Sunnyview Pre-Construction Monitoring Report Year 3

Prepared for:
The Harford County Department of Public Works

April 2008

Prepared by:
KCI Technologies Inc.
10 North Park Drive
Hunt Valley, MD
21030

Environmental Assessment
Open End Contract No:
07-041

KCI Job Number:
01066041.12

KCI TECHNOLOGIES

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 MONITORING YEAR 3: RESULTS AND DISCUSSION 1

2.1 FLUVIAL GEOMORPHIC ASSESSMENT 4
2.1.1 Longitudinal Profile, and Cross-sectional Surveys 4
2.1.2 Wolman Pebble Counts 7
2.1.3 General Bank and Bed Stability 7
2.2 BANKFULL EVENT INSPECTIONS 8
2.3 BIOLOGICAL MONITORING RESULTS 9
2.3.1 Benthic Macroinvertebrate Results 9
2.3.2 Physical Habitat Assessment 10

3.0 CONCLUSION 11

4.0 REFERENCES 13

List of Figures

FIGURE 1 SITE VICINITY MAP 2
FIGURE 2 MODIFIED GEOMORPHIC AND BIOLOGICAL MONITORING LOCATIONS FOR YEAR 3 3

List of Tables

TABLE 1 CHANNEL BED SLOPES 5
TABLE 2 RESULTS OF CROSS-SECTIONAL SURVEY ANALYSIS 6
TABLE 3 PEBBLE COUNT DATA 7
TABLE 4 PIN LOCATIONS AND MEASUREMENTS 8
TABLE 5 SUMMARY: BENTHIC MACROINVERTEBRATE RESULTS 9
TABLE 6 SUMMARY: PHYSICAL HABITAT INDEX RESULTS 11

List of Appendices

APPENDIX A SITE PHOTOGRAPHS
APPENDIX B LONGITUDINAL PROFILE AND SURVEY DATA
APPENDIX C CROSS SECTIONAL SURVEY DATA
APPENDIX D PEBBLE COUNT DATA
APPENDIX E MACROINVERTEBRATE DATA

1.0 INTRODUCTION

Harford County has requested the pre-construction monitoring of a 2,800-foot unnamed tributary to Bynum Run, which is situated in the general vicinity of Sunnyview and Ring Factory Roads. Specifically, the post-stream restoration project will extend from the tributary's confluence with Bynum Run near McPhail Road and terminate upstream at the Town of Bel Air corporate limits, in Harford County, Maryland (see Figure 1- Site Vicinity Map).

The methods and associated references were outlined previously in the Year One Monitoring Report (KCI 2007), and therefore are not presented in detail in this document. Please refer to the aforementioned report for further information. The majority of this report focuses on the results, discussion, and conclusions from the pre-construction monitoring effort as collected in the third year of monitoring and compared to year's one and two. The following is a brief of summary of methodologies:

Longitudinal Profile and Cross-sectional Surveys
- Installation of 3 concrete benchmarks
- Six cross-section locations
  - Cross-section 1 Station 1+46
  - Cross-section 2 Station 7+78
  - Cross-section 3 Station 12+23
  - Cross-section 4 Station 12+70
  - Cross-section 5 Station 24+24
  - Cross-section 6 Station 26+60

General Bank Stability (Bed and Bank Pins)
- Installation of rebar pins
  - Riffle Station 7+78
  - Pool Station 12+70
  - Pool Station 26+61

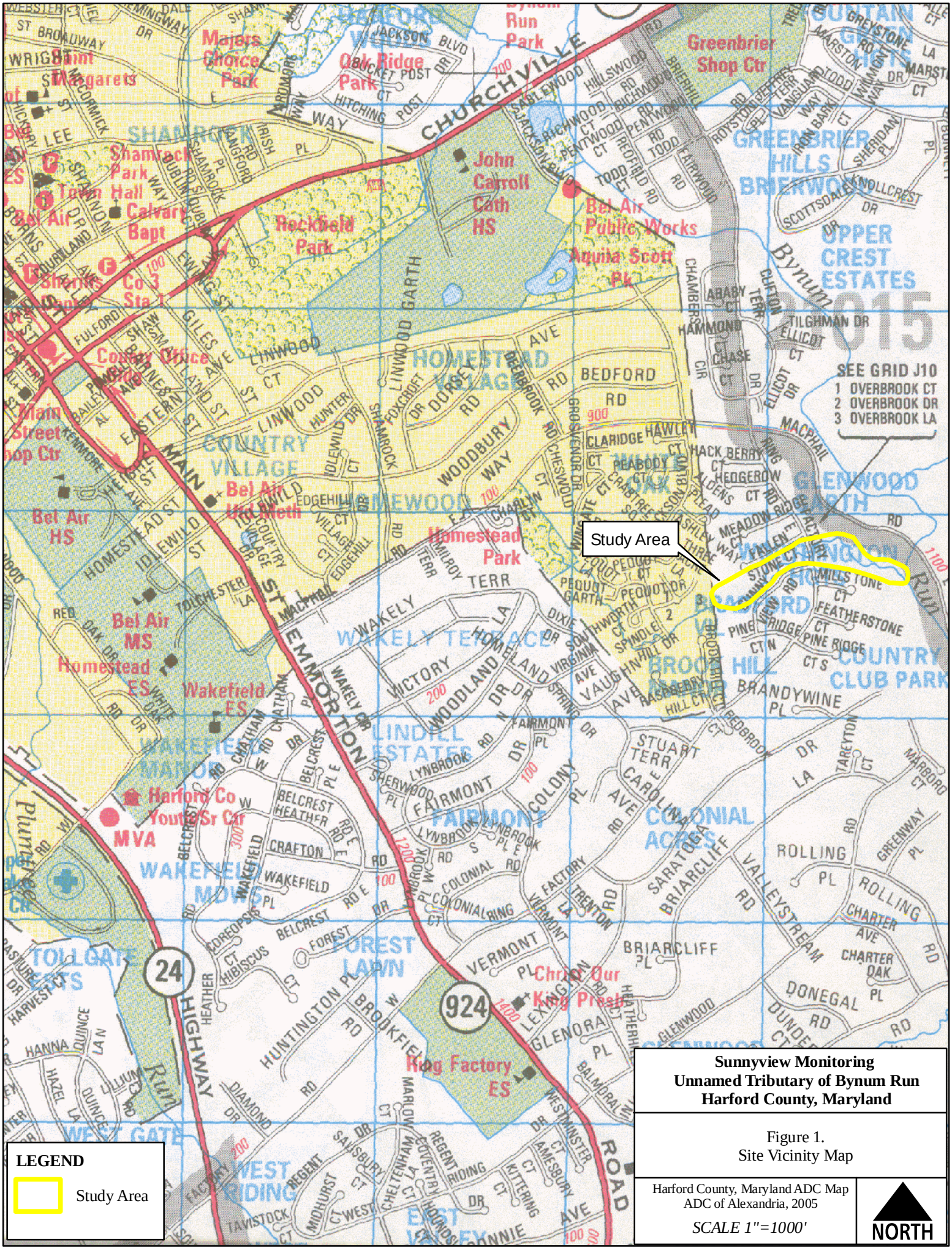
Bankfull Event Inspection

Sediment and Discharge Analysis

Biological Monitoring
- Monitoring stations
  - Station 1 – Upstream Reach
  - Station 2 – Restoration Reach
  - Station 3 – Reference Reach

2.0 MONITORING YEAR 3: RESULTS AND DISCUSSION

This report presents the results of the year 3 monitoring efforts, and a comparison between this recently collected information and the year 1 and year 2 data. The Sunnyview site is being monitored to establish baseline pre-construction conditions, which will be compared to geomorphic and biological data collected after the completion of restoration activities to evaluate the success of the project. Data collected for year 3 monitoring were taken during both 2007 and 2008. Collection dates for each data source are noted in the associated section.



LEGEND

Study Area

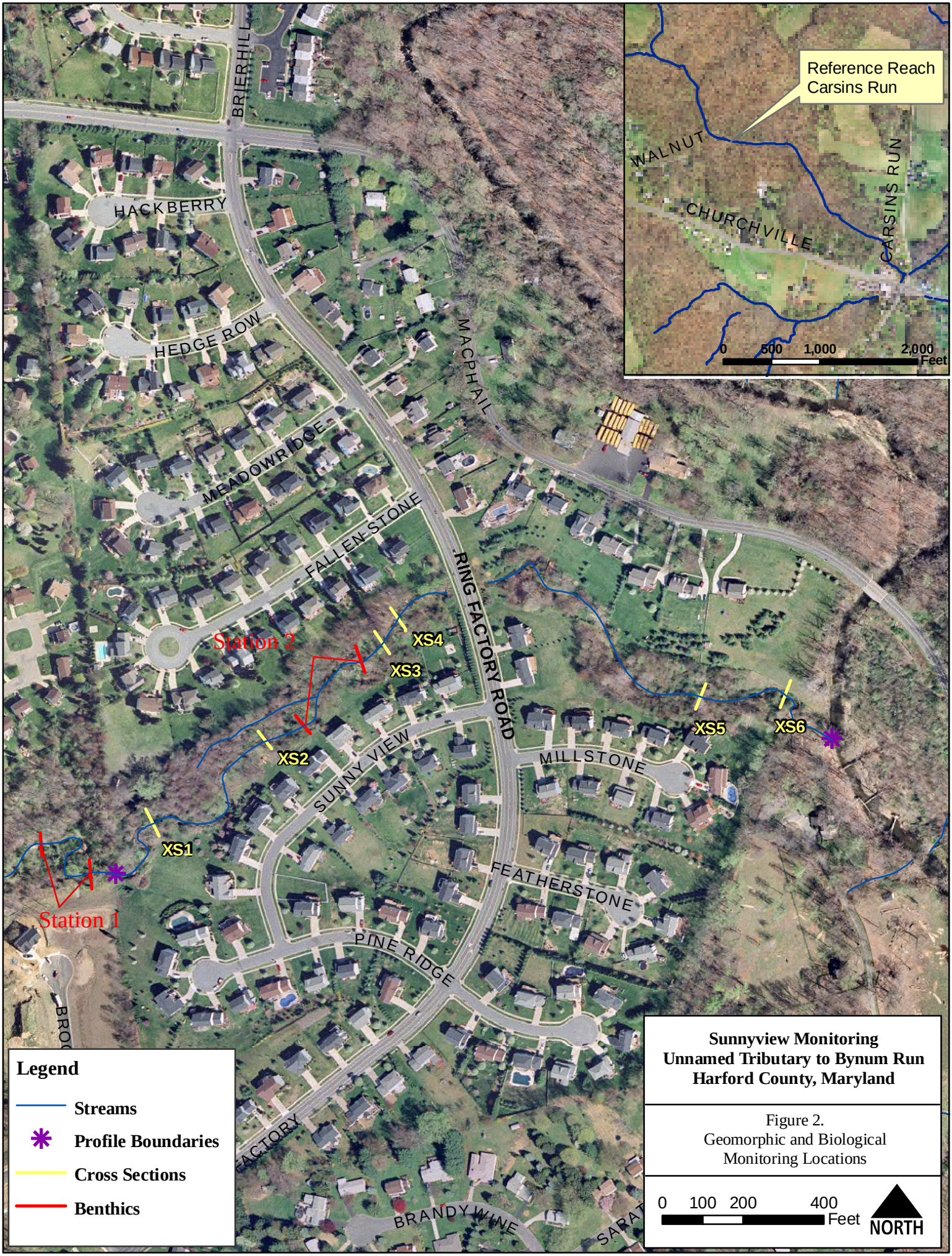
Sunnyview Monitoring
Unnamed Tributary of Bynum Run
Harford County, Maryland

Figure 1.
Site Vicinity Map

Harford County, Maryland ADC Map
ADC of Alexandria, 2005

SCALE 1"=1000'

NORTH



Sunnyview Monitoring
Unnamed Tributary to Bynum Run
Harford County, Maryland

Figure 2.
Geomorphic and Biological
Monitoring Locations

2.1 Fluvial Geomorphic Assessment

2.1.1 Longitudinal Profile, and Cross-section Surveys

The stream profile and six cross-sections established in year 1 were resurveyed by KCI in November 2007 for the year 3 monitoring report. The year 1, year 2 and year 3 data were compared to document changes in channel morphology and evaluate trends. The longitudinal profile elevations were difficult to compare due to the inability to locate the starting benchmark used in year 1 for the following two monitoring years. The profile therefore shows relative elevation and a close approximation of bed features. The cross-sections were adjusted to match the top of pin elevations marking permanent monitoring locations, which allows a direct and accurate identification of morphology and elevation changes.

Longitudinal Profile Survey

Profile data are overlaid in Appendix B to show changes occurring in the channel bed between the three monitoring years. The comparison indicates the same features and trends within the channel bed as seen in year 1 and year 2, such as pool locations and riffle sequences. Refer to the cross-section overlays in Appendix C and channel bed slope data for channel degradation and aggradation changes between the three monitoring years.

Several factors are influencing the slope of the channel between monitoring years upstream and downstream of the Ring Factory Road culvert. The culvert is located at approximately the middle of the monitoring reach and functions as a grade control. Riprap protection extends 100 feet upstream of the culvert. Downstream of the culvert several small scour holes occur within areas of riprap protection. Immediately downstream of the riprap is a meader with a scoured bank 15 feet high that shows signs of active erosion. Slope calculations were taken from the top of the riffle at the upstream start of the profile to the top of the riprap immediately upstream of the culvert. The downstream reach slope calculation is taken at the first riffle downstream of the culvert riprap and scoured bank.

As detailed in Table 1 the overall slope recorded during the year 3 monitoring event is closer to the year 1 data. The year 3 monitoring data indicated a slope of 0.97 percent. Based on the approximate stationing from year 1 monitoring, upstream of Ring Factory Rd the slope decreased to 0.76 percent while downstream of the road the slope is 1.1 percent. As documented in the year 2 Monitoring Report, this similarity in the overall channel slopes between monitoring years is likely due to the previously described bed control functions of the culvert and riprap. The riprap protection upstream of Ring Factory Road continues to hold the bed in place and act as grade control for the entire upstream reach and allows only minor slope adjustments.

Based on existing conditions and field observations it appears that the downstream reach has previously headcut up to the culvert and riprap protection downstream of Ring Factory Road. The bed drop at the end of the riprap is the first location for energy dissipation from the culvert and further energy is dissipated against the bank in the meander bend causing the erosion. The riprap may continue to erode up to the culvert but this will not affect the overall slope of the bed or the downstream slope. The downstream extent of the channel terminates at Bynum Run, therefore changes in the bed of Bynum Run will impact the unnamed tributary. The bed elevation of the downstream reach will likely only change if there is aggradation or degradation within Bynum Run.

The upstream reach's decreased slope may be a result of different upstream starting locations between monitoring years or minor aggradation due to the riprap protection at the downstream extent of the reach. The downstream slope and the overall channel slopes between monitoring year had minor changes.

Table 1 Channel Bed Slopes

Monitoring Event	Upstream Slope (%)	Downstream Slope (%)	Overall Channel Slope (%)
Year 1	0.95	1.1	0.98
Year 2	0.85	1.2	0.93
Year 3	0.76	1.1	0.97

Cross-Section Survey

As described in the year 1 monitoring report, cross-section surveys were analyzed at each of the six permanent monitoring locations to determine bankfull width, mean depth, the width/depth ratio, and cross-sectional area during baseline conditions. Field indicators of bankfull were used to establish initial bankfull elevations during the first year of monitoring. In subsequent monitoring years, the bankfull discharge for each cross-section was approximated (within two tenths) to equate to the bankfull discharge originally estimated in year 1.

This method of comparison was considered most appropriate assuming that bankfull discharge will not change within the three monitoring years due to the relatively stable condition of the watershed. No significant further development has occurred between monitoring years thus equalizing discharge provides opportunity to track changes between each monitoring year. If the cross-section has changed between the two monitoring years the bankfull elevation may also vary despite the constant discharge. The results are summarized in Table 2 and graphical depictions of each section are presented in Appendix C.

Maintaining the bankfull discharge constant between monitoring years, allows for easy identification of changes in bankfull characteristics. Cross-section 1, located upstream near the beginning of the longitudinal profile, has experienced some minor changes. The left bank has eroded likely due to a rock structure placed in the channel immediately upstream of cross-section 1. A tree located on the left bank is beginning to show signs of undercutting, see Appendix A for photographs of cross-section 1. The changes on the right bank are likely due to deposition of sediments on the bank, mainly sandy material, when bankfull flow occurs. Overall, the changes between the left and right banks have somewhat balanced and did not significantly impact cross-section geometry values. Both the bankfull width and the width-to-depth ratio increased slightly by 0.5-ft. but no other significant changes were noted.

Cross-section 2 has undergone significant changes, evident in both the graphical depiction and cross-section analysis data. The most significant change occurred on the right bank where bank materials appear to have slumped in addition to the dumping of other materials, possibly a response by a homeowner to the eroding bank. A downed tree immediately downstream of the cross-section may also be influencing the changes. There were minor signs of erosion at the toe of the left bank. The bankfull width has decreased by 4.2-ft., the width-to-depth ratio decreased by 4.4, and cross-sectional area decreased by 2.9-ft.

Analysis of cross-section 3 data indicates only minor changes. The cross-sectional area has continued to decrease slightly over the monitoring years while the width-to-depth ratio has increased. The graphical depiction shows slight adjustments with the formation of a mid-channel bar during the year 2 monitoring that was not evident during the year 1 or year 3

monitoring results. The bankfull elevations were the very similar between monitoring years, indicating minor adjustment within the cross-section.

Cross-section 4, similar to cross-section 3, also exhibited minimal change. Both are located within 400-ft. upstream of the Ring Factory Road culvert. Bankfull elevations were very similar between monitoring years. An error in the data for year 1 was corrected to address the right bank. The year 2 survey of the left bank lacked sufficient detail therefore the year 3 monitoring effort more accurately represent conditions of the bank. As a result, further erosion is evident at the toe of the left bank. A bar also formed towards the right bank. The erosion and deposition appear to have balanced to allow for minimal overall changes channel geometry.

Cross-section 5, located downstream of the culvert, has shown some changes. The most significant change occurred on the left bank between year 1 and year 2 monitoring. During year 3, the channel adjusted slightly. There was further erosion at the toe of the left bank in addition to aggradation within the channel. The analysis data reflects minimal change besides an increase in bankfull width by 0.8-ft. and increase in the width-to-depth ratio by 1.4.

Cross-section 6 has shown changes throughout the entire cross-section. A detailed survey of the left bank indicated erosion. Material has aggraded within the channel, potentially material eroded from the bank upstream has been deposited there. Erosion is evident at the toe of the right bank also. All values in the analysis data have adjusted somewhat, most notably the bankfull width has increased by 1.0-ft. Overall the cross-section appears to be in an area of very mobile channel material.

Table 2 Results of Cross-sectional Survey Analysis

Year Performed	Bankfull Width (ft)	Mean Depth (ft)	Width/Depth Ratio	Cross-sectional Area (ft^2)	Bankfull Discharge (ft^3/s)
Cross-section 1 Station 1+46					
Year 1	14.9	1.9	7.8	28.2	168.1
Year 2	16.4	1.8	9.3	29.0	168.0
Year 3	23.8	1.4	17.0	33.3	168.0
Cross-section 2 Station 7+78					
Year 1	20.0	1.4	14.1	28.4	125.9
Year 2	18.5	1.4	13.3	25.9	125.9
Year 3	15.5	1.5	10.1	23.6	125.7
Cross-section 3 Station 12+23					
Year 1	23.2	1.7	13.9	38.6	189.2
Year 2	24.0	1.5	15.8	36.4	189.4
Year 3	24.0	1.5	16.2	35.7	189.3
Cross-section 4 Station 12+70					
Year 1	15.0	2.0	7.4	30.7	165.3
Year 2	14.6	2.1	7.1	30.0	165.3
Year 3	15.3	2.0	7.7	30.4	165.2
Cross-section 5 Station 124+24					
Year 1	20.9	1.6	12.9	34.0	163.1
Year 2	23.3	1.4	16.1	33.7	163.1
Year 3	24.1	1.4	17.5	33.1	163.0
Cross-section 6 Station 26+60					
Year 1	21.0	1.4	14.6	30.2	155.2
Year 2	23.8	1.4	17.4	32.5	155.2
Year 3	24.8	1.3	18.5	33.1	155.1

2.1.2 Wolman Pebble Counts

In analyzing the year 1 monitoring data it was determined that pebble count data would be valuable to aid in the analysis of bed material and erosion. As a result two pebble count stations were established at riffles within the study reach during year 2. One was established just down stream of cross-section 2 and the second was located in the riffle at cross-section 6. Pebble count data at these sections provides an evaluation of changes in channel material and coarseness over the monitoring years. Particle size distribution charts of the combined pebble counts are included in Appendix D. The results are summarized in Table 3 below. No pebble count data was collected during year 1 monitoring.

Table 3 Pebble Count Data

Date	Cross-section 2		Cross-section 6	
	D_{50} (mm)	**D_{84}** (mm)	**D_{50}** (mm)	**D_{84}** (mm)
01/04/2007	24	46	21	50
07/18/2007	24	65	24	53
11/20/2007	12	61	19	43

Both the graphical depiction and the data in Table 3 indicated a shift in material size at cross-section 2. Between the sampling dates the D_{50} changed from coarse to medium gravel. Although the D_{84} value increased in size the graphical depiction indicates it to be a minor change. There is an increase in the amount of smaller materials. Cross-section 6 data and the graphical depiction indicate minor shifting but no significant changes in values. The changes in cross-section 2 may be influenced by the failed bank within the riffle reach where the pebble count data was collected.

2.1.3 General Bank and Bed Stability

During the baseline condition monitoring, bed and bank pins were installed at three locations and the exposed length of each pin was measured. The data for bank pin measurement are summarized below in Table 4. Negative values for the measurements indicate the length of pin exposed, while positive values indicate the amount of deposition on top of the pin. Total changes, both erosion and deposition, from 2005 to 2008 are provided. These values reflect the total change seen over the monitoring periods. In general, annual erosion rates of 0.03 feet are considered typical, rates between 0.03 and 0.1 foot are considered to be moderate and rates that exceed 0.1 foot per year are considered high (Pizzuto 2007).

Cross-section 2 (7+78) was difficult to evaluate due to the deposition of materials previously described in the cross-section analysis section. The three remaining pins continued to be buried between year 2 and year 3 monitoring years and could not be located. This bank shows sings of erosion yet determining the rate is difficult. Total change in rebar exposure at cross-section 4 (12+70) indicates there is active bank erosion. The full bank profile survey during year 3 monitoring characterized the high rate of erosion on the bank. There is some deposition in the channel which reduced the exposure of the channel pin in addition to aggradation on the bank over the bank pin at cross-section 4. The bank pin is located beneath a tree root system on an outer meander bend. Previous measurements indicate this pin has experienced high rates of

erosion although the more recent measurements are not considered highly erosive. The likely explanation for this difference would be the method used to measure the pin due to a collection of loose woody debris between the pin and the bank.

The last bank pin location, cross-section 6 (26+61), indicated high rates of erosion for two of three pins. The bank pin and toe pin had the highest rates of erosion between the monitoring years in comparison to the channel pin. The channel pin was slightly exposed on the 11/20/07 monitoring and later appeared to be buried. The graphical depiction of cross-section 6 clearly indicates significant bank erosion and deposition on the channel pin.

Table 4 Pin Locations and Measurements

		Measurement of Exposure (-) / Deposition (+) (ft)						
	Location	11/03/05	08/30/06	11/22/06	01/04/07	11/20/07	02/08/08	Total Change (ft)
Cross-section 2 - Station 7+78								
0+02.7 V	Bank	-0.08	-1.12	-1.08	DNF	DNF	DNF	removed
0+0.82 V	Bank	-0.15	-0.25	-0.28	-0.32	DNF	DNF	buried
0+0.11 V	Toe Pin	-0.13	DNF	DNF	DNF	DNF	DNF	buried
0+12.5 H	Channel	-0.20	+0.25	+0.25	DNF	DNF	DNF	buried
Cross-section 4 - Station 12+70								
0+1.44 V	Bank	-0.38	-0.7	-0.86	-0.90	-0.40	-0.40	-0.02
0+7.7 H	Channel	-0.73	-0.58	DNF	-0.78	-0.48	-0.48	0.25
Cross-section 6 - Station 26+61								
0+1.78 V	Bank	-0.07	-0.40	-0.46	-0.44	-0.88	-1.2	-1.13
0+0.38 V	Toe	-0.10	-0.64	-0.72	-0.71	-0.72	-0.36	-0.26
0+8.0 H	Channel	-0.04	-0.07	DNF	-0.26	-0.01	DNF	buried

"H" represents a horizontal offset from the nearest cross section pin (pin is located in the channel)
"V" represents a vertical distance from the channel pin (pin is located in the bank)
"DNF" indicates field observations did not find pins due to burial or eroded out of the bank
"removed" assumes the pin was completely removed from the bank based on indications at the section
"buried" assumes the pin was completely buried in place based on indications at the section

Data from cross-section 2 is difficult to evaluate. Although some material appears to have slumped from the bank, other material may have been displaced by the fallen tree or dumped by a landowner. There was an inability to locate all the pins in year 2, however erosion rates can be considered high based on year 1 monitoring. Therefore, erosion at cross-section 2 is a concern despite the previously described factors. Similar to the year 2 monitoring results, data from the beginning monitoring period compared to the ending monitoring period indicates moderate to high bank erosion at both cross-section 4 and cross-section 6.

2.2 Bankfull Event Inspections

During year 3 monitoring one bankfull event inspection occurred in addition to the initial longitudinal profile survey in November 2007. Rainfall records indicated 1.96" of precipitation during a storm event within the week prior to the inspection which justified a bankfull event inspection. During both inspections, bank pin measurements were taken to document changes. The second inspection on February 8, 2008 did not indicate significant changes therefore the banks were not surveyed beyond the bank pin measurements. The greatest observed change occurred between the geomorphic survey of year 2 and the geomorphic survey for year 3, similar to the previous monitoring results.

2.3 Biological Monitoring Results

2.3.1 Benthic Macroinvertebrate Results

A summary of Benthic Macroinvertebrate Sampling Data is presented in Table 5 below. Complete taxa lists and metric evaluation data are included as Appendix E.

Results for the three years of sampling indicate fluctuating scores for the upstream sampling reach (Station 1). In contrast, the reference and restoration reaches have maintained fairly consistent scores over the course of sampling. For 2007, the upstream reach (Station 1) was classified as "Very Poor", the restoration reach (Station 2) was classified as "Poor" and the reference reach at Carsins Run was classified as "Good." This is a decrease in score for the upstream reach from 2006. Scores for the restoration reach (Station 2) and the reference reach received the same narrative rating as 2006.

Table 5 Summary: Benthic Macroinvertebrate Results

Raw Scores	**2005**			**2006**			**2007**		
	Sta.1	**Sta.2**	**Reference**	**Sta.1**	**Sta.2**	**Reference**	**Sta.1**	**Sta.2**	**Reference**
Total Number of Taxa	21	24	29	35	28	34	23	23	28
Number of EPT Taxa	4	5	10	9	2	15	4	5	11
Number of Ephemeroptera Taxa	0	0	4	4	1	6	1	0	7
Percent Intolerant Urban	8	9	51	17	19	60	10	12	52
Percent Chironomidae	30	5	15	60	67	27	61	76	27
Percent Clingers	33	60	70	28	21	83	27	15	25
BIBI Scores	**2005**			**2006**			**2007**		
	Sta.1	**Sta.2**	**Reference**	**Sta.1**	**Sta.2**	**Reference**	**Sta.1**	**Sta.2**	**Reference**
Total Number of Taxa	3	3	5	5	5	5	3	3	5
Number of EPT Taxa	1	3	3	3	1	5	1	3	5
Number of Ephemeroptera Taxa	1	1	5	5	1	5	1	1	5
Percent Intolerant Urban	1	1	5	3	3	5	1	3	5
Percent Chironomidae	3	3	3	3	1	3	3	1	3
Percent Clingers	3	3	3	1	1	5	1	1	1
BIBI Score	***2.0***	***2.3***	***4.0***	***3.3***	***2.0***	***4.7***	***1.7***	***2.0***	***4.0***
Narrative Rating	***Poor***	***Poor***	***Good***	***Fair***	***Poor***	***Good***	***Very Poor***	***Poor***	***Good***

For the 2007 sampling, the upstream reach (Station 1), received an overall rating of "Very Poor" with a score of 1.7. Taxa diversity was fair with 23 taxa identified in the sample. The percentage of chironomids (midges) was high, making up 61 percent of the sample. The sample lacked sensitive taxa, receiving the lowest possible scores for three metrics that are based on the presence of sensitive taxa. Only ten percent of the sample (7 individuals) was considered intolerant to urban stressors.

There were 23 taxa identified at Station 2, the proposed restoration reach. This is the lowest of the three stations, and a decrease from the 2005 and 2006 samples, but still indicates a fairly diverse macroinvertebrate community. As with the 2006 sample, this site was heavily dominated by Chironomidae taxa, which made up 76 percent of the sample, leading to the lowest possible score for the Percent Chironomidae metric. There were no Ephemeroptera taxa present in the sample, giving the lowest possible score for this metric as well. This sampling reach received the lowest possible score for three of the six metrics, leading to an overall score of 2.0, with a rating of "Poor."

The 2007 sample for the Reference Reach on Carsins Run, northeast of Walnut Road, had 28 taxa identified. Eleven of the identified taxa were Ephemeroptera, Plecoptera or Trichoptera taxa. Fifty-seven percent of the sample was made up of individuals considered intolerant to urban stressors (tolerance values between 0 and 3), which is similar to percentages in the 2005 and 2006 samples at this site. Of the five calculated metrics only two scored lower than the highest possible score of five. The percentage of Chironomidae has increased for each sample collected since 2005 (although the score for this metric remained the same) while the percentage of clingers has significantly decreased, lowering the score for the Percent Clingers metric. The overall rating remained in the "Good" range with a score of 4.0.

2.3.2 Physical Habitat Assessment

A summary of the Physical Habitat data is presented in Table 6 below.

In 2007, the upstream reach (Station 1), received an overall physical habitat score of 63.50, or "Degraded." Changes in this sampling reach from the previous year were obvious with more erosion overall and less vegetation along the right bank. The channel is highly entrenched and eroding with an unconsolidated gravel and cobble substrate. Riffle quality and epifaunal substrate were rated as adequate with a good number of woody debris and rootwads available for colonization. The benthic macroinvertebrate rating of "Very Poor" at Station 1 supports the "Degraded" habitat rating for 2007.

Station 2, the proposed restoration reach, also scored in the "Degraded" range, with a PHI score of 60.85, slightly lower than Station 1. This reach runs parallel to Magnolia Road, reducing the possibility for a healthy riparian zone along the right bank. The right bank is experiencing moderate to severe erosion for over half the sampling reach. The riparian buffer along the left bank (facing downstream) is forested for the entire length of the sampling reach. Streambank vegetation along this bank provides ample shading and some bank stability.

The Reference Reach scored 82.15 with a rating of "Minimally Degraded." The reference reach was chosen based on its similarities in stream conditions to Stations 1 and 2. It is consistently rated the highest of the three sampling sites. The reach is composed primarily of pool and run sequences with stable pool habitat and small riffles with gravel cobble substrate. Habitat availability is good for both fish and aquatic macroinvertebrates.

Table 6 Summary: Physical Habitat Index Results

Site		Remoteness (0 – 20)	Percent Shading (0 – 100)	Epifaunal Substrate (0 – 20)	Instream Habitat (0 – 20)	Number of Instream Woody Debris	Bank Stability (0 – 20)	PHI (0 – 100)	Narrative Rating*
2005	Station 1	5	40	10	8	4	10	***54.76***	***Degraded***
	Station 2	4	60	10	13	8	10	***61.18***	***Degraded***
	Reference Reach	15	65	12	15	4	20	***76.95***	***Partially Degraded***
2006	Station 1	6	70	18	18	9	15	***81.89***	***Minimally Degraded***
	Station 2	6	75	18	16	5	16	***78.78***	***Partially Degraded***
	Reference Reach	18	85	17	18	7	18	***90.34***	***Minimally Degraded***
2007	Station 1	4	50	15	17	6	6	***63.50***	***Degraded***
	Station 2	4	60	14	15	6	10	***60.85***	***Degraded***
	Reference Reach	13	75	16	17	3	15	***82.15***	***Minimally Degraded***

*PHI Narrative Rating Categories: Minimally Degraded: 81 – 100; Partially Degraded: 66 – 80.9; Degraded: 51 – 65.9; Severely Degraded: 0 – 50.9.

The subjective habitat ratings have fluctuated over the course of monitoring at all three sampling stations. These differences are likely a combination of the time of year in which the sample was collected and differences in sampling crews. In 2005, sampling was conducted in November. For 2006 and 2007, sampling was completed in May. Analyses using MBSS methods are meant to be applied to samples collected in the spring. Accordingly, the second and third years of pre-construction monitoring should be a more accurate representation of baseline conditions. Results of the habitat assessments for 2006 and 2007 indicate degrading habitat at Stations 1 and 2. Macroinvertebrate scores showed a corresponding decrease at Station 1. However, macroinvertebrate scores remained consistent at Station 2 despite a decrease in perceived habitat quality.

3.0 CONCLUSION

The Harford County Department of Public Works, Water Resources Engineering Division requested KCI to perform stream monitoring to assist with the documentation of existing physical and biological conditions within an 2,800-foot reach of an unnamed tributary to Bynum Run at Sunnyview Road.

Trends from the year 2 monitoring continue to be evident at the conclusion of the year 3 monitoring. The banks continue to erode in several locations throughout the monitoring reach. These changes are visible based on the graphical depictions of cross-sections in addition to the bank pin measurements at various cross-sections. Despite a decrease in slope, monitoring data from year 3 supports previous conclusions of greater stability upstream of Ring Factory Rd. although there are several areas of severe bank erosion within the upper monitoring section. This is evident based on the similarities of the longitudinal profile between monitoring years.

The riprap extending upstream from the culvert continues to protect the upstream reach by serving as a grade control.

Year 3 pebble count data indicates only minor changes, mainly in material size, transitioning from coarser to finer materials, as seen in the graphical depictions of cross-section 2. It is likely these changes are within the normal expected variation caused by ongoing channel adjustment. The majority of sediment transported through the system is likely from eroded bank material in the upstream reach of the monitoring site as noted with the changes in cross-section 2 and the eroded bank within that riffle. Recommendations for the problems associated with the tributary are consistent with previous monitoring years due to the trends in monitoring results and analysis. In general, the use of vegetation to stabilize banks and increasing floodplain access could significantly reduce problems within the tributary. In some areas where meander bends are greater than 90 degrees a more hardened approach (such as vanes) may be required to protect banks (stone toe or imbricated banks) depending on confounding issues with easements and infrastructure.

The third year of pre-construction monitoring at the unnamed tributary to Bynum Run at Sunnyview indicates a degraded habitat. Stations 1 (upstream of the restoration reach) and 2 (within the restoration reach) received 'Very Poor' and 'Poor' ratings for benthic macroinvertebrates, respectively. Diversity at both sites is good, but both lack sensitive taxa. Habitat assessment scores for both sites were in the 'Degraded' range. Baseline conditions will be compared to conditions and data collected in the post-construction phase to assess the impact of the restoration on the water quality and biotic community in the unnamed tributary.

4.0 REFERENCES

ADC of Alexandria. Harford County, Maryland ADC Map, 2005.

Boward, D. and E. Friedman. 2000. Maryland Biological Stream Survey Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD. CBWP-MANTA-EA-00-6.

Heasted Methods Inc. 2004. FlowMaster V7.

Kazyak, P.F. 2001 Maryland Biological Stream Survey Sampling Manual. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Leopold, L. B., M.G. Wolman and J.P. Miller. 1964. Fluvial Processes in Geomorphology. Freeman, San Francisco, CA.

Mecklenburg, D. 2006. The Reference Reach Spreadsheet- For Channel Survey Data Management. V 4.1L. Ohio Department of Natural Resources.

Merritt, R.W. and Cummins, K.W. 1996 An Introduction to the Aquatic Insects of North America, 3rd edition, Kendall / Hunt Publishing Company.

Paul, M.J., J.B. Stribling, R.J Klauda, P.F. Kazyak, M.T. Southerland and N.E. Roth. 2003. A Physical Habitat Index for Freshwater Wadeable Streams in Maryland, Final Report. Maryland Department of Natural Resources. Monitoring and Non-Tidal Assessment Division. CBWP-MANTA-EA-03-4.

Pizzuto, J. 2007, Personal communication. Professor, Department of Geology, University of Delaware. Newark, DE. February 8, 2007

Southerland, M.T., G.M. Rogers, M.J. Kline, R.P. Morgan, D.M. Boward, P.F. Kazyak, R.J. Klauda, S.A. Stranko. 2005. New Biological Indicators to Better Assess the Condition of Maryland Streams. DNR-12-0305-0100. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Strum, T.W. 2001. Open Channel Hydraulics, 1st ed. McGraw-Hill. 493p.

APPENDIX A

SITE PHOTOGRAPHS

View facing upstream at upstream start of survey, approximately station 0+50.

View facing downstream at upstream start of the survey.

View facing upstream at cross-section 1, located at station 1+46; note the man-made rock structure in channel obstructing flow.

View facing downstream at cross-section 1, located at station 1+46.

View facing the left bank at cross-section 1, station 1+46.

View facing the right bank at cross-section 1, station 1+46.

View facing upstream at cross-section 2, located at station 7+78.

View facing downstream at cross-section 2, located at station 7+78.

View facing the left bank at cross-section 2.

View of slumped right bank at cross-section 2. Note: bank pins at this location are not visible. Material appears to include matter “dumped” on top of slumping area. See text for further explanation.

View facing upstream at cross-section 3 located at station 12+23.

View facing downstream at cross-section 3 located at station 12+23.

View facing the left bank at cross-section 3, note eroding of the bank.

View facing the right bank at cross-section 3, area includes yard waste.

View facing upstream at cross-section 4, located at station 12+70.

View facing downstream at cross-section 4, located at station 12+70.

View facing the left bank at cross-section 4, note undercutting of bank and exposed roots. Bank pins are located on this bank and in the channel.

View facing upstream of the downstream end of culvert at Ring Factory Road.

View facing upstream at large scour pool, located at station 16+91; note steep, eroding banks along residential yards on outside meander.

View facing upstream at cross-section 5, located at station 24+24

View facing downstream at cross-section 5, located at station 24+24.

View facing the left bank at cross section 5.

View facing the right bank at cross-section 5. Note the exposed roots along the bank.

View facing upstream at cross- section 6, located at station 26+61.

View facing downstream at cross-section 6, located at station 26+61. Note the undercutting of the bank and exposed roots.

View facing the left bank at cross-section 6. Note the eroding of the bank and exposed roots where bank and channel pins are located.

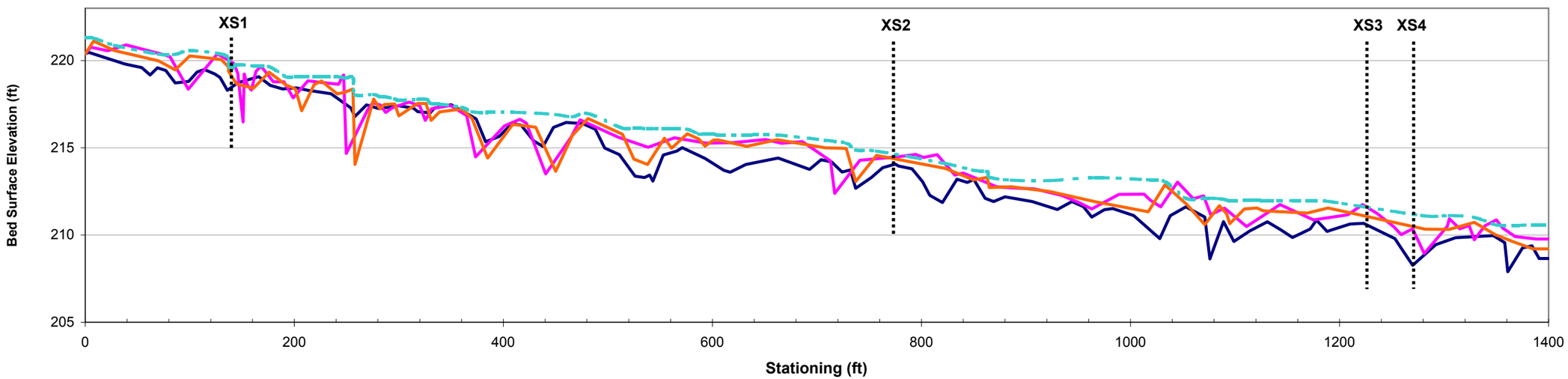
View facing the right bank at cross section 6.

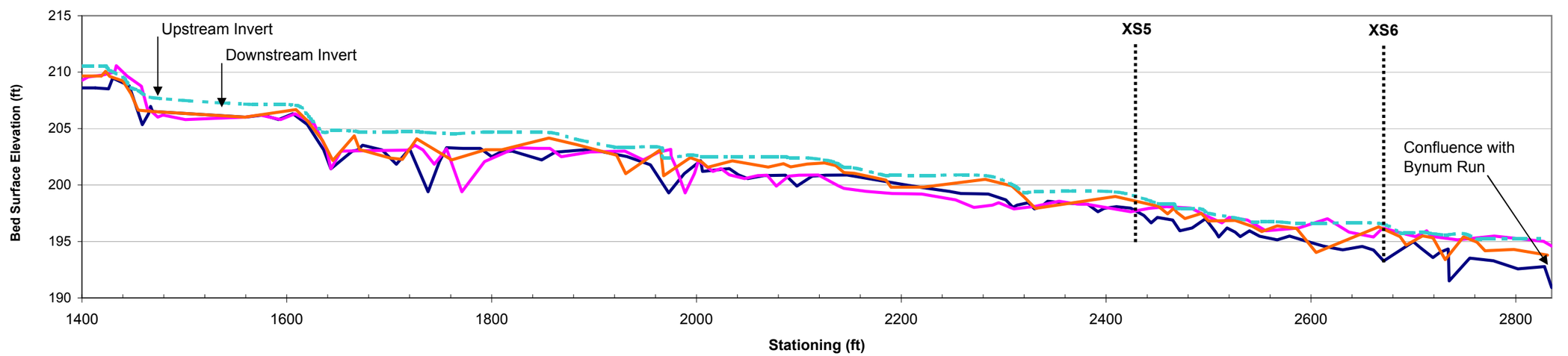
View facing downstream of the confluence with Bynum Run and end of survey.

APPENDIX B

LONGITUDINAL PROFILE SURVEY DATA

Sunnyview Physical Assessment
Longitudinal Profile 2005-2007





Year 1 | Year 2 | Year 3 | Year 3 Water Surface

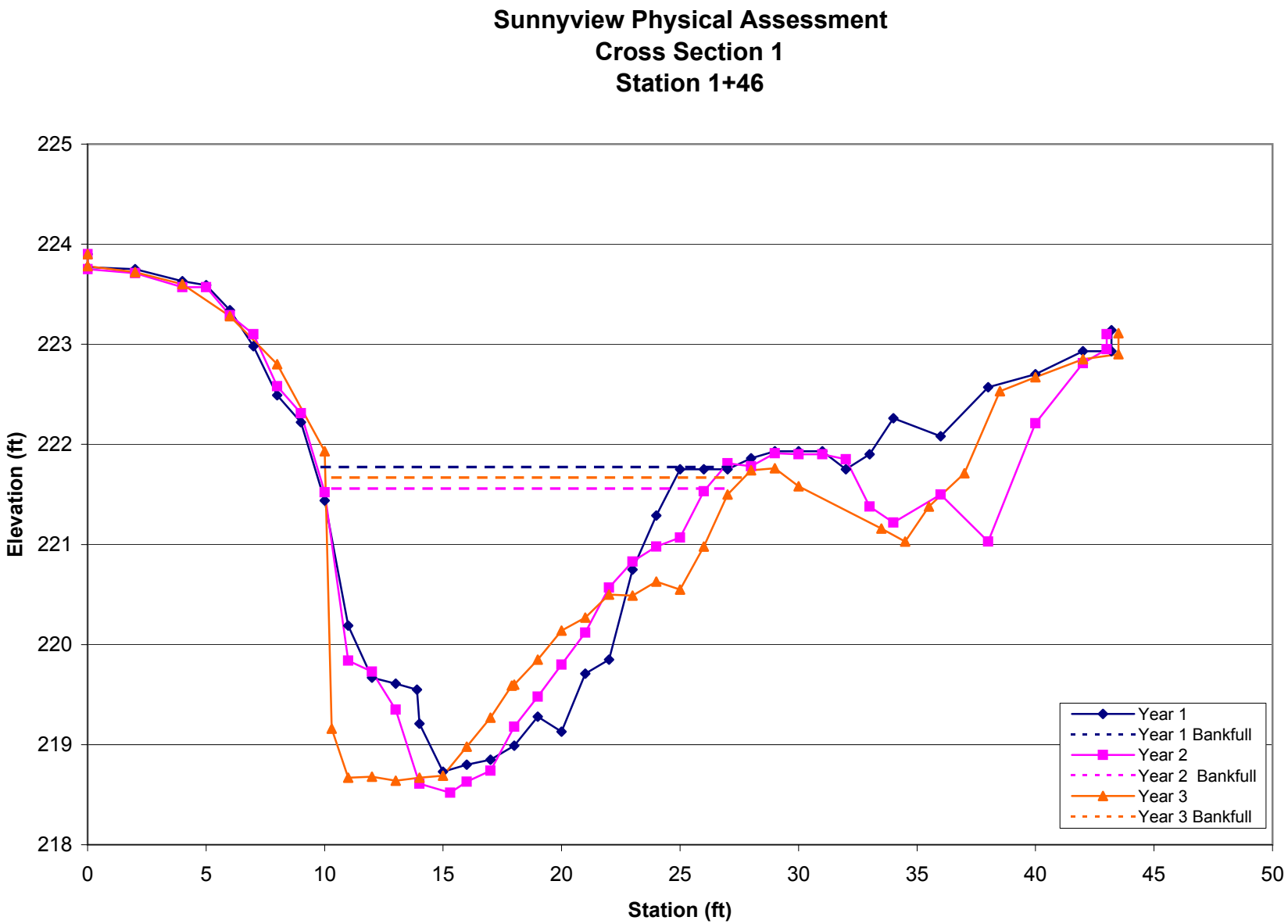
APPENDIX C

CROSS-SECTIONAL SURVEY DATA

CROSS-SECTION 1 STATION 1+46

Pin Adjustment Factors			Year 2	**0.13**		Year 3	**0.19**	
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	223.9	Pin	0	223.9	Pin	0	223.9	Pin
0	223.77	Pin	0	223.75	Pin	0	223.78	Pin
2	223.75		2	223.71		2	223.72	
4	223.63		4	223.57		4	223.6	
5	223.59		5	223.57		6	223.28	
6	223.34		6	223.29		8	222.8	
7	222.98		7	223.1		10	221.93	
8	222.49		8	222.58		10.3	219.16	
9	222.22		9	222.31		11	218.67	
10	221.44		10	221.52	bnkfl	12	218.68	
11	220.19		11	219.84		13	218.64	
12	219.67		12	219.73		14	218.67	
13	219.61		13	219.35		15	218.69	
13.9	219.55		14	218.61		16	218.98	
14	219.21		15.3	218.52		17	219.27	
15	218.73		16	218.63		17.9	219.59	
16	218.8		17	218.74		18	219.6	
17	218.85		18	219.18		19	219.85	
18	218.99		19	219.48		20	220.14	
19	219.28		20	219.8		21	220.27	
20	219.13		21	220.12		22	220.5	
21	219.71		22	220.57		23	220.49	
22	219.85		23	220.83		24	220.63	
23	220.75		24	220.98		25	220.55	
24	221.29		25	221.07		26	220.98	
25	221.75	bnkfl	26	221.53		27	221.5	
26	221.75		27	221.81		28	221.74	
27	221.75		28	221.78		29	221.76	
28	221.86		29	221.91		30	221.58	
29	221.93		30	221.9		33.5	221.16	
30	221.93		31	221.9		34.5	221.03	
31	221.93		32	221.85		35.5	221.38	
32	221.75		33	221.38		37	221.71	
33	221.9		34	221.22		38.5	222.53	
34	222.26		36	221.5		40	222.67	
36	222.08		38	221.03		42	222.85	
38	222.57		40	222.21		43.5	222.9	Pin
40	222.7		42	222.81		43.5	223.11	Pin
42	222.93		43	222.95	Pin			
43.2	222.93	Pin	43	223.1	Pin			
43.2	223.14	Pin						
Bankfull Year 1		221.75	**Bankfull Year 2**		221.52	**Bankfull Year 3**		221.46

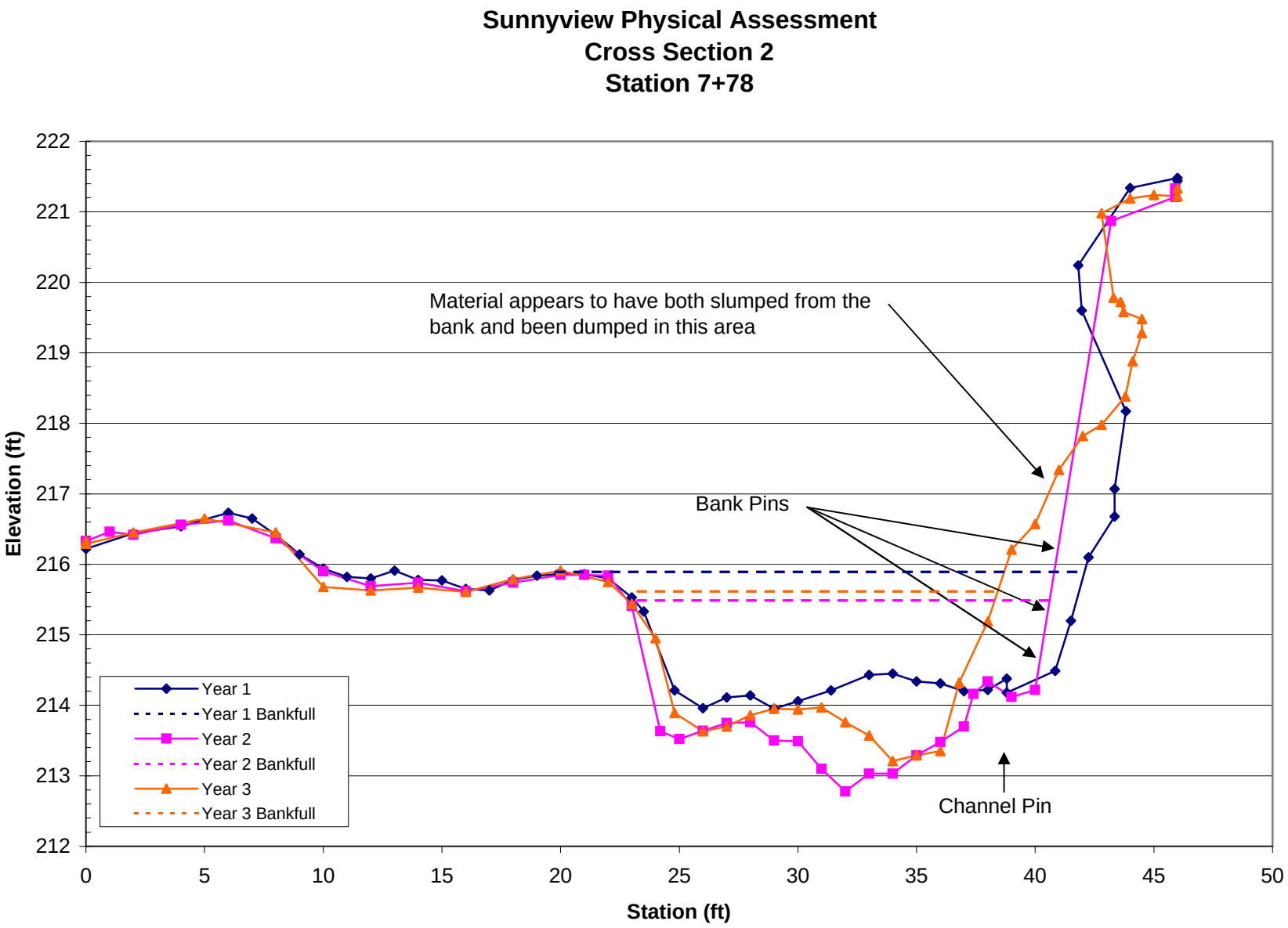
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



CROSS-SECTION 2 STATION 7+78

Pin Adjustment Factors				**Year 2**	2.05		**Year 3**	2.05
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	216.33	Pin	0	216.33	Pin	0	216.33	Pin
0	216.22	Pin	1	216.46		0	216.29	Pin
2	216.44		2	216.42		2	216.45	
4	216.54		4	216.56		5	216.65	
6	216.73		6	216.62		8	216.45	
7	216.65		8	216.37		10	215.68	
8	216.42		10	215.9		12	215.63	
9	216.14		12	215.69		14	215.67	
10	215.94		14	215.74		16	215.61	
11	215.82		16	215.62		18	215.79	
12	215.8		18	215.74		20	215.91	
13	215.91		20	215.85		22	215.75	
14	215.78		21	215.85		23	215.44	
15	215.77		22	215.84		24	214.95	
16	215.65		23	215.41	bnkfl	24.8	213.89	
17	215.63		24.2	213.63		26	213.63	
18	215.78		25	213.52		27	213.7	
19	215.84		26	213.64		28	213.86	
19.9	215.86		27	213.75		29	213.95	
21	215.86		28	213.76		30	213.94	
22	215.8	bnkfl	29	213.5		31	213.97	
23	215.53		30	213.49		32	213.76	
23.5	215.33		31	213.1		33	213.57	
24.8	214.21		32	212.78		34	213.21	
26	213.96		33	213.03		35	213.29	
27	214.11		34	213.03		36	213.35	
28	214.14		35	213.29		36.8	214.32	
29	213.95		36	213.48		38	215.19	
30	214.06		37	213.7		39	216.21	
31.4	214.21		37.4	214.16		40	216.57	
33	214.43		38	214.34		41	217.34	
34	214.45		39	214.12		42	217.82	
35	214.34		40	214.22		42.8	217.98	
36	214.31		43.2	220.87		43.8	218.38	
37	214.2		45.9	221.21	Pin	44.1	218.88	
38	214.22		45.9	221.33	Pin	44.5	219.28	
38.8	214.38					44.5	219.48	
38.8	214.18					43.72	219.58	
40.8	214.49					43.6	219.72	
41.5	215.2					43.3	219.78	
42.3	216.1					42.8	220.98	
43.3	216.68					44	221.19	
43.3	217.07					45	221.24	
43.8	218.17					46	221.22	Pin
42	219.6					46	221.33	Pin
41.8	220.24							
44	221.34							
46	221.48	Pin						
46	221.44	Pin						
Bankfull Year		215.8	**Bankfull Year 2**		215.41	**Bankfull Year 3**		215.46

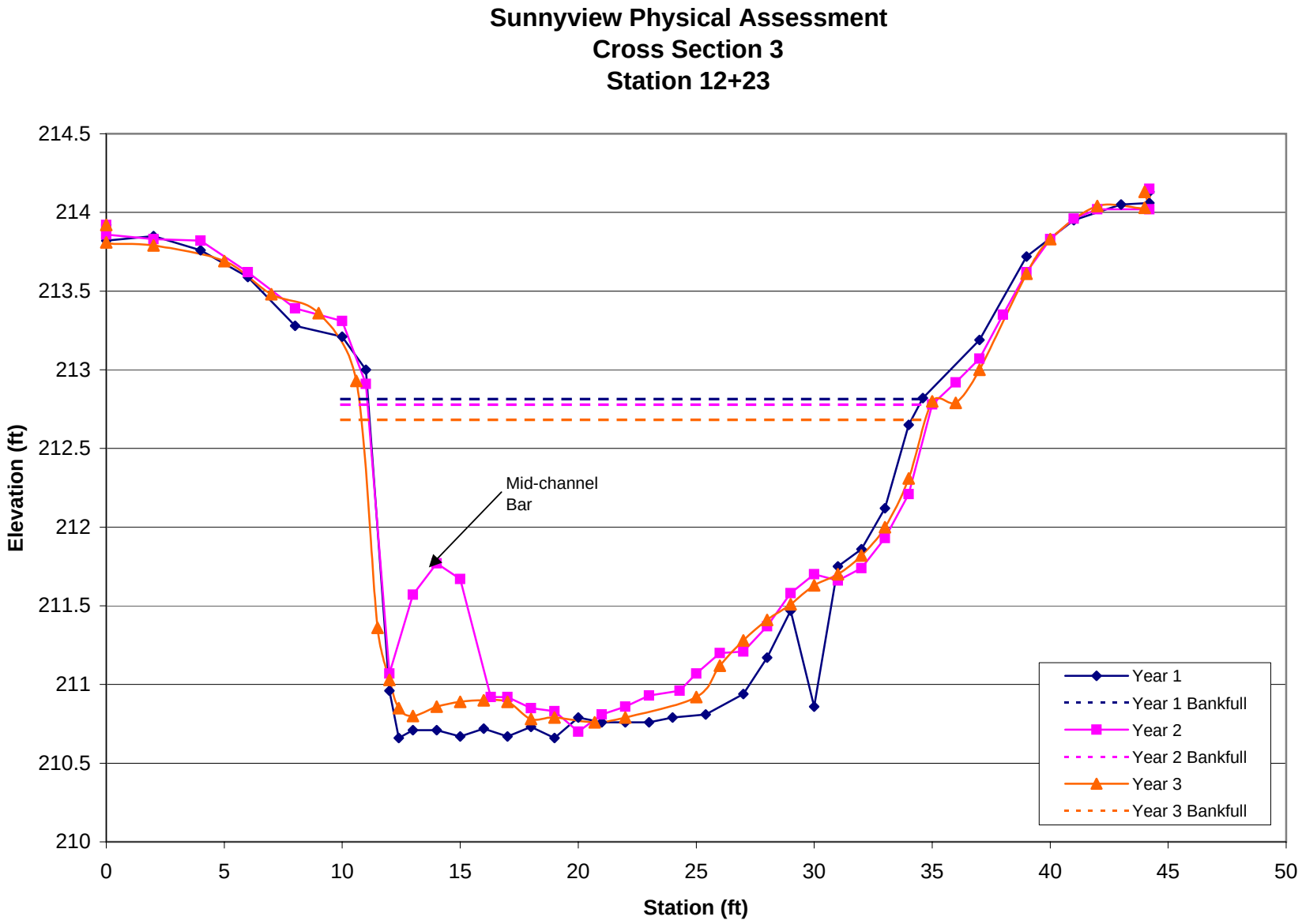
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



CROSS-SECTION 3 STATION 12+23

Pin Adjustment Factor			Year 2	**2.97**		**Year 3**		0.83
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	213.92	Pin	0	213.92	Pin	0	213.92	Pin
0	213.82	Pin	0	213.86	Pin	0	213.81	Pin
2	213.85		2	213.83		2	213.79	
4	213.76		4	213.82		5	213.69	
6	213.59		6	213.62		7	213.48	
8	213.28		8	213.39		9	213.36	
10	213.21		10	213.31		10.6	212.93	
11	213		11	212.91		11.5	211.36	
12	210.96		12	211.07		12	211.03	
12.4	210.66		13	211.57		12.4	210.85	
13	210.71		14	211.77		13	210.8	
14	210.71		15	211.67		14	210.86	
15	210.67		16.3	210.92		15	210.89	
16	210.72		17	210.92		16	210.9	
17	210.67		18	210.85		17	210.89	
18	210.73		19	210.83		18	210.78	
19	210.66		20	210.7		19	210.79	
20	210.79		21	210.81		20.7	210.76	
21	210.76		22	210.86		22	210.79	
22	210.76		23	210.93		25	210.92	
23	210.76		24.3	210.96		26	211.12	
24	210.79		25	211.07		27	211.28	
25.4	210.81		26	211.2		28	211.41	
27	210.94		27	211.21		29	211.51	
28	211.17		28	211.37		30	211.63	
29	211.47		29	211.58		31	211.7	
30	210.86		30	211.7		32	211.82	
31	211.75		31	211.66		33	212	
32	211.86		32	211.74		34	212.31	
33	212.12		33	211.93		35	212.8	
34	212.65		34	212.21		36	212.79	
34.6	212.82		35	212.78		37	213	
37	213.19		36	212.92		39	213.61	
39	213.72		37	213.07		40	213.83	
41	213.95		38	213.35		42	214.04	
43	214.05		39	213.62		44	214.03	Pin
44.2	214.06	Pin	40	213.83		44	214.13	Pin
44.2	214.13	Pin	41	213.96				
			42	214.02				
			44.2	214.02	Pin			
			44.2	214.15	Pin			
Bankfull Year 1		212.82	**Bankfull Year 2**		212.78	**Bankfull Year 3**		212.7

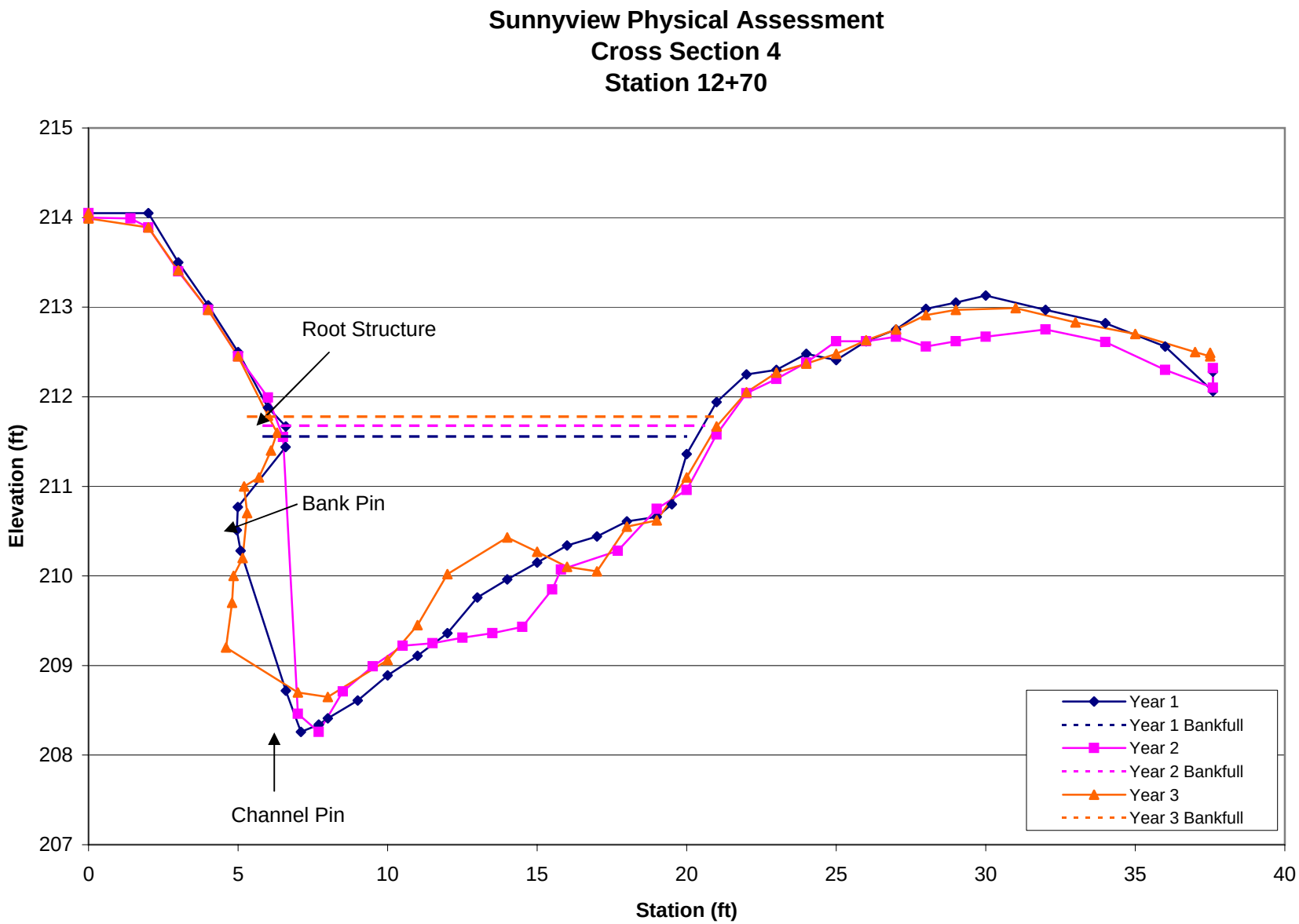
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



CROSS-SECTION 4 STATION 12+70

Pin Adjustment Factor			Year 2		-1.16	Year 3		-2.91
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	214.05	Pin	0	214.05	Pin	0	214.05	Pin
2	214.05		0	214	Pin	0	213.99	Pin
3	213.5		1.4	213.99		2	213.89	
4	213.02		2	213.89		3	213.41	
5	212.5		3	213.4		4	212.97	
6	211.88		4	212.97		5	212.45	
6.6	211.67		5	212.45		6	211.79	
6.59	211.44		6	211.99		6.3	211.6	
4.99	210.77		6.5	211.55		6.1	211.4	
4.96	210.51		7	208.46		5.7	211.1	
5.08	210.28		7.7	208.26		5.2	211	
6.6	208.72		8.5	208.71		5.3	210.7	
7.1	208.26		9.5	208.99		5.15	210.2	
7.7	208.34		10.5	209.22		4.85	210	
8	208.41		11.5	209.25		4.8	209.7	
9	208.61		12.5	209.31		4.6	209.2	
10	208.89		13.5	209.36		7	208.7	
11	209.11		14.5	209.43		8	208.65	
12	209.36		15.5	209.85		10	209.06	
13	209.76		15.8	210.07		11	209.45	
14	209.96		17.7	210.28		12	210.02	
15	210.15		19	210.75		14	210.43	
16	210.34		20	210.96		15	210.27	
17	210.44		21	211.58		16	210.1	
18	210.61		22	212.04		17	210.05	
19	210.66		23	212.2		18	210.55	
19.5	210.8		24	212.38		19	210.62	
20	211.36		25	212.62		20	211.1	
21	211.94		26	212.62		21	211.67	
22	212.25		27	212.67		22	212.05	
23	212.3		28	212.56		23	212.27	
24	212.48		29	212.62		24	212.37	
25	212.41		30	212.67		25	212.48	
26	212.62		32	212.75		26	212.63	
27	212.75		34	212.61		27	212.75	
28	212.98		36	212.3		28	212.91	
29	213.05		37.6	212.1	Pin	29	212.97	
30	213.13		37.6	212.32	Pin	31	212.99	
32	212.97					33	212.83	
34	212.82					35	212.7	
36	212.56					37	212.5	
37.6	212.06	Pin				37.5	212.45	Pin
37.6	212.28	Pin				37.5	212.49	Pin
Bankfull Year 1		211.6	**Bankfull Year 2**		211.72	**Bankfull Year 3**		211.74

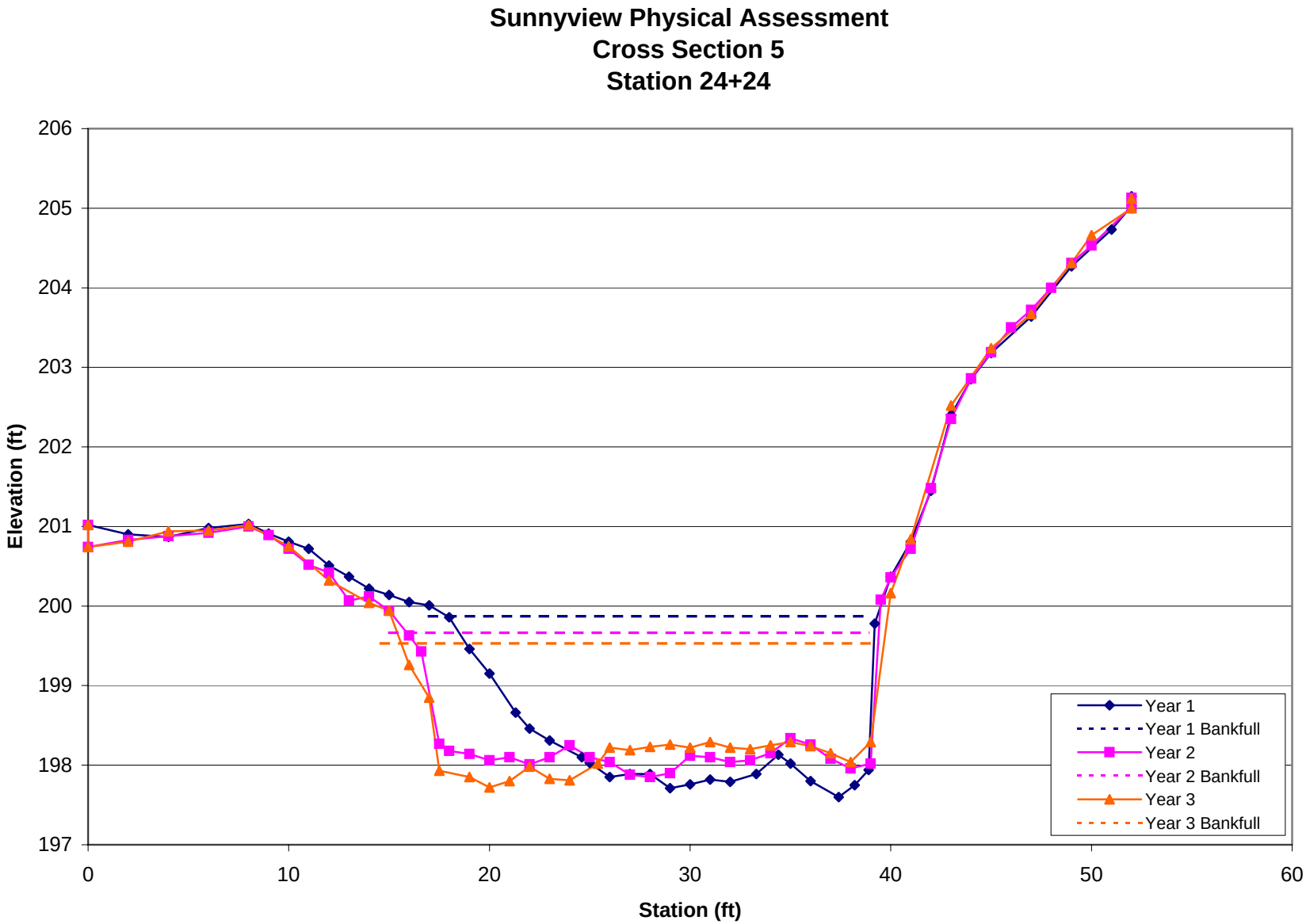
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



CROSS-SECTION 5 STATION 24+24

Pin Adjustment Factor			**Year 2**	206.12		**Year 3**	-2.08	
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	201.02	Pin	0	201.02	Pin	0	201.02	Pin
2	200.9		0	200.74	Pin	0	200.74	Pin
4	200.87		2	200.83		2	200.81	
6	200.98		4	200.88		4	200.94	
8	201.03		6	200.92		6	200.95	
9	200.91		8	201		8	201.02	
10	200.81		9	200.89		10	200.75	
11	200.72		10	200.72		12	200.32	
12	200.51		11	200.52		14	200.04	
13	200.37		12	200.42		15	199.94	
14	200.22		13	200.07		16	199.26	
15	200.14		14	200.12		17	198.85	
16	200.05		15	199.94		17.5	197.93	
17	200.01		16	199.63		19	197.85	
18	199.86		16.6	199.43		20	197.72	
19	199.46		17.5	198.27		21	197.8	
20	199.15		18	198.18		22	197.98	
21.3	198.66		19	198.14		23	197.83	
22	198.46		20	198.06		24	197.81	
23	198.31		21	198.1		25.4	198.02	
24.6	198.1		22	198.01		26	198.22	
25	198.03		23	198.1		27	198.19	
26	197.85		24	198.25		28	198.23	
27	197.89		25	198.1		29	198.26	
28	197.89		26	198.04		30	198.22	
29	197.71		27	197.88		31	198.29	
30	197.76		28	197.85		32	198.22	
31	197.82		29	197.9		33	198.2	
32	197.79		30	198.12		34	198.25	
33.3	197.89		31	198.1		35	198.29	
34.4	198.13		32	198.04		36	198.24	
35	198.02		33	198.06		37	198.15	
36	197.8		34	198.15		38	198.04	
37.4	197.6		35	198.34		39	198.29	
38.2	197.75		36	198.26		40	200.16	
38.9	197.94		37	198.08		41	200.84	
39.2	199.78		38	197.96		43	202.52	
40	200.37		39	198.02		45	203.24	
41	200.81		39.5	200.08		47	203.67	
42	201.45		40	200.36		49	204.31	
43	202.4		41	200.72		50	204.66	
44	202.85		42	201.48		52	205	
45	203.18		43	202.35		52	205.12	
47	203.64		44	202.86				
49	204.27		45	203.19				
51	204.73		46	203.5				
52	205.03	Pin	47	203.72				
52	205.15	Pin	48	204				
			49	204.31				
			50	204.53				
			52	205.02	Pin			
			52	205.13	Pin			
Bankfull Year 1		199.86	**Bankfull Year 2**		199.63	**Bankfull Year 3**		199.55

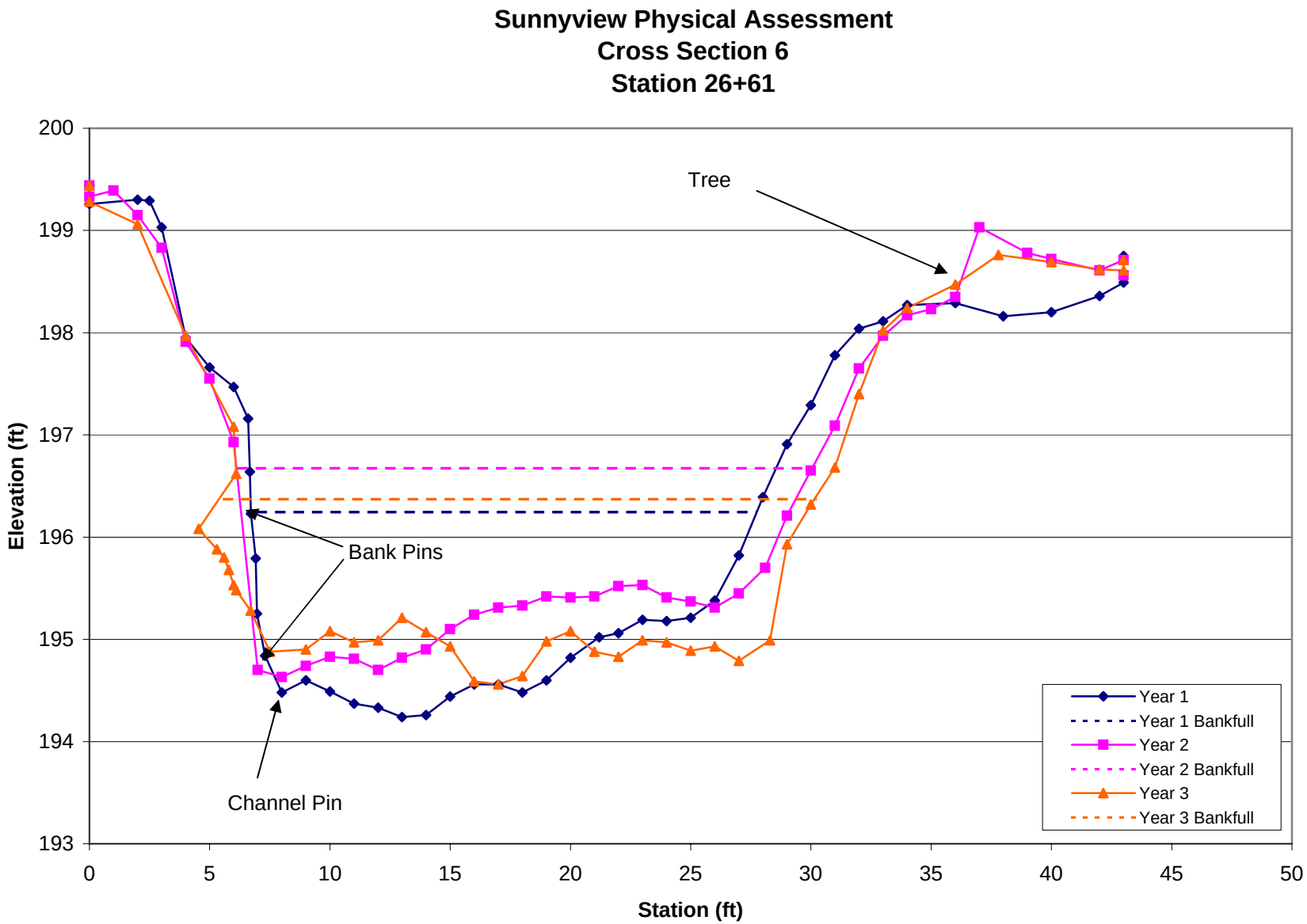
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



CROSS-SECTION 6 STATION 26+61

Pin Adjustment Factor			**Year 2**	201.33		**Year 3**	-1.38	
Survey Date: 11/03/05			Survey Date: 08/30/2006			Survey Date: 11/21/2007		
Sta.	**Year 1**	**Notes**	**Sta.**	**Year 2 adj.**	**Notes**	**Sta.**	**Year 3 adj.**	**Notes**
0	199.44	Pin	0	199.44	Pin	0	199.44	Pin
0	199.26	Pin	0	199.33	Pin	0	199.28	Pin
2	199.3		1	199.39		2	199.06	
2.5	199.29		2	199.15		4	197.97	
3	199.03		3	198.83		6	197.08	
4	197.95		4	197.91		6.1	196.62	
5	197.66		5	197.55		4.54	196.08	
6	197.47		6	196.93		5.3	195.88	
6.6	197.16		7	194.7		5.6	195.8	
6.7	196.64		8	194.63		5.8	195.68	
6.7	196.23		9	194.74		6	195.53	
6.9	195.79		10	194.83		6.1	195.48	
7	195.25		11	194.81		6.7	195.28	
7.3	194.84		12	194.7		7.5	194.88	
8	194.48	Pin	13	194.82		9	194.9	
9	194.6		14	194.9		10	195.08	
10	194.49		15	195.1		11	194.97	
11	194.37		16	195.24		12	194.99	
12	194.33		17	195.31		13	195.21	
13	194.24		18	195.33		14	195.07	
14	194.26		19	195.42		15	194.93	
15	194.44		20	195.41		16	194.59	
16	194.56		21	195.42		17	194.56	
17	194.56		22	195.52		18	194.64	
18	194.48		23	195.53		19	194.98	
19	194.6		24	195.41		20	195.08	
20	194.82		25	195.37		21	194.88	
21	195.02		26	195.31		22	194.83	
22	195.06		27	195.45		23	194.99	
23	195.19		28.1	195.7		24	194.97	
24	195.18		29	196.21		25	194.89	
25	195.21		30	196.65		26	194.93	
26	195.38		31	197.09		27	194.79	
27	195.82		32	197.65		28.3	194.99	
28	196.39		33	197.97		29	195.93	
29	196.91		34	198.17		30	196.32	
30	197.29		35	198.23		31	196.68	
31	197.78		36	198.35		32	197.4	
32	198.04		37	199.03		33	198.02	
33	198.11		39	198.78		34	198.24	
34	198.27		40	198.72		36	198.47	
36	198.29		42	198.61		37.8	198.76	
38	198.16		43	198.71	Pin	40	198.69	
40	198.2		43	198.56	Pin	42	198.62	
42	198.36					43	198.61	Pin
43	198.49	Pin				43	198.71	Pin
43	198.75	Pin						
Bankfull Year 1		196.23	**Bankfull Year 2**		196.65	**Bankfull Year 3**		196.4

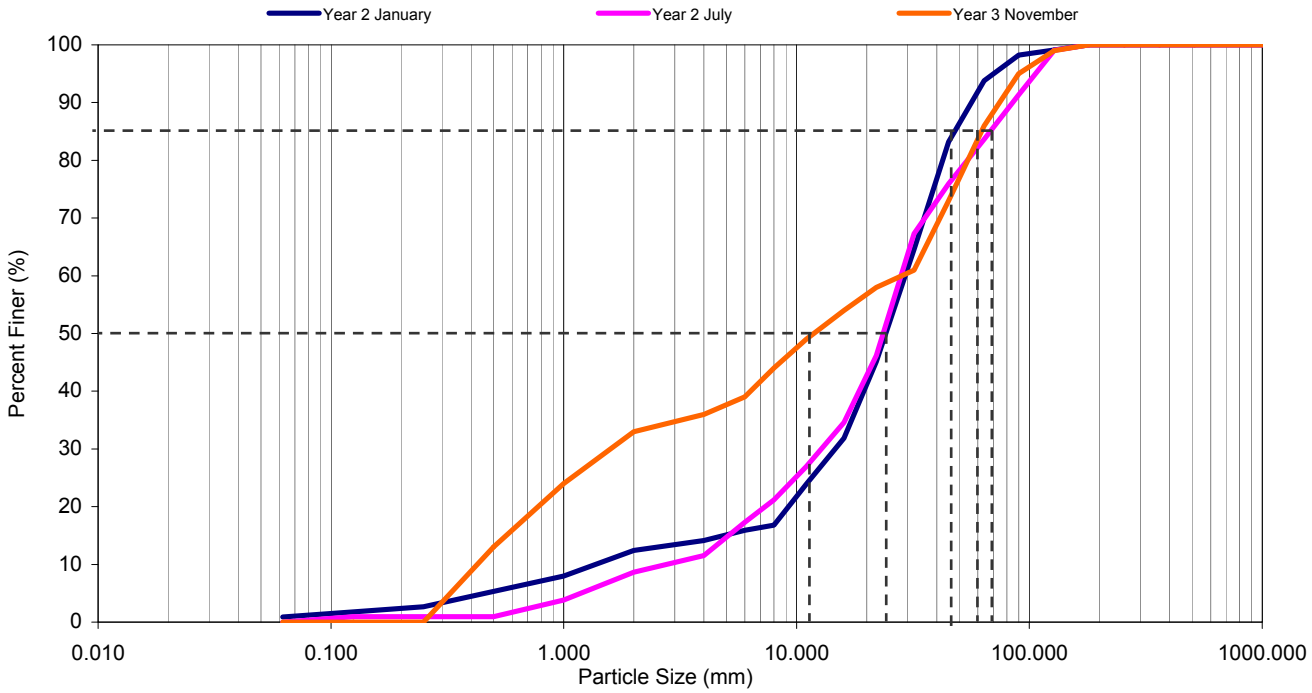
Note: Bankfull values may vary between monitoring years. See report, Section 2.1.1 for explanation.



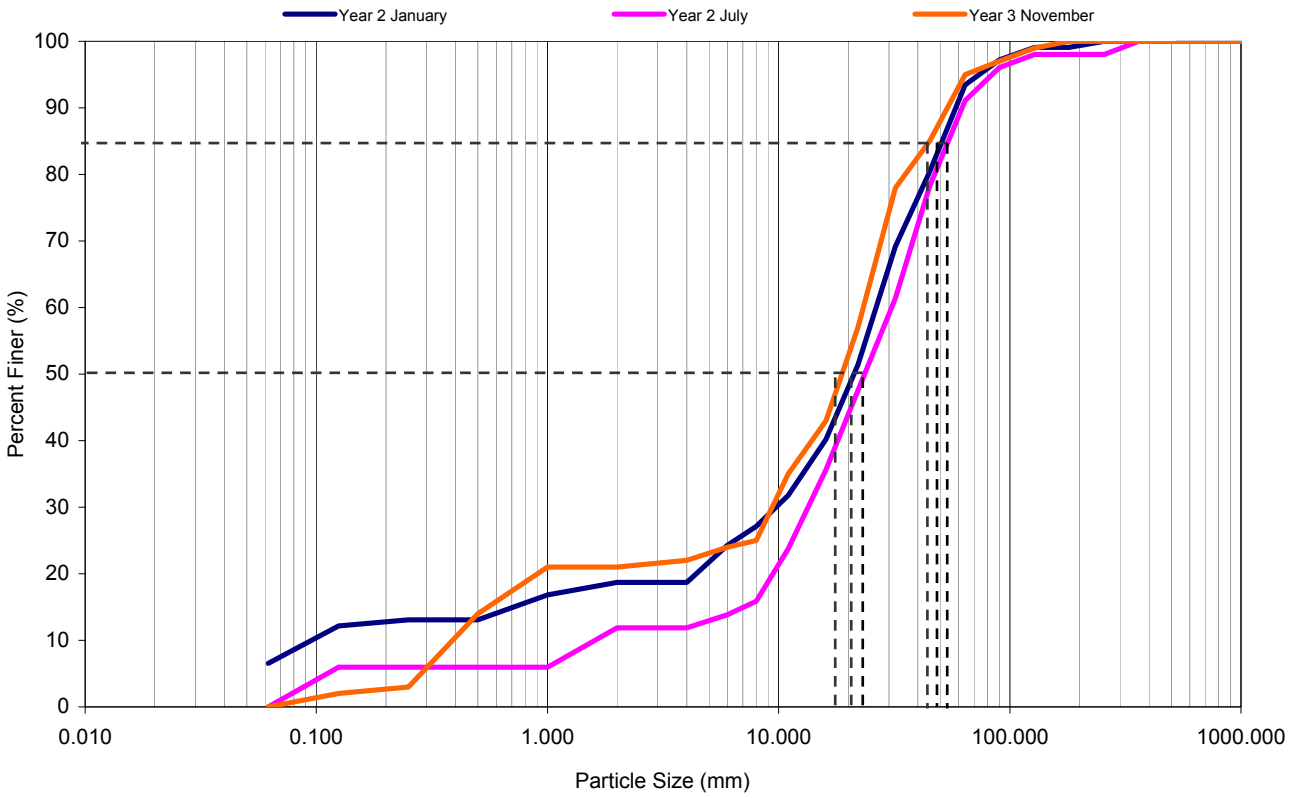
APPENDIX D

PEBBLE COUNT DATA

Cumulative Pebble Count Data 2006-2007
Unnamed Tributary to Bynum Run
Cross-section 2, Station 7+78



Cross-section 6, Station 26+61



APPENDIX E

MACROINVERTEBRATE DATA

Unnamed Tributary to Bynum Run at Sunnyview Road
Benthic Macroinvertebrate Data

Harford County
2007

Sunnyview Summary

Metric	2007			2006			2005		
	Station 1	**Station 2**	**Ref**	**Station 1**	**Station 2**	**Ref**	**Station 1**	**Station 2**	**Ref**
	Raw Scores								
Total Number of Taxa	23	23	28	35	28	34	21	24	29
Number of EPT Taxa	4	5	11	9	2	15	4	5	10
Number of Ephemeroptera Taxa	1	0	7	4	1	6	0	0	4
Percent Intolerant Urban	10	12	52	12	16	55	8	9	51
Percent Chironomidae	61	76	27	60	67	16	30	5	15
Percent Clingers	27	15	25	22	16	56	33	60	70
	BIBI Scores								
Total Number of Taxa	3	3	5	5	5	5	3	3	5
Number of EPT Taxa	1	3	5	3	1	5	1	3	3
Number of Ephemeroptera Taxa	1	1	5	5	1	5	1	1	5
Percent Intolerant Urban	1	3	5	3	3	5	1	1	5
Percent Chironomidae	3	1	3	3	1	3	3	3	3
Percent Clingers	1	1	1	1	1	3	3	3	3
BIBI Score	***1.7***	***2.0***	***4.0***	***3.3***	***2.0***	***4.3***	***2.0***	***2.3***	***4.0***
Narrative Rating	***VP***	***P***	***G***	***F***	***P***	***G***	***P***	***P***	***G***

Piedmont Scoring Criteria

Metric	*Score*		
	5	**3**	**1**
Total Number of Taxa	≥24	15 - 24	<15
Number of EPT Taxa	≥11	5 - 10	<5
Number Ephemeroptera Taxa	≥4	2 - 3	<2
Percent Intolerant Urban Taxa	≥51	12 - 50	<12
Percent Chironomidae Taxa	≤4.6	4.7 - 63	>63
Percent Clinger Taxa	≥74	31 - 73	<31

Unnamed Tributary to Bynum Run at Sunnyview Road
Benthic Macroinvertebrate Data

Harford County
2007

2007 SV - Station 1

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acentrella	Acentrella		1	Collector	sw	4.9
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		5	Predator	cb	8.3
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		2	Shredder	sp	3
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		2	Scraper	cn	5.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius		4	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		2	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu	7.4
Insecta	Diptera	Chironomidae	Chaetocladius	Chaetocladius		1	Collector	sp	7
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura		1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		3	Collector	bu	9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		11	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra		1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		10	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stilocladius	Stilocladius		1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		3	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3
Insecta	Diptera	Empididae	Clinocera	Clinocera		1	Predator	cn	7.4
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		6	Filterer	cn	6.5
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae		1	Predator	sp	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomini		2	Collector	bu	5.9
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra		2	Filterer	cn	4.4
Clitellata	Haplotaxida	Naididae	not identified	Naididae		2	Collector	bu	9.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

Unnamed Tributary to Bynum Run at Sunnyview Road
Benthic Macroinvertebrate Data

Harford County
2007

2007 SV - Station 2

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		6	Shredder	sp	3
Insecta	Coleoptera	Psephenidae	Ectopria	Ectopria		1	Scraper	cn	2.2
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu	7.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		1	Collector	bu	9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		19	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra		4	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		27	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila		1	Predator	bu	2.8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		4	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes		1	Filterer	cn	1.7
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia		1	Shredder	sp	4.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Clitellata	Haplotaxida	not identified	not identified	Lumbricina		2	Collector	bu	10
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Not Identified	not identified	not identified	not identified	Nematoda		1	Parasite	na	na

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

Unnamed Tributary to Bynum Run at Sunnyview Road
Benthic Macroinvertebrate Data

Harford County
2007

2007 SV - Station 3 - Reference

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus		1	Collector	sw	2.6
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum		0	Collector	sw	2.3
Insecta	Ephemeroptera	Baetidae	Diphetor	Diphetor hageni		0	Collector	sw	2.3
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		1	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		5	Scraper	cn	4.5
Insecta	Ephemeroptera	Leptophlebiidae	Leptophlebia	Leptophlebia		2	Collector	sw	1.8
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium		10	na	na	na
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		37	Shredder	sp	3
Insecta	Plecoptera	Taeniopterygidae	Taeniopteryx	Taeniopteryx		1	Shredder	sp	4.8
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius		0	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		4	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		6	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella		2	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		0	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Neozavrelia	Neozavrelia		2	Collector	na	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		9	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		2	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb	4.9
Insecta	Diptera	Empididae	Clinocera	Clinocera		1	Predator	cn	7.4
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea		1	Collector	sp	3.6
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium		7	Filterer	cn	2.4
Insecta	Diptera	Simuliidae	Simulium	Simulium		2	Filterer	cn	5.7
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		3	Filterer	cn	2.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		1	Collector	cn	8.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea		4	Collector	sp	2.6

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

NOTE: This sample underwent a desktop subsample due to the large number of individuals in the original sample

KCI Harford County Benthos 2007
Data are NOT adjusted for subsampling

	Stream	**Carsin's Run**	**Sunnyview**	**Sunnyview**
		21307061135	**2130704**	**2130704**
	Site	**Carsin's Run**	**Sunnyview_01_Restoration**	**Sunnyview_01_US**
	Rep			
	Date	**04-19-2007**	**04-19-2007**	**04-17-2007**
	Device	**D-Net**	**D-Net**	**D-Net**
	EcoAnalysts Sample ID	**5056-3**	**5056-9**	**5056-10**
Ephemeroptera	Acentrella sp.		1	
	Ameletus sp.	3		
	Centroptilum sp.	1		
	Diphetor hageni	1		
	Ephemerella sp.	1		
	Eurylophella sp.	7		
	Isonychia sp.			
	Leptophlebia sp.	2		
	Maccaffertium sp.	11		
Odonata	Argia sp.			
	Calopteryx sp.		5	
	Coenagrionidae			
	Gomphus sp.			
	Ischnura sp.			
	Stylogomphus albistylus			
Plecoptera	Amphinemura sp.	51	2	6
	Leuctra sp.			
	Perlesta sp.			
	Taeniopteryx sp.	1		
Coleoptera	Anchytarsus bicolor			
	Dubiraphia sp.		2	
	Ectopria sp.			1
	Heterosternuta sp.			
	Macronychus glabratus			
	Neoporus sp.			
	Oulimnius sp.	1	4	
	Peltodytes sp.			
	Stenelmis sp.			
Diptera-Chironomidae	Ablabesmyia sp.		2	
	Brillia sp.		1	1
	Chaetocladius sp.		1	
	Chironomus sp.			
	Cladotanytarsus sp.			
	Corynoneura sp.		1	
	Cricotopus sp.	6		1
	Cryptochironomus sp.			
	Diamesa sp.	7	1	
	Dicrotendipes sp.		3	1
	Diplocladius sp.			
	Eukiefferiella sp.	4		
	Hydrobaenus sp.	1		
	Limnophyes sp.			
	Micropsectra sp.	2	1	1
	Microtendipes sp.			
	Neozavrelia sp.	2		
	Orthocladiinae			1
	Orthocladius Complex	1	1	1
	Orthocladius sp.	11	10	18
	Parakiefferiella sp.			
	Parametriocnemus sp.			2
	Paratendipes sp.			
	Phaenopsectra sp.		1	4
	Polypedilum sp.	3	10	27
	Potthastia sp.			

KCI Harford County Benthos 2007
Data are NOT adjusted for subsampling

	Stream	**Carsin's Run**	**Sunnyview**	**Sunnyview**
		21307061135	**2130704**	**2130704**
	Site	**Carsin's Run**	**Sunnyview_01_Restoration**	**Sunnyview_01_US**
	Rep			
	Date	**04-19-2007**	**04-19-2007**	**04-17-2007**
	Device	**D-Net**	**D-Net**	**D-Net**
	EcoAnalysts Sample ID	**5056-3**	**5056-9**	**5056-10**
	Prodiamesa sp.			
	Rheocricotopus sp.			
	Rheotanytarsus sp.	1	2	
	Stilocladius sp.		1	
	Sympotthastia sp.			
	Tanytarsus sp.	1	3	2
	Thienemanniella sp.			1
	Thienemannimyia gr. sp.			
	Tvetenia sp.			1
	Zavrelimyia sp.		1	1
Diptera	Antocha sp.			
	Bezzia/Palpomyia sp.			
	Clinocera sp.	1	1	
	Dasyhelea sp.	1		
	Empididae			
	Hemerodromia sp.			
	Neoplasta sp.			
	Prosimulium sp.	10		
	Pseudolimnophila sp.			1
	Simulium sp.	2		
	Tabanidae			
	Tipula sp.			
Trichoptera	Cheumatopsyche sp.	2	6	4
	Chimarra sp.		2	
	Diplectrona sp.	3		
	Dolophilodes sp.			1
	Hydropsyche sp.			1
	Hydroptila sp.			
	Ironoquia sp.			1
	Micrasema sp.			
	Neophylax sp.			
	Rhyacophila sp.			
Lepidoptera	Lepidoptera			
Gastropoda	Physa sp.			
Bivalvia	Corbicula sp.			
Annelida	Enchytraeidae			1
	Erpobdellidae			
	Lumbricina			2
	Lumbriculidae			
	Naididae		2	1
	Tubificidae	1		
Crustacea	Caecidotea sp.	7		
	Cambarus sp.			
	Crangonyx sp.			
Other Organisms	Nematoda			1
	Prostoma sp.			
	TOTAL	**145**	**64**	**82**