As-built report for the Racey Mitigation Site, Laxon Creek, Watauga County

North Carolina Wildlife Resources Commission

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CONTENTS

Introduction

This as-built plan is submitted as part of the fulfillment of the off-site stream mitigation agreement between the North Carolina Department of Transportation (DOT) and North Carolina Wildlife Resources Commission (WRC) for the R-529 US 421 road improvement project in Watuaga County. Under this agreement, a total of 14,814 linear feet of stream mitigation is required by the United States Army Corps of Engineers (COE) and 7,407 linear feet of mitigation for the North Carolina Division of Water Quality (DWQ). The purpose of this report is to summarize 1160 linear feet of stream restoration at the Racey site on Laxon Creek, Watauga County.

Preconstruction Site conditions

The Racey site (Figure 1) is located in the South Fork New River Watershed on Laxon Creek. Drainage area of the site is 1696 acres (2.65 sq mi.). The lower end of the project is located at the confluence with the South Fork New River. The watershed is developed with a low density of homes with the primary land disturbing activity in the watershed being agriculture. Most of the hillsides and valleys are used for cattle grazing, hay production, and Christmas tree farming. A significant portion of the watershed remains in secondary growth forest. At the present time, there is some conversion of agricultural land to single family home sites. Sedimentation of the stream comes from livestock pastures and gravel roads.

Before the Racey's purchased the property in the early 1990's, Laxon Creek was void of an established riparian buffer zone due to pastures along the stream (Racey personal photos). Since then there has been some recovery of the riparian vegetation due to the elimination of livestock grazing. However, problems still existed in the form of severely eroding banks at several locations, an over-wide channel in the lower third of the reach, and lack of fish habitat in some sections. Fish habitat is considered moderate in the upper sections of the stream and poor in the lower reaches at the confluence with the South Fork New River.

Based on stream survey data (Conceptual Restoration Plan, March 2000, WRC) utilizing longitudinal profile and cross-sections, Laxon Creek through was classified as a C_4 (Table 1). Soils at the site are Class 4A - Nikwasi loam, found on 0 to 3% slopes. These soils are very deep, poorly drained soils on floodplains in the Southern Appalachian Mountains.

Project Objectives

The objectives at this mitigation site were to improve water quality, fish habitat, riparian quality and stream stability of Laxon Creek on the Racey property. The primary activity used to achieve these goals was a Priority II and III restoration. Specific objectives at the Racey site were:

1. Slope stream banks in appropriate areas so that they are more resistant to erosion during flooding.

2. Install rootwads, rock/log vanes or rock weirs to reduce erosion, narrow the water surface cross-section and provide long term bank stability and fish habitat.

3. Construct a stable stream crossing following Natural Resource Conservation Service Guidelines and with the use of a rock cross vane.

4. Plant native trees, bushes and ground cover that will provide long term bank stability, stream shading, and cover and food for wildlife.

Potential Restoration sites:	Recommended practice:
Station 80+00	Rock vane or rock weir (Right bank)
Stations 99+00 - 133+00	Rock vane, both banks, to redirect thalwag to center of stream, slope left bank
Station 343+00 -360+00	Improve crossing to NRCS standards
Station 640+00 - 750+00	Reshape bank, consolidate channel, add 2 rock weirs, root wads
Station 750+00 - 900+00	Left bank sloping, make point bar
Station 833+00	Rock weir
Station 858+00-1041+00	Slope high bank along yard
Station 889+00	Rock weir
Station 936+00	Rock vane
Station 971+00	Rock vane on left bank at pool
Station 1041+00	Rock vane at start of high bank at yard
Station 1103+00	Rock vane
Station 1137+00	Rock vane/root wad to save tree and bank at confluence with South Fork New River

Conservation Easement

In order to ensure long term protection of the site, a conservation easement was signed by the landowner, DOT and WRC on October 10, 2000. The conservation easement put limitations and restrictions on 1.42 acres of land that includes the restoration site and riparian zone. The conservation easement is perpetual and will be held by the WRC. The conservation easement is described in Book 176, page 233, of the Watauga County Registry and plat titled "Conservation Easement" recorded in Plat Book 15, page 133 of the Watauga County Registry. A copy of the conservation has been submitted to DWQ, COE and DOT for their files.

Channel Modifications

Construction at the site was carried out through an informal contract with Rick's Excavating. Work began on October 30, 2000 by hauling rootwads and large rock from the US 421 road construction project to the site. These materials were stockpiled at the site and moved as needed by the backhoe. Some large riprap existing at the site from stations 2+49 to 3+43 located above the ford, placed by previous owners, was used for construction of rock vanes/weirs at other locations. Construction at the Racey site began on October 31 and was completed on November 3, 2000 for a total of 3.25 days (Photos). The contractor provided one trackhoe, one backhoe with loader, and one dump truck. Access to the site was from SR 1353 and across land owned by Mr. and Mrs. Fred Racey.

At some locations, we constructed a floodplain bench at the bankfull elevation to enhance and facilitate the natural meander of the stream. This did not involve filling the existing creek,

but rather moving the slope of the stream bank back away from the water for approximately 3 to 5 feet. Above this floodplain the stream bank was sloped to the top of the bank and vegetated. As banks were sloped, sod mats salvaged from the site were used to stabilize the new banks. In some areas a blanket of erosion control fabric was installed to provide temporary bank protection until vegetation could be established. Rock weirs and rock vanes were installed to prevent stream head cutting and create pool habitat. Large footer rocks support all top boulders in the weirs and vanes. Holes were dug below the weir apex to accelerate and maintain pool formation by stream water velocities. Excess streambed materials were excavated at rock weirs and rock vanes and placed upstream of the structure near the bank where natural deposition would be expected. Rock vanes were used to divert water away from past eroding banks and for habitat diversity. At two sites root wads were used to block off an existing side channel, improve bank stability, decrease width and improve aquatic habitat. One rock vane was constructed near the confluence with the South Fork New River in order to reduce bank undercutting in order to protect the large white oak tree (*Quercus alba*). At approximately station 3+43 a stable ford crossing was constructed with a rock weir located at station 3+58 as a grade control structure. A rock weir stair step configuration and sloping point bar were constructed to eliminate a braided channel and vertical eroding left bank at cross-section 7+13 (Figure 6d and Photos).

The pre-construction and post-construction thalwag longitudinal profiles (Figures 3) show how the project increased pool and deep-water habitat. Pool habitat has increased from 26% to 40%. The scour action of root wad meanders, rock weirs, and rock and log vanes can be observed from the as-built profile (Figure 4). The weirs and vanes are creating the desired deep-water habitat and sorting bed material in a way that will provide needed fish spawning gravel.

Figure 5 summarizes pre and post-construction pebble count data. Post-construction pebble count data shows an overall increase in particle size when compared to pre-construction data. Improvements in stream profile and dimension have resulted in better transport of fine bed materials. This should have a positive impact on aquatic invertebrates and fish spawning substrate.

Figures 6a-e show post construction cross-sections of the new channel. These cross-sections will be used to monitor long-term channel stability. Based on data from the pre-and post cross-sections, the channel is classified as a C_4 in the upper sections (Figures 6a & 6c) above station 8+40 (Figure 6e) (Table 1). Below station 8+40 to the South Fork New River the stream is a F_4 type.

Riparian Improvements

During construction, sod mats salvaged from the site were used to provide instant bank stability and long term erosion control. Sod mats had the advantage of containing an established seed mix. On sites where sod mats were not used, the area was seeded with a native riparian mix and cover crop of winter wheat and rye. After seeding, an eight-foot wide straw erosion control blanket was used to cover the soil. These blankets were used to stabilize the soil surface until a vegetative cover could be achieved and to contribute to soil stability after vegetation is established. As the straw blankets decompose over a 2-year period, permanent vegetation should be well established. Since the site was seeded in early November, only the winter wheat and rye spouted over-winter as the native vegetation lay dormant. By April 2001, both the existing

native vegetation and seeded areas were experiencing good growth. It is expected that native vegetation will be well established by the end of summer.

Three hundred (300) live stakes and bare root nursery trees were planted on the 1.42 acre site during March 2001. Fewer trees were required at the site due to existing trees located at several locations along the stream corridor. Live stakes, collected from nearby stream corridors, were silky dogwood (*Cornus amomum*), silky willow (*Salix sericea*), and black willow (*Salix nigra*). Bare root trees from the NC Forest Service were northern red oak (*Quercus rubra)*, black cherry (*Prunus serotina*), persimmon (*Diospyros virginiana*), sugarberry (*Celtis laevigata*), white ash (*Fraxinus americana*), and white pine (*Pinus strobus*). We had hoped to plant tag alder (*Alnus serrulata*) at the site but a source could not be located. The site will be monitored to ensure that a good stand of trees is established.

Livestock Management

Livestock is not grazed at this site so livestock management practices were not installed for this project. However, if livestock are allowed to graze the area in the future, language in the conservation easement requires that the landowner install fencing at his expense to protect the restoration project.

Conclusion

Through natural stream design, stream dimension and profile was improved at the Racey site (Table 1, Photos). Water quality should be improved through reduced sedimentation from eroding banks. As the riparian zone matures, water temperatures should decrease, improving the likelihood that trout could once again inhabit the stream. In-stream habitat for fish and aquatic invertebrates has been increased with the installation of rock weirs, rock and log vanes and root wads. Both aquatic and wildlife species will benefit with the return of a functioning riparian corridor and stream aesthetics have been improved.

Figure 1. Site Map

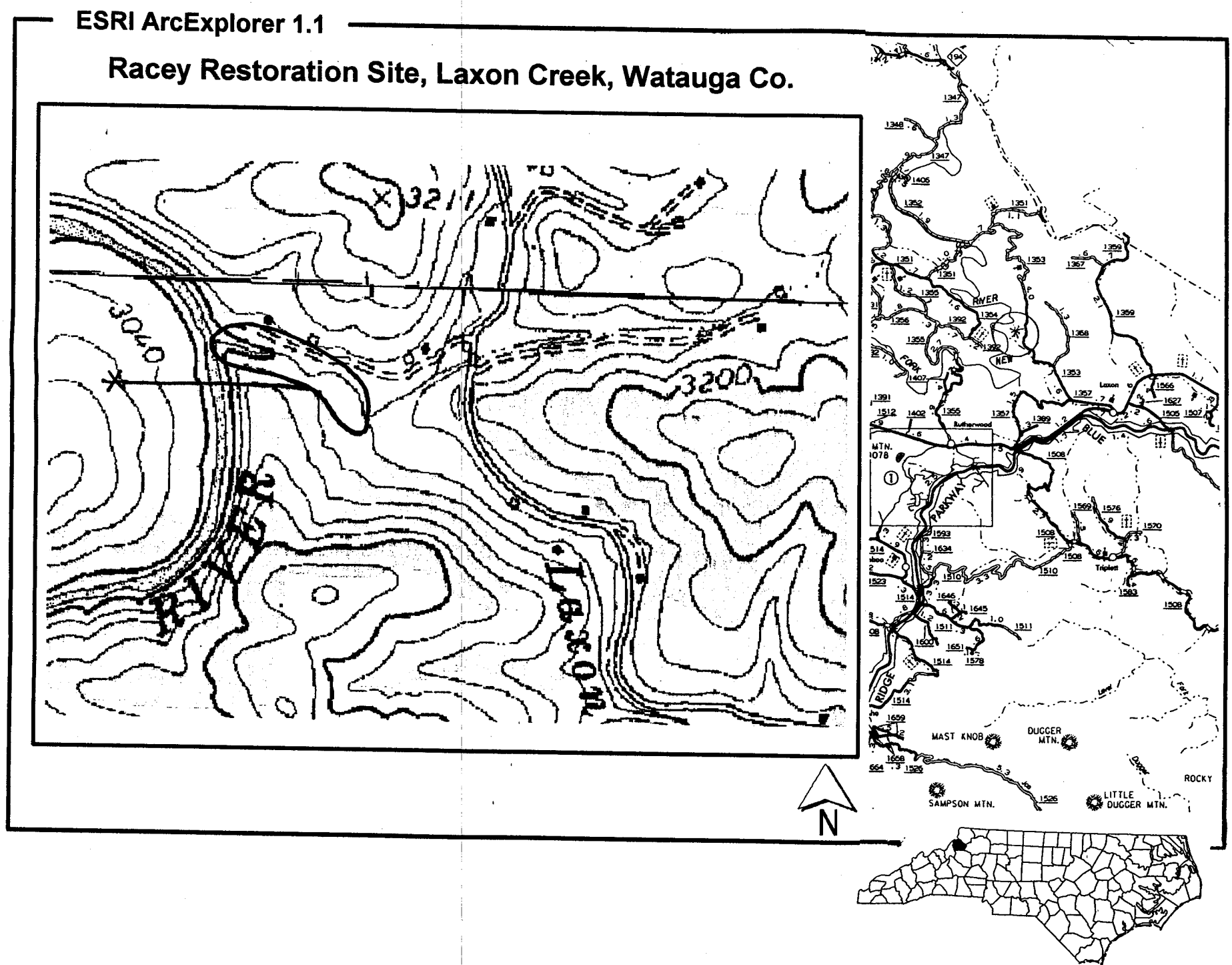


Figure 2. Plan view of Proposed Work

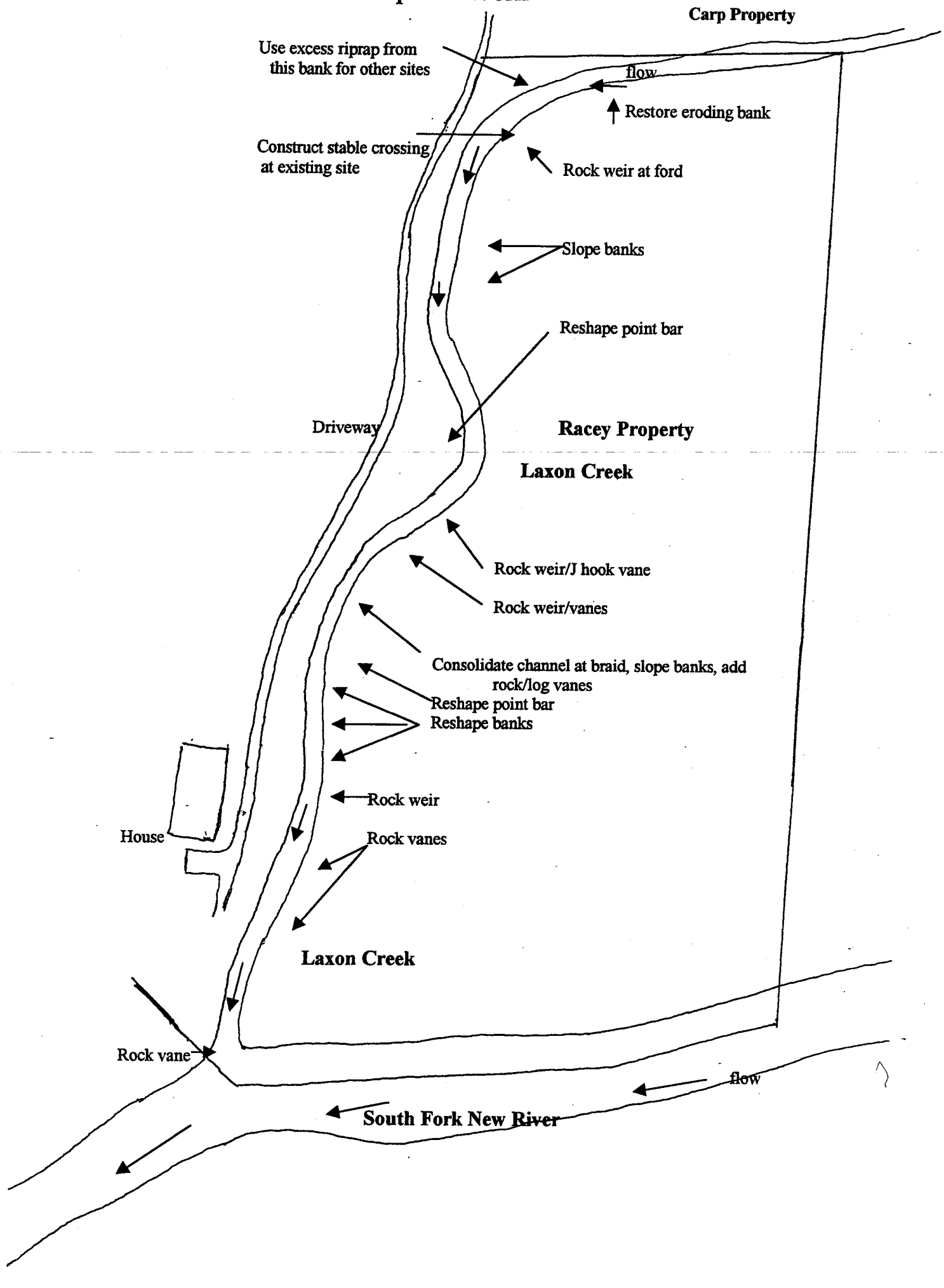


Figure 3. Longitudinal Profile Comparison

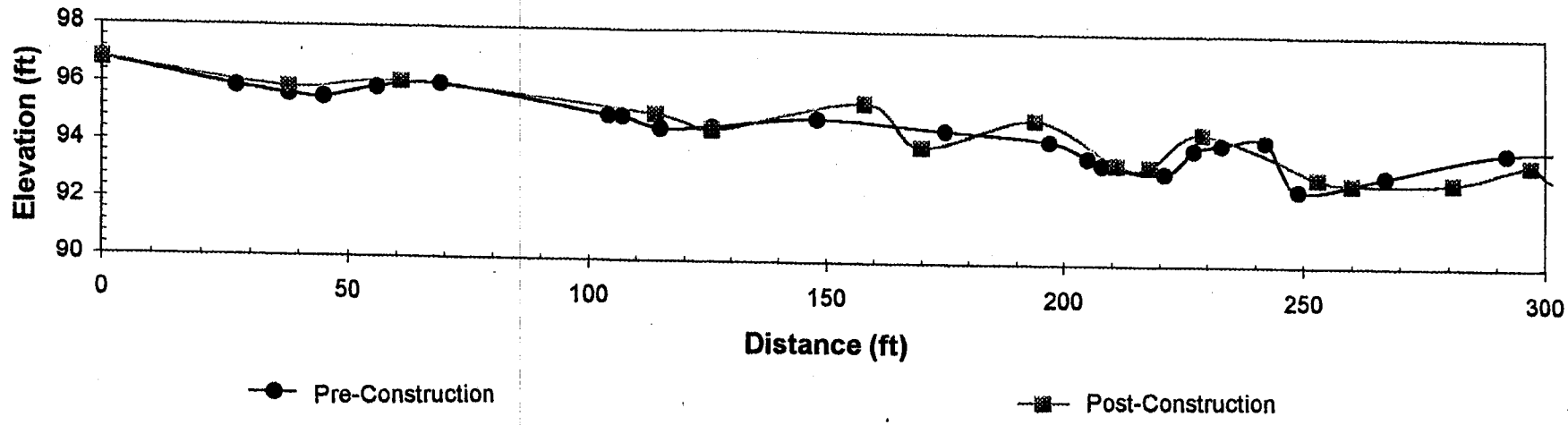


Figure 3. (cont.) Longitudinal Profile Comparison

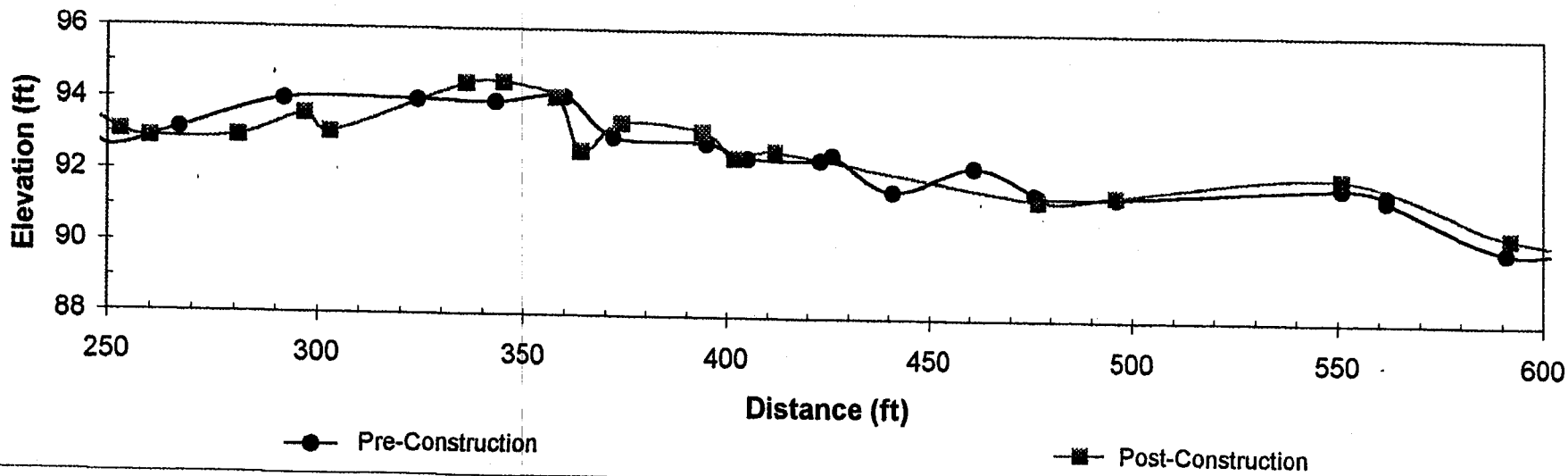


Figure 3. (cont.) Longitudinal Profile Comparison

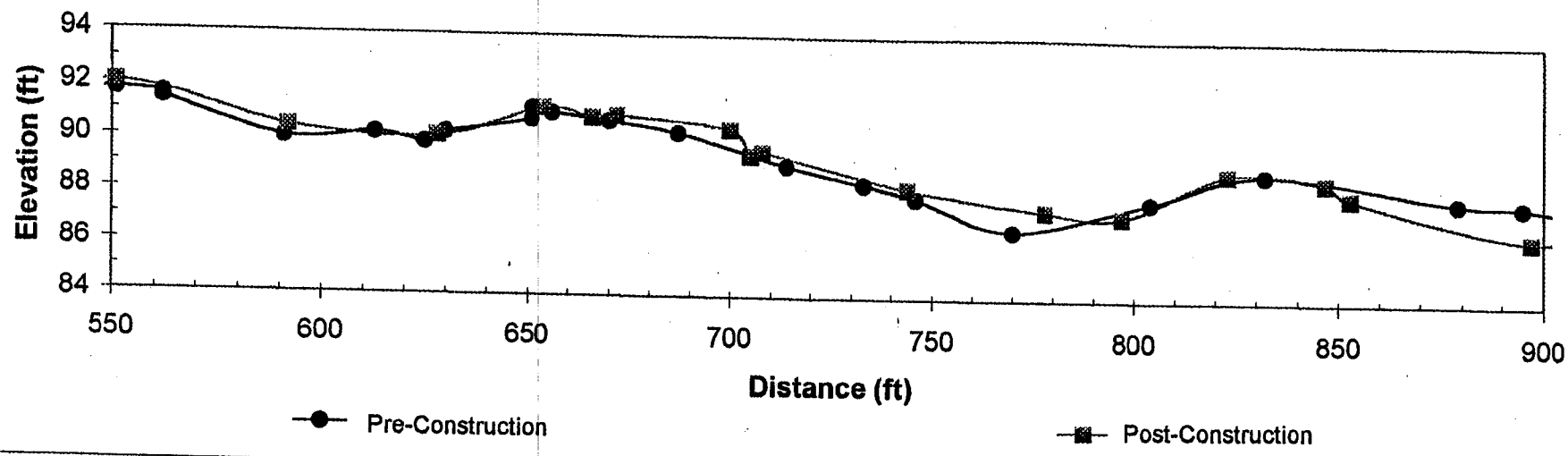


Figure 3. (cont.) Longitudinal Profile Comparison

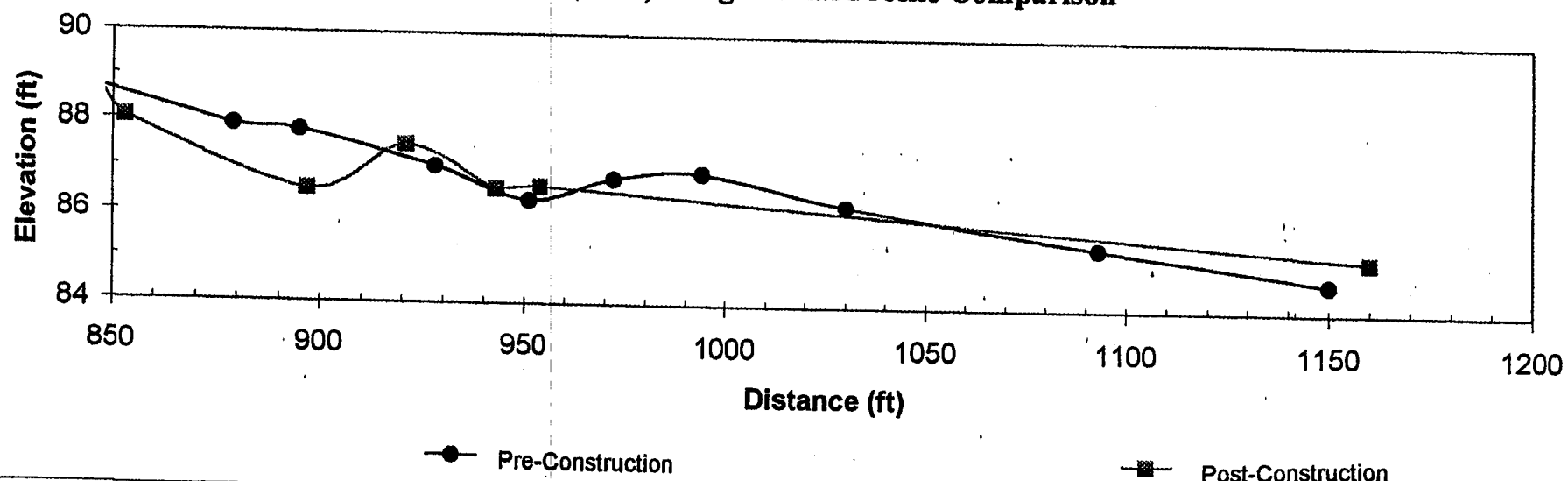


Figure 4. Longitudinal Profile Racey as-built survey - Laxon Cr.

Post-Construction

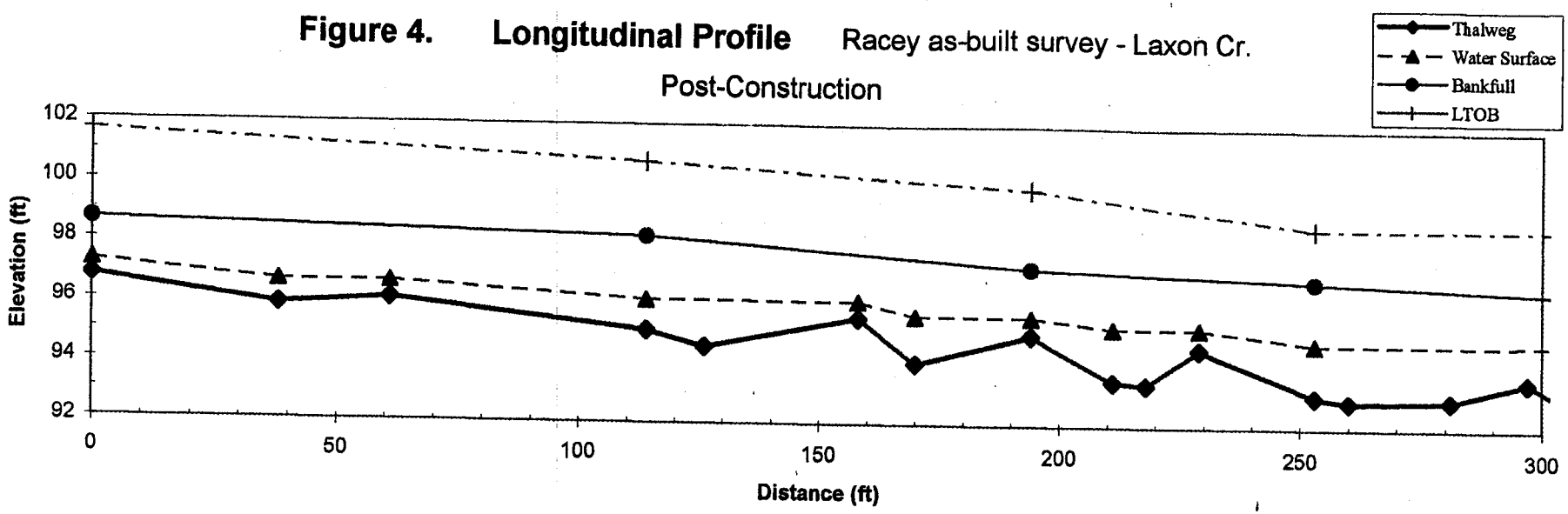


Figure 4. (cont.) Longitudinal Profile Racey as-built survey - Laxon Cr.

Post-Construction

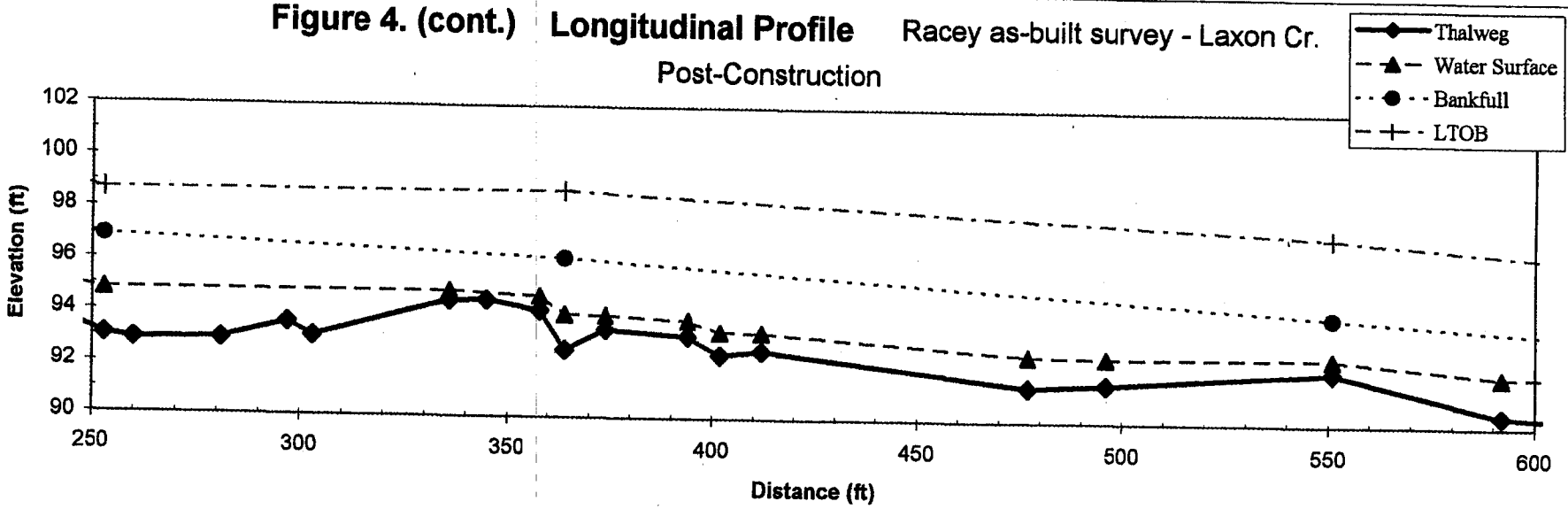


Figure 4. (cont) **Longitudinal Profile** Racey as-built survey - Laxon Cr.

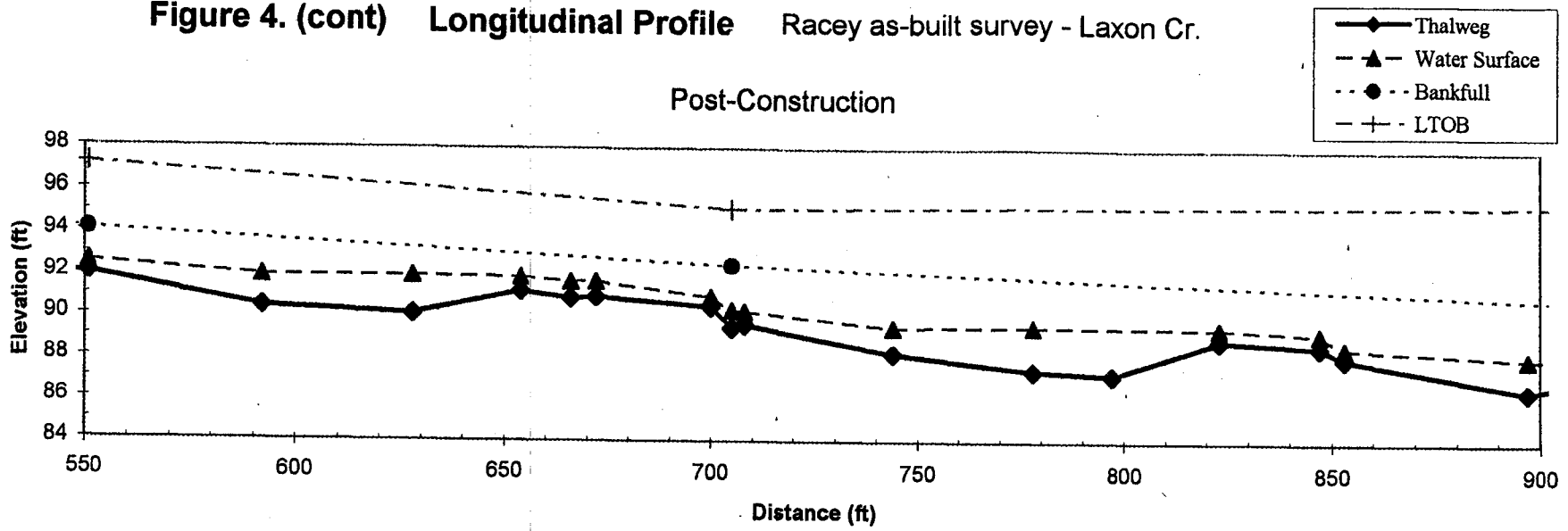
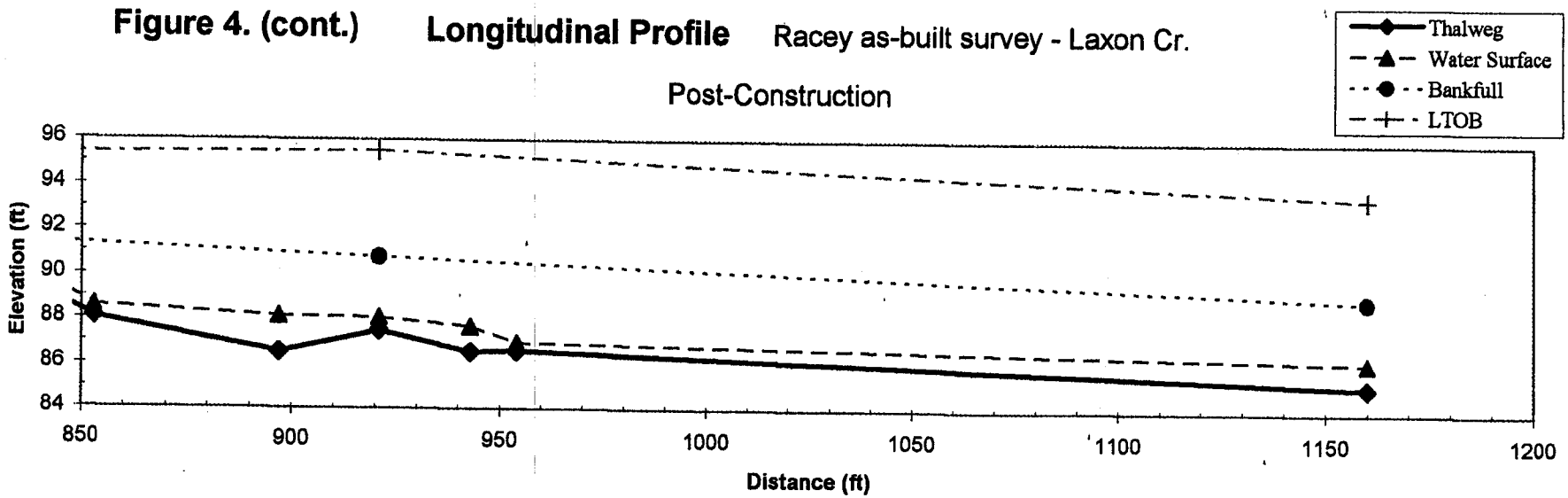
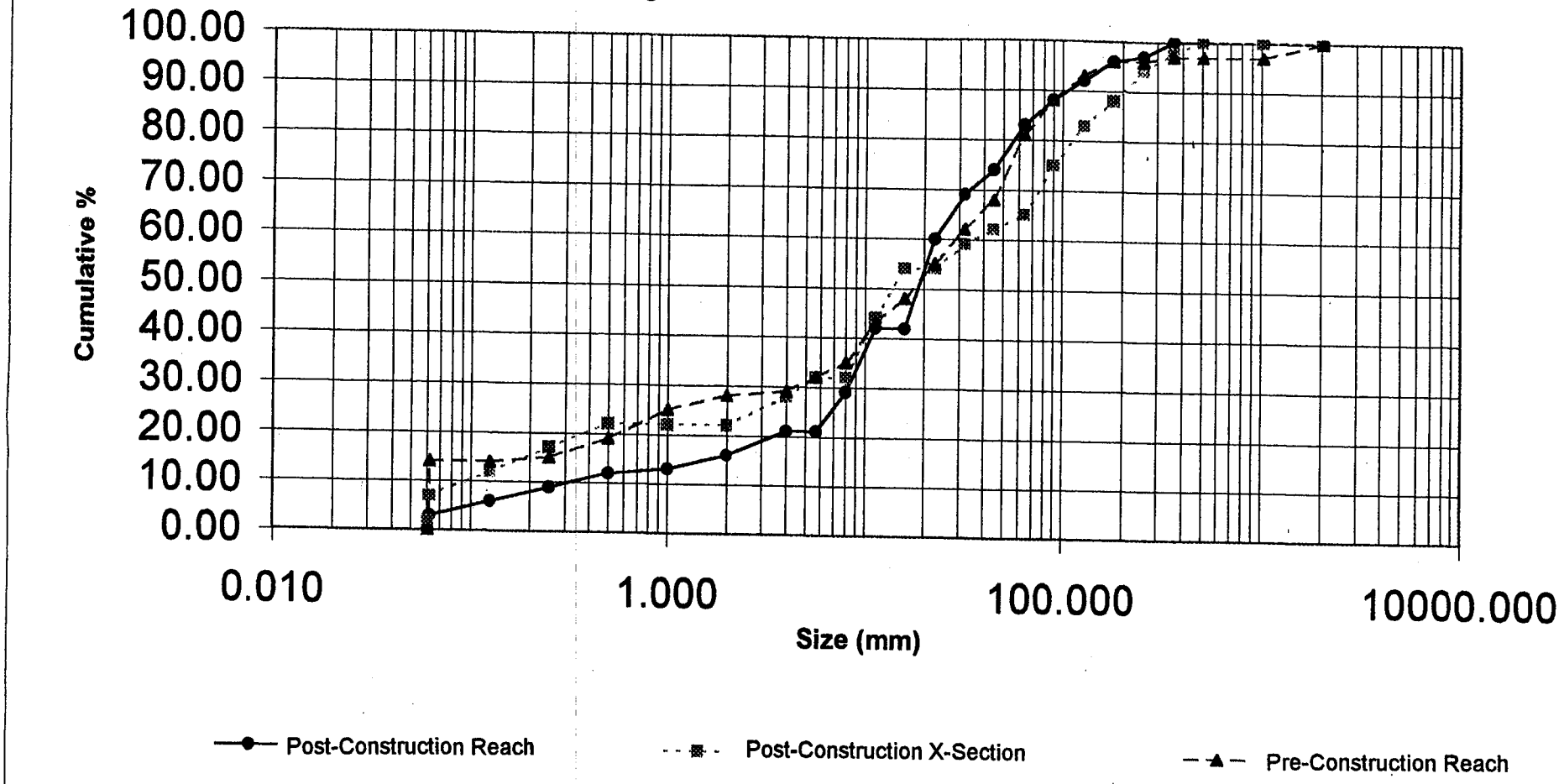


Figure 4. (cont.) **Longitudinal Profile** Racey as-built survey - Laxon Cr.



Racey as-built survey - Laxon Cr.

Figure 5. Pebble Count



Post-Construction Reach
Particle Sizes (mm):

D16	2
D35	10
D50	20
D84	65
D95	170

Post-Construction X-Section
Particle Sizes (mm):

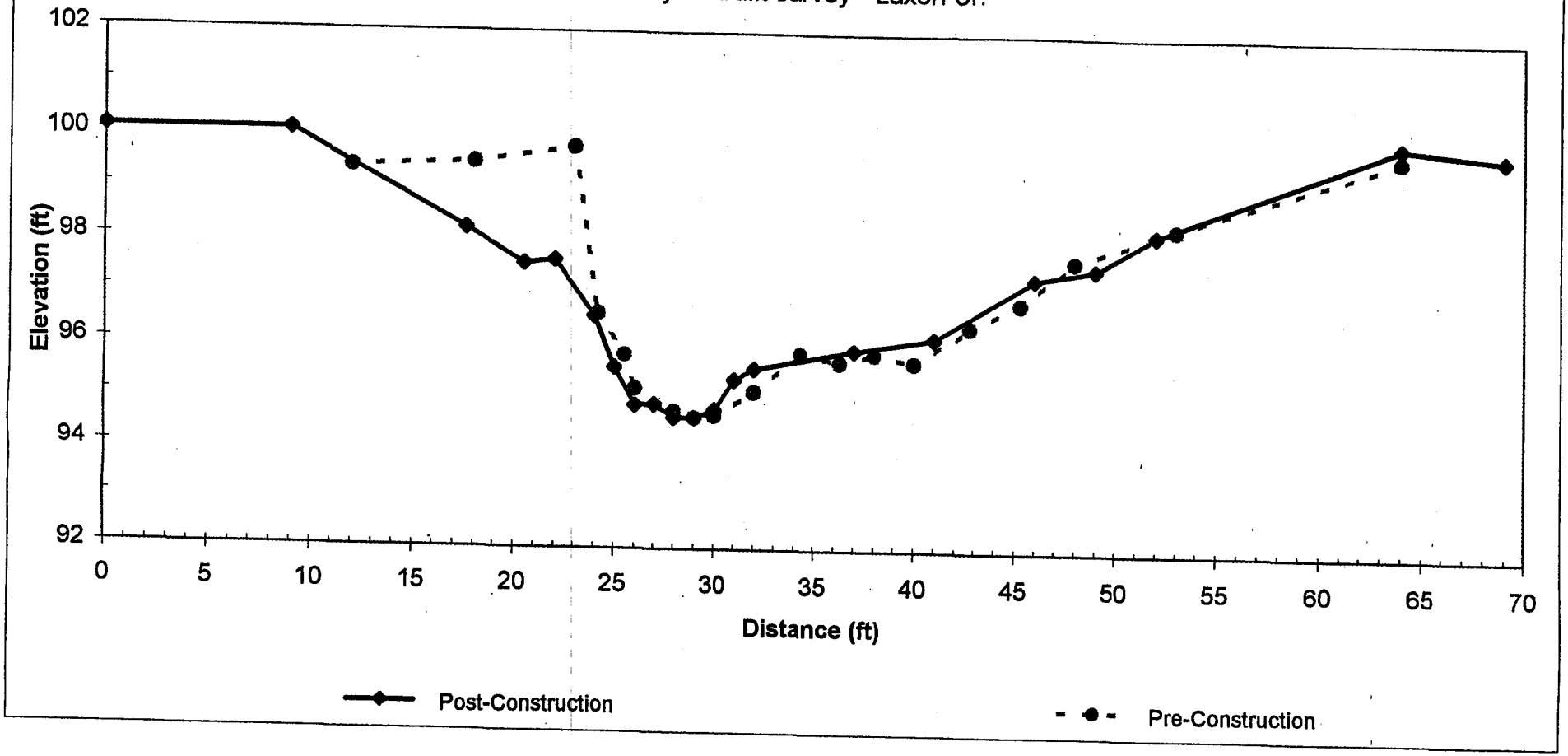
D16	0.2
D35	6
D50	14
D84	130
D95	300

Pre-Construction Particle Sizes (mm):
Particle Sizes (mm):

D16	0.3
D35	8
D50	9
D84	70
D95	105

Figure 6a. Cross Section STN 1+88

Racey as-built survey - Laxon Cr.



1+88	Feature	Wfpa	LBKF	RBKF	ELEVbkf	Wbkf	Dbkf	W/D	Abkf	Dmax	ER
As-Built	Constructed run	100	17.6	46.0	98.21	28.4	2.1	13.4	60.3	3.6	3.5

Figure 6b. Cross Section STN 2+08

Racey as-built survey - Laxon Cr.

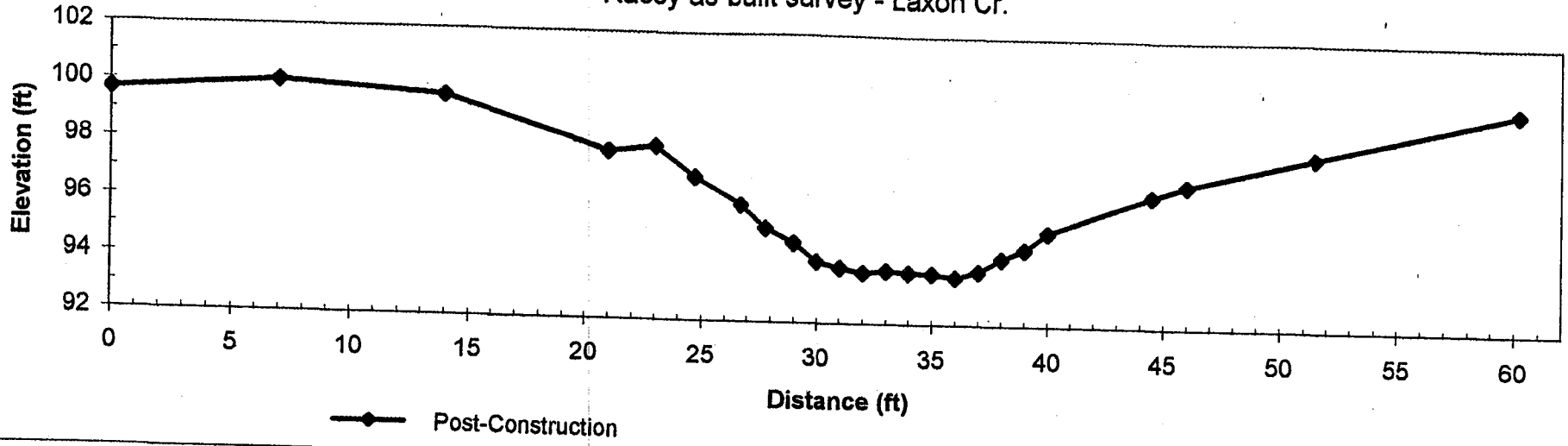
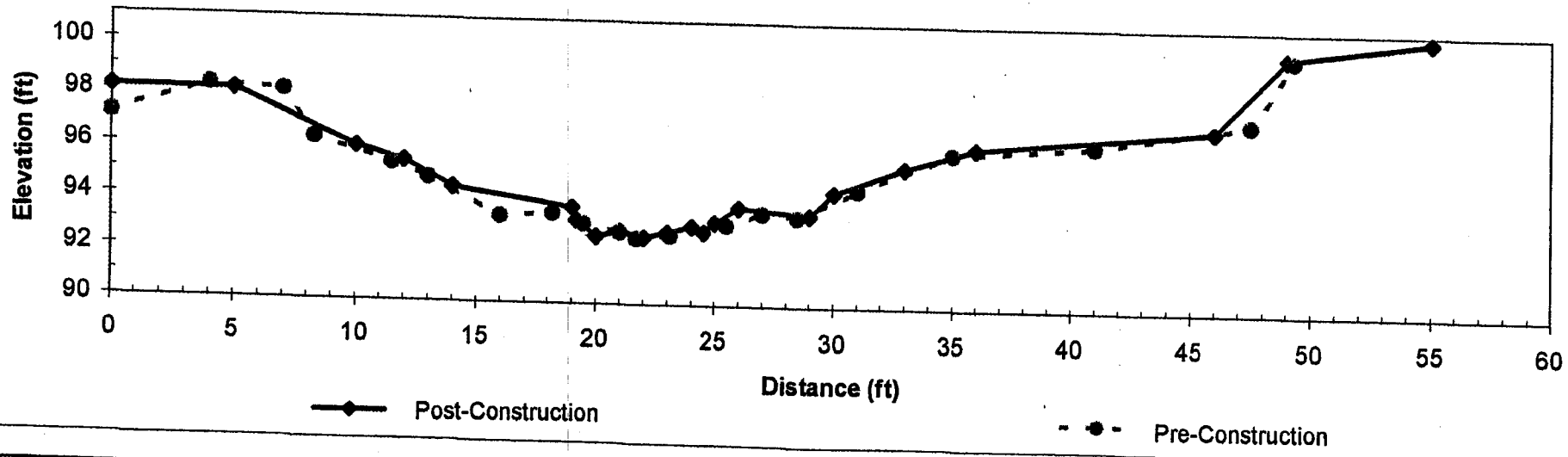


Figure 6c. Cross Section STN 4+26

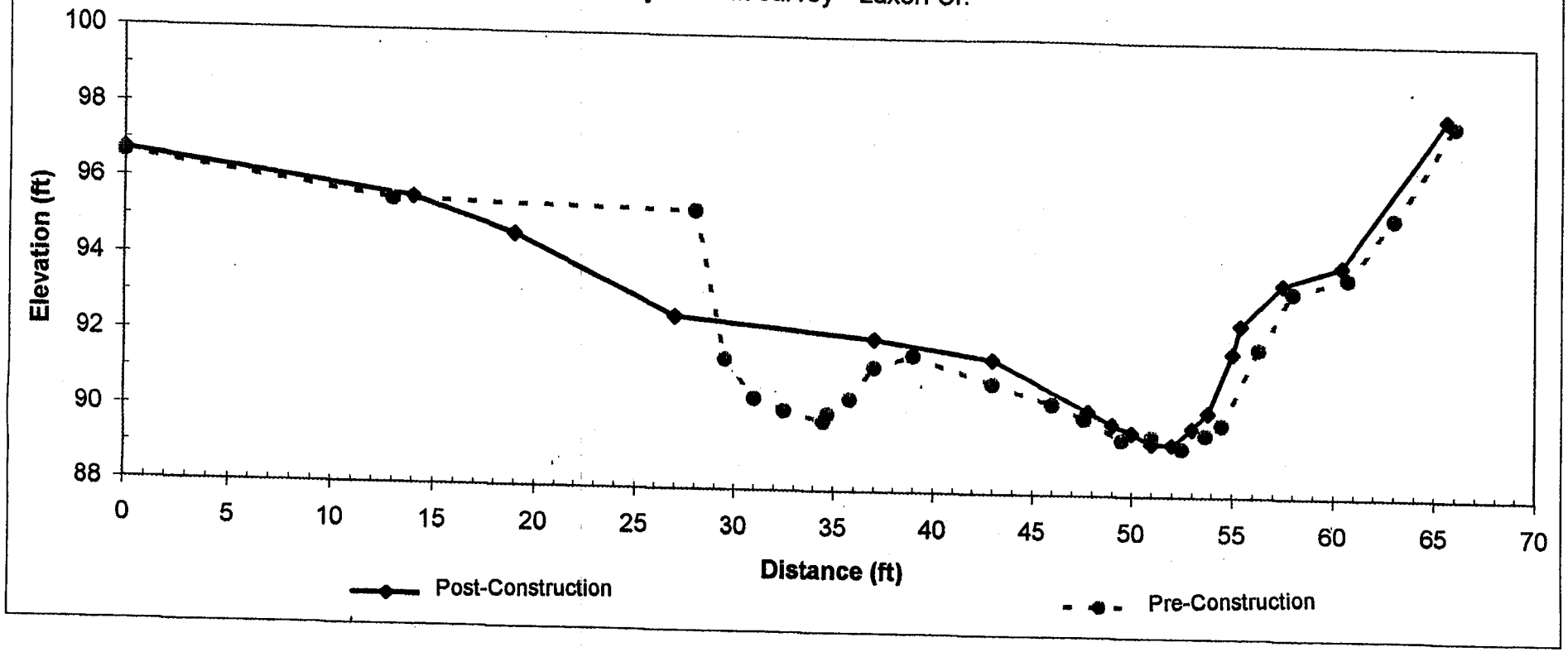
Racey as-built survey - Laxon Cr.



4+26	Feature	Type	Wfpa	LBKF	RBKF	ELEVbkf	Wbkf	Dbkf	W/D	Abkf	Dmax	ER
Existing	Reference Riffle	C4	50	12.0	33.0	95.45	21.0	1.5	13.9	31.7	2.8	2.4

Figure 6d. Cross Section STN 7+13

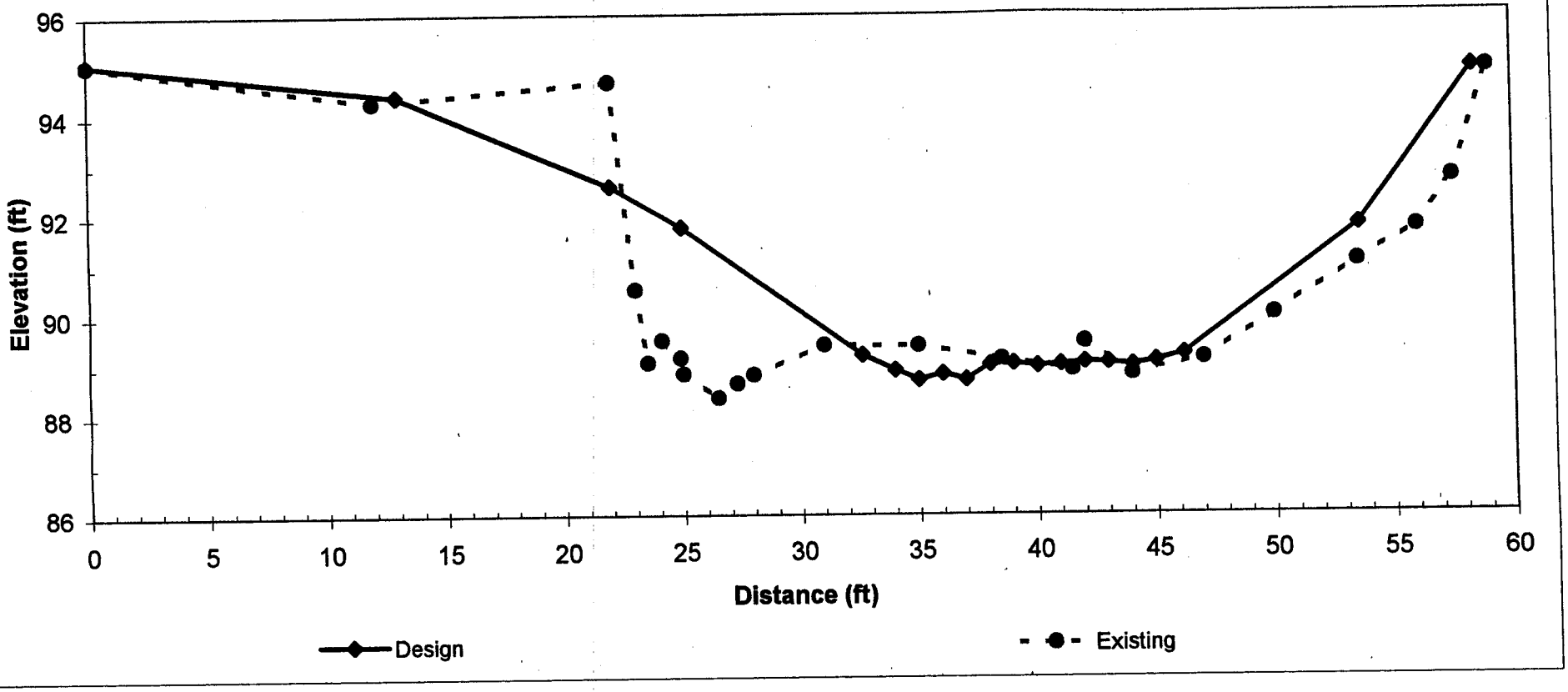
Racey as-built survey - Laxon Cr.



7+13	Feature	Type	Wfpa	LBKF	RBKF	ELEVbkf	Wbkf	Dbkf	W/D	Abkf	Dmax	ER
Existing	Riffle	C4	56	27.0	55.4	92.57	28.4	1.2	23.7	34.0	3.2	2.0

Figure 6e. Cross Section STN 8+40

Racey as-built survey - Laxon Cr.



8+40	Feature	Type	Wfpa	LBKF	RBKF	ELEVbkf	Wbkf	Dbkf	W/D	Abkf	Dmax	ER
Existing	Constructed Riffle	C4	60	25.0	53.6	91.78	28.6	1.7	17.0	48.0	3.1	2.1

Table 1. Stream Reach Data

Stream Name: **Laxon Creek** Date: 5/30/01

Basin Name: **NEW** Drainage AREA: 1696 Ac. 2.65 MI^2

Location: Racey stream enhancement site, 421 Stream Mitigation Program

Observers: J. Mickey, S. Scott

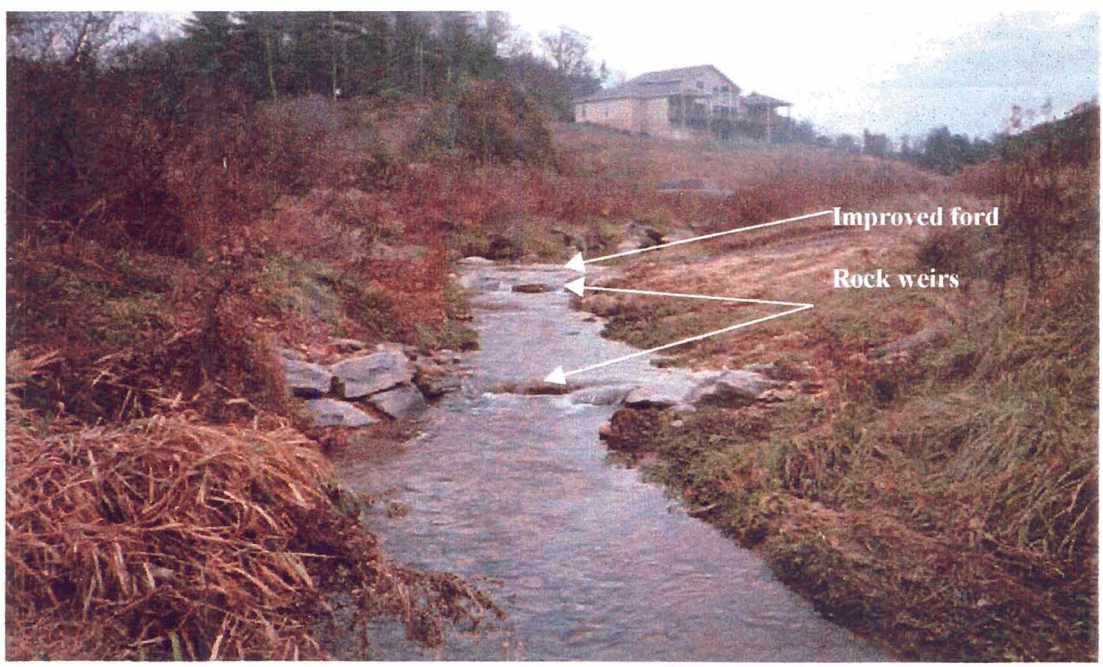
	Stable X-section stn. 4+26	Regional Curve Data	As-built X- section Ranges
Bankfull WIDTH (W_{bkf}):	18	20	21-29
Mean DEPTH (D_{bkf}):	1.39	1.8	1.2-2.1
Bankfull X-sectional AREA (A_{bkf}):	25	42	32-60
Width / Depth RATIO (W_{bkf}/d_{bkf}):	13		13-24
Maximum DEPTH (d_{mbkf}):	2.5		2.8-3.6
WIDTH of Flood-Prone Area (W_{fpa}):	40		50-100
Entrenchment Ratio (ER):	2.2		2.0-3.5
Channel Materials D50:	20		20 - reach
Water Surface SLOPE (S):	0.01		0.01
Channel SINUOSITY (K):	1.2		1.2
STREAM TYPE:	C4		C4
Q bankfull discharge	150 cfs		150 cfs

Photos

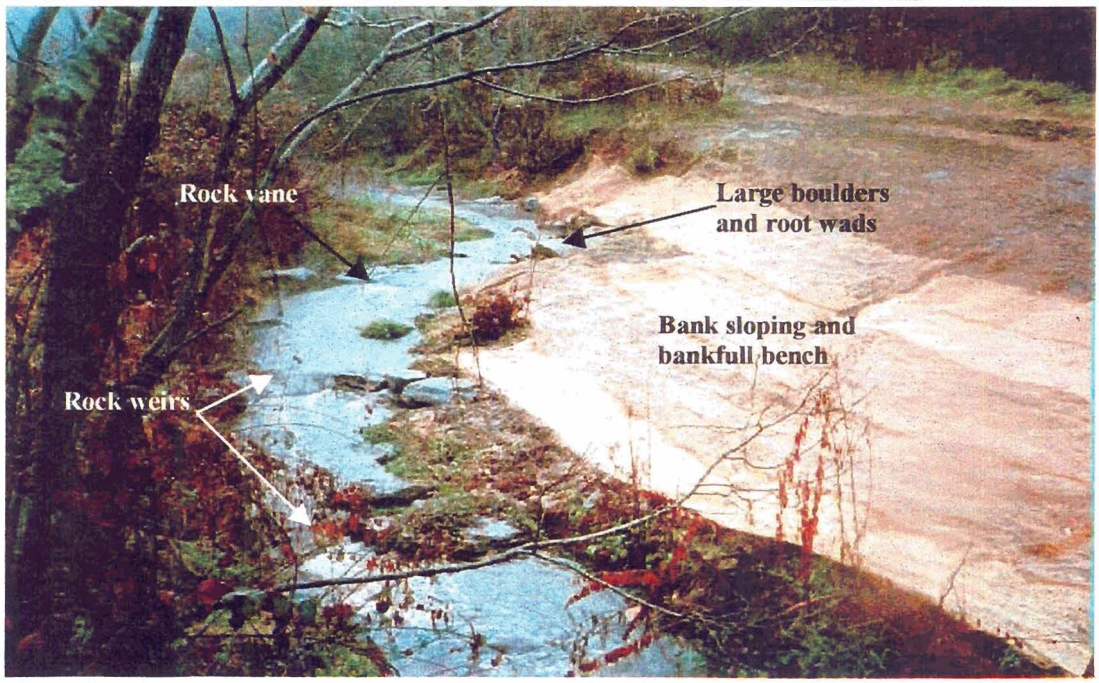
Racey site, unnamed tributary to Laxon Creek, Watauga County. 10/30-11/2/00

Looking upstream towards upper end of conservation easement. Laxon Creek before stream restoration work. This area contained a badly eroding bank and a riffle where a pool should have been. Banks were sloped and rock weirs installed to create a step/pool habitat. Location of cross-section 1+88.

Looking upstream towards the ford. A stable ford was constructed with a rock weir immediately below it to maintain stream grade. Another rock weir was constructed to create fish habitat in a long riffle. Station 3+58 top of weir at ford.



Before construction (above): Area of severely eroding right bank (facing upstream) and braided channel. **After construction (below):** The channel was consolidated into a single channel and the right bank was sloped to resist erosion and create a bankful bench. Large boulders and root wads were used to block the right channel and the channel was filled. One rock vane and two rock weirs were constructed in the consolidated channel to provide for grade controls, step/pool habitat and bank stability. Cross-section 7+13.



Braided channel and eroding left bank (looking downstream). **Above:** Before construction. **Below:** After construction showing bankfull bench, root wads and large boulders used to block off old channel and two rock weirs and one rock vane to create step/pool habitat and serve as grade controls. X-S 7+13