Buffalo Creek Watershed
Phase I
Year 1 Monitoring Report
Greensboro, North Carolina

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program

Prepared By:

BUCK ENGINEERING
8000 Regency Parkway
Suite 200
Cary, North Carolina 27511
Phone: 919.463.5488
Fax: 919.463.5490
www.buckengineering.com

April 2005

Buffalo Creeks Phase I
Gillespie Golf Course and Hillsdale Park
Year One Monitoring Report
Table of Contents

Tab 1	Year 1 Monitoring Report
Tab 2	Hillsdale/Gillespie Cross Sections
Tab 3	Hillsdale/Gillespie Longitudinal Profiles
Tab 4	Hillsdale/Gillespie Photo Logs
Tab 5	Hillsdale Vegetation Survival Plots
Tab 6	Maintenance Concerns

Buffalo Creeks Phase I Hillsdale Park and Gillespie Golf Course Year 1 Monitoring Report Greensboro, North Carolina

Prepared For:

NC Department of Environment and Natural Resources,
Ecosystem Enhancement Program

April 2005

Monitoring Report Prepared By Buck Engineering PC

William A. Harman, P.G.
Principal

Michael K. Rooney
Project Engineer

Table of Contents

1. Introduction 1-1
   1.1. 1.1 Summary 1-1
   1.2. 1.2 Year 1 Monitoring 1-1
   1.3. 1.3 Year 1 Results 1-1
2. Success Criteria 2-1
   2.1. Dimension 2-1
      2.1.1 Reach HR1 2-1
      2.1.2 Reach HR2 2-1
      2.1.3 Reach HR3 2-2
      2.1.4 Reach GR1 2-2
      2.1.5 Reach GR2 2-2
      2.1.6 Reach GR3 2-3
      2.1.7 Reach GR4 2-3
      2.1.8 Reach GR5 2-3
   2.2. Pattern and Profile 2-3
   2.3. Bed Material Analysis 2-4
   2.4. Photo Reference Sites 2-4
   2.5. Vegetation Survival Plots 2-4
   2.6. Benthic Macroinvertebrate Monitoring 2-5
3. Maintenance and Contingency Plans 3-1
   3.1. City of Greensboro Catch Basin 3-1
   3.2. Buffer Vegetation at Hillsdale and Gillespie 3-1

1. Introduction

1.1. Summary

In 2003, the North Carolina Ecosystem Enhancement Program (EEP) restored 11,235 feet of streams at four sites, in two phases, in the Buffalo and South Buffalo Creek Watersheds in Greensboro, North Carolina. The specific reaches in Phase I are located in Gillespie Golf Course and Hillsdale Park. Construction began on February 4, 2003 and was completed on March 15, 2004. Planting was completed on March 15, 2004 and a final walk-through was conducted by NCEEP, State Construction Office, City of Greensboro Water Resource Department, and Buck Engineering on August 5, 2004. Both sites were accepted as complete. Project close-out was delayed until January 2005 because the contractor (LJ Inc.) took several months to complete a minor post construction punch list. Phase II of the project consists of two reaches in Brown Bark and Benbow Parks that were completed in March 2005 and are on a different monitoring schedule.

1.2. Year 1 Monitoring

Buck Engineering conducted the first of five years of monitoring from April 4 to April 29, 2005. This included cross section surveys done with a total station between permanent cross section pins (Tab 2). The longitudinal surveys were done with a total station (Tab 3). The photographs were taken with a digital camera which included the cross sections, structures, and vegetation plots (Tab 4). All photographs were taken from the photo points indicated on plan view and match the photo log in the original Buffalo Creek Watershed Phase I Mitigation Plan dated February 2005. The vegetation survival plots were counted for both bare-root plantings and live stakes (Tab 5). Finally, Buck Engineering checked both sites for maintenance concerns and impacts. (Tab 6).

1.3. Year 1 Results

Overall the streams are functioning as designed. In most cases, changes in dimension represent an increase in stability. The pattern has remained constant, and there has been no change to sinuosity. The profile indicates bedform features are remaining within a stable range. The planting plan has not been as successful. Survival rates for all but the herbaceous perennials at Gillespie Golf Course have been poor and are addressed in detail in section 2.5.

2. Success Criteria

Environmental components monitored in this project are those that allow an evaluation of channel stability and riparian survivability. Specifically, the success of channel modification, erosion control, seeding, and woody vegetation plantings were evaluated. The details for the first year follow.

2.1. Dimension

All 18 permanent cross section pins are still in place. Stakes were re-established as needed. The data in Tab 2 shows comparisons of the as-built cross sections to year 1 data.

2.1.1 Reach HR1

The natural channel design for Hillsdale Park Reach 1 (HR1) of South Buffalo Creek was based on a Rosgen Priority 3 restoration approach. A new floodplain was created at a lower elevation by excavating a stable bankfull bench of varying width. The resulting bank height ratio is 1.0. Reach HR1 was broken into sub-reaches as HR1a and HR1b. The break between the sub-reaches is the Vanstory Street culvert. Reach HR1a, from station 10+00 to 23+75, was converted from an incised E4/B4c to a B4c channel as part of the restoration work. The existing channel functioned like a Gc due to the high banks. Bedform was improved through the use of instream structures. Root wads were used to stabilize the streambanks and improve aquatic habitat. Instream structures were used to provide grade control, protect streambanks, and enhance bedform.

Cross sections 1 through 8 are located in Reach 1 a/b. These cross sections are all stable. Minor bed and/or bank deposition is evident in cross sections 1, 2, 3, 4, 5, 6, and 8. Cross section 7 has had some slight scour on the left and right bench, which probably occurred shortly after construction, but it has good vegetative cover. Cross sections 1, 2, 3, 5, 6, 7, and 8 have all had decreases in their width/depth (w/d) ratios. The w/d ratio for cross section 7 remained static. Cross section 4 had a slight increase in its w/d ratio due to minor erosion on its left bank, which occurred shortly after construction. Currently it has good vegetative cover and should remain stable. The pool at cross section 6 has deepened, with a corresponding increase in the bankfull area.

2.1.2 Reach HR2

The existing straight channel in South Buffalo Creek Reach 2 (HR2) ran from West Meadow View Road to the I-40 culvert. The reach was stabilized by using rock cross vanes, J- hooks, and root wads for bank stability. Woody transplants and sod mats were also used to stabilize the streambanks along the channel. Reach HR2, from station 52+00 to 62+12, was converted from a B4c/E4/F4 to a B4c.

Cross sections 9 through 12 are located in Reach 2. As with the cross sections in Reach 1 a/b, these are all in a stable state. The riffles in cross section 9 and 11 have had nominal change, due primarily to settling, and there has been no change in thalweg

location or elevation. The pools in cross sections 10 and 12 have both had a decrease in their w/d ratios and the pool in 12 has deepened. All four cross sections have good vegetative cover providing bank stabilization.

2.1.3 Reach HR3

The existing channel of Reach 3 (HR3) was an unnamed tributary to South Buffalo Creek, flowing into the creek at the end of Reach 2 just prior to the I-40 culvert. There were no changes in dimension, pattern, or profile for this reach. However, three rock cross vanes were used to stabilize the channel upstream of its confluence with Reach HR2.

Monumented cross sections were not done in this reach. There is good vegetative cover on the streambanks, and the banks are stable. The three rock cross vanes are functioning as designed. There is no down-cutting evident.

2.1.4 Reach GR1

The natural channel design for Mile Run Creek Reach GR1 in Gillespie Golf Course was based on a Rosgen Priority 3 restoration approach. Bankfull benches of varying width were constructed along both banks. Instream structures (including root wads, double wing deflectors, and rock vanes) were used to stabilize eroding streambanks and improve the channel profile and bedform.

Cross sections 1, 2 and 3 are stable with minor changes (settling, deposition on the banks, decrease in width depth ratio) indicating a positive change in channel evolution. The pool in cross section 1 shows minor deposition on the right bank and in the pool, along with very minor erosion of the left and right toe. The riffle in cross section 2 has had moderate deposition on the left bench and more substantial deposition on the right bench and the right wing of the double wing deflector. The thalweg in cross section has moved from the center of the riffle to the right toe, with minimal down-cutting. All three have stable banks with good vegetative cover and functioning bankfull benches.

Cross section 4 has had some minor erosion near the top of the left terrace from surface flow during storm events, along with minor deposition on its bench. However, both banks have good vegetative cover and are stable. There has been deposition of fines in the pool, and the thalweg has moved slightly over to the right toe, resulting in a slight increase of the w/d ratio and a slight decrease (2.7 square feet) in the bankfull area. Cross section 5 is a stable riffle, with a minimal change in its thalweg from the left toe to the right toe. At J-hook #1 (Photo point 17 in photo log) a large tree has fallen over and is suspended above the structure. The tree is low enough to present an obstacle to channel flow during substantial rain events and should be removed. The tree's root mass may be left in place to provide bank protection.

2.1.5 Reach GR2

The natural channel design for Reach GR2 of Mile Run Creek was based on a Rosgen Priority 3 restoration approach. Reach GR2 is an unnamed tributary that drains off of the city maintenance yard and flows into Reach 1 at Station 17+00. Seven rock vanes were

used to stabilize the streambanks and improve bedform diversity. A forested buffer 25 feet wide was planted to provide additional bank stabilization.

Cross section 6 has remained stable and has slight deposition in its riffle. Of note is the ongoing construction of a new city truck wash rack at the top of Reach GR2. The impact of this construction is unknown and will need to be assessed in future monitoring.

2.1.6 Reach GR3

The natural channel design for Reach GR3 of Mile Run Creek was based on a Rosgen Priority 3 restoration approach. Reach GR3 is an unnamed tributary that is 450 feet long. A forested buffer, varying in width from 50 to 55 feet, was planted for additional stabilization. Live stakes have provided bank stabilization, but aggressive mowing has had a negative impact on bare-root survival in the forested buffer.

2.1.7 Reach GR4

The natural channel design for Reach GR4 of Mile Run Creek was based on a bank stabilization approach. Reach GR4 is an unnamed tributary that runs 1,300 feet before it intersects with Reach GR5 and then runs 300 feet into Mile Run Creek. Forested and herbaceous buffers, varying in width from 20 to 50 feet, were planted along the reach to provide stability. Live stakes have done well in this reach, and the banks are stabilized. Unfortunately, most of the bare roots and shrubs that were planted have been damaged or destroyed by the golf course mowers.

2.1.8 Reach GR5

The natural channel design for Reach GR5 of Mile Run Creek was based on a bank stabilization approach. Reach GR5 is an unnamed tributary that runs 800 feet before it intersects with Reach 4 and then runs 300 feet into Mile Run Creek. Forested and herbaceous buffers, varying in width from 20 to 50 feet, were planted along the reach to provide stability. Live stakes and herbaceous perennials are doing well and the banks are stable. Mowing continues to be the biggest challenge to buffer growth.

2.2. Pattern and Profile

Buck Engineering completed longitudinal profiles using a total station. This included 7,936 feet of channel in GR1 a-f, HR 1, and HR2. Measurements included the thalweg and water surface. The survey shows there is no change in sinuosity or pattern. The bedform diversity has improved and the riffle/pool sequence has remained fairly constant. The new thalweg shows some deeper pools and some with minor deposition. In GR1c there is some deposition below, in, and above cross section 4 but no bar has formed.

2.3. Bed Material Analysis

We did not complete a bed material analysis since this is a sand/small gravel stream. We do not expect significant coarsening over time.

2.4. Photo Reference Sites

Photographs were taken at all permanent photo points. The photographs are in Tab 4. The photographs generally show the maturation of the sites. The vegetation is coming in on the banks and has good herbaceous growth. Woody vegetation is an issue, primarily due to mowing and human incursion into the buffer, and is nonexistent in places. Erosion control is not an issue on the site. There are two areas at Gillespie where mid-channel bars formed at the confluence of Reach 1e and Reach 3 and 4 because of deposition during storm flows. Banks are stable, with no unusual bank erosion.

2.5. Vegetation Survival Plots

Hillsdale Park planting plan consisted of a 25-foot forested buffer on both banks in Reach 1 and on the left bank in Reach 2. Gillespie Golf Course was more complex, with forested and managed buffers of varying widths. Each will be addressed separately.

Hillsdale Park: Two vegetation survival plots were staked out at ~ Station 17+00 (right bank) and at ~ Station 26+00 (right bank). Sixty-six of 98 live stakes at Plot 2 were located for a 67% survival rate. Some had been washed way or covered by deposition along the bench. Only 15 of 38 bare roots were found at bare root Plot 1 (39% survival rate) and eight of 53 bare roots at bare-root Plot 2 were present (15% survival rate). Plot 1 is located in a less trafficked portion of Reach 1, which contributed to a higher survival rate; however, both plots indicate vegetative failure. Replanting is clearly needed and should be done after the installation of some kind of permanent buffer easement marker. It should be noted that immediately after bare-root installation the City of Greensboro Parks and Recreation Department mowers were still aggressively mowing right up to the top of the terrace, where some of the bare roots were. Mowing, coupled with human intrusion into the buffer, has been the primary cause for the failure of woody vegetation.

Gillespie Golf Course: The complexity of the planting plan required the establishment of numerous vegetation survival plots. There are three live stake plots, one bare-root plot, two managed buffer shrub plots, and two managed buffer herbaceous perennials plots. Of the original total of 223 Live Stakes, 112 were found, resulting in a 50% survival rate. Bare roots faired worse, with 10 of the original 31 found, for a survival rate of 32%. Shrub Plot 4 was essentially destroyed by mowing, evidenced by the survival of 22 of the original 101 shrubs (22% survival rate). Shrub Plot #2 faired better, with 55 of the original 63 evident (83% survival rate). The combined survival rate for the herbaceous perennials was 83% (146 found out of 176) probably due to the low height of the plant—

mowing blades could not reach it. The overall failure of the planting plan is predominantly due to aggressive mowing by the golf course staff. Golf course staffers frequently say the golfers do not like the buffer because they have trouble finding their golf balls. Replanting will be required to comply with the original planting plan; however, easement markers should be installed first to preclude trespass by mowing staff.

2.6. Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrate monitoring will be conducted by the NC Division of Water Quality.

3. Maintenance and Contingency Plans

3.1. City of Greensboro Catch Basin

During the monitoring survey, new construction was observed at the top of Reach 2 at Gillespie Golf Course. A picture at Tab 7 shows the large stilling basin, berm, and newly constructed wash rack. The future impact of this new facility on Reach 2 is unclear but will need to be examined during subsequent visits.

3.2. Buffer Vegetation at Hillsdale and Gillespie

Poor survival of woody vegetation at both sites and shrubs at Gillespie Golf Course is largely attributable to City of Greensboro's Parks and Recreation Department mowers. Shortly after planting, the mowers destroyed many of the trees and shrubs that were planted. Thus monitoring is problematic because it is difficult to estimate the true survival rate. Clearly, the issue of replanting needs to be addressed. In fairness, there were no permanent buffer markers installed at the sites. But, during regular communication between Buck Engineering, Gillespie Golf Course Manager (Pat Falls), and representatives from the Parks and Recreation Department, the limits of the buffers at both sites were iterated numerous times. In fact, during planting at Gillespie Golf Course, white buffer boundary lines had been spray painted on the grass to delineate the buffer limits. Once the planting issue is resolved, buffer markers similar to the ones used in Phase II (Tab 7) of the project should be installed prior to planting.

Hillsdale Park
Cross Section Summary

Reach 1A (from Meadow View Road to Vanstory Street)

Cross Section 1	Pool Below Vane #2	Photo Point 2
Cross Section 2	Riffle in Constructed Riffle #1	Photo Point 4
Cross Section 3	Pool on Arm of Vane #5	Photo Point 6
Cross Section 4	Riffle in Constructed Riffle #2	Photo Point 9

Reach 1B (from Vanstory Street to Meadow View Road)

Cross Section 5	Riffle in Double Wing Deflector (DWD) #1	Photo Point 15
Cross Section 6	Pool Below DWD #1	Photo Point 16
Cross Section 7	Riffle Above Vane #1	Photo Point 19A
Cross Section 8	Pool Below Vane #1	Photo Point 20

Reach 2 (from Meadow View Drive to Interstate 40)

Cross Section 9	Riffle Above Cross Vane (CV) #1	Photo Point 31
Cross Section 10	Pool Below CV #1	Photo Point 32
Cross Section 11	Riffle Above CV #3	Photo Point 39
Cross Section 12	Pool Between Arms of CV #3	Photo Point 40

Notes:

1. All cross sections are marked on each bank by permanent pins set in concrete.
2. All pins are shown on the plan views (with North Carolina State plane and elevation coordinates) and are marked in the field with wooden stakes with orange flagging tape.
3. Photo point locations are shown on the plan views.

Hillsdale Cross Section Pin Locations

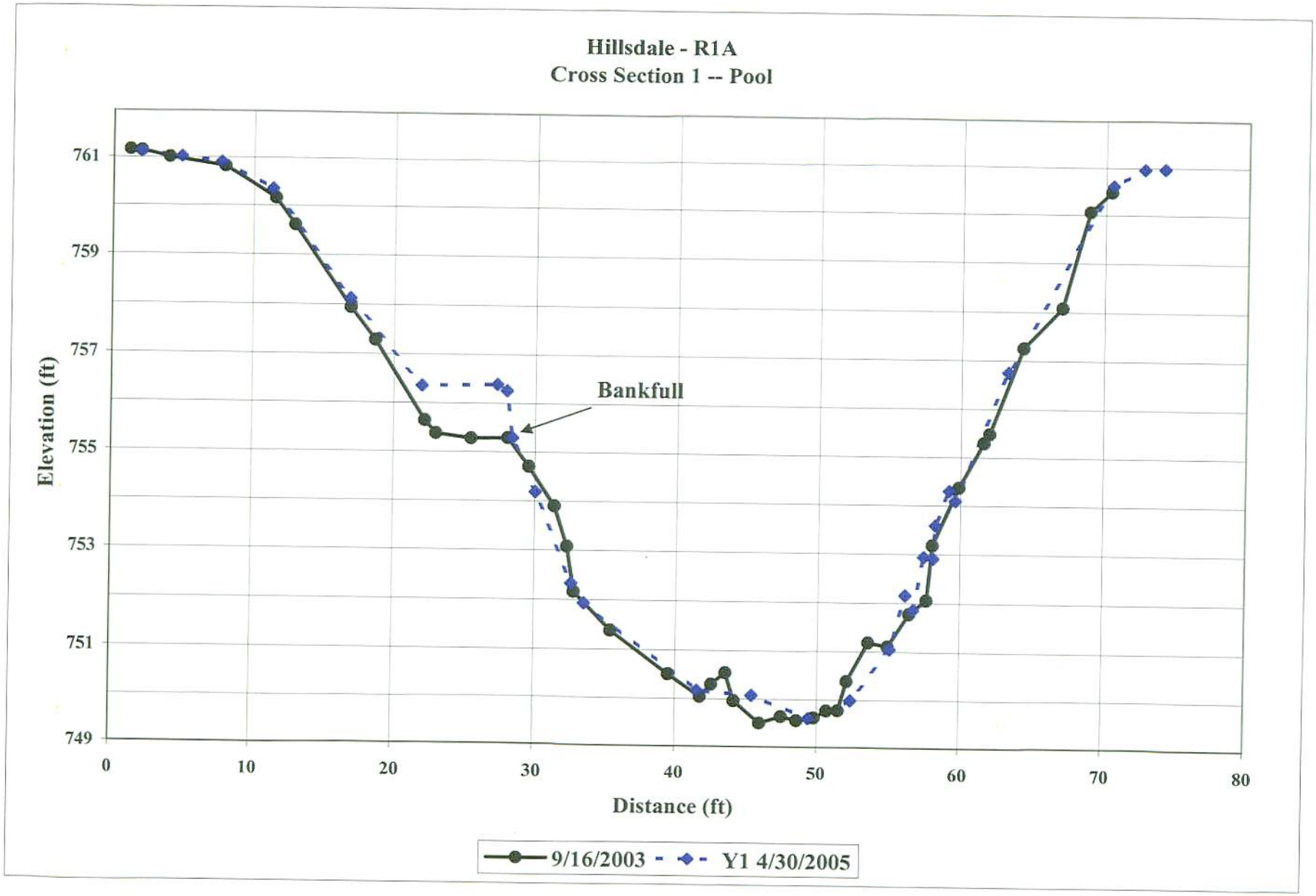
Point#	Northing	Easting	Elevation	Decscription	Stationing
8900	835752.1382	1753147.886	761.1481	X1-LPIN	12+01.26
8901	835703.7899	1753201.363	760.9648	X1-RPIN	
8902	835970.7633	1753243.501	759.9601	X2-LPIN	14+61.36
8894	835943.6117	1753324.756	760.8312	X2-RPIN	
8895	836094.5846	1753384.276	758.4273	X3-LPIN	16+30.57
8893	836019.8979	1753399.713	760.0804	X3-RPIN	
8889	835945.2474	1753757.608	758.9343	X4-LPIN	20+30.64
8888	835853.0495	1753669.33	761.5428	X4-RPIN	
8884	835859.2519	1754213.249	759.0016	X5-LPIN	25+42.85
8883	835764.1522	1754206.222	759.6819	X5-RPIN	
8885	835855.5873	1754253.408	758.7675	X6-LPIN	25+82.28
8886	835763.4917	1754244.426	759.0965	X6-RPIN	
9175	835696.7957	1754757.952	757.7009	X7-LPIN	30+88.70
9172	835641.3152	1754684.438	756.6987	X7-RPIN	
9174	835575.1663	1754779.482	757.334	X8-LPIN	31+81.14
9173	835592.7996	1754689.241	756.2497	X8-RPIN	
9094	834557.4582	1754875.487	753.7234	X9-LPIN	44+40.89
9097	834487.0356	1754839.223	750.7299	X9-RPIN	
9095	834527.1273	1754957.206	752.9958	X10-LPIN	45+37.80
9096	834447.6264	1754928.289	751.0701	X10-RPIN	
9331	834214.3318	1755828.635	751.1528	X-11-LPIN	54+95.55
9350	8341164.409	1755812.226	747.8203	X11-RPIN	
9333	834204.3903	1755873.728	751.368	X12-LPIN	55+43.29
9337	834139.9146	1755855.799	750.4006	X12-RPIN	

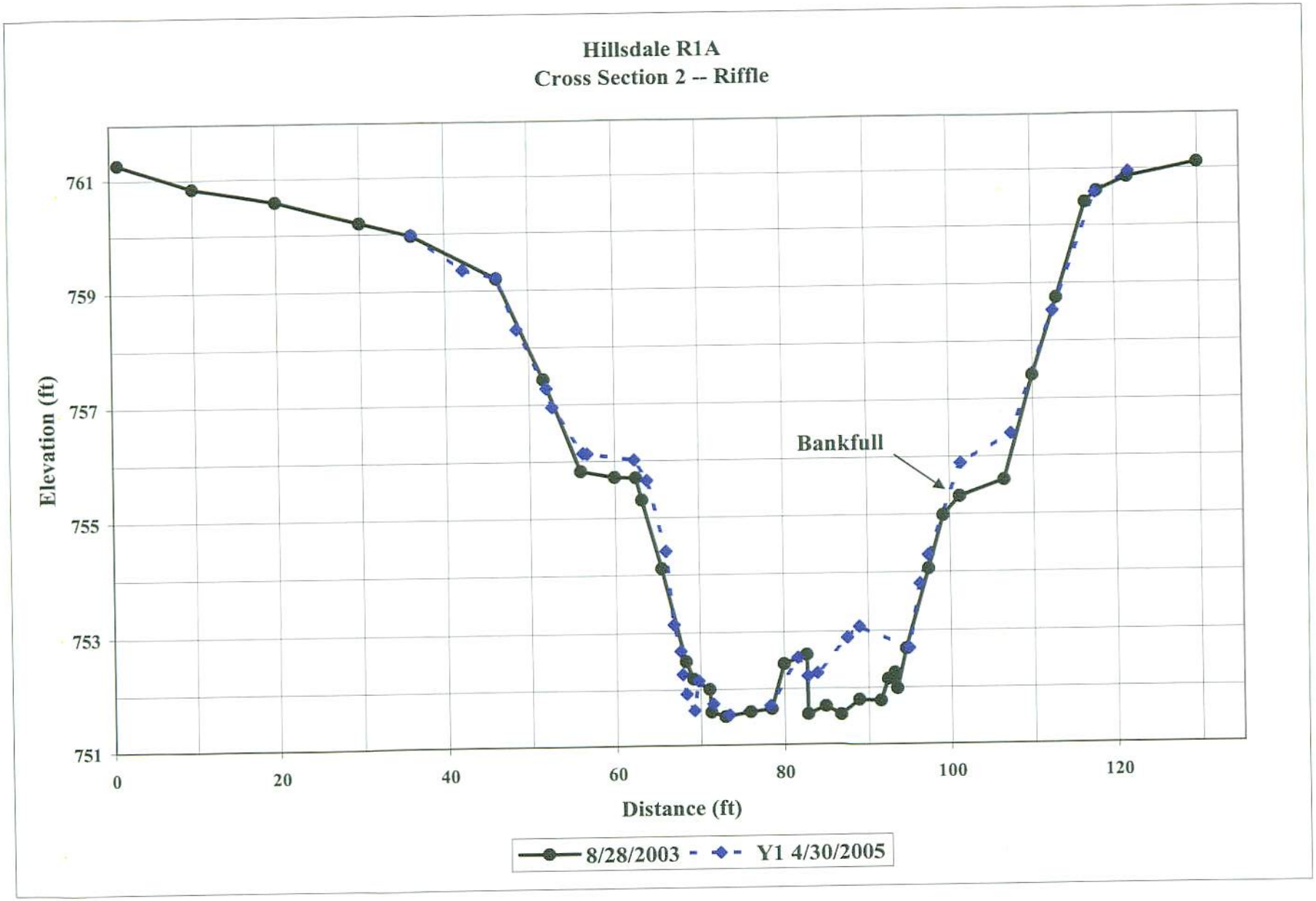
Hillsdale R1A

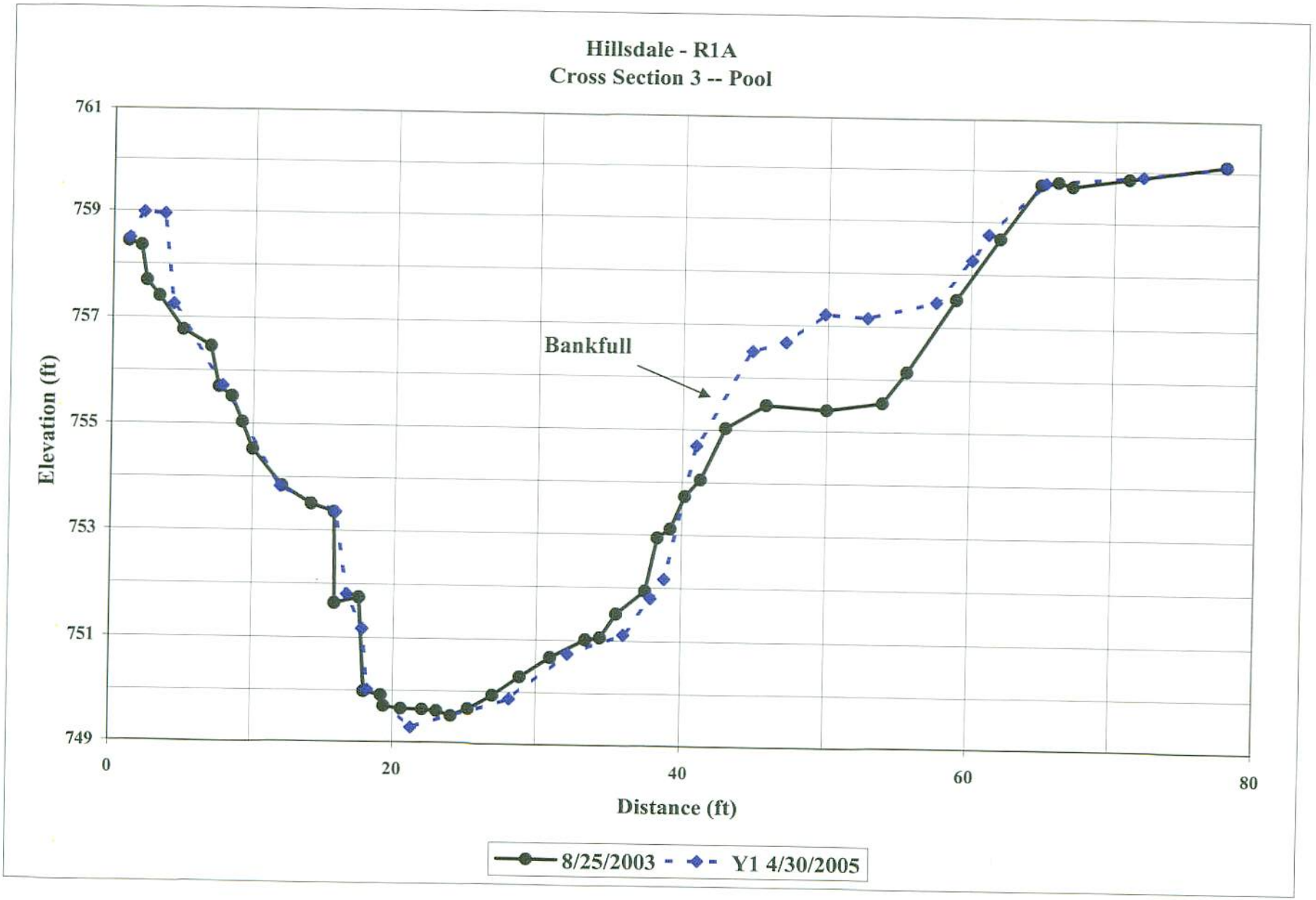
Cross Section Dimension Summary

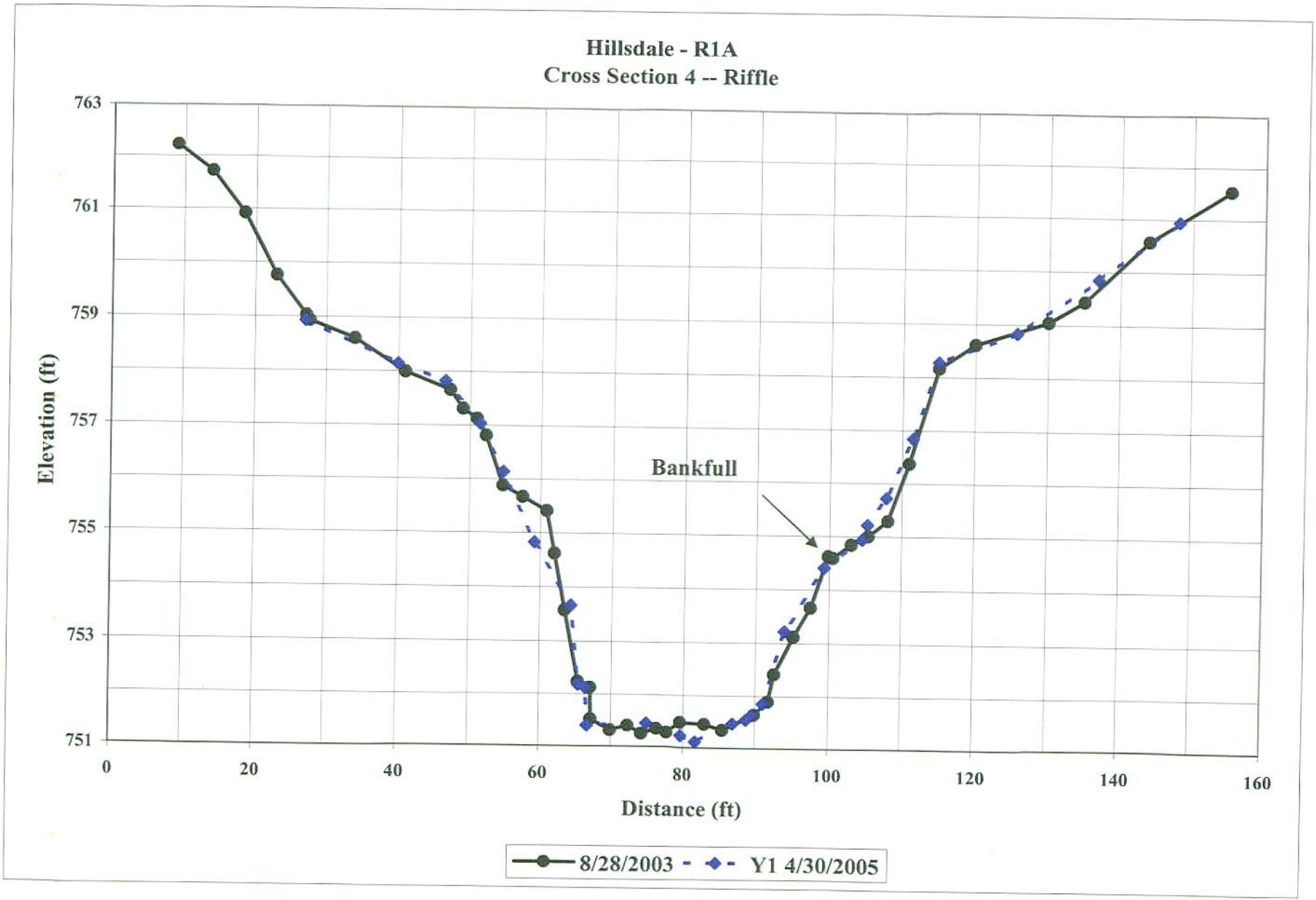
XSEC	STA	Date	Feature	Str Type	Wfpa	Wbkf	Dbkf	W/D	Abkf	Dmax	ER	BHR
1	12+01	9/16/2003	Pool		95	33.5	3.8	8.8	127.0	5.8	2.8	1.0
	12+01	4/30/2005	Pool		95	32.8	3.8	8.6	125.5	5.7	2.9	1.0
	12+01	Y2	Pool									
	12+01	Y3	Pool									
	12+01	Y4	Pool									
2	14+61	8/28/2003	Riffle	B5c	68	38.0	2.8	13.8	104.7	3.8	1.8	1.0
	14+61	4/30/2005	Riffle	B5c	68	37.5	2.7	13.7	102.6	4.1	1.8	1.0
	14+61	Y2	Riffle									
	14+61	Y3	Riffle									
	14+61	Y4	Riffle									
3	16+31	8/25/2003	Pool		110	33.8	3.4	10.0	114.2	5.5	3.3	1.0
	16+31	4/30/2005	Pool		110	36.9	3.8	9.8	138.6	6.4	3.0	1.0
	16+31	Y2	Pool									
	16+31	Y3	Pool									
	16+31	Y4	Pool									
4	20+31	8/28/2003	Riffle	B5c	75	37.9	2.6	14.7	97.8	3.4	2.0	1.0
	20+31	4/30/2005	Riffle	B5c	75	40.1	2.6	15.4	104.2	3.7	1.9	1.0
	20+31	Y2	Riffle									
	20+31	Y3	Riffle									
	20+31	Y4	Riffle									

Str Type = Rosgen Classification
Wfpa = Width Flood Prone Area (ft)
Wbkf = Bankfull Width (ft)
Dbkf = Bankfull Mean Depth (ft)
W/D = Bkf Width to Depth Ratio (ft/ft)
Abkf = Bkf Cross Section Area (sq ft)
Dmax = Bankfull Maximum Depth (ft)
ER = Entrenchment Ratio, Wfpa/Wbkf (ft/ft)
BHR = Bank Height Ratio, Dtob/Dmax (ft/ft)


Hillsdale - R1A
Cross Section 1 -- Pool
Elevation (ft)
761
759
757
755
753
751
749
Bankfull
0
10
20
30
40
50
60
70
80
Distance (ft)
9/16/2003
Y1 4/30/2005


Hillsdale R1A
Cross Section 2 -- Riffle
Elevation (ft)
761
759
757
755
753
751
0
20
40
60
80
100
120
Distance (ft)
Bankfull
8/28/2003
Y1 4/30/2005


Hillsdale - R1A
Cross Section 3 -- Pool
761
759
757
755
753
751
749
Elevation (ft)
Bankfull
0
20
40
60
80
Distance (ft)
8/25/2003
Y1 4/30/2005

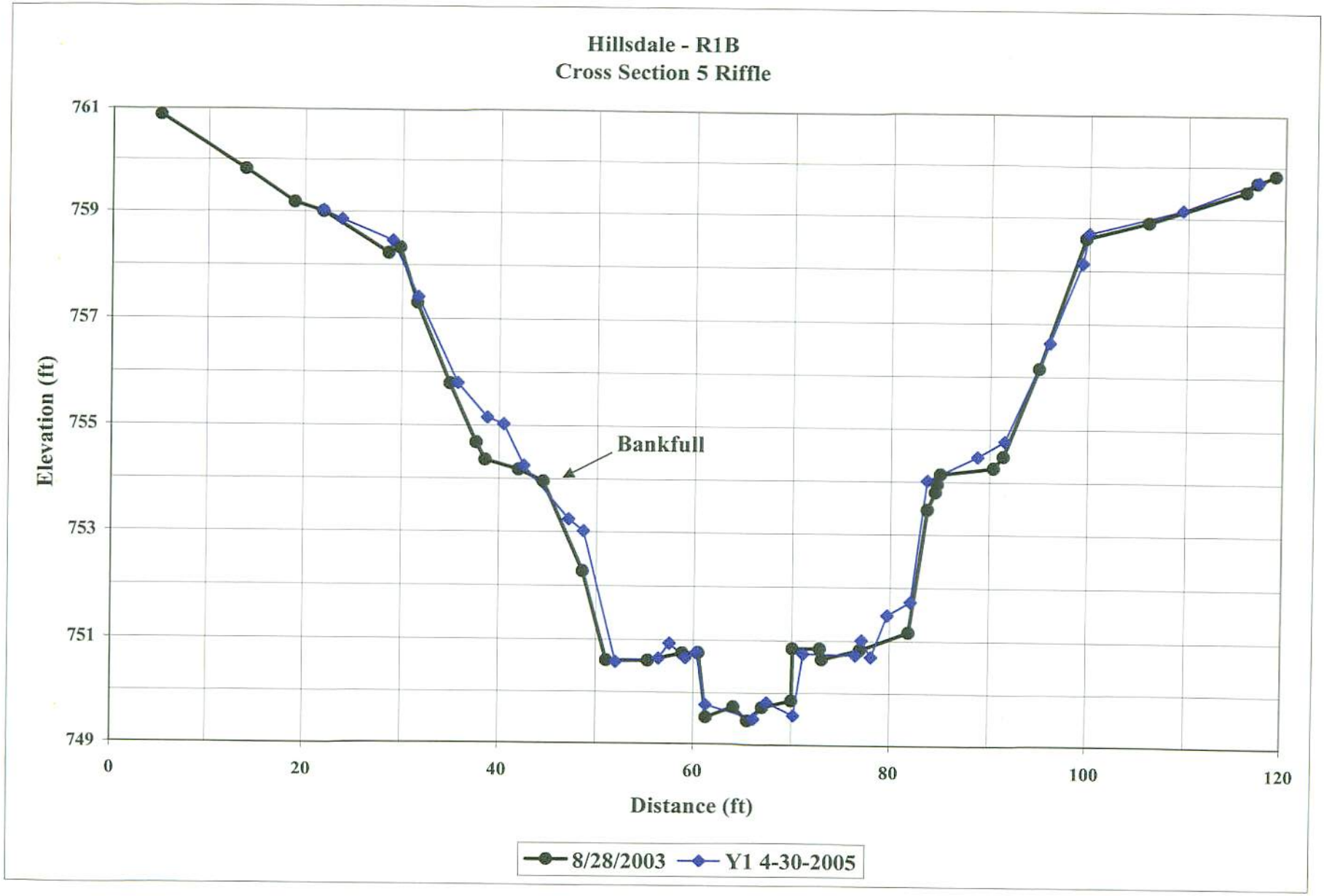

Hillsdale - R1A
Cross Section 4 -- Riffle
763
761
759
757
755
753
751
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
140
160
Distance (ft)
8/28/2003
Y1 4/30/2005

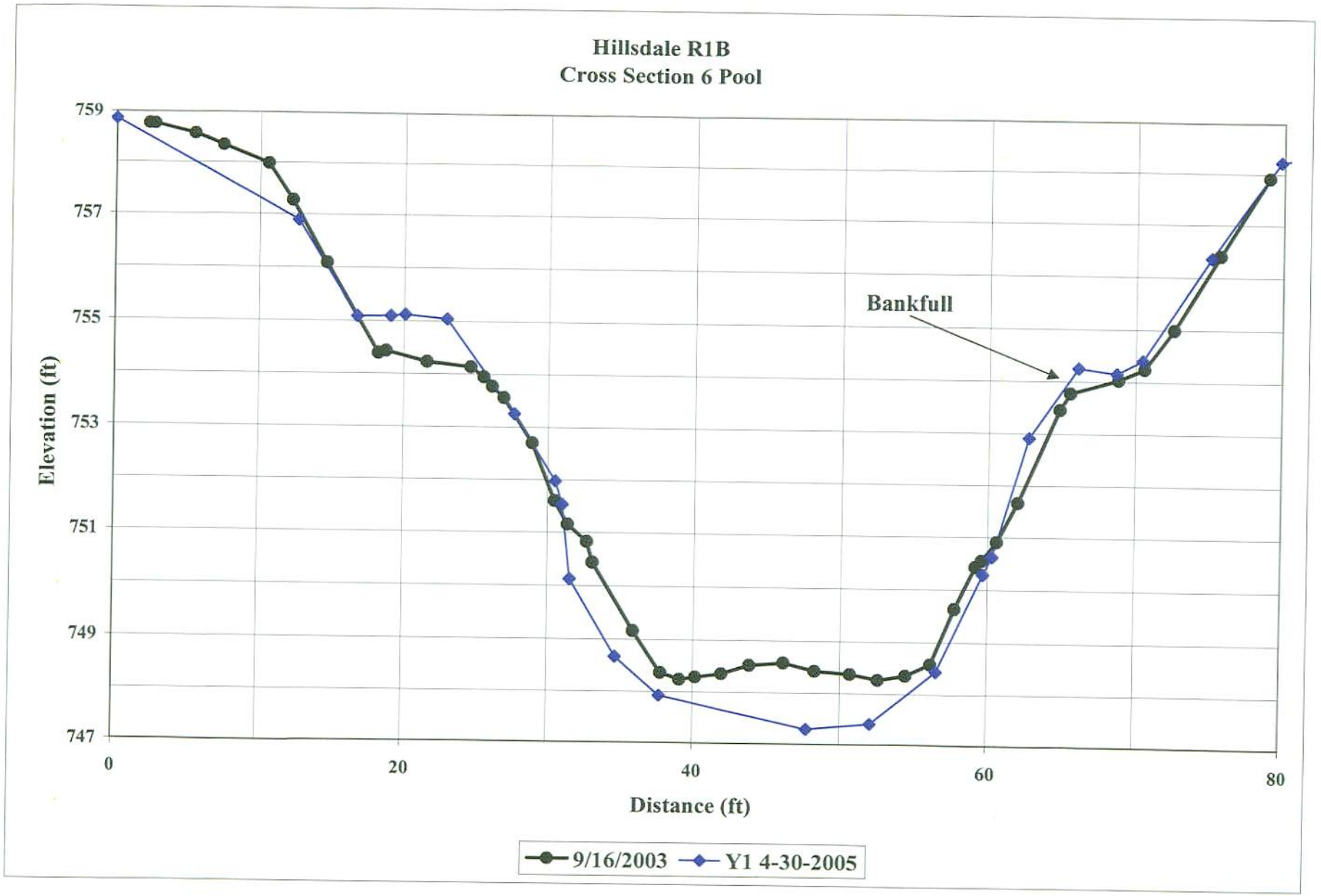
Hillsdale R1B

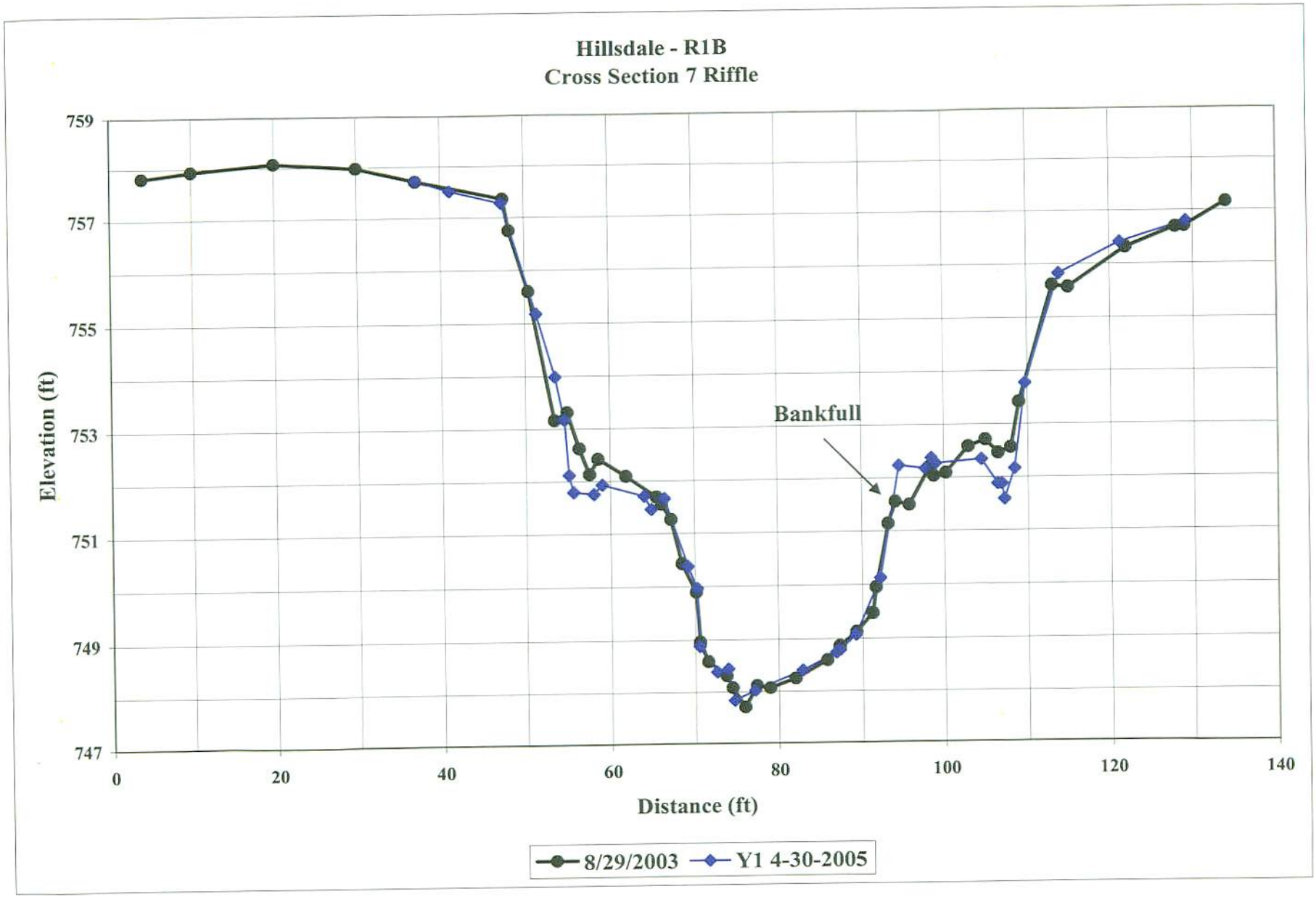
Cross Section Dimension Summary

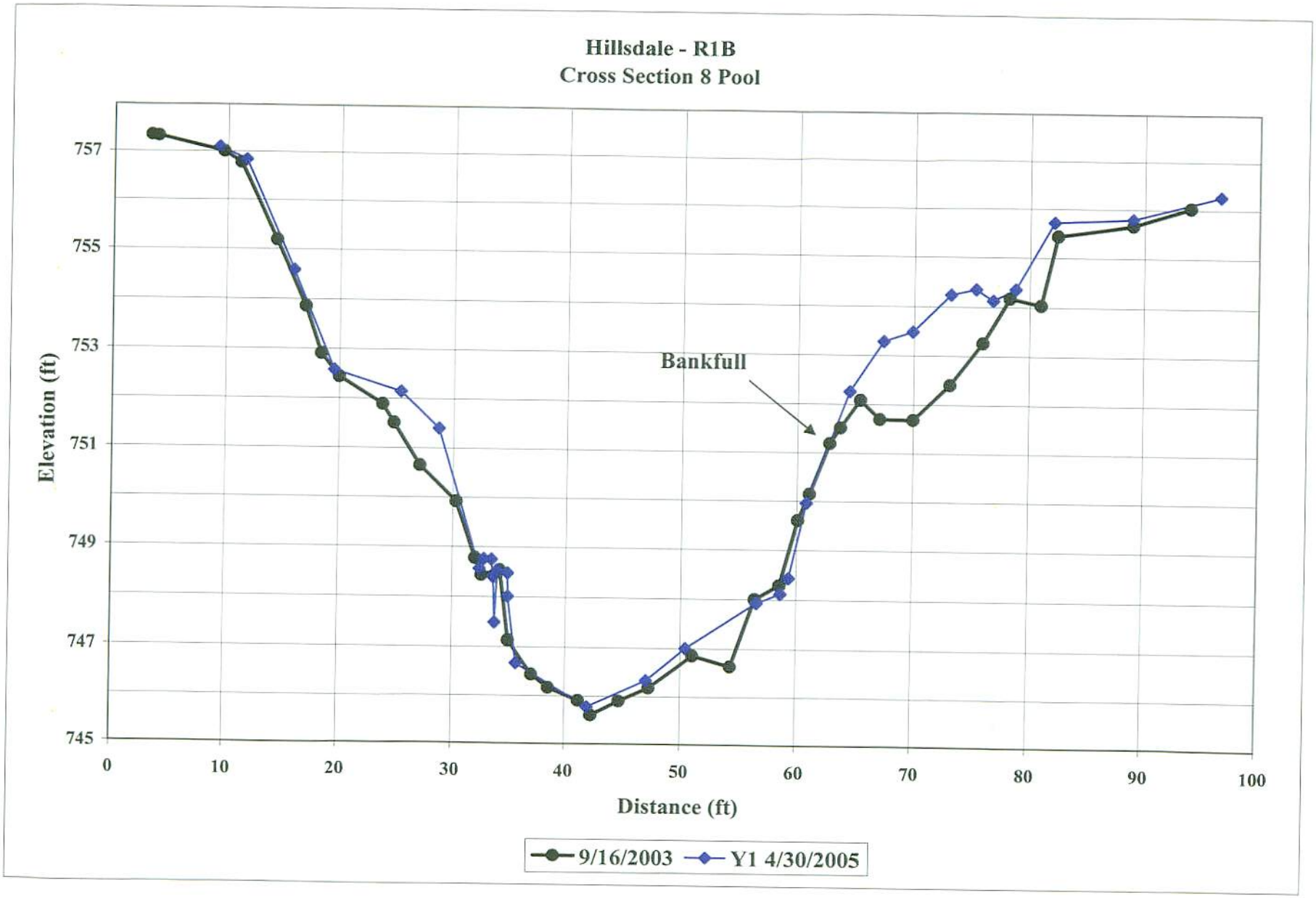
XSEC	STA	Date	Feature	Str Type	Wfpa	Wbkf	Dbkf	W/D	Abkf	Dmax	ER	BHR
5	25+43	8/28/2003	Riffle	B5c	73	40.2	3.0	13.4	120.9	4.5	1.8	1.0
	25+43	4/30/2005	Riffle	B5c	73	41.1	3.1	13.2	128.0	4.7	1.8	1.0
	25+43	Y2	Riffle									
	25+43	Y3	Riffle									
	25+43	Y4	Riffle									
6	25+82	9/16/2003	Pool		110	39.4	3.9	10.1	154.4	5.5	2.8	1.0
	25+82	4/30/2005	Pool		110	38.4	4.2	9.2	159.5	6.0	2.9	1.0
	25+82	Y2	Pool									
	25+82	Y3	Pool									
	25+82	Y4	Pool									
7	30+89	8/29/2003	Riffle	B5c	62	28.0	2.5	11.1	70.7	3.8	2.2	1.0
	30+89	4/30/2005	Riffle	B5c	62	28.1	2.5	11.1	71.3	3.8	2.2	1.0
	30+89	Y2	Riffle									
	30+89	Y3	Riffle									
	30+89	Y4	Riffle									
8	31+81	9/16/2003	Pool		130	38.9	3.7	10.7	142.1	5.9	3.3	1.0
	31+81	4/30/2005	Pool		130	35.7	3.6	10.0	128.0	5.6	3.6	1.0
	31+81	Y2	Pool									
	31+81	Y3	Pool									
	31+81	Y4	Pool									

Str Type = Rosgen Classification
Wfpa = Width Flood Prone Area (ft)
Wbkf = Bankfull Width (ft)
Dbkf = Bankfull Mean Depth (ft)
W/D = Bkf Width to Depth Ratio (ft/ft)
Abkf = Bkf Cross Section Area (sq ft)
Dmax = Bankfull Maximum Depth (ft)
ER = Entrenchment Ratio, Wfpa/Wbkf (ft/ft)
BHR = Bank Height Ratio, Dtob/Dmax (ft/ft)


Hillsdale - R1B
Cross Section 5 Riffle
761
759
757
755
753
751
749
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
Distance (ft)
8/28/2003
Y1 4-30-2005


Hillsdale R1B
Cross Section 6 Pool
759
757
755
753
751
749
747
Elevation (ft)
0
20
40
60
80
Distance (ft)
Bankfull
9/16/2003
Y1 4-30-2005


Hillsdale - R1B
Cross Section 7 Riffle
759
757
755
753
751
749
747
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
140
Distance (ft)
8/29/2003
Y1 4-30-2005

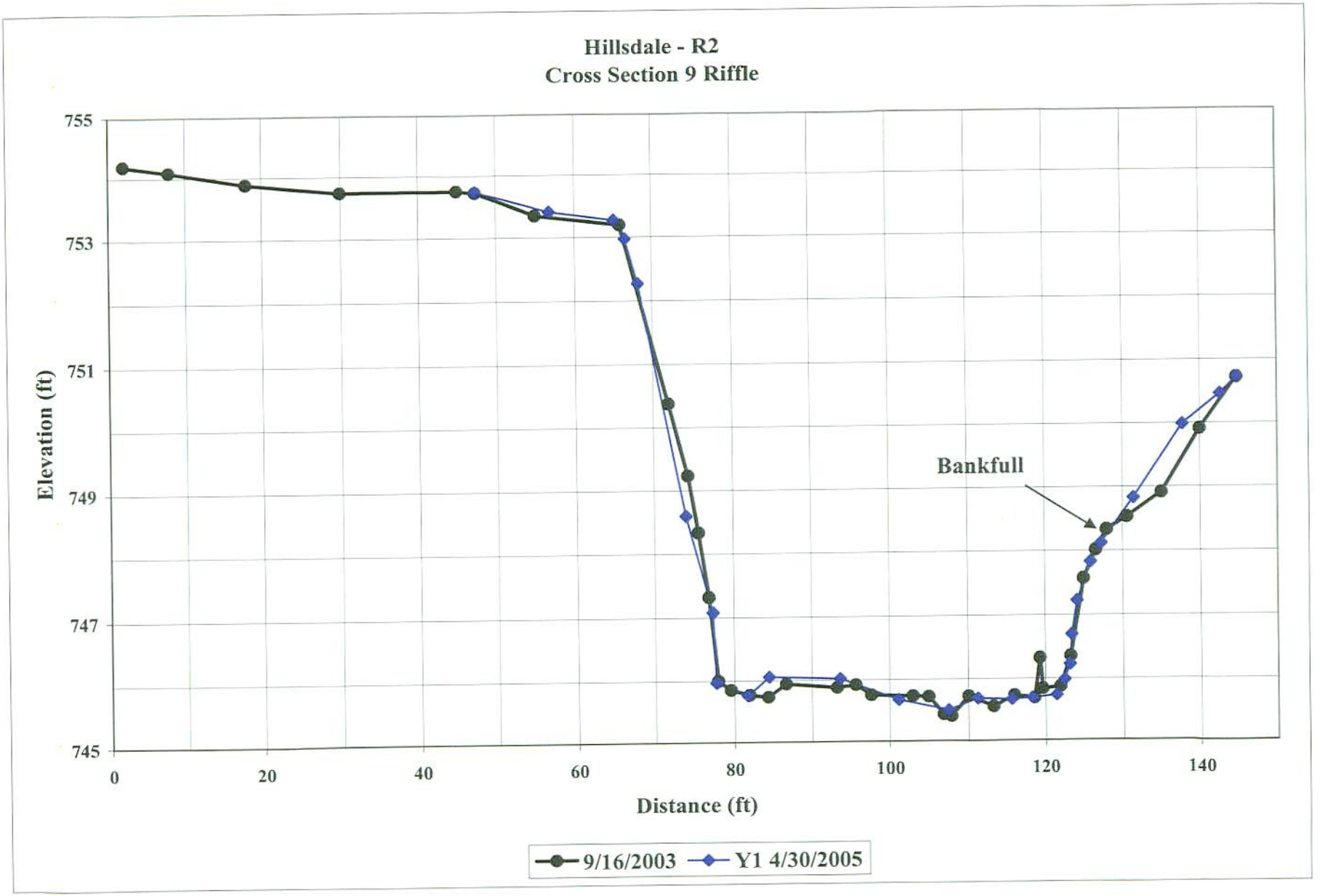

Hillsdale - R1B
Cross Section 8 Pool
Elevation (ft)
757
755
753
751
749
747
745
Bankfull
0
10
20
30
40
50
60
70
80
90
100
Distance (ft)
9/16/2003
Y1 4/30/2005

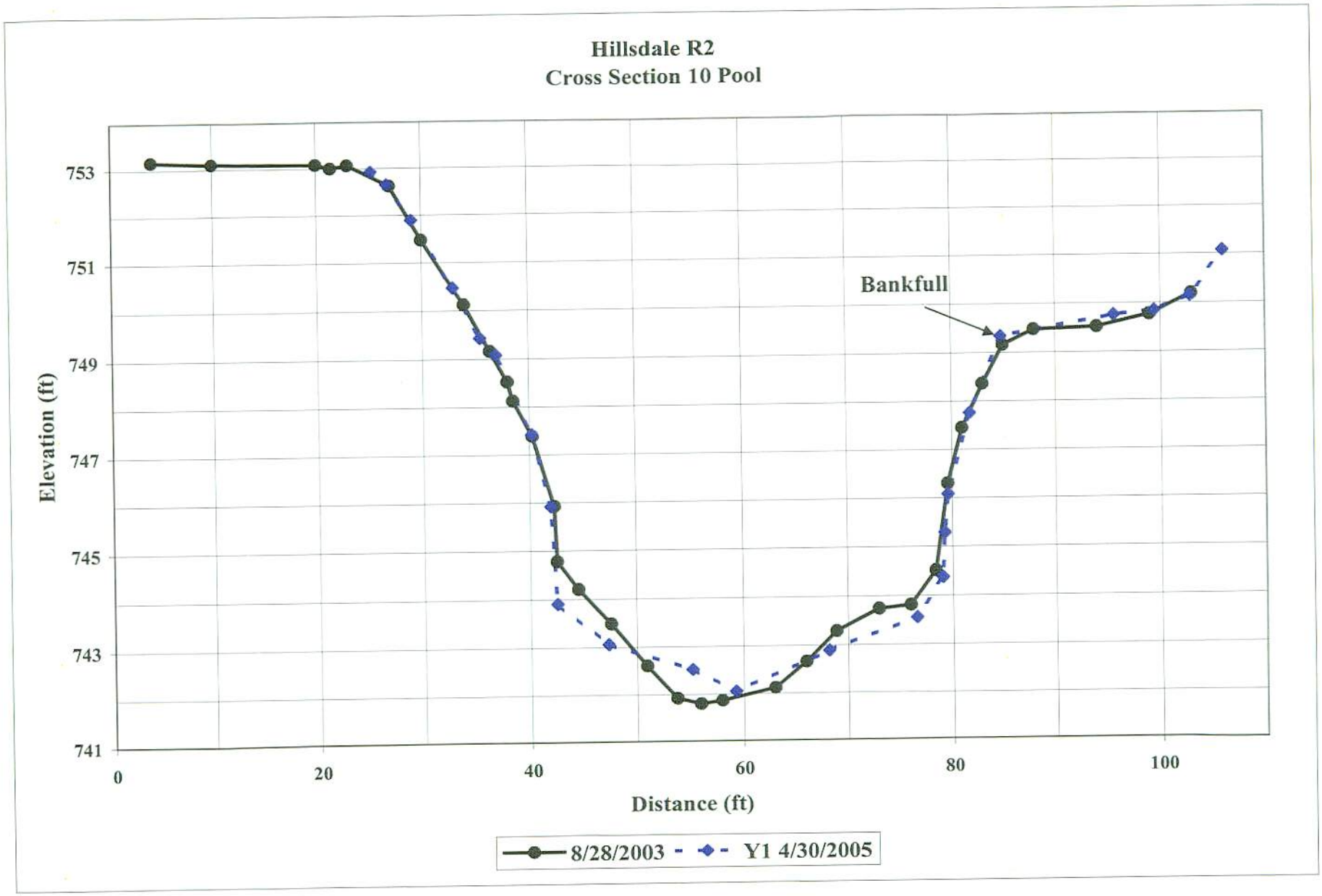
Hillsdale R2

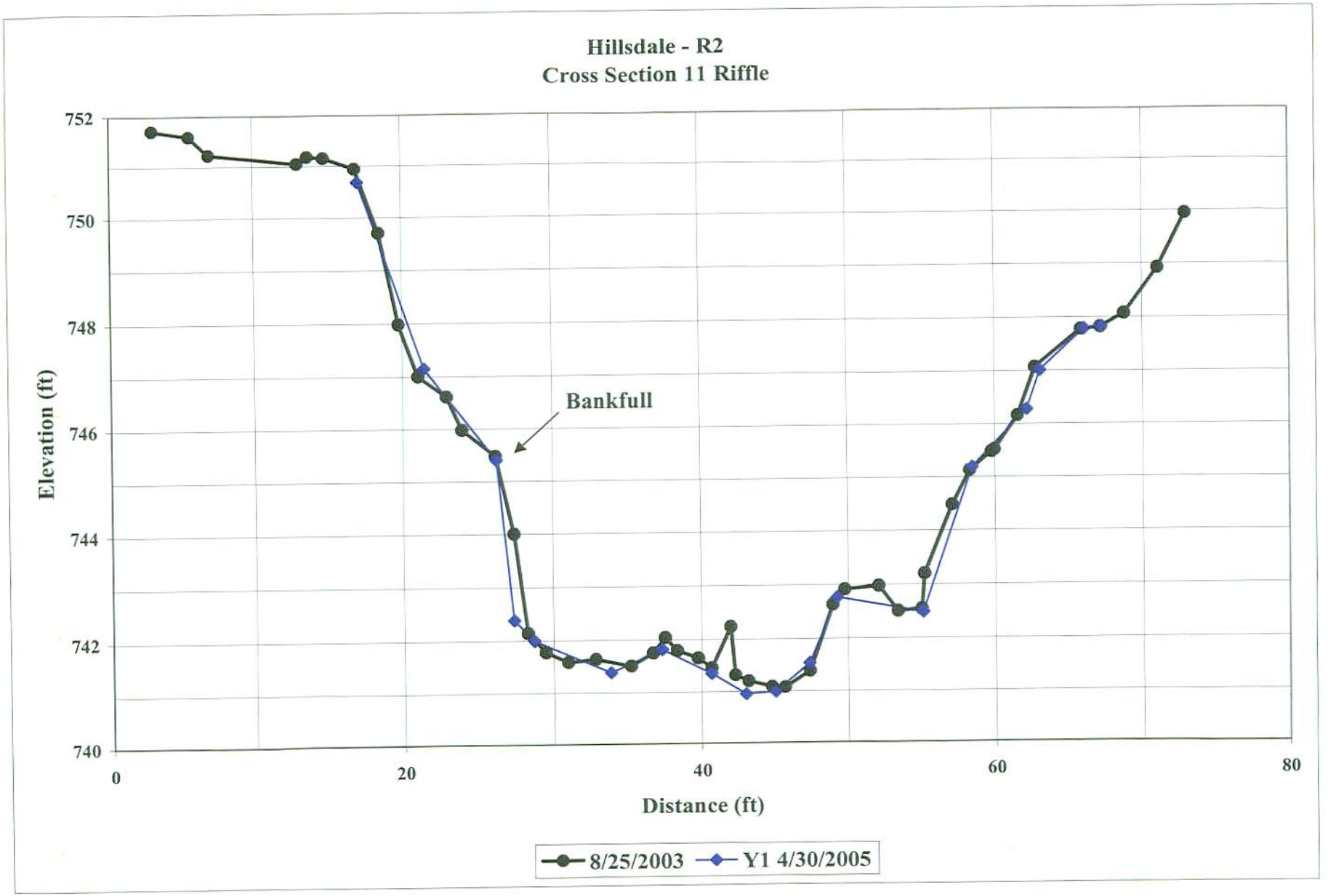
Cross Section Dimension Summary

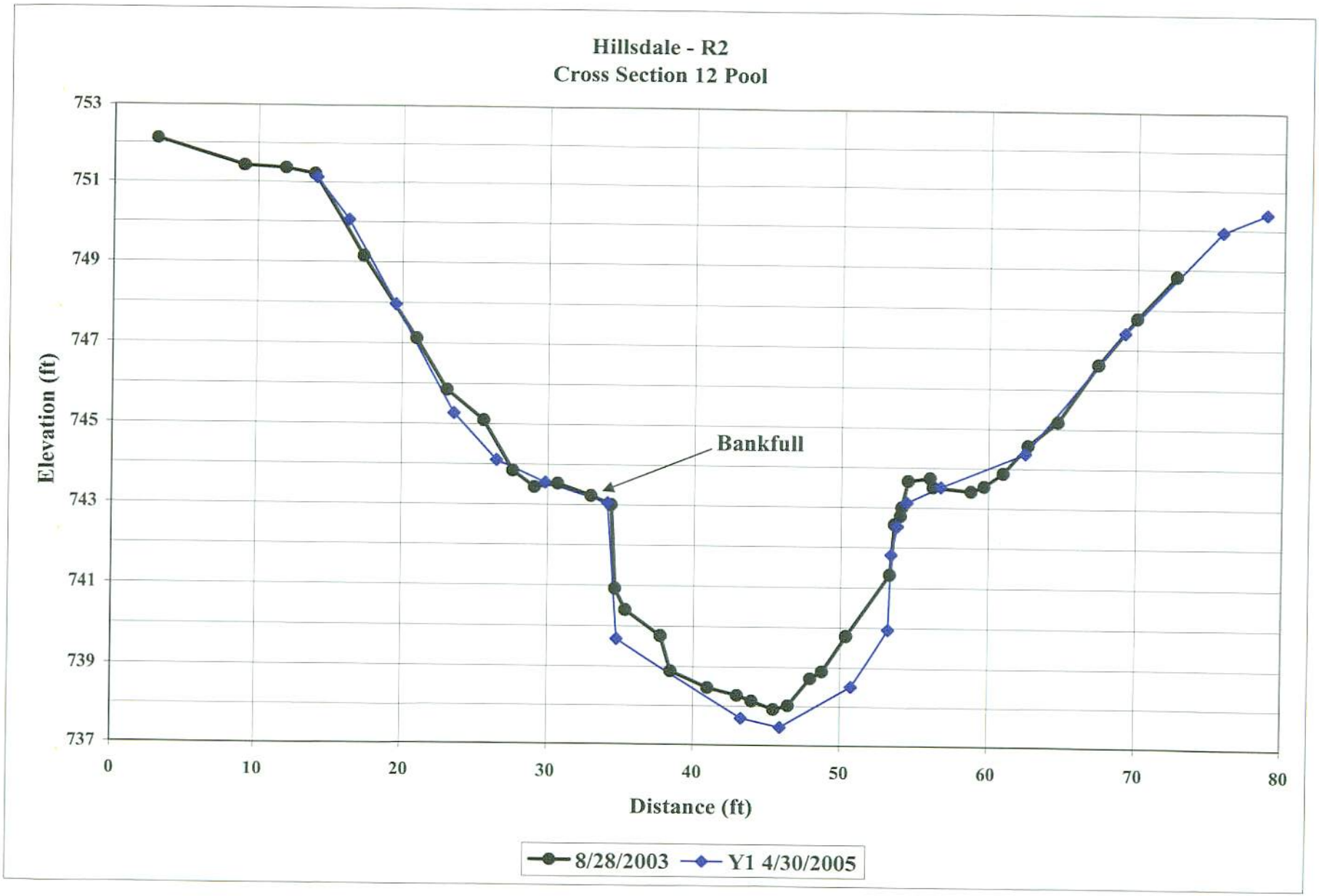
XSEC	STA	Date	Feature	Str Type	Wfpa	Wbkf	Dbkf	W/D	Abkf	Dmax	ER	BHR
9	44+41	9/16/2003	Riffle	B4c	80	52.4	2.3	22.6	121.5	2.9	1.5	1.0
	44+42	4/30/2005	Riffle	B4c	80	53.6	2.3	23.6	122.1	2.9	1.5	1.0
	44+43	Y2	Riffle									
	44+44	Y3	Riffle									
	44+45	Y4	Riffle									
10	45+39	8/28/2003	Pool		210	48.6	5.0	9.8	242.3	7.4	4.3	1.0
	45+40	4/30/2005	Pool		210	47.8	5.0	9.5	240.6	7.0	4.4	1.0
	45+41	Y2	Pool									
	45+42	Y3	Pool									
	45+43	Y4	Pool									
11	54+96	8/25/2003	Riffle	B4c	55	33.6	3.1	10.8	104.3	4.4	1.6	1.0
	54+97	4/30/2005	Riffle	B4c	55	36.9	2.9	12.7	107.2	4.4	1.5	1.0
	54+98	Y2	Riffle									
	54+99	Y3	Riffle									
	54+100	Y4	Riffle									
12	55+43	8/28/2003	Pool		53	19.7	3.7	5.3	72.6	5.1	2.7	1.0
	55+44	4/30/2005	Pool		53	20.3	4.3	4.7	87.1	5.6	2.6	1.0
	55+45	Y2	Pool									
	55+46	Y3	Pool									
	55+47	Y4	Pool									

Str Type = Rosgen Classification
Wfpa = Width Flood Prone Area (ft)
Wbkf = Bankfull Width (ft)
Dbkf = Bankfull Mean Depth (ft)
W/D = Bkf Width to Depth Ratio (ft/ft)
Abkf = Bkf Cross Section Area (sq ft)
Dmax = Bankfull Maximum Depth (ft)
ER = Entrenchment Ratio, Wfpa/Wbkf (ft/ft)
BHR = Bank Height Ratio, Dtob/Dmax (ft/ft)


Hillsdale - R2
Cross Section 9 Riffle
755
753
751
749
747
745
Elevation (ft)
0
20
40
60
80
100
120
140
Distance (ft)
Bankfull
9/16/2003
Y1 4/30/2005


Hillsdale R2
Cross Section 10 Pool
Elevation (ft)
753
751
749
747
745
743
741
0
20
40
60
80
100
Distance (ft)
Bankfull
8/28/2003
Y1 4/30/2005


Hillsdale - R2
Cross Section 11 Riffle
752
750
748
746
744
742
740
Elevation (ft)
Bankfull
0
20
40
60
80
Distance (ft)
8/25/2003
Y1 4/30/2005


Hillsdale - R2
Cross Section 12 Pool
753
751
749
747
745
743
741
739
737
Elevation (ft)
Bankfull
0
10
20
30
40
50
60
70
80
Distance (ft)
8/28/2003
Y1 4/30/2005

Mile Run Creek
Gillespie Golf Course
Cross Section Summary

Reach 1A (from Randolph Avenue to Bridge 1)

Cross Section 1	Pool between arms of Cross Vane (CV) #3	Photo Point 2

Reach 1B (from Bridge 1 to Bridge 2)

Cross Section 2	Riffle in Double Wing Deflector (DWD) #1	Photo Point 5
Cross Section 3	Riffle in DWD #3	Photo Point 6

Reach 1C (from Bridge 2 to Concrete Crossing at STA 13+05)

Cross Section 4	Pool below DWD #1	Photo Point 8B
Cross Section 5	Riffle in DWD #3	Photo Point 10

Reach 2

Cross Section 6	Riffle between CV #5 and #6	Photo Point 22

Notes:

1. All cross sections are marked on each bank by permanent pins set in concrete.
2. All pins are shown on the plan views (with North Carolina State plane and elevation coordinates) and are marked in the field with wooden stakes with orange flagging tape.
3. Photo point locations are shown on the plan views.

Gillespie Cross Section Pin Locations

Point#	Northing	Easting	Elevation	Decscription	Stationing
6962	836721.2408	1768240.768	731.593021	X1-LPIN	2+09.41
6959	836661.4391	1768188.143	727.386603	X2-RPIN	
6958	836547.672	1768574.591	727.323399	X2-LPIN	5+85.75
6957	836455.5351	1768498.907	726.222079	X2-RPIN	
6955	836450.0104	1768663.792	727.584322	X3-LPIN	7+31.09
6956	836379.1641	1768627.222	726.94595	X3-RPIN	
6954	836373.6691	1768866.661	727.000947	X4-LPIN	9+64.85
6953	836308.9286	1768847.733	724.7526	X4-RPIN	
7290	836336.2576	1769164.713	723.878659	X5-LPIN	12+76.23
6952	836152.7361	1769152.928	725.460507	X5-RPIN	
7332	836035.9265	1769389.533	733.438601	X6-LPIN	no stationing
7337	8359978.245	1769468.044	730.65315	X6-RPIN	on Reach 2

Gillespie Golf Course

Cross Section Dimension Summary

XSEC	STA	Date	Feature	Str Type	Wfpa	Wbkf	Dbkf	W/D	Abkf	Dmax	ER	BHR
1	2+09	5/28/2003	Pool		235	24.9	3.4	7.3	85.5	5.7	9.4	1.0
	2+09	4/5/2005	Pool		235	25.4	3.6	7.1	91.0	5.3	9.2	1.0
	2+09	Y2	Pool									
	2+09	Y3	Pool									
	2+09	Y4	Pool									
2	5+86	5/28/2003	Riffle	B5c	56	26.7	2.0	13.6	52.3	3.1	2.1	1.0
	5+86	4/5/2005	Riffle	B5c	66	26.3	2.3	11.3	61.4	3.8	2.5	1.0
	5+86	Y2	Riffle									
	5+86	Y3	Riffle									
	5+86	Y4	Riffle									
3	7+31	5/28/2003	Riffle	B5c	52	24.0	2.2	11.1	51.9	3.4	2.2	1.0
	7+31	4/5/2005	Riffle	B5c	63	26.8	3.0	9.0	79.6	4.6	2.4	1.0
	7+31	Y2	Riffle									
	7+31	Y3	Riffle									
	7+31	Y4	Riffle									

Str Type = Rosgen Classification

Wfpa = Width Flood Prone Area (ft)

Wbkf = Bankfull Width (ft)

Dbkf = Bankfull Mean Depth (ft)

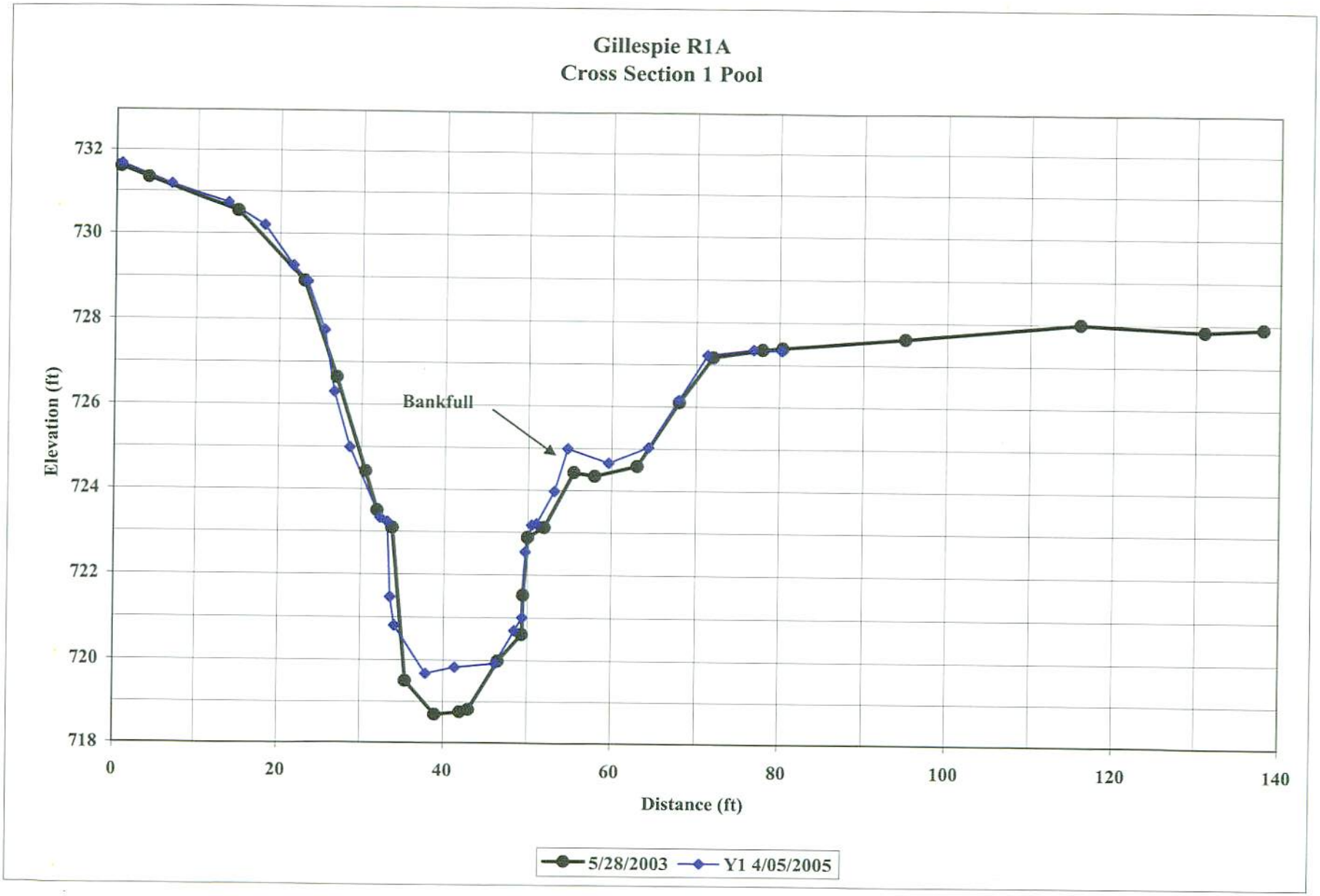
W/D = Bkf Width to Depth Ratio (ft/ft)

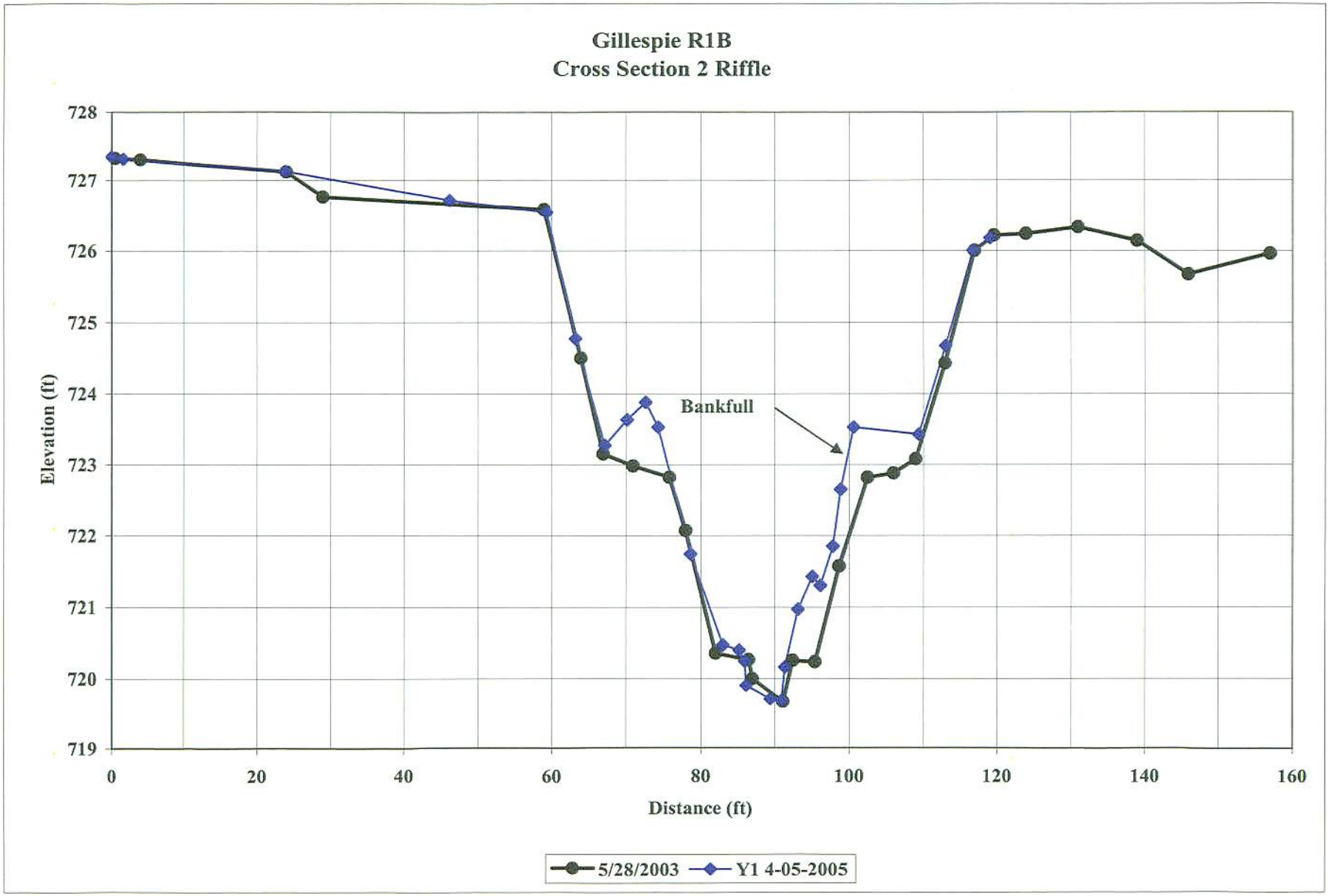
Abkf = Bkf Cross Section Area (sq ft)

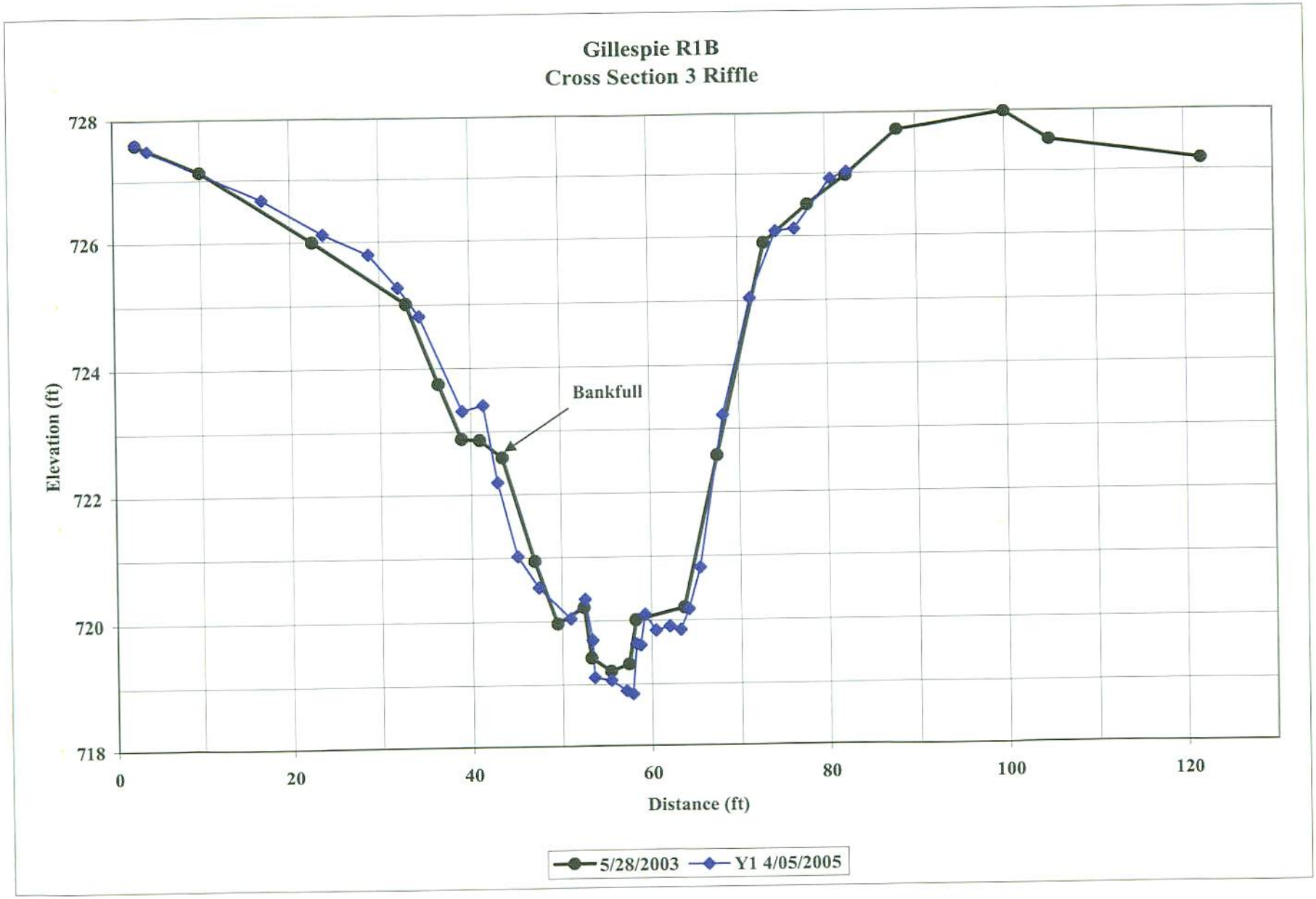
Dmax = Bankfull Maximum Depth (ft)

ER = Entrenchment Ratio, Wfpa/Wbkf (ft/ft)

BHR = Bank Height Ratio, Dtob/Dmax (ft/ft)


Gillespie R1A
Cross Section 1 Pool
Elevation (ft)
732
730
728
726
724
722
720
718
Bankfull
0
20
40
60
80
100
120
140
Distance (ft)
5/28/2003
Y1 4/05/2005


Gillespie R1B
Cross Section 2 Riffle
728
727
726
725
724
723
722
721
720
719
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
140
160
Distance (ft)
5/28/2003
Y1 4-05-2005


Gillespie R1B
Cross Section 3 Riffle
728
726
724
722
720
718
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
Distance (ft)
5/28/2003
Y1 4/05/2005

Gillespie Golf Course

Cross Section Dimension Summary

XSEC	STA	Date	Feature	Str Type	Wfpa	Wbkf	Dbkf	W/D	Abkf	Dmax	ER	BHR
4	9+65	5/28/2003	Pool		262	28.5	2.9	9.8	82.6	4.4	9.2	1.0
	9+65	4/5/2005	Pool		262	30.1	2.7	11.3	79.9	4.0	8.7	1.0
	9+65	Y2	Pool									
	9+65	Y3	Pool									
	9+65	Y4	Pool									
5	12+76	5/28/2003	Riffle	E5	115	26.3	1.9	13.9	49.9	2.9	4.4	1.0
	12+76	4/5/2005	Riffle	E5	115	27.1	1.9	14.2	51.6	3.1	4.2	1.0
	12+76	Y2	Riffle									
	12+76	Y3	Riffle									
	12+76	Y4	Riffle									
6	n/a	5/28/2003	Riffle	E5b	22	7.2	0.6	11.2	4.6	1.0	3.1	1.0
		4/5/2005	Riffle	E5b	22	7.4	0.4	19.8	2.8	0.8	3.0	1.0
		Y2	Riffle									
		Y3	Riffle									
		Y4	Riffle									

Str Type = Rosgen Classification

Wfpa = Width Flood Prone Area (ft)

Wbkf = Bankfull Width (ft)

Dbkf = Bankfull Mean Depth (ft)

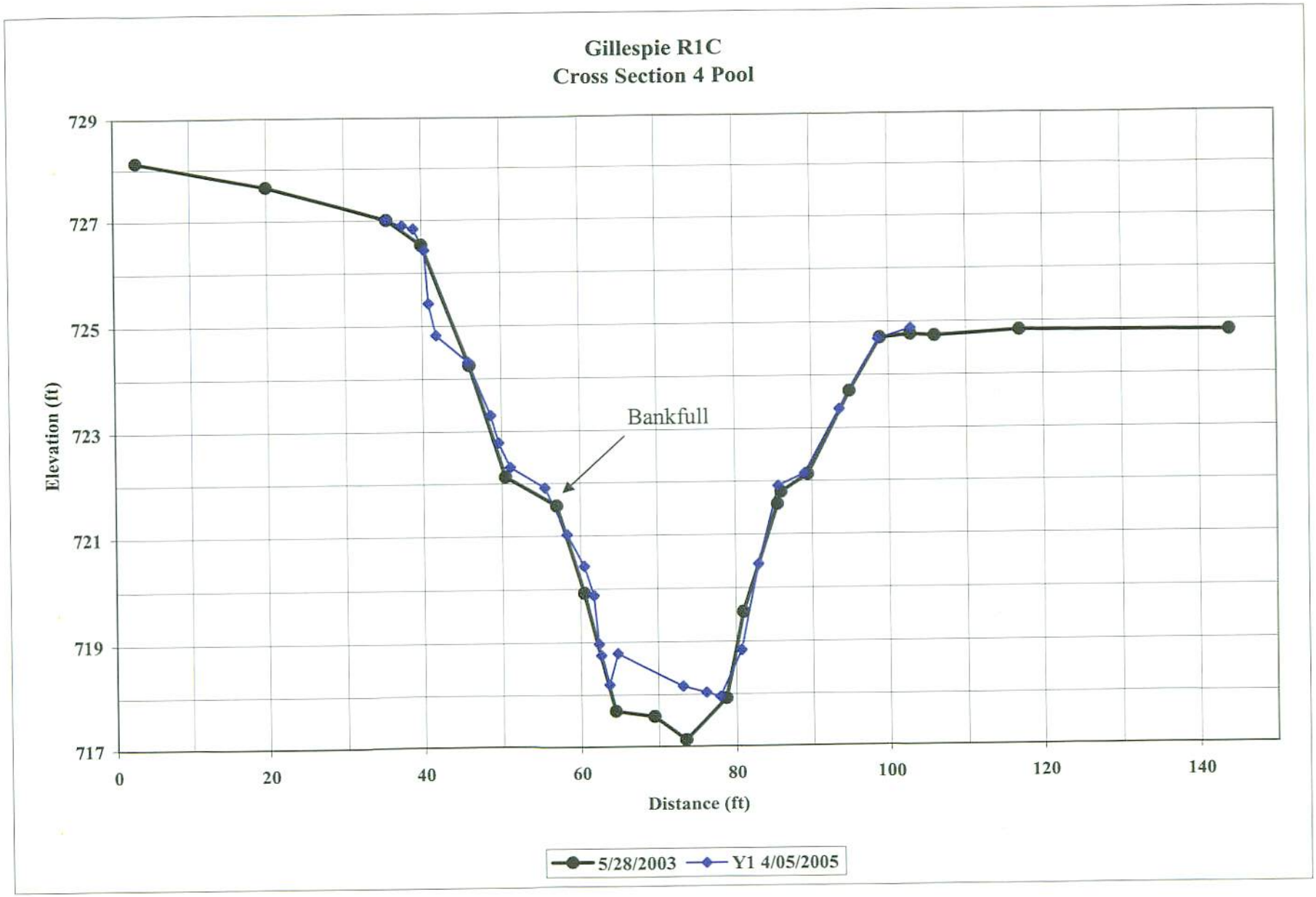
W/D = Bkf Width to Depth Ratio (ft/ft)

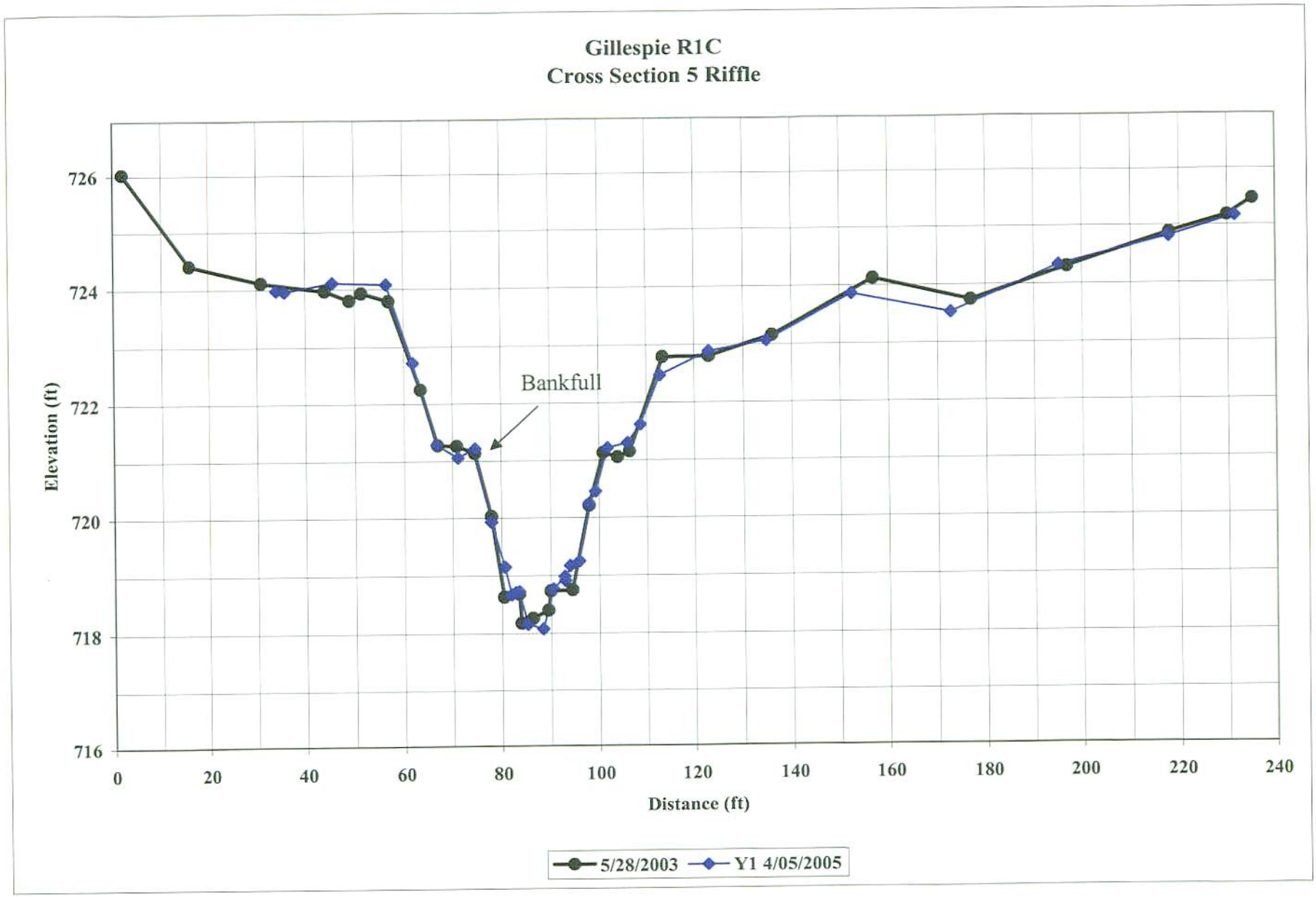
Abkf = Bkf Cross Section Area (sq ft)

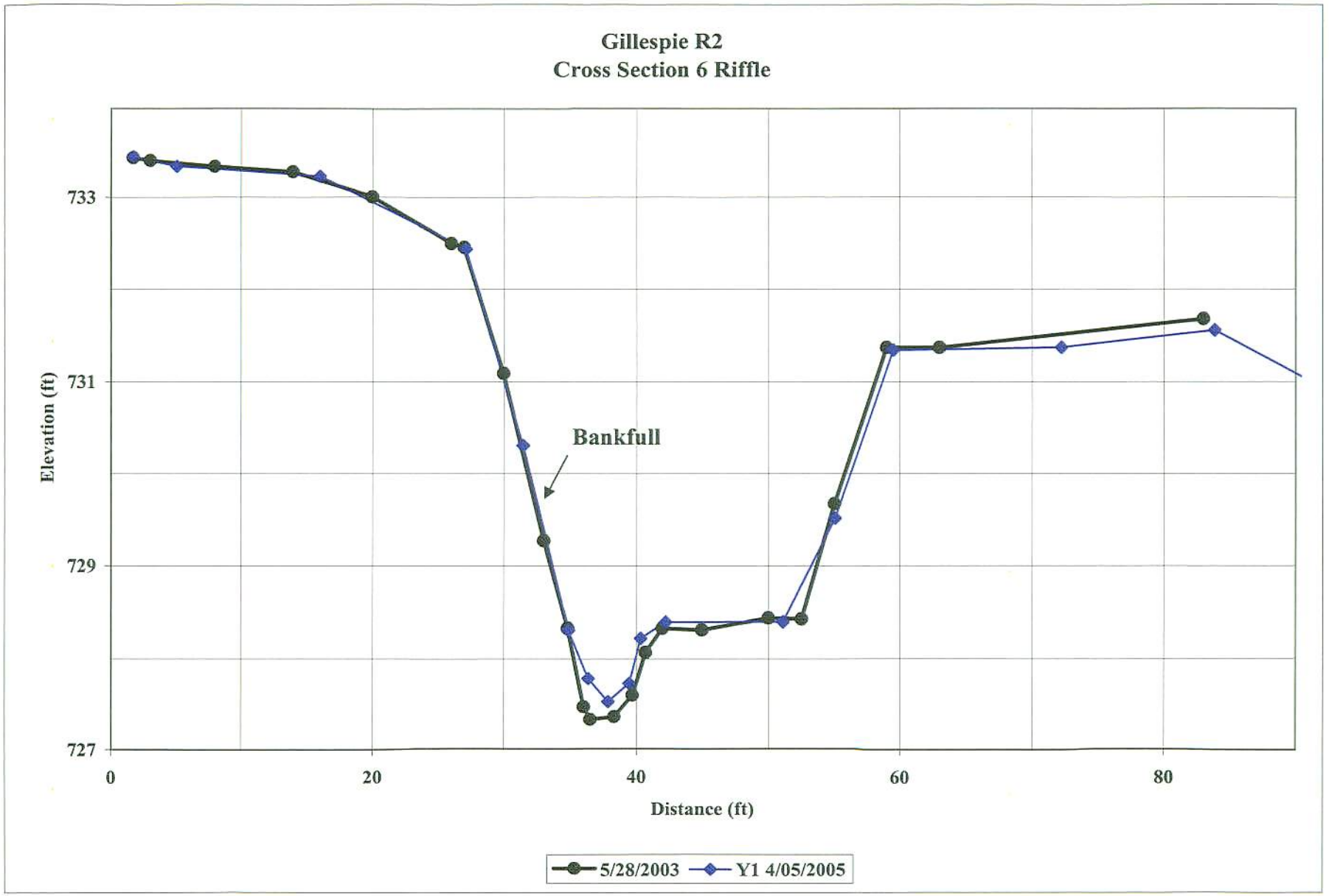
Dmax = Bankfull Maximum Depth (ft)

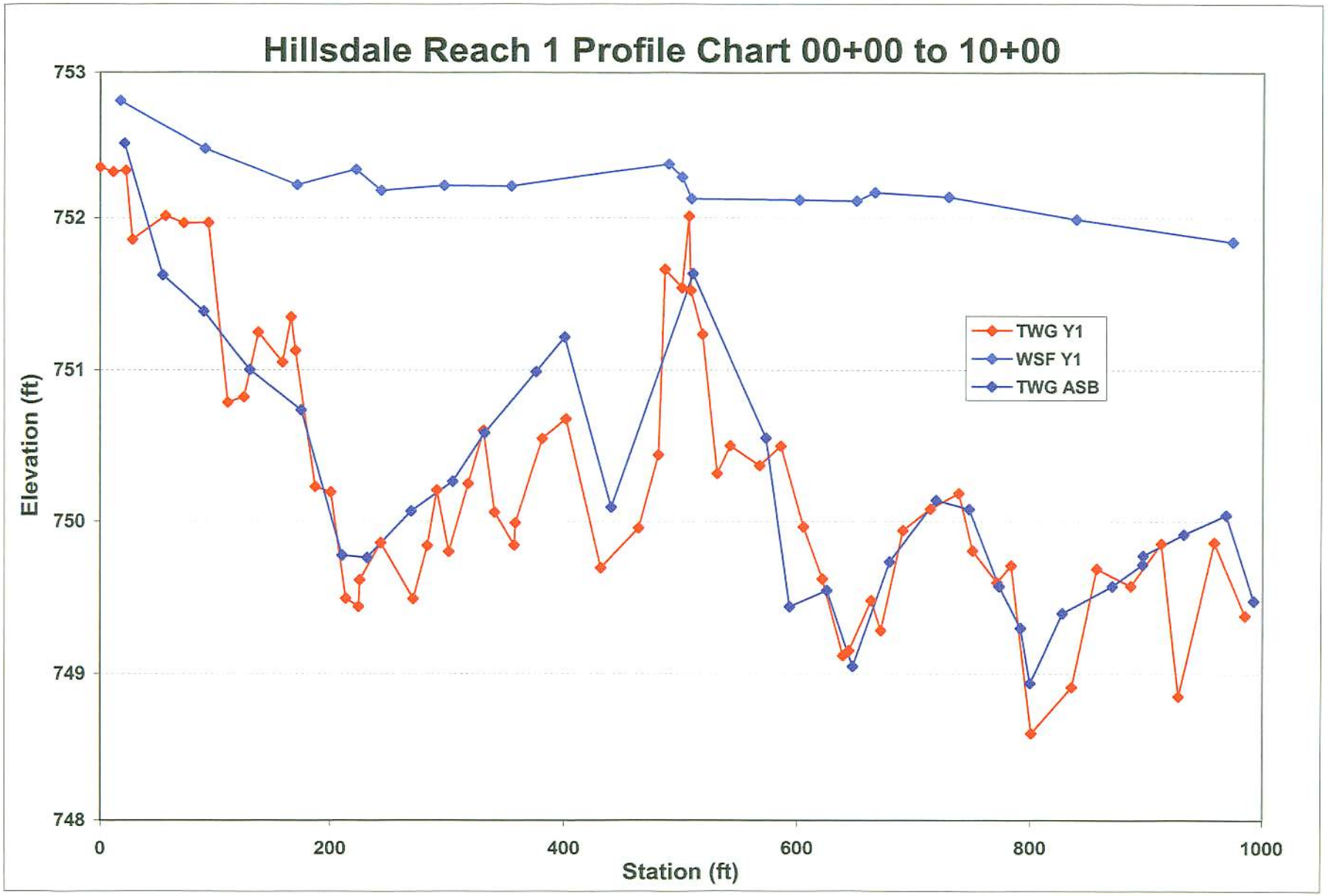
ER = Entrenchment Ratio, Wfpa/Wbkf (ft/ft)

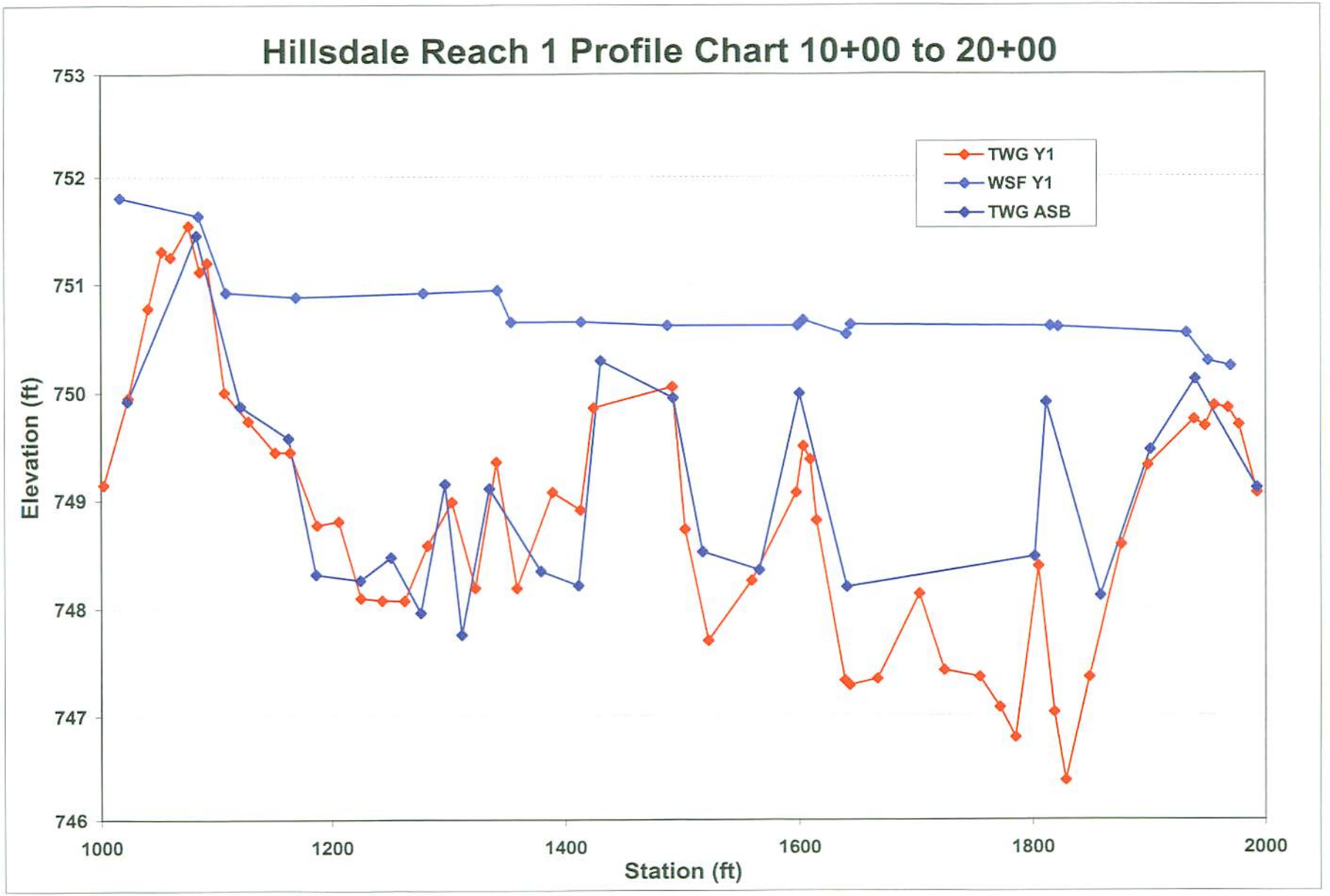
BHR = Bank Height Ratio, Dtob/Dmax (ft/ft)

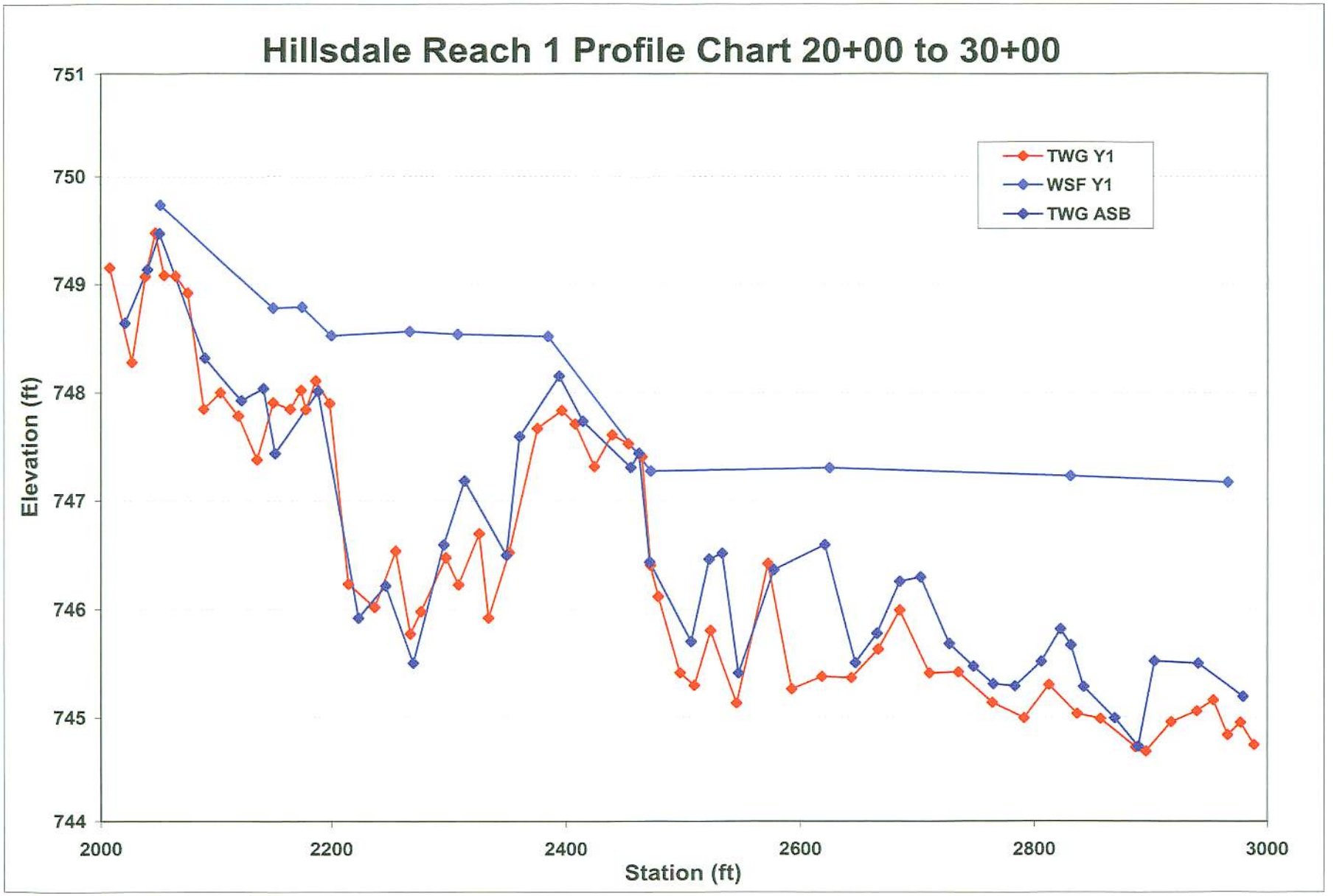

Gillespie R1C
Cross Section 4 Pool
729
727
725
723
721
719
717
Elevation (ft)
Bankfull
0
20
40
60
80
100
120
140
Distance (ft)
5/28/2003
Y1 4/05/2005

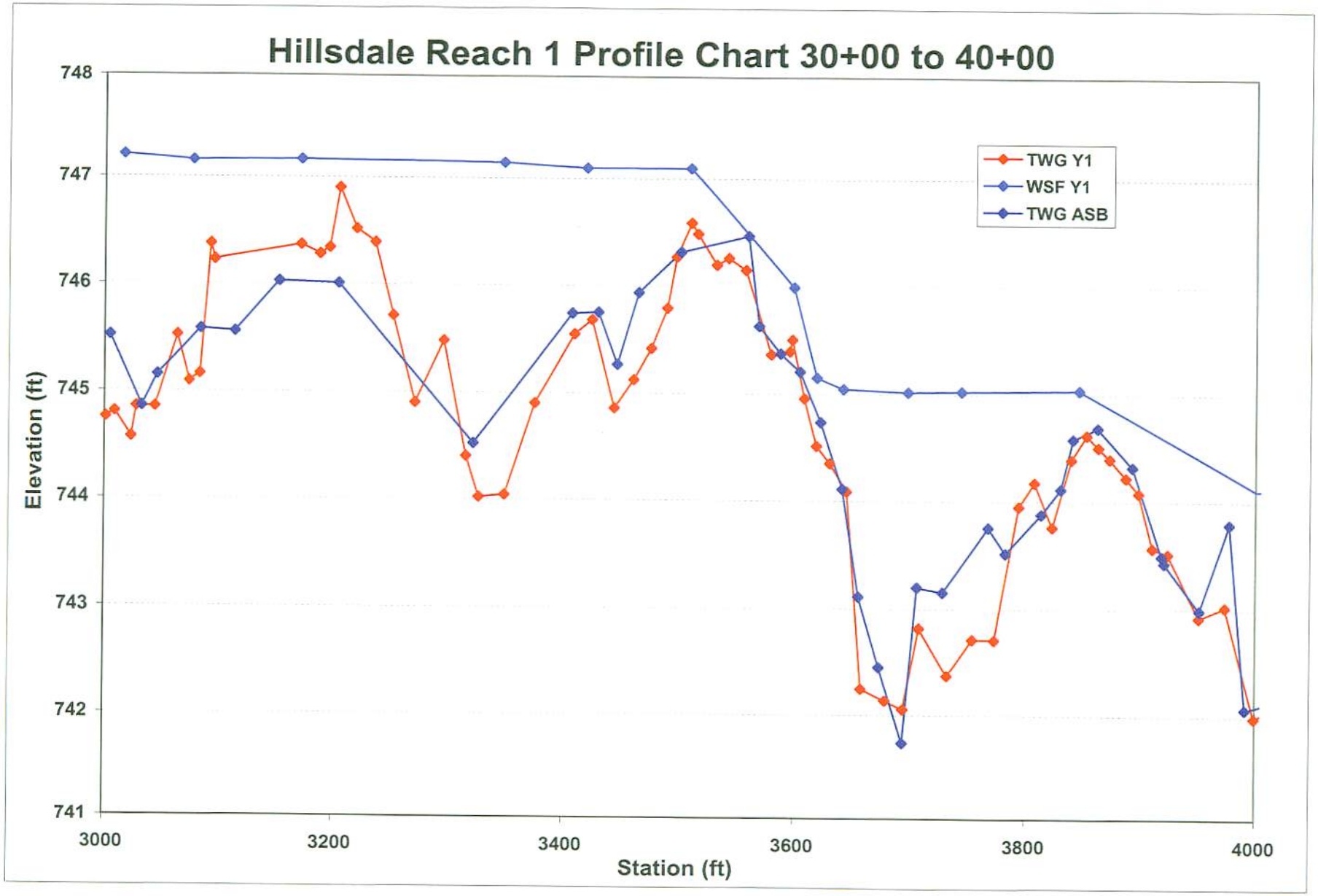

Gillespie R1C
Cross Section 5 Riffle
Elevation (ft)
726
724
722
720
718
716
Bankfull
0
20
40
60
80
100
120
140
160
180
200
220
240
Distance (ft)
5/28/2003
Y1 4/05/2005

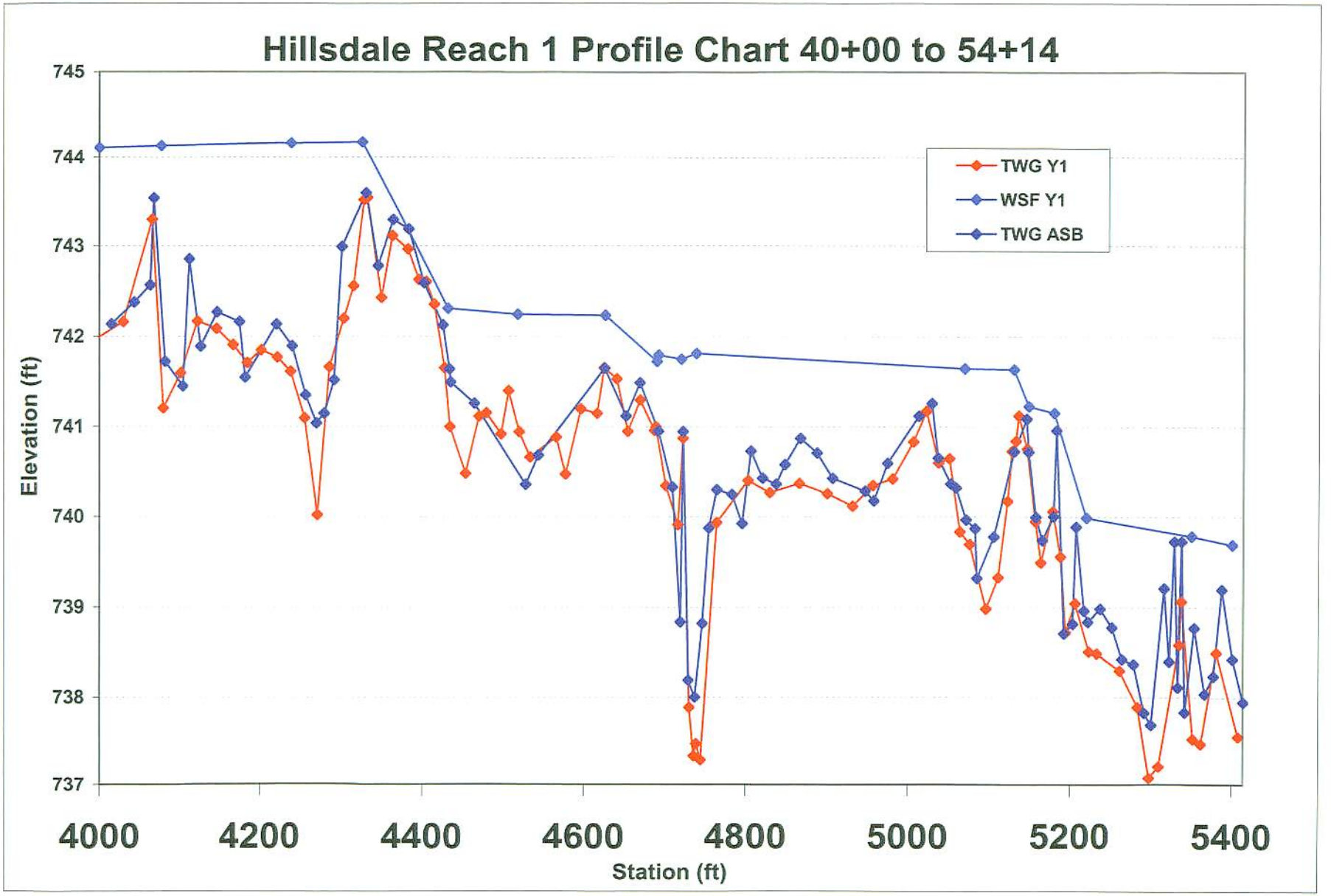

Gillespie R2
Cross Section 6 Riffle
Elevation (ft)
733
731
729
727
Bankfull
0
20
40
60
80
Distance (ft)
5/28/2003
Y1 4/05/2005

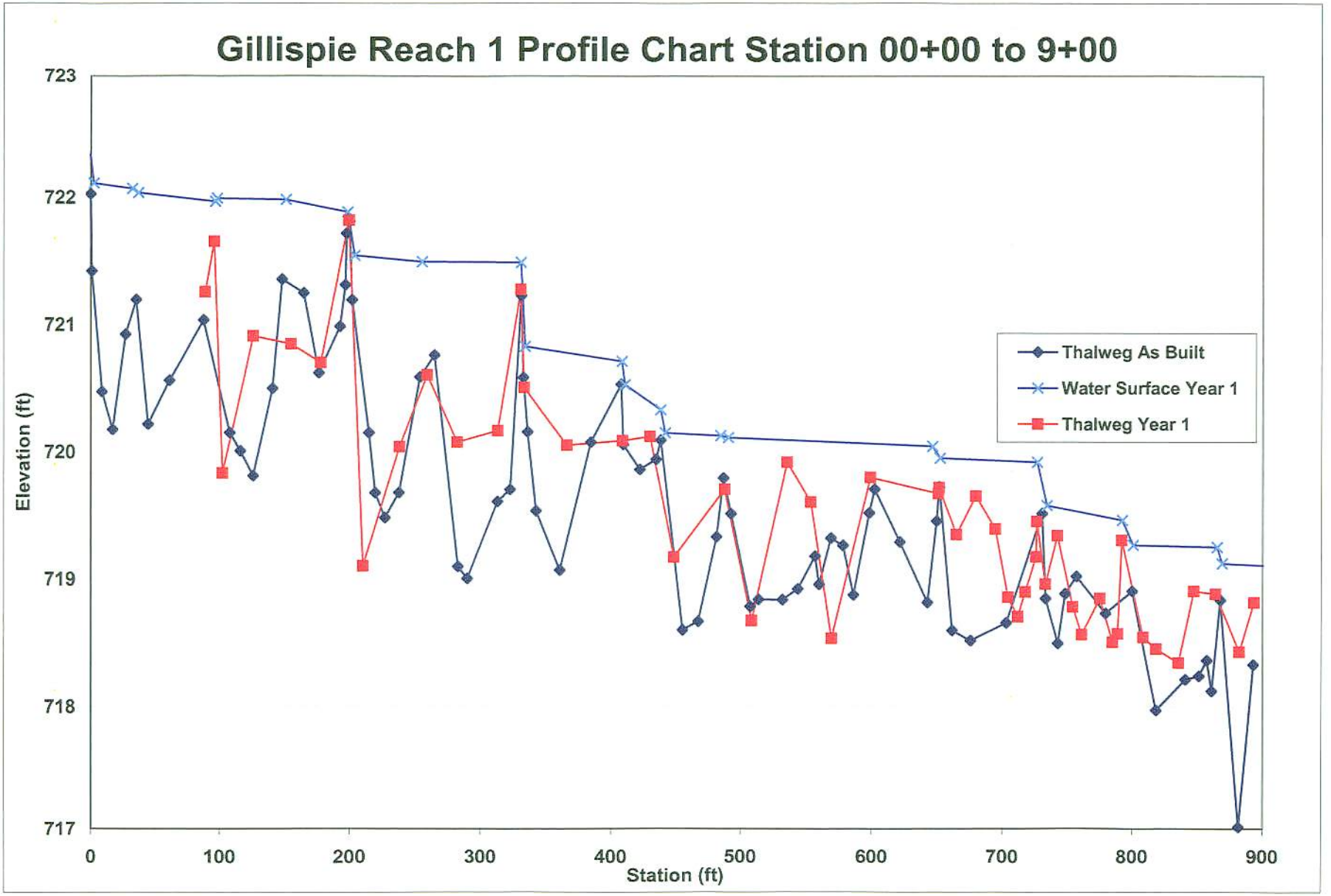

Hillsdale Reach 1 Profile Chart 00+00 to 10+00
753
752
751
750
749
748
Elevation (ft)
0
200
400
600
800
1000
Station (ft)
TWG Y1
WSF Y1
TWG ASB

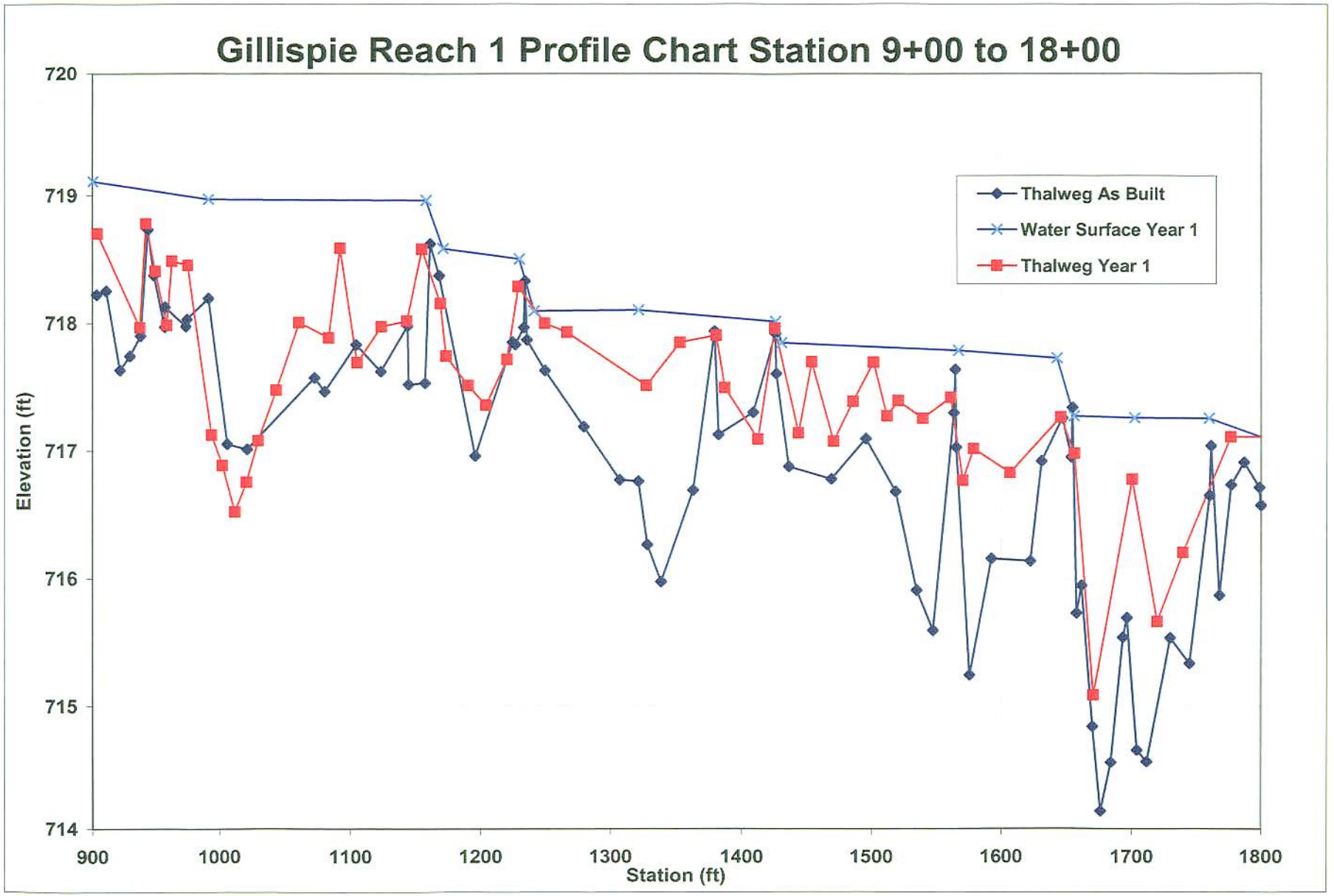

Hillsdale Reach 1 Profile Chart 10+00 to 20+00
753
752
751
750
749
748
747
746
Elevation (ft)
1000
1200
1400
1600
1800
2000
Station (ft)
TWG Y1
WSF Y1
TWG ASB

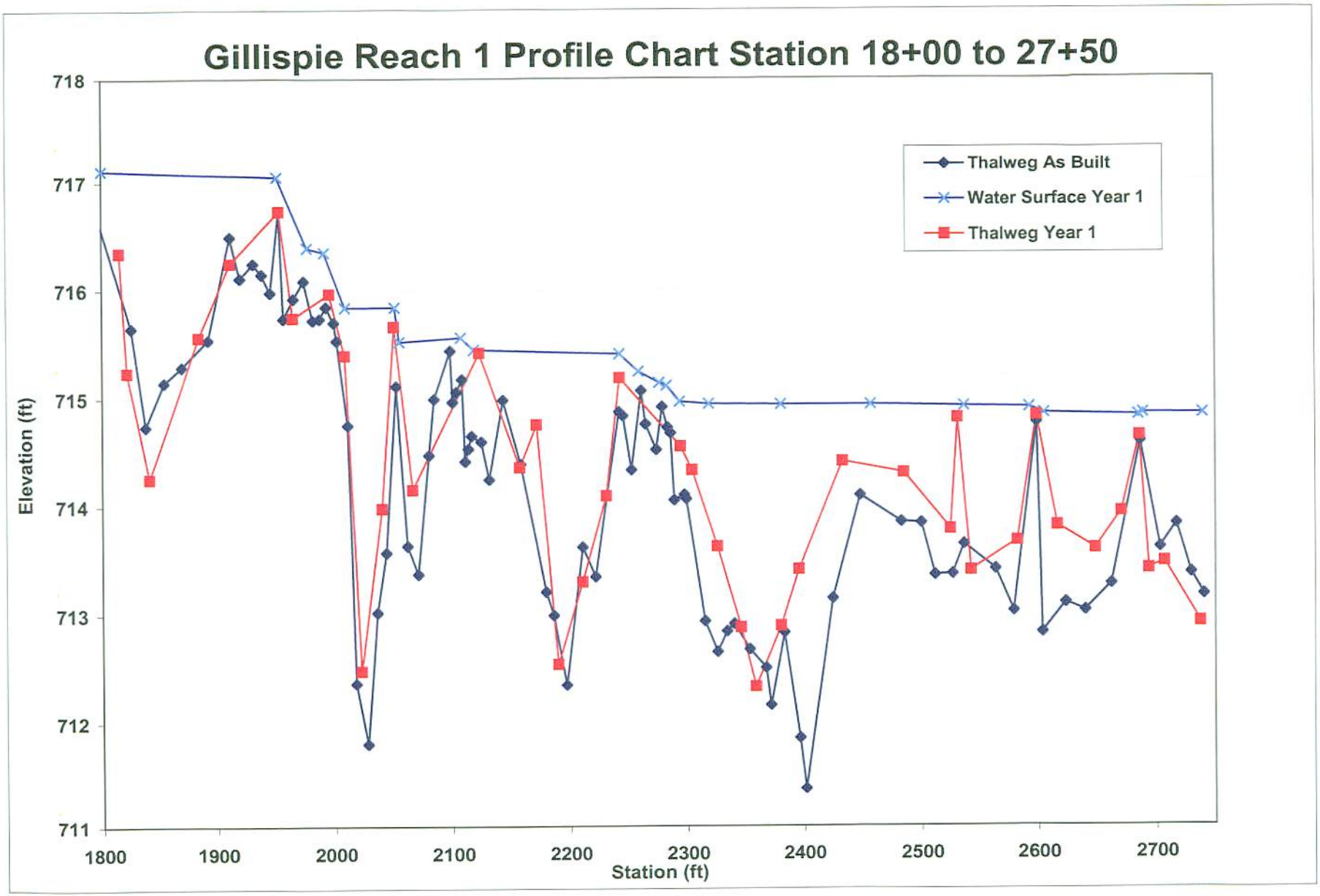

Hillsdale Reach 1 Profile Chart 20+00 to 30+00
751
750
749
748
747
746
745
744
Elevation (ft)
2000
2200
2400
2600
2800
3000
Station (ft)
TWG Y1
WSF Y1
TWG ASB


Hillsdale Reach 1 Profile Chart 30+00 to 40+00
748
747
746
745
744
743
742
741
Elevation (ft)
3000
3200
3400
3600
3800
4000
Station (ft)
TWG Y1
WSF Y1
TWG ASB


Hillsdale Reach 1 Profile Chart 40+00 to 54+14
745
744
743
742
741
740
739
738
737
Elevation (ft)
TWG Y1
WSF Y1
TWG ASB
4000
4200
4400
4600
4800
5000
5200
5400
Station (ft)


Gillispie Reach 1 Profile Chart Station 00+00 to 9+00
723
722
721
720
719
718
717
Elevation (ft)
0
100
200
300
400
500
600
700
800
900
Station (ft)
Thalweg As Built
Water Surface Year 1
Thalweg Year 1


Gillispie Reach 1 Profile Chart Station 9+00 to 18+00
720
719
718
717
716
715
714
Elevation (ft)
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
Station (ft)
Thalweg As Built
Water Surface Year 1
Thalweg Year 1


Gillispie Reach 1 Profile Chart Station 18+00 to 27+50
Thalweg As Built
Water Surface Year 1
Thalweg Year 1
Elevation (ft)
718
717
716
715
714
713
712
711
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
Station (ft)

South Buffalo Creek
Hillsdale Park
Photo Point Locations

Photo Point	Location	View
Reach 1A		
1	Top of Meadow View Road Culvert	Project Start
2	Thalweg (TW) at invert of Vane #1	Cross Section (XSEC) 1
3	TW at Vane #2 Tie-in	Vane #3
4	TW at STA 14+00, 50' above Constructed Riffle (CR) #1	XSEC 2
5	Left Top of Terrace by manhole cover	CR #1 and Step Pool #1
6	TW at invert of Vane #4	XSEC 3
7	TW at Vane #5 Tie-in	Vane #6
8A	TW at Vane #6 Tie-in	Bedrock knick point
8B	Top of terrace at Station 18+00	Vegetation Plot
9	TW 2' above Bedrock knick point	XSEC 4
10A	TW at Step Pool #2	Vane #7
10B	TW at Step Pool #2 looking to Right	Step Pool #2
11A	TW at Step Pool #3	Cross Vane (CV) #1
11B	TW at Step Pool #3 looking to Left	Step Pool #3
12	TW at Invert of CV #1	CV #1 and Culvert
13	Top of Vanstory St. Culvert, upstream side	Looking Upstream
Reach 1B		
14	Top of Vanstory St. Culvert, downstream side	Reach 1B Start
15	TW at STA 24+75, 50' above DWD #1	XSEC 5
16A	TW at STA 25+00, 25' above DWD #1	XSEC 6
16B	Left Wing of DWD#1 looking downstream	Vegetation Plot
17A	TW at Step Pool #1	CV #1
17B	TW at Step Pool #1 looking to Right	Step Pool # 1
18A	TW at Step Pool #2	Riffle below CV #1
18B	TW at Step Pool #2 looking to Left	Step Pool #2
19A	TW at Step Pool #3	XSEC 7
19B	TW at Step Pool #3 looking to Left	Step Pool #3
20	TW at invert of Vane #1	XSEC 8
21	On top of Reinforced Concrete Pipe (RCP) off unnamed Tributary	Unnamed Tributary behind Vane #1
22A	TW at Step Pool #4	Boulder Cluster
22B	TW at Step Pool #4 looking to Left	Step Pool #4
23A	TW at Step Pool #5	DWD #2
23B	TW at Step Pool #5 looking to Left	Step Pool #5
24A	TW at Step Pool #6	DWD #3

Photo Point	Location	View
24B	TW at Step Pool #6 looking to Right	Step Pool #6
25A	TW at Step Pool #7	CV #2
25B	TW at Step Pool #7 looking to Left	Step Pool #7
26A	TW at Step Pool #8	Vanes #2 and #3
26B	TW at Step Pool #8 looking to Right	Step Pool #8
27	Top of Meadow View Road Culvert, upstream side	Looking upstream
Reach 2		
28	Top of Meadow View Road Culvert, downstream side	Reach 2 Start, J-Hook #1
29	TW above J-Hook #1 at Left Bench Start	J-Hook #1 and Bedrock
30A	TW above Bedrock	Riffle
30B	TW above Bedrock looking to back Left	Step Pool #1
30C	TW above Bedrock looking to Left	Rootwads #1
31	TW below Bedrock	XSEC 9
32	TW at Tail of Riffle above CV #1	XSEC 10, Boulder Cluster #1
33A	TW at Rootwads #2	J-Hook #2
33B	TW at Rootwads #2 looking to Left	Rootwads #2
34A	TW between Rootwads #3 and Step Pool #2	CV #2, Boulder Cluster #2
34B	TW between Rootwads #3 and Step Pool #2 looking to back Left	Rootwads #3
34C	TW between Rootwads #3 and Step Pool #2 looking to Left	Step Pool #2
35	TW below Boulder Cluster #2	J-Hook #3
36	TW at Head of Riffle below J-Hook #3	Riffle
37	TW at Tail of Riffle 100'above J-Hook #4	J-Hook #4
38A	TW at Step Pool #3	Riffle
38B	TW at Step Pool #3 looking to Left	Step Pool #3
39	TW at Head of Riffle below Step Pool #3	XSEC 11
40	TW at center of Riffle below Step Pool #3	XSEC 12, CV #3
41	TW at Bedrock 10' below CV #3	Riffle
42	TW at Left Bench Start	J-Hook #5
43A	TW at Step Pool #4	Riffle
43B	TW at Step Pool #4 looking to Left	Step Pool #4
44	TW at Water Line Crossing	CV #4
45A	Center Left I-40 Culvert, Left side	Looking upstream Reach 2
Reach 3		
45B	Center Left I-40 Culvert, Left side	Looking upstream Reach 3
46	Top of Aerial Sewer Line Crossing	Reach 3 Start

PP1 Reach 1A Start-Year 1

PP2 Reach 1A Cross Section 1 (Pool)-Year 1

PP3 Reach 1AVane #3-Year 1

PP4 Reach 1A Cross Section #2 (Riffle)-Year 1

PP5 Reach 1A Constructed Riffle #1 & Step Pool-#1-Year 1

PP6 Reach 1A Cross Section #3 (Pool)-Year 1

PP7 Reach 1A Vane #6-Year 1

PP8A Reach 1A Bedrock Knickpoint-Year 1

PP8B Forested Buffer Bare-root Vegetation Plot Looking Upstream From Top of Terrace at Station 18+00-Year 1

PP9 Reach 1A Cross Section #4 (Riffle)-Year 1

PP10A Reach 1A Vane # 7-Year 1

PP10B Reach 1A Step Pool #2-Year 1

PP11A Reach 1A Cross Vane #1-Year 1

PP11B Reach 1A Step Pool #3-Year 1

PP12 Reach 1A Cross Vane #1 & Vanstory Culvert-Year 1

PP13 Reach 1A End (Upstream view)-Year 1

PP14 Reach 1B Start-Year 1

PP15 Reach 1B Cross Section 5 (Riffle)-Year 1

PP16A Reach 1B Cross Section 6 (Pool)-Year 1

PP16B Forested Buffer Bare-root Vegetation Plot-Year 1

PP17A Reach 1B Cross Vane #1-Year 1

PP17B Reach 1B Step Pool #2-Year 1

PP18A Reach 1B Riffle-Year 1

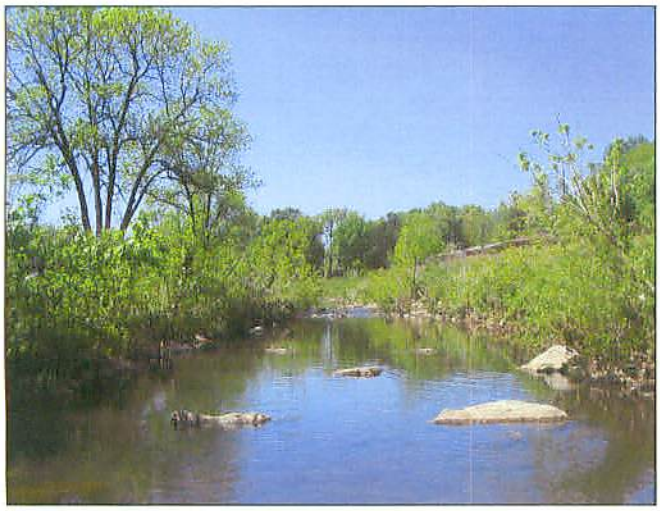
PP18B Reach 1B Step Pool #2-Year 1

PP19A Reach 1B Cross Section #7-Year 1

PP19B Reach 1B Step Pool #3-Year 1

PP20 Reach 1B Cross Section #8 (Pool)-Year 1

PP21 Reach 1B Unnamed Tributary-Year 1



PP22A Reach 1 B Boulder Cluster-Year 1

PP22B Reach 1B Step Pool #4-Year 1

PP23A Reach 1B DWD #2-Year 1

PP23B Reach 1B Step Pool #5-Year 1

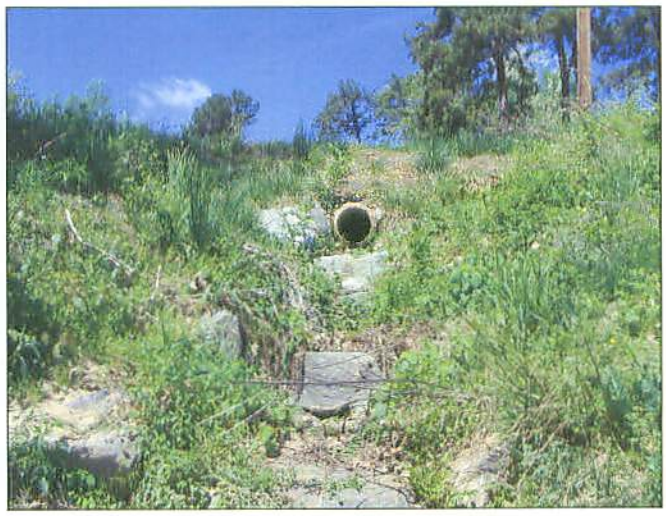
PP24A Reach 1B DWD #3-Year 1

PP24B Reach 1B Step Pool #6-Year 1

PP25A Reach 1B Cross Vane #2-Year1

PP25B Reach 1B Step Pool #7-Year 1

PP26A Reach 1B Vanes #2 & #3-Year 1

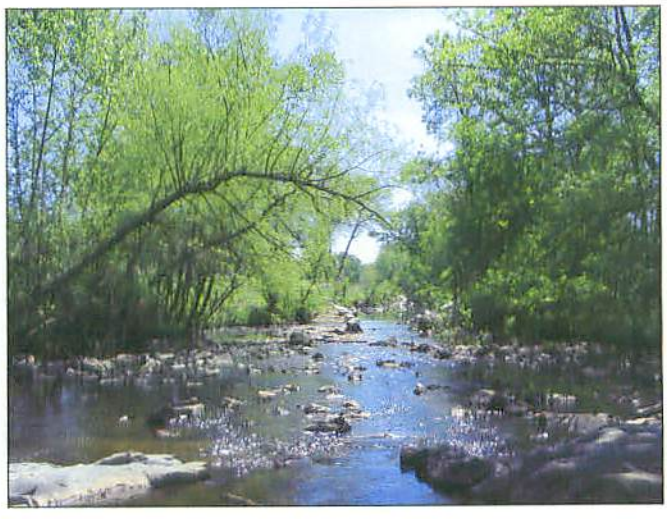


PP26B Reach 1B Step Pool #8-Year 1

PP27 Reach 1B End (Upstream View)-Year 1

PP28 Reach 2 Start-Year 1 (with new Monitoring Station on left bank)

PP29 Reach 2 J-Hook #1-Year 1



PP30A Reach 2 Riffle-Year 1

PP30B Reach 2 Step Pool #1-Year 1

PP30C Reach 2 Root-wads #1-Year 1

PP31 Reach 2 Cross Section #9 (Riffle)-Year 1

PP32 Reach 2 Cross Section #10 (Pool)-Year 1

PP33A Reach 2 J-Hook #2-Year 1

PP33B Reach 2 Root-wads #2-Year 1

PP34A Reach 2 Cross Vane #2-Y1

PP34B Reach 2 Root-wads #3-Year 1

PP34C Reach 2 Step Pool #2-Year 1

PP35 Reach 2 J-hook #3-Year 1

PP36 Reach 2 Riffle-Year 1

PP37 Reach 2 J-hook #4-Year 1

PP38A Reach 2 Riffle-Year 1

PP38B Reach 2 Step Pool #3-Year 1

PP39 Cross Section #11 (Riffle)-Year 1

PP40 Reach 2 Cross Section 12 (Pool)-Year 1

PP41 Reach 2 Riffle-Year 1

PP42 Reach 2 J-hook #5-Year 1

PP43A Reach 2 Riffle-Year 1

PP43B Reach 2 Step Pool #4-Year 1

PP44 Reach 2 Cross Vane #4-Year 1

PP45A Reach 2 End (Upstream View)-Year 1

PP45B Reach 3 End (Upstream View)-Year 1

PP46 Reach 3-Year 1

Mile Run Creek
Gillespie Golf Course
Photo Point Locations

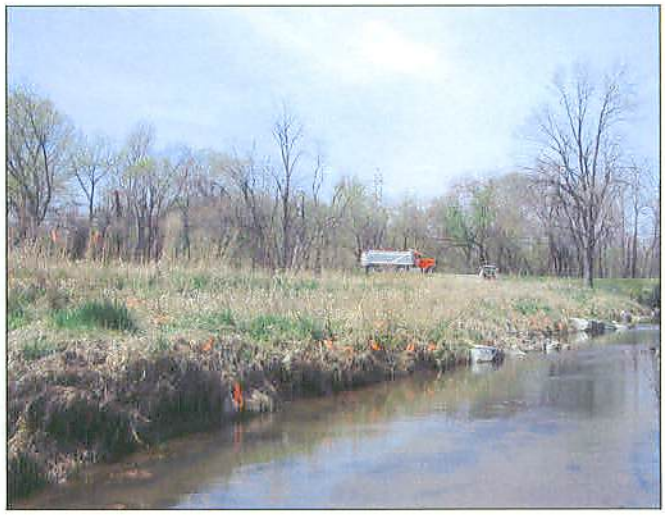
Photo Point	Location	View
Reach 1A		
1	Top of Culvert at Randolph Avenue	Project Start
2	Thalweg (TW) at Double Wing Deflector (DWD) #1	Cross Section (XSEC 1) XSEC 1
3A	TW at invert of Cross Vane (CV) #4	Towards Bridge 1
3B	TW at invert of CV #4	Looking upstream at Bare root vegetation plot
4A	Top of Bridge 1, upstream side	Looking upstream
Reach 1B		
4B	Top of Bridge 1, downstream side	Start of Reach 1B
5	TW at invert of CV #2	XSEC 2
6	TW 20' upstream of Aerial Sewer Line Crossing	XSEC 3
7	Top of Aerial Sewer Line Crossing	Towards Bridge 2
8A	Top of Bridge 2, downstream side	Looking upstream
Reach 1C		
8B	Top of Bridge 2, upstream side	Start of Reach 1C, XSEC 4
9A	TW at invert of DWD #2	CV #2
9B	Left Wing of DWD #2	Looking downstream at bareroot vegetation plot
10	TW at STA 12+00, 75' above DWD #3	XSEC 5
Reach 1D		
11	TW at invert of CV #1	DWD #1
12	TW at invert of DWD #2	J-Hook #1
13	TW at confluence with Reach 2 RCP	Constructed Riffle
Reach 1E		
14	TW at confluence with Reach 4	Towards Bridge 3
15A	Top of Bridge 3, upstream side	Looking upstream
15B	Top of Bridge 3, downstream side	Looking downstream
Reach 1F		
16	TW at invert of vane #1	J-Hook #1
17	TW at invert of J-Hook #1	CV #1
18	TW at invert of CV #1	CV #2 and #3
19	TW at invert of CV #3	Project End

Photo Point	Location	View
Reach 2		
20	TW 10' above invert of CV #1	Reach 2 Start
21	TW at invert of CV #2	CV #3 and #4
22	TW at invert of CV #4	XSEC 6
Reach 3		
23	Top of Culvert	Reach 3A Start
24A	Top of Pedestrian Bridge, upstream side	Looking upstream
24B	Top of Pedestrian Bridge, downstream side	Reach 3B Start
25	TW at invert of CV #2	Confluence with Reach 1
Reach 4		
26	Top of Cart Path Crossing	Reach 4 Start
27A	Top of Cart Path Crossing below 12th Tee Box, upstream side	Looking upstream
27B	Top of Cart Path Crossing below 12th Tee Box, downstream side	Looking downstream
27C	Top of Cart Path Crossing Below 12th Tee Box, downstream side	Looking at Shrub Vegetation Plot
28	Top of Cart Path Crossing below 3d Tee Box	Looking downstream
29	Right Top of Bank at Bend to left	Confluence with Reach 5
30A	Left Top of Bank at confluence with Reach 5	Looking downstream
30B	4Cart Path at Confluence with Reach 5	Looking upstream at Reach 4 Herbaceous/Livestake Plot
31	Top of Cart Path Crossing on Fairway 2	Confluence with Reach 1
Reach 5		
32	TW at Fence Line on left side of Fairway 6	Reach 5 Start
33	Top of Cart Path Crossing on right side of Fairway 6	Looking downstream
34	Left Top of Bank at Bend to Right	Confluence with Reach 4

PP1 Reach 1A Project Start-Year 1

PP2 Reach 1A Cross Section 1-Year 1

PP3A Reach 1A Towards Bridge 1-Year 1



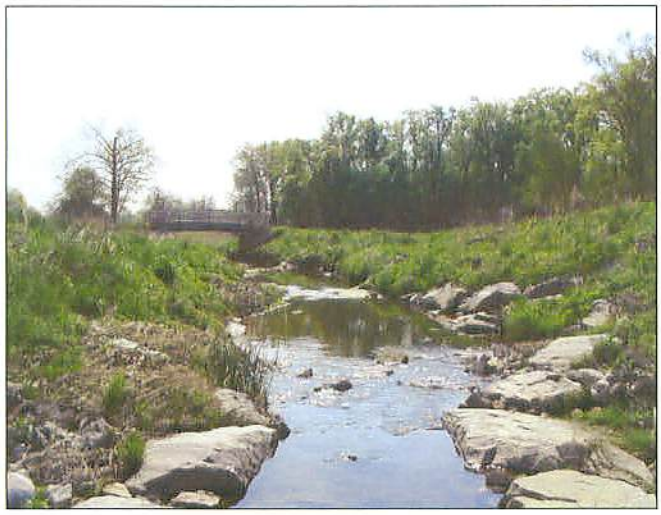
PP3B Reach 1A Forested Buffer Bare-root/Live stake Plot Looking Upstream-Year 1

PP4A Reach 1A Looking Upstream-Year 1

PP4B Reach 1B Start-Year 1

PP5 Reach 1B Cross Section 2-Year 1

PP6 Reach 1B Cross Section 3-Year 1



PP7 Reach 1B Towards Bridge 2-Year 1

PP8A Reach 1B Looking Upstream-Year 1

PP8B Reach 1C Start, Cross Section 4-Year 1

PP9A Reach 1C Cross Vane #2-Year 1

PP9B Managed Buffer
Livestakes/Shrubs/Herbaceous Perennials
Vegetation Plot Looking Downstream-Year 1

PP10 Reach 1C Cross Section 5-Year 1

PP11 Reach 1D Double Wing Deflector #1-Year 1

PP12 Reach 1D J-hook #1-Year 1

PP13 Reach 1D Constructed Riffle-Year 1

PP14 Reach 1E Towards Bridge 3-Year 1

PP15A Reach 1E Looking Upstream-Year 1

PP15B Reach 1E Looking Downstream-Year 1

PP16 Reach 1F J-hook #1-Year 1

PP17 Reach 1F Cross Vane #1-Year 1

PP18 Reach 1F Cross Vanes #2 and #3-Year 1

PP19 Reach 1F Project End-Year 1

PP 20 Reach 2 Start-Year 1

PP 21 Reach 2 Cross Vanes #3 and #4-Year 1

PP22 Reach 2 Cross Section 6-Year 1

PP23 Reach 3A Start-Year 1

PP24A Reach 3A Looking Upstream-Year 1

PP24B Reach 3B Start-Year 1

PP25 Reach 3B Confluence with Reach 1-Year 1

PP26 Reach 4 Start Looking Downstream-Year 1

PP27A Reach 4 Looking Upstream-Year 1

PP27B Reach 4 Looking Downstream-Year 1

PP27C Managed Buffer Vegetation Shrub Plot Looking Downstream

PP28 Reach 4 Looking Downstream-Year 1

PP29 Reach 4 Confluence with Reach 5-Year 1

PP30A Reach 4 Looking Downstream-Year 1

PP30B Managed Buffer Herbaceous Perennials/Live stakes Plot Looking Upstream to Reach 4 from Confluence with Reach 5-Year 1

PP31 Reach 4 Confluence with Reach 1-Year 1

PP32 Reach 5 Start-Year 1

PP33 Reach 5 Looking Downstream-Year 1

PP34 Reach 5 Confluence with Reach 4-Year 1

Buffalo Creek Watershed Phase I
Hillsdale Park
Vegetation Survival Plots

Bare Root Plantings

Reach 1	Photo Point (#)	Planted (stems)	Year 1 (stems)	Year 2 (stems)	Year 3 (stems)	Year 4 (stems)	Year 5 (stems)
Plot #1	8B	38	15 39% Survival				
Plot #2	16A	53	8 15% Survival				

Live Stakes

Reach 1	Photo Point (#)	Planted (stakes)	Year 1 (stakes)	Year 2 (stakes)	Year 3 (stakes)	Year 4 (stakes)	Year 5 (stakes)
Plot #2	16A	98	66 67% Survival				

Note: Live stakes counted from eastern end of plot down to culvert at Vanstory Street

Buffalo Creek Watershed Phase I
Gillespie Golf Course
Vegetation Survival Plots

Live Stakes

Reach	Photo Point (#)	Planted (stakes)	Year 1 (stakes)	Year 2 (stakes)	Year 3 (stakes)	Year (stakes)	Year 5 (stakes)
R1C Plot #2	9B	95	46 48% Survival				
R1A Plot #1	3B	66	29 44% Survival				
R4 Plot #3	30B	62	37 60% Survival				

Bare-Root Plantings

Reach	Photo Point (#)	Planted (stems)	Year 1 (stems)	Year 2 (stems)	Year 3 (stems)	Year 4 (stems)	Year 5 (stems)
R1A Plot #1	3B	31	10 32% Survival				

Managed Buffer Shrub Plot

Reach	Photo Point (#)	Planted (shrubs)	Year 1 (shrubs)	Year 2 (shrubs)	Year 3 (shrubs)	Year (shrubs)	Year 5 (shrubs)
R4 Plot #4	27B	101	22 22% Survival				
R1C Plot #2	9B	61	55 90% Survival				

Managed Buffer Herbaceous Perennials

Reach	Photo Point (#)	Planted (plants)	Year 1 (plants)	Year 2 (plants)	Year 3 (plants)	Year (plants)	Year 5 (plants)
R4 Plot #3	30B	113	96 85% Survival				
R1C* Plot#2	9B	63	50 79% Survival				

*in a 2-foot buffer along the top of terrace

Notes:

1. All plots are shown on the plan views. All plot corners are marked with wooden stakes with orange flagging tape.
2. Each counted stem or live stake is marked with pink flagging tape or pin flags.
3. Photo point locations are shown on the plan views and marked with wooden stakes with orange flagging tape.
4. Use successive columns for survivability from year to year.