

AGENCY PACKET
BACK CREEK STREAM AND WETLAND MITIGATION SITE
MECKLENBURG COUNTY, NORTH CAROLINA



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INTRODUCTION

The North Carolina Department of Transportation (NCDOT) is currently evaluating stream and wetland mitigation potential on property owned by three landowners: Daniel H. Fisher (Back Creek II Developers), Thelma C. Morgan, and Mecklenburg County Storm Water Services, collectively referred to as the Back Creek Site.

Back Creek Stream and Wetland Mitigation Site

- located approximately 5 miles northeast of the City of Charlotte in Mecklenburg County, North Carolina (Figure 1);
- 17.5-acre conservation easement; and
- Site encompasses 4117 linear feet of stream and 3.3 acres of jurisdictional wetlands.

Mitigation goals for the Site include floodplain grading, restoration of approximately 4352 linear feet of meandering, E-type (highly sinuous) stream channel, enhancement/restoration to 3.3 acres of jurisdictional wetlands, and 0.5 acre of wetland creation within the Site.

EXISTING CONDITIONS

The Site encompasses a reach of Back Creek, two unnamed tributaries to Back Creek, the associated floodplain, and wetland pockets located within the floodplain. General attributes of Site valley morphology include:

- 3300 linear feet of third order stream
 - Upstream Valley Slope of 0.0038
 - Downstream Valley Slope of 0.0052
- 827 linear feet of first order stream

DISCHARGE

- Watershed area 4.1 square miles
 - Rapidly Urbanizing
 - Urban land use > 57%
- Bankfull Discharge 250-300 cfs

SOILS

- Chewacla/Wehadkee 15.2 acres (NRCS mapped as Monocan)
- Enon/Wilkes 1.3 acres



SITE LOCATION
BACK CREEK MITIGATION SITE
Detailed Mitigation Planning
Mecklenburg County, North Carolina

Dwn. by:	MJR
Ckd by:	MJR
Date:	JAN 2003
Project:	02-113.04

FIGURE
1

STREAM CHARACTERIZATION

- Upstream Straightened: E-Type
 - Subclassification 5 (sand)
- Downstream Sinuous: C-Type and E-Type
 - Subclassification 5 (sand) and 4 (gravel) respectively
- Summarized in Table 1 (existing, reference, and proposed)
- Upstream sediment load sand dominated
 - Urbanization
 - Bank collapse

STREAM STABILITY ISSUES

- Bank height ratio range from 1.0 to 1.5
- Existing cross-sectional area of 76.6 ft² (proposed 56.0)
- Width/Depth Ratio of 13.4 (proposed 9)
- Upstream dredging and straightening
- Utility line impacts

RESTORATION PLAN

The primary goals of this restoration plan include:

- construction of a stable, riffle-pool stream channel
- enhancement of water quality functions in the on-site, upstream, and downstream segments of the channel
- creation of a natural vegetation buffer along restored stream channels
- maximization of the area returned to historic wetland function
- restoration of wildlife functions associated with a riparian corridor/stable stream.

The complete mitigation plan is depicted in Figures 2A and 2B and the morphologic characteristics of the existing, proposed, and reference channel are included in Table 1.

Stream Restoration

Stream restoration includes floodplain grading, construction of approximately 4352 linear feet of meandering, E-type (highly sinuous) stream channel. Stream restoration activities are expected to include:

- restoration of approximately 1390 linear feet of Back Creek on new location
- restoration of approximately 2135 linear feet of Back Creek in-place
- restoration of approximately 827 linear feet of secondary tributary to Back Creek
- installation of structures for bank stabilization and habitat
- restoration of buffer along the full reach of Back Creek.

TABLE 1
BACK CREEK STREAM RESTORATION SITE
Morphological Characteristics of Existing, Reference, and Proposed Channels

Variables	Existing Channel			Reference Reach	Proposed Reach
	Upstream Straightened	Downstream Sinuous (C)	Downstream Sinuous (E)	UT to Crane Creek	Back Creek
1 Stream Type	E5	C5	E4	E4/5	E4/5
2 Drainage Area (mi ²)	3.7-3.8	3.8-4.0	4.0-4.1	1.5	3.7-4.1
3 Bankfull Discharge (cfs)	250-300	250-300	250-300	85	250-300

Dimension Variables					
4 Bankfull Cross Sectional Area (A_{bkr})	54	56.2	55.7	20.5	56
5 Bankfull Width (W_{bkr})	Mean: 19.0 Range: 16.7-21.9	Mean: 32.2 Range: 29.5-36	Mean: 22.7 Range: --	Mean: 10.1 Range: 9.5-11.9	Mean: 22.4 Range: 21.2-23.7
6 Bankfull Mean Depth (D_{bkr})	Mean: 2.9 Range: 2.2-3.4	Mean: 1.8 Range: 1.6-1.9	Mean: 2.5 Range: --	Mean: 2.0 Range: 1.9-2.1	Mean: 2.5 Range: 2.4-2.6
7 Bankfull Maximum Depth (D_{max})	Mean: 4.4 Range: 4.0-4.7	Mean: 3.3 Range: 3.0-3.6	Mean: 3.8 Range: --	Mean: 2.6 Range: 2.5-2.9	Mean: 3.3 Range: 2.8-3.8
8 Pool Width (W_{pool})	No distinctive repetitive pattern of riffles and pools due to straighting activities	Mean: 26.5 Range: 24.5-28.5	Mean: 26.5 Range: 24.5-28.5	Mean: 11.1 Range: 10.5-11.7	Mean: 29.1 Range: 22.4-33.6
9 Maximum Pool Depth (D_{pool})		Mean: 4.3 Range: 4.1-4.5	Mean: 4.3 Range: 4.1-4.5	Mean: 2.9 Range: 2.8-3.0	Mean: 4.3 Range: 3.5-7.5
10 Width of Floodprone Area (W_{fpa})	Mean: 253 Range: 290-235	Mean: 179 Range: 114-293	Mean: 297 Range: --	Mean: 237 Range: 232-345	Mean: 230 Range: 114-297

Dimension Ratios					
11 Entrenchment Ratio (W_{fpa}/W_{bkr})	Mean: 13.3 Range: 13-14	Mean: 6 Range: 4-10	Mean: 13 Range: --	Mean: 25.0 Range: 20.0-34.5	Mean: 10.3 Range: 5.1-13.3
12 Width/Depth Ratio (W_{bkr}/D_{bkr})	Mean: 7 Range: 5-10	Mean: 19 Range: 16-23	Mean: 9 Range: --	Mean: 5 Range: 5-6	Mean: 9 Range: 8-10
13 Max. D_{riff}/D_{bkr} Ratio	Mean: 1.6 Range: 1.4-1.8	Mean: 1.9 Range: 1.7-2.1	Mean: 1.5 Range: --	Mean: 1.3 Range: 1.3-1.5	Mean: 1.3 Range: 1.1-1.5
14 Low Bank Height/Max. D_{bkr} Ratio	Mean: 1.0 Range: 1.0-1.0	Mean: 1.2 Range: 1.1-1.5	Mean: 1.4 Range: --	Mean: 1.2 Range: 1.1-1.2	Mean: 1.0 Range: 1.0-1.2
15 Pool Depth/Bankfull Mean Depth (D_{pool}/D_{bkr})	No distinctive repetitive pattern of riffles and pools due to straighting activities	Mean: 1.5 Range: 1.4-1.6	Mean: 1.5 Range: 1.4-1.6	Mean: 1.5 Range: --	Mean: 1.7 Range: 1.4-3.0
16 Pool width/Bankfull Width (W_{pool}/W_{bkr})		Mean: 0.8 Range: 0.8-0.9	Mean: 0.8 Range: 0.8-0.9	Mean: 1.1 Range: 1.0-1.2	Mean: 1.3 Range: 1.0-1.5
17 Pool Area/Bankfull Cross Sectional Area		Mean: 1.2 Range: --	Mean: 1.2 Range: --	Mean: 0.9 Range: --	Mean: 1.2 Range: 1.1-1.4

Pattern Variables					
18 Pool to Pool Spacing (L_{p-p})	No distinctive repetitive pattern of riffles and pools due to straighting activities	Mean: 180 Range: 59-351	Mean: 180 Range: 59-351	Mean: 53 Range: 26-114	Mean: 126 Range: 60-210
19 Meander Length (L_m)		Mean: 313 Range: 129-608	Mean: 313 Range: 129-608	Mean: 73 Range: 61-115	Mean: 220 Range: 166-347
20 Belt Width (W_{belt})		Mean: 95 Range: 41-199	Mean: 95 Range: 41-199	Mean: 86.1 Range: 74.3-101.3	Mean: 57 Range: 25-140
21 Radius of Curvature (R_c)		Mean: 67 Range: 23-135	Mean: 67 Range: 23-135	Mean: 25.3 Range: 18.6-30.4	Mean: 58 Range: 43-100
22 Sinuosity (Sin)	1.02	1.4	1.4	1.8	1.5

TABLE 1 Continued
BACK CREEK STREAM RESTORATION SITE
Morphological Characteristics of Existing, Reference, and Proposed Channels

Variables	Existing Channel			Reference Reach	Proposed Reach
	Upstream Straightened	Downstream Sinuous (C)	Downstream Sinuous (E)	UT to Crane Creek	Back Creek
Pattern Ratios					
23 Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkt})	No distinctive repetitive pattern of riffles and pools due to straightening activities	Mean: 5.6 Range: 1.8-10.9	Mean: 7.9 Range: 2.6-15.5	Mean: 5.2 Range: 2.6-11.3	Mean: 5.6 Range: 2.7-9.4
24 Meander Length/ Bankfull Width (L_m/W_{bkt})		Mean: 9.7 Range: 4.0-18.9	Mean: 13.8 Range: 5.7-26.8	Mean: 7.2 Range: 6.0-11.4	Mean: 9.8 Range: 7.4-15.5
25 Meander Width Ratio (W_{bel}/W_{bkt})		Mean: 3.0 Range: 1.3-6.2	Mean: 4.2 Range: 1.8-8.8	Mean: 8.5 Range: 7.4-10.0	Mean: 2.5 Range: 1.1-6.3
26 Radius of Curvature/ Bankfull Width (R_c/W_{bkt})		Mean: 2.1 Range: 0.7-4.2	Mean: 3.0 Range: 1.0-5.9	Mean: 2.5 Range: 1.8-3.0	Mean: 2.6 Range: 2.0-4.5

Profile Variables					
27 Average Water Surface Slope (S_{ave})	0.0037	0.0037	0.0037	0.0014	0.0034
28 Valley Slope (S_{valley})	0.0038	0.0052	0.0052	0.0025	0.0051
29 Riffle Slope (S_{riffle})	No distinctive repetitive pattern of riffles and pools due to straightening activities	Mean: 0.0144 Range: 0-0.0507	Mean: 0.0144 Range: 0-0.0507	Mean: 0.0019 Range: 0.0006-0.0033	Mean: 0.005 Range: 0.0033-0.0079
30 Pool Slope (S_{pool})		Mean: 0.0006 Range: 0-0.0035	Mean: 0.0006 Range: 0-0.0035	Mean: 0.0004 Range: 0.0000-0.0006	Mean: 0.0017 Range: 0-0.003

Profile Ratios					
31 Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	No distinctive repetitive pattern of riffles and pools due to straightening activities	Mean: 3.9 Range: 0-13.7	Mean: 3.9 Range: 0-13.7	Mean: 1.4 Range: 0.4-2.4	Mean: 1.5 Range: 1.0-2.3
32 Pool Slope/Water Surface Slope (S_{pool}/S_{ave})		Mean: 0.16 Range: 0-0.9	Mean: 0.16 Range: 0-0.9	Mean: 0.3 Range: 0.0-0.4	Mean: 0.5 Range: 0.1-0.9

Materials					
D16	0.15	0.14	0.31	NA	NA
D35	0.39	0.28	2	0.44	0.4
D50	0.7	0.6	19.8	1.9	2
D84	10	32	55	12	34
D95	149	152	139	36	140

Wetland Restoration

Wetland restoration includes the re-establishment of historic water table elevations, excavation and grading of elevated spoil and sediment embankments, and reestablishing hydrophytic vegetation. Wetland restoration activities will include the following:

- restore approximately 1.5 acres of jurisdictional wetland
- enhance approximately 1.8 acres of jurisdictional wetland
- create approximately 0.5 acre of open water/freshwater marsh within the Site.

SPECIAL TOPICS

The Morgan's property, located at the southwestern end of the Site, contains the first of two secondary tributaries that enter Back Creek. Four options have been offered for this tributary and are depicted on Figure 2a. These options will need to be finalized before construction plans are created. These options include:

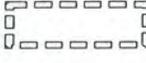
- no action,
- reconstruction of stream channel from property line (Alt 1)
- reconstruction of stream channel from rip-rap terminus (Alt 2)
- re-direction of channel into the wetland enhancement area.

SUMMARY

Back Creek and the associated floodplain have been significantly impacted by past and present land use practices and rapid development within the Back Creek watershed. The Back Creek Stream and Wetland Mitigation Plan proposes restoration improvements to:

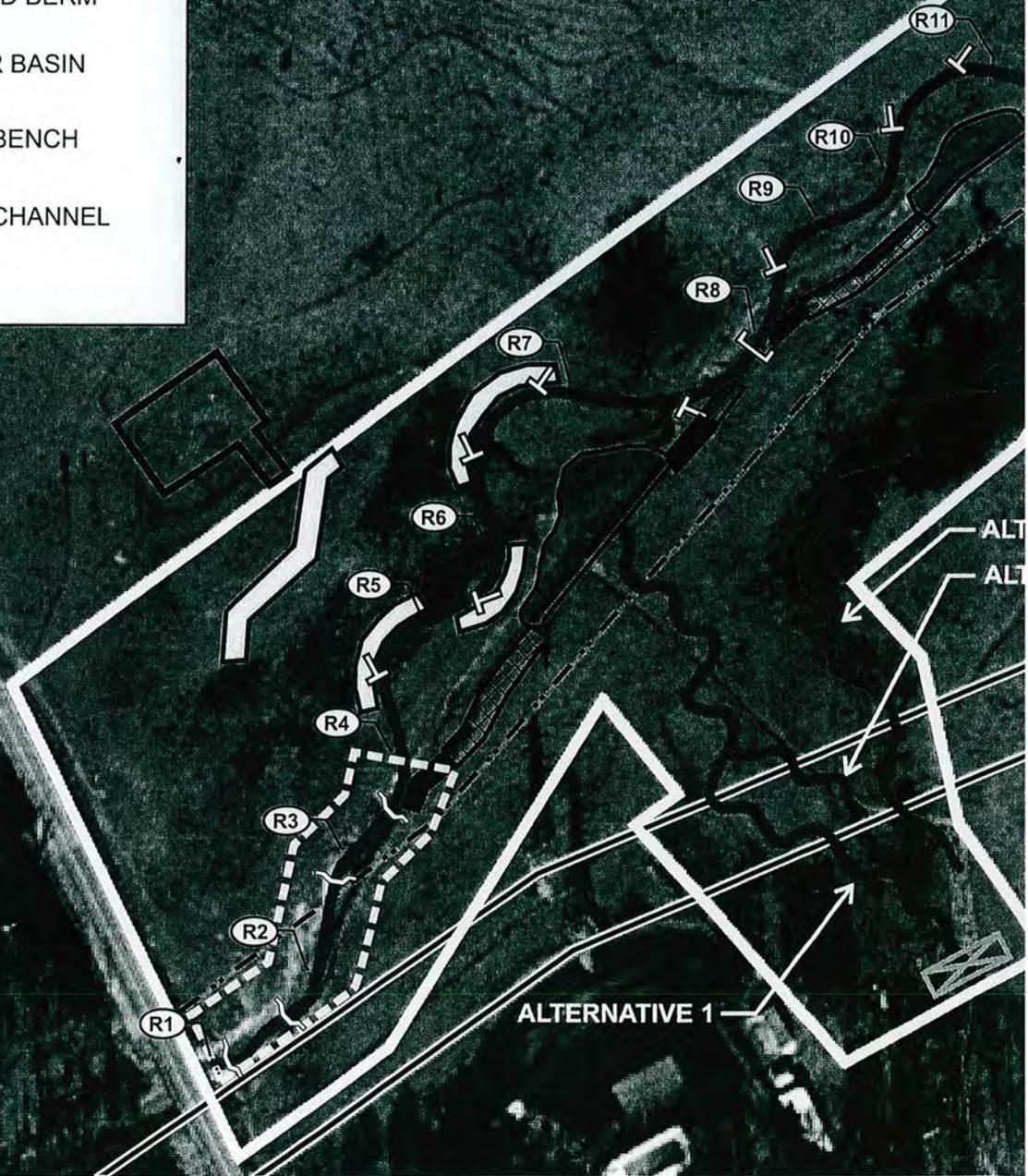
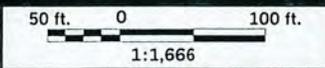
- restore both streams and wetlands on Site to relic conditions
- significantly enhance water quality functions in the on-site, upstream, and downstream segments of the channel
- reduce flooding concerns for the existing property owner
- provide habitat for a variety of wildlife and plant species
- increase surface water storage during major storm events
- enhance nutrient cycling and removal of imported elements and compounds.

MITIGATION LEGEND

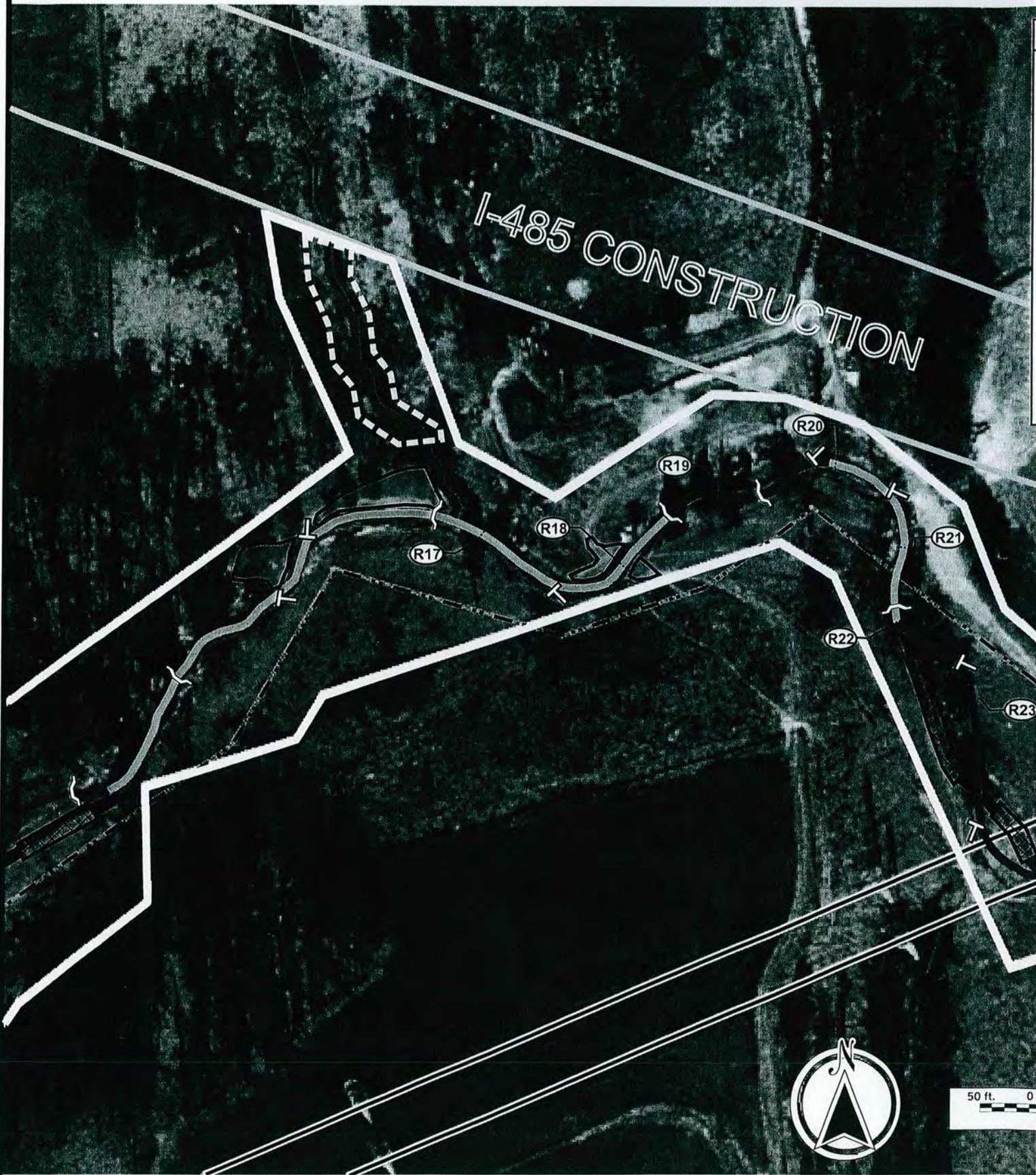
-  CROSS-VANE WEIR
-  J-HOOK VANE OR LOG VANE WEIR
-  RIP-RAP SILL
-  IMPERMEABLE CHANNEL PLUG
-  CONSTRUCTED FORD
-  OXBOW DEPRESSION
-  CONSTRUCTED BERM
-  STORMWATER BASIN
-  FLOODPLAIN BENCH EXCAVATION
-  ABANDONED CHANNEL BACKFILL

GENERAL LEGEND

-  SITE BOUNDARY (17.5 ac.)
-  SEWER LINE
-  HIGH TENSION POWER LINES
-  CHANNEL ON NEW LOCATION



I-485 CONSTRUCTION



NOTE:
FOR RIFFLE ELEVATIONS AND SLOPE,
SEE TABLE, FIGURE 2-A.