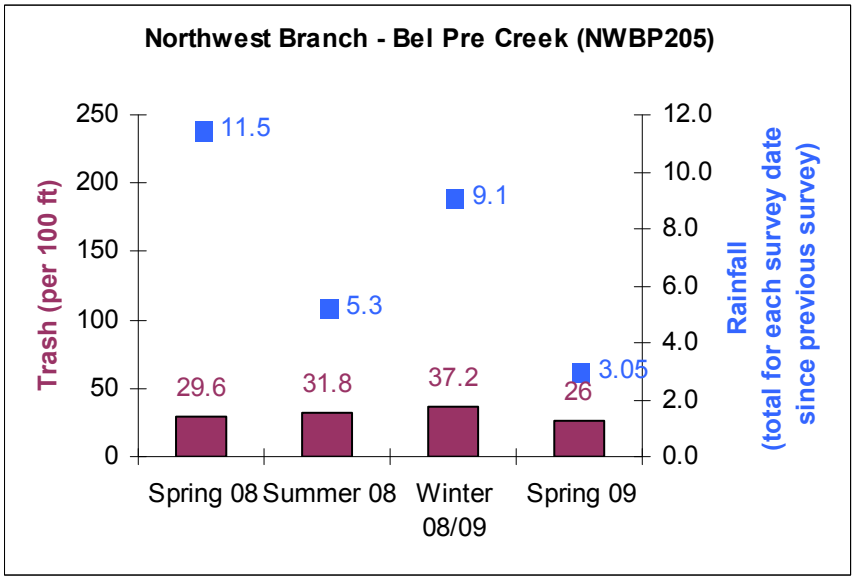

Little Paint Branch - Briggs Chaney Rd (LPLP202)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.0
10.7
5.4
2.47
8
7
2.2
2.6
Spring 08
Summer 08
Winter 08/09
Spring 09

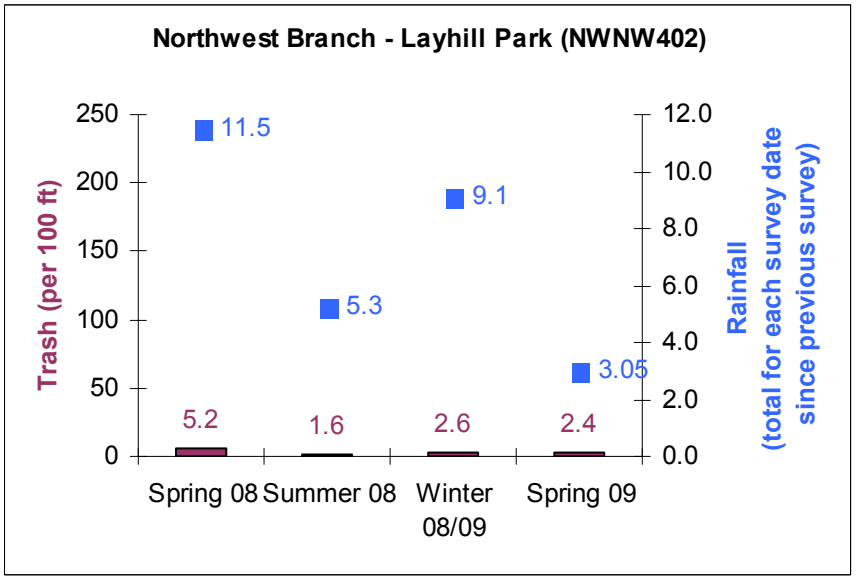

Little Paint Branch - South of Greencastle Rd (LPLP205)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.0
10.7
5.4
2.355
20.8
15.4
14
8.2
Spring 08
Summer 08
Winter 08/09
Spring 09

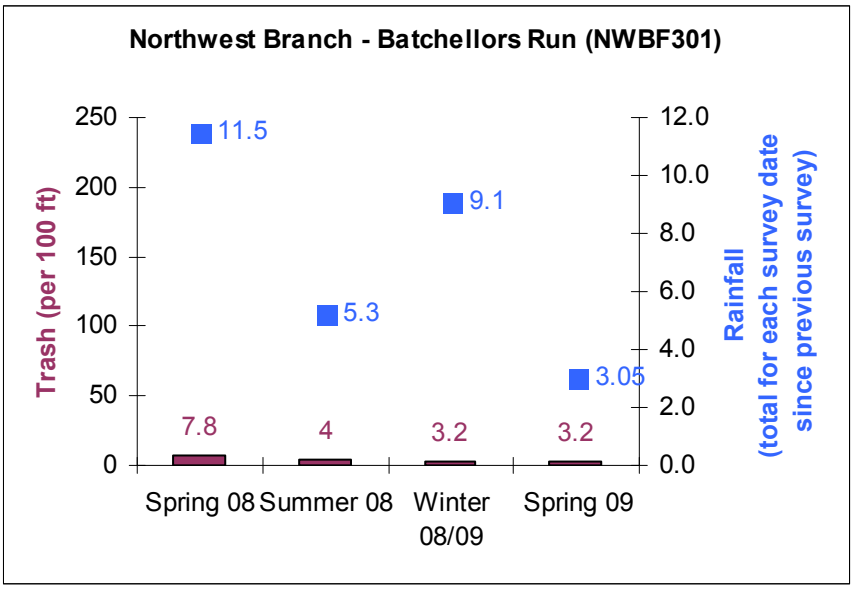

Little Paint Branch - Fairland Park Central (LPLP301A)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.6
10.7
5.4
2.47
10
10.4
19.2
9.4
Spring 08
Summer 08
Winter 08/09
Spring 09

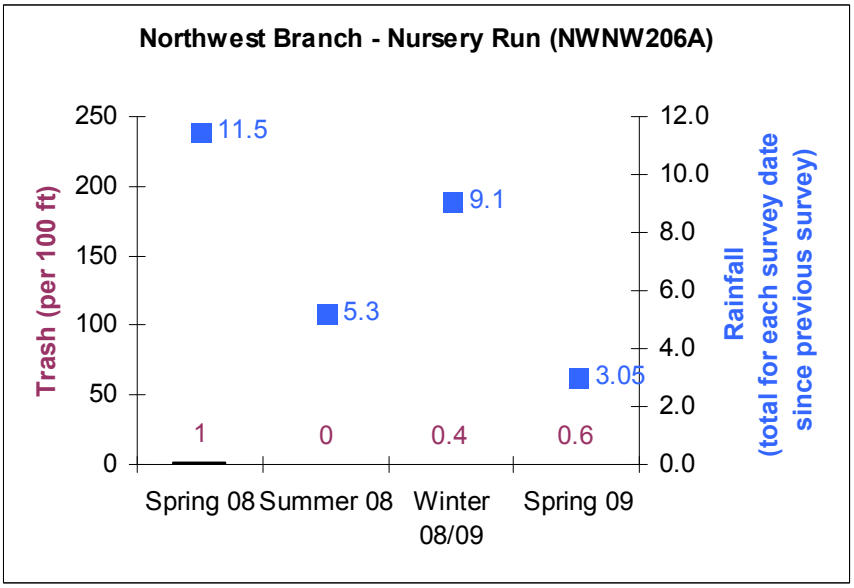

Little Paint Branch - Fairland Park North (LPLP109)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.6
10.7
5.4
2.47
16.6
18.2
9
7.6
Spring 08
Summer 08
Winter 08/09
Spring 09

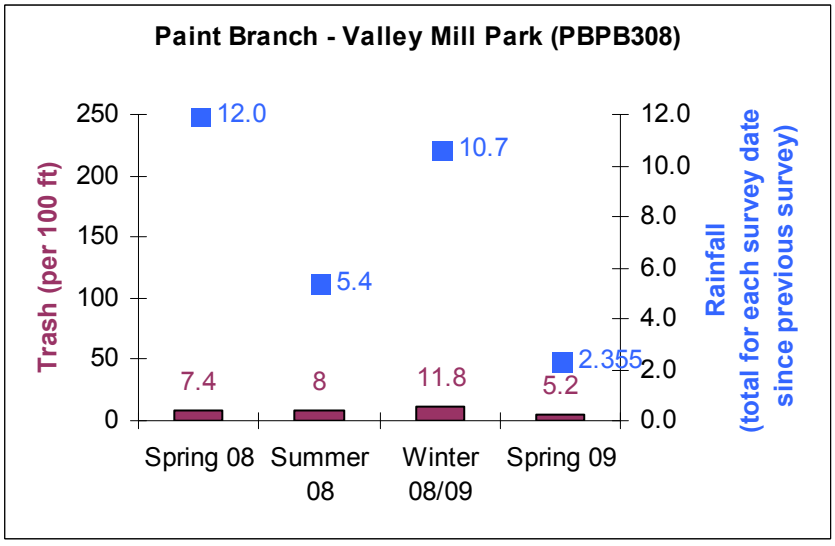

Northwest Branch - Kemp Mill Rd (NWNW407D)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
3.05
33.2
19.4
28.4
19.8
Spring 08
Summer 08
Winter 08/09
Spring 09


Northwest Branch - Bel Pre Creek (NWBP205)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
3.05
29.6
31.8
37.2
26
Spring 08
Summer 08
Winter 08/09
Spring 09


Northwest Branch - Layhill Park (NWNW402)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
3.05
5.2
1.6
2.6
2.4
Spring 08
Summer 08
Winter 08/09
Spring 09


Northwest Branch - Batchellors Run (NWBF301)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
3.05
7.8
4
3.2
3.2
Spring 08
Summer 08
Winter 08/09
Spring 09


Northwest Branch - Nursery Run (NWNW206A)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
11.5
5.3
9.1
3.05
1
0
0.4
0.6
Spring 08
Summer 08
Winter 08/09
Spring 09


Paint Branch - Valley Mill Park (PBPB308)
Trash (per 100 ft)
Rainfall (total for each survey date since previous survey)
250
200
150
100
50
0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
12.0
5.4
10.7
2.355
7.4
8
11.8
5.2
Spring 08
Summer 08
Winter 08/09
Spring 09

Appendix C:

Graph showing average number of pieces of trash per 100 feet of stream over 4 seasons at each survey site in Montgomery and Prince George's County