STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

September 27, 2004

US Army Corps of Engineers
Raleigh Field Office
6508 Falls of Neuse Road, Suite 120
Raleigh, NC 27615-6814

Attn: Mr. Eric Alsmeyer
NCDOT Coordinator, Division 5

Dear Sir:

Subject: **Application for Modification to Section 404 and Section 401 permits and Neuse Buffer Certificate** for the Northern Wake Expressway (I-540) from US 1 to US 64 in Wake County, Division 5. State Project No. 8.2401701, Federal Aid Project No. F-123-1(1), TIP No. R-2000 F&G; $475.00 Debit Work Order 8.2401701, WBS Element No. 34365.1.1. NCDENR-DWQ Water Quality Certification Project No. 030114 and USACE Action ID 199920387.

The North Carolina Department of Transportation (NCDOT) proposes to construct a new controlled-access six-lane, divided highway to be known as the Northern Wake Expressway (I-540). The new location of the project is from US 1 to US 64 in Wake County. NCDOT submitted an individual Section 404 (of the Clean Water Act) Permit Application to the U.S. Army Corps of Engineers (USACE) for the subject project on March 29, 1996. On October 10, 1996, the Section 404 Permit was issued by the USACE (Action ID No. 199601917) and on September 27, 1996, a Section 401 Water Quality Certification was issued by the N.C. Division of Water Quality (DWQ Project 960319). NCDOT submitted a Section 404 and Section 401 Water Quality Certification modification application on January 31, 2003. The USACE issued the Section 404 Permit Modification on June 2, 2003 (Action ID No. 199920387) and The North Carolina Division of Water Quality (DWQ) issued a Section 401 Water Quality Certificate Modification on May 5, 2003 (DWQ Project No. 030114. The project has been let and construction has begun.

The purpose of this submittal is to request a modification to the Section 404 permit and Section 401 Water Quality Certification and Neuse Buffer Certificate, specifically for Sections F&G. The modification for the permit is for several changes to jurisdictional and buffer impacts through construction modifications and to state discrepancies found by NCDOT personnel between the permit drawings and the construction plan sheets.

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT AND ENVIRONMENTAL ANALYSIS
1598 MAIL SERVICE CENTER
RALEIGH NC 27699-1598

TELEPHONE: 919-715-1500
FAX: 919-715-1501
WEBSITE: WWW.NCDOT.ORG

LOCATION:
2728 CAPITAL BLVD.
PARKER LINCOLN BUILDING, SUITE 168
RALEIGH NC 27604

The revised design does not compromise NCDOT's compliance with the existing permit conditions. The revision has been evaluated for compliance with the avoidance/minimization criteria and are in compliance with all previous issues, including the following:

- Protected Species
- Aquatic Life passage
- FEMA compliance
- Cultural Resources

Summary of Jurisdictional Impacts

The above stated activities will result in 0.22 ac of additional temporary wetland impacts for Section F (Site 8). Section G will have an additional 0.12 ac of permanent fill in wetlands (0.094 ac in Site 2 and 0.025 ac in Site 6). We propose mitigate for these wetland impacts through the Ecosystem Enhancement Program (EEP). Enclosed with this application is a letter with acceptance of this mitigation from EEP.

Summary of Buffer Impacts

In Section F, Sites 2, 3, 5, and 6 and in Section G, Site 2 have additional buffer impacts from the original permitted buffer impacts due to road crossings. All of these sites were originally mitigated for, therefore additional mitigation is needed for these impacts. The amount of buffer impacts and needed mitigation is shown in Table 1. At Site 6, the amount fill in buffers increased because of the required mechanized clearing in the buffers along the toe of fill. At the same site buffer impacts were decreased to the change in fill slopes from 3:1 to 2:1. Because the amount of reduced buffer impacts at this site is greater than the increased amount of buffer impacts, we are not proposing any mitigation for this site (Table 2). Buffer impacts to Site 8 are due to the construction of a bridge and are allowable. No mitigation is required for the additional buffer impacts at Site 8.

Table 1. Required Mitigation for Additional Buffer Impacts (square feet)

Site	Zone 1 Impacts	Mitigation Required (3:1)	Zone 2 Impacts	Mitigation Required (1.5:1)	**Total Mitigation Required**
Section F					
Site 2	1707	5121	1141	1712	**6833**
Site 3	348	1044	305	458	**1502**
Site 5	87	261	0	0	**261**
Site 6	87		261		**0**
Site 6 Reduced impacts	-174		-261		**0**
Site 8	6005	0	2483	0	**0**
Section G					
Site 2	3006	9018	0	0	**9018**
Total	**11,066**	**15,444**	**3929**	**2170**	**17,614**

Additional buffer impacts from this project requires 15,444 sq ft of mitigation in Zone 1 and 2170 sq ft of mitigation in Zone 2. We propose to provide mitigation through EEP. Enclosed with this application is a letter with acceptance of this mitigation from EEP.

Jurisdictional and Buffer Impacts

Section F

Permit Drawing 7/Plan Sheet 8/Site 2

The permit drawing was revised to show buffer impacts associated with construction of the 0.6m base tail ditch. Additional buffer impacts are 96 square feet (sq ft) of excavation in each Zone 1 and Zone 2, 1611 sq ft mechanized clearing in Zone 1 and 1045 sq ft mechanized clearing in Zone 2.

Permit Drawing 9/Plan Sheet 10/Site 3

The permit drawing was revised to reflect the toe protection at Station 369+10 to be in agreement with the construction plans. There are no additional impacts at this site.

Permit Drawing 14/Plan Sheet 10/Site 3

The permit drawing was revised to depict the additional buffer impacts of mechanized clearing along the toe of fill from Station 370+60 to 370+80. The additional buffer impacts are 348 sq ft of mechanized clearing in Zone 1 and 305 sq ft in Zone 2.

Permit Drawing 21/Plan Sheet 12/Site 5

A pre-formed scour hole is proposed to be constructed beyond the original permitted area. The permit drawing was revised to reflect these additional buffer impacts. The impacts are 87 sq ft of mechanized clearing in Zone 1.

In addition, Plan Sheet 12 will be revised to reflect the correct dimensions of the pre-formed scour hole on the permit drawing.

Permit Drawing 23/Plan Sheet 12/Site 5

Permit drawing will be revised to reflect the proposed berm drainage outlet (BDO) as reflected on the plans. No jurisdictional impacts will be result from this addition.

Permit Drawing 29/Plan Sheet 14/Site 6

Original permit drawing depicted excavation in a wetland outside the project construction limits. This impact is more correctly described as a drained wetland instead of excavated. The wetland is considered a total take. The permit drawing is revised as such. There are no changes in jurisdictional impacts.

The permit drawing was also revised to depict the required mechanized clearing in the buffers along the toe of fill from Station 387+60 to 387+80. The additional impacts are 87 sq ft of mechanized clearing in Zone 1 and 261 sq ft in Zone 2.

Permit Drawing 30/Plan Sheet 15/Site 6

Original permit drawing depicted excavation in a wetland outside the project construction limits. This impact is more correctly described as a drained wetland instead of excavated. The permit drawing is revised as such. There are no changes in jurisdictional impacts.

Permit Drawing 31/Plan Sheet 15/Site 6

The permit drawing, Sheet 31, will be revised to reflect the proposed Shoulder Berm Gutter. No change in jurisdictional impacts. Revised only to agree with plan sheets.

Fill slopes adjacent to the culvert at Station 389+10 have been revised to reflect the change in fill slopes from 3:1 to 2:1. The reduction of wetlands at this site was too small to change on the summary sheet although a small amount of fill in buffers was reduced and reflected on the summary sheet. The reduction in impacts to buffers in Zone 1 are 174 sq ft and in Zone 2 are 261 sq ft.

Permit Drawing 32/Plan Sheet 15/Site 6

Plan Sheet 15 will be revised to reflect corrected dimensions of PFSH on permit drawing. No jurisdictional impacts will result from this addition.

Fill slopes adjacent to culvert at Station 389+60 have been revised to reflect the change in fill slopes from 3:1 to 2:1. See Permit Drawing 31 explanation for reduction in impacts at this site.

The permit drawing will be revised to match Plan Sheet 15 to reflect the rock toe protection at the outlet of the culvert. No jurisdictional impacts will result from this addition.

Permit Drawing 38/Plan Sheet 16/Site 8

A construction revision to Plan Sheet 16 will be changed to add the additional wetland boundary limits to agree with the approved permit.

Permit Drawings 41, 42, 43, 47/Plan Sheet17/Site 8

The Permit Drawing 41 and 47 will be revised to reflect the additional temporary impacts to wetlands and for hand clearing impacts in buffers for the extension of the timber mats to allow installation of the proposed Class II Rip Rap End Bent Slope Protection. Additional temporary impacts to wetlands are 0.21 acres (ac) and additional impacts of hand clearing in buffer Zone 1 are 1176 sq ft and buffer Zone 2 are 2483 sq ft. Buffer impacts for bridges are allowable. No mitigation will be required for wetlands or buffers.

Permit Drawings 42 and 43 and buffer impacts will be revised to reflect excavation in Zone 1 along the East Bank of the Neuse River to allow for excavation and shaping of the existing bank and installation of the proposed Class II Rip Rap. The amount of excavation is 4835 sq ft in Zone 1. The hand clearing in the buffers was then reduced by 3354 sq ft.

The Permit Drawing 47 will be revised to reflect the proposed finger of the temporary work bridge for the construction of interior bent #3 to be moved from the east side to the west side on interior bent #3. No change in impacts will be required for this specific action.

Plan sheet 17 will be revised to reflect the correct dimensions of the pre-formed scour hole reflected on the approved permit drawing.

Permit Drawing 48/Plan Sheet17/Site 9

A revision to Plan Sheet 17 has been made to reflect the correct dimensions of the pre-formed scour hole on the approved permit drawing. This is the same pre-formed scour hole on permit drawing sheets 43 and 47.

Permit Drawing Sheet 48 has been revised to show additional temporary wetland fill impacts that were extended to the right-of-way/controlled access fence. These additional impacts are 0.008 ac.

Permit Drawing 49/Plan Sheet 18/Site 9

Plan Sheet 18 was revised to reflect the correct dimensions of the pre-formed scour hole on the approved Permit Drawing 49.

Permit Drawing 63/Plan Sheet 25, Detail Ditch Sheet 2-M, Revised Crsoo Section Sheets X-87 and X-88/Site 12

The hydraulic design at this site has changed. Originally a lateral base ditch was shown through the buffers. The permit drawing and plan sheet have been revised to show the lateral base ditch flowing into a preformed scour hole. The lateral base ditch and preformed scour hole are located outside the buffer. Buffer impacts on the summary sheet were not changed because the impact reductions were too small.

Permit Drawing 87

Permit Drawing revised to reflect change in lateral base ditch from Permit Drawing 63.

Section G

Permit Drawing 9/Plan Sheet 6/Site 2

Permit Drawing 9 was revised to reflect the proposed rock cross vane in the correct location to agree with the Plan Sheet 6. It was also revised to reflect additional mechanized clearing impacts to Zone 1 of the buffers (to the proposed R/W / C/A fence) to allow room for installation of the proposed cross vane at the inlet of the box culvert. The additional buffer

impacts of mechanized clearing in Zone 1 are 741 sq ft. The additional mechanized clearing will also have permanent wetland impacts of 0.042 ac.

No revisions to the permit drawing will be required at the outlet of the box culvert due to the overlap of buffer and wetlands. The mechanized clearing limits were included in the original wetland and buffer impacts in the approved permit. Additional buffer impacts to Zone 1 within the wetland boundary from the approved mechanized clearing line out to the C/A fence and the limits of the TDE will be added to the impact summary sheets (0.021 ha) (2265 sq ft). Wetlands will also be permanently impacted by this action. Wetland impacts are 0.052 ac.

Also, Permit Drawing Sheet 9 was revised to reflect the addition of toe protection from Sta. 422+05 –L- lt. to end of the proposed culvert wing wall at approximately Sta. 422+20 –L- lt. The addition of Rock Plating along the proposed fill slope from approximately 422+30 –L- lt. to 422+90 –L- lt. will also be reflected. A construction revision to Plan Sheet 6 has been revised to reflect the addition of the toe protection and the new proposed rock plating of the fill slope. No change in jurisdictional or buffer impacts for either of these additions will be required based on discussion with the resource agencies.

Bedrock in the streambed is located at the inlet of the proposed culvert at this Site. During a field visit with Division 5 personnel and NCDWQ representative John Hennessy on September 21, 2004 it was approved that the cross vane shown on Permit Drawing 9 at the inlet of the culvert will not be feasible to construct. The permit drawing and plan sheet are revised. No jurisdictional impacts will occur.

Permit Drawing 14/Plan Sheet 8/Site 12

Permit Drawing 14 was revised to fix the discrepancy of the depiction of the level spreader and the toe protection (near Station 9+70 Rt Y 12) and now matches the construction Plan Sheet 8 dated 3/15/04. There are no changes to jurisdictional or buffer impacts.

This permit drawing was also revised to reflect a change in the hydraulic design at Structures 45 and 46. These structures were moved slightly to conform to existing topography. There are no change in pipe sizes or jurisdictional impacts.

Permit Drawing 18/Plan Sheet 10/Site 6

The permit drawing has been revised to reflect the addition of toe protection from –L- Sta. 441+20 lt. to 442+00 Lt. No change in impacts for this addition of toe protection based on discussion with the resource agencies. An additional 0.01 ha of fill in wetlands left of 441+30 +/- has been included since it was missed on the original submittal.

Permit Drawing 31 and 50/Plan Sheet 15/Site 10

Modifications were made to the Natural Stream Design on the permit drawing and plan sheet. This information was requested by the Corps. This consists of widening the floodplain by 2.4 meters (7.9 feet) to ensure appropriate floodprone width is obtained. Rock cross vanes will be moved from the glide to the run in order to enhance the downstream pool as well as the armored riffle. A rock cross vane will be installed at the outlet of the 1050 mm pipe with the

invert of the cross vane set at the invert of the pipe. The cross vane will help dissipate the energy created by the pipe as well as enhance the pool downstream of the pipe. No changes to jurisdictional or buffer impacts.

Permit Drawing 32/Plan Sheet 15/Site 10

Field conditions indicated that a small channel that flows into the main channel near Station 461+20 Lt actually flows under the proposed fill limits. Permit Drawing 32 has been revised to show rock toe protection to provide stabilization to the fill slope. No change in impacts based on discussion with the resource agencies and a construction revision to Plan Sheet 15 dated 1/13/04 has been made.

Permit Drawings 39, 44-49/Site 10

These permit drawings refer to the stream relocation at Site 10 and were previously submitted to NCDWQ to adhere to Condition 7 of the 401 Water Quality Certification dated May 5, 2003. This condition stated "*No impacts shall occur anywhere on the project until a final design that provides a stable stream pattern, dimension, and profile is submitted to and approved by the NCDWQ.*" These drawings were approved by NCDWQ in a letter dated August 29, 2003. These drawings are included in this application for the Corps of Engineers information.

Permit Drawing 39a, 39b, 39c/Plan Sheet 17/Site 13 and 14

These Sites were initially permitted in the R-2547/R-2641 permit. As you are aware, these sites later became part of the R-2000G project and thus, these drawings are submitted for your information. Impacts were previously mitigated for in the R-2547/R-2641 permit. Impacts from these Sites are listed on revised impact summary sheet for R-2000G (Sheet 41).

Permit Drawing 39c/Plan Sheet 17/Site 14

The Plan Sheet 17 (specifically Detail TT) depicts rip rap in the bottom of the head base ditches at the inlets of Structures 126 and 130. Permit Drawing 39c was revised to match the plan sheet, with Class B Rip Rap in both proposed head ditches. Original stream impact limits reflected in the approved permit cover both of these areas. Therefore, no additional jurisdictional impacts.

Regulatory Approvals

Application is hereby made for the modification of the Section 404 Permit from the USACE and Section 401 Water Quality Certification and Neuse Buffer Certification from the NCDENR-DWQ. The modification of the permit site on this project (R-2000 F&G) has been designed to comply with the Riparian Buffer Mitigation Program (15A NCAC 2B .0242) and the Neuse River Basin Riparian Buffer Rules (15A NCAC 2B .0233). Therefore, as part of the Modification request, we respectfully request that the NCDENR-DWQ issue an Authorization Certificate pursuant to 15A NCAC 2B .0233 for the proposed use. In compliance with Section 143-215.3D(e) of the NCAA we have provided a method of debiting $475, as noted in the subject line of this application, as payment for processing the Section 401 Water Quality Certification modification application. We are providing seven copies of this application to NCDENR-DWQ, for their use.

If you have any questions or need additional information, please call Ms. Rachelle Beauregard at (919) 715-1383.

Sincerely,

for Gregory J. Thorpe, Ph.D.
Environmental Management Director, PDEA

cc: w/attachment
Mr. John Hennessy, NCDWQ (7 copies)
Mr. Travis Wilson, NCWRC
Ms. Becky Fox, USEPA – Whittier, NC
Mr. Ronald Mikulak, USEPA – Atlanta, GA
Mr. Gary Jordan, USFWS
Mr. David Chang, P.E., Hydraulics
Mr. Greg Perfetti, P.E., Structure Design
Mr. Jon Nance, P.E., Division 5 Engineer
Mr. Reese Briley, Division 5 Resident Engineer
Mr. Chris Murray, Division 5 Environmental Officer
w/o attachment
Mr. Jay Bennett, P.E., Roadway Design
Mr. Omar Sultan, Programming and TIP
Mr. Art McMillan, P.E., Highway Design
Mr. Mark Staley, Roadside Environmental
Mr. David Franklin, USACE, Wilmington
Mr. Brian Yamamoto, PDEA Project Planning Engineer

NCDENR
North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

September 15, 2004

Mr. Gregory J. Thorpe, Ph.D.
Environmental Management Director
Project Development and Environmental Analysis Branch
North Carolina Department of Transportation
1548 Mail Service Center
Raleigh, NC 27699-1548

Dear Dr. Thorpe:

Subject: I-540 (Northern Wake Expressway), Durham County
TIP Number R-2000F and G

The purpose of this letter is to notify you that the Ecosystem Enhancement Program (EEP) will provide compensation for the subject project. Based on the information supplied by you in a letter dated August 27, 2004, the impacts are located in CU 3020201 of the Neuse River Basin in the Central Piedmont Eco-Region, and are as follows:

Riverine Wetland Impacts: 0.12 acre

The subject project is not listed in Exhibit 2 of the Memorandum of Agreement among the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the U. S. Army Corps of Engineers, Wilmington District dated July 22, 2003. However, the EEP has agreed to provide compensatory riverine wetland mitigation at a ratio up to 2:1.

If you have any questions or need additional information, please contact Ms. Beth Harmon at (919) 715-1929.

Sincerely,

William D. Gilmore

William D. Gilmore, P.E.
Transition Manager

cc: Eric Alsmeyer, USACE-Raleigh
John Hennessy, Division of Water Quality, Wetlands/401 Unit
File: R-2000F/G

NC DENR Ecosystem Enhancement Program
1652 Mail Service Center, Raleigh, North Carolina 27699-1652
Phone: 919-715-1413 \ FAX: 919-715-2219 \ Internet: h2o.enr.state.nc.us/wrp/

NCDENR
North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor

William G. Ross Jr., Secretary

September 15, 2004

Mr. Eric Alsmeyer
US Army Corps of Engineers
Raleigh Regulatory Field Office
6508 Falls of the Neuse Road, Suite 120
Raleigh, North Carolina 27615

Dear Mr. Alsmeyer:

SUBJECT: Wake County, R-2000F and G, I-540 (Northern Wake Expressway)
Neuse River Basin, CU 3020201

The purpose of this letter is to notify you that the Ecosystem Enhancement Program (EEP) will provide compensatory mitigation for the unavoidable 0.12-acre riverine wetland impacts associated with the above referenced project.

The subject project is not listed in Exhibit 2 of the Memorandum of Agreement among the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the U. S. Army Corps of Engineers, Wilmington District dated July 22, 2003; therefore, the EEP intends to provide compensatory riverine wetland mitigation up to a 2:1 ratio in Cataloging Unit 3020201 of the Neuse River Basin.

If you have any questions or need additional information, please contact Ms. Beth Harmon at (919) 715-1929.

Sincerely,

William D. Gilmore, P.E.
Transition Manager

cc: Phil Harris, Office of Natural Environment, NCDOT
John Hennessy, Division of Water Quality, Wetlands/401 Unit
File: R-2000F/G

NC DENR Ecosystem Enhancement Program
1652 Mail Service Center, Raleigh, North Carolina 27699-1652
Phone: 919-715-1413 \ FAX: 919-715-2219 \ Internet: h2o.enr.state.nc.us/wrp/

Ecosystem Enhancement PROGRAM

September 20, 2004
DOT TIP#: R-2000 F & G
DWQ#: N/A
COE#: N/A

Greg Thorpe
Department of Transportation
1548 Mail Service Center
Raleigh, NC 27699-1548

Subject: Project: Northern Wake Expressway (I-540) to US 64
County: Wake

The purpose of this letter is to notify you that the North Carolina Ecosystem Enhancement Program (NCEEP) is willing to accept payment for buffer impacts associated with the subject project. Please note that the decision by the NCEEP to accept the mitigation requirements of this project does not assure that this payment will be approved by the U.S. Army Corps of Engineers and the N.C. Division of Water Quality Wetlands/401 Unit. It is the responsibility of the applicant to contact these agencies to determine if payment to the NCEEP for impacts associated with this project is appropriate.

Based on the information supplied by you in a letter dated August 27, 2004 the buffer restoration that is necessary to satisfy the compensatory mitigation requirements for this project is summarized in the following table. The maximum amount of mitigation that the NCEEP will accept for this project is also indicated in this table.

	Stream (linear feet)	Wetlands Non-Riparian (acres)	Riparian Buffer (ft^2)
Impacts			6,594
Mitigation Maximum			17,614

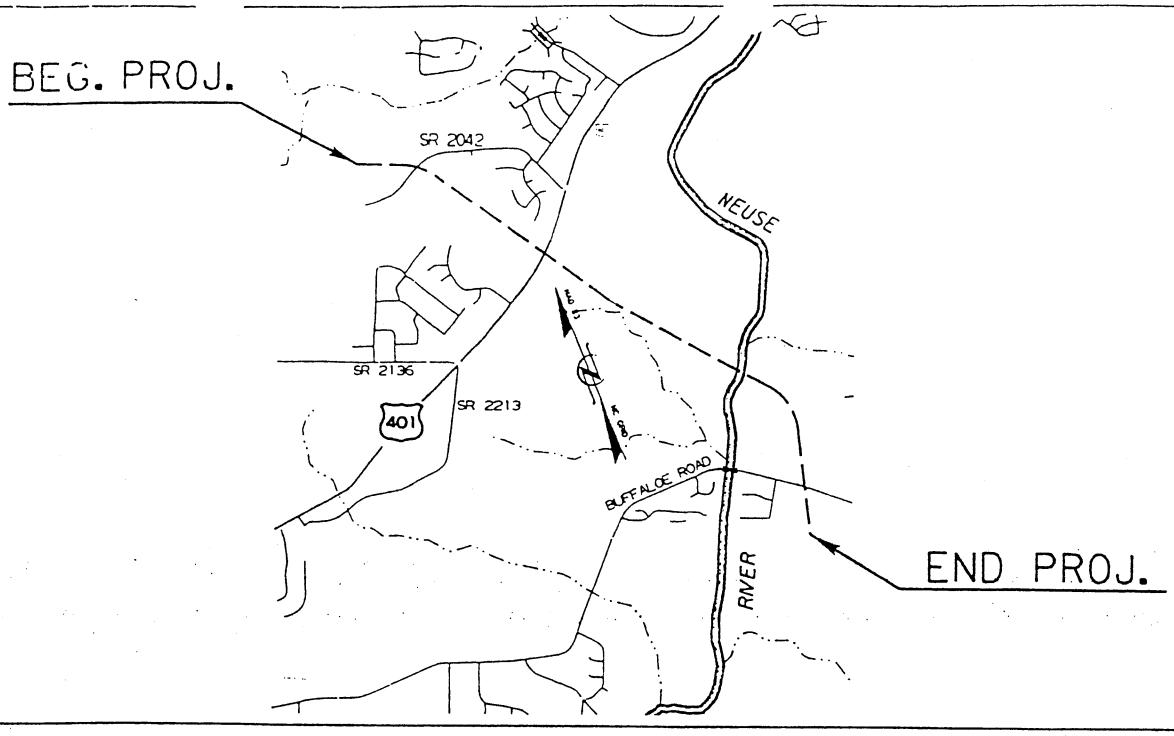
The riparian buffer mitigation will be provided as specified in the 401 Water Quality Certification and/or Section 404 Permit for impacts associated with the subject project in Cataloging Unit 03020201 of the Neuse River Basin. The mitigation will be performed in accordance with the Memorandum of Understanding between the N.C. Department of Environment and Natural Resources and the U.S. Army Corps of Engineers dated November 4, 1998.

If you have any questions or need additional information, please contact Carol Shaw at (919) 733-5208.

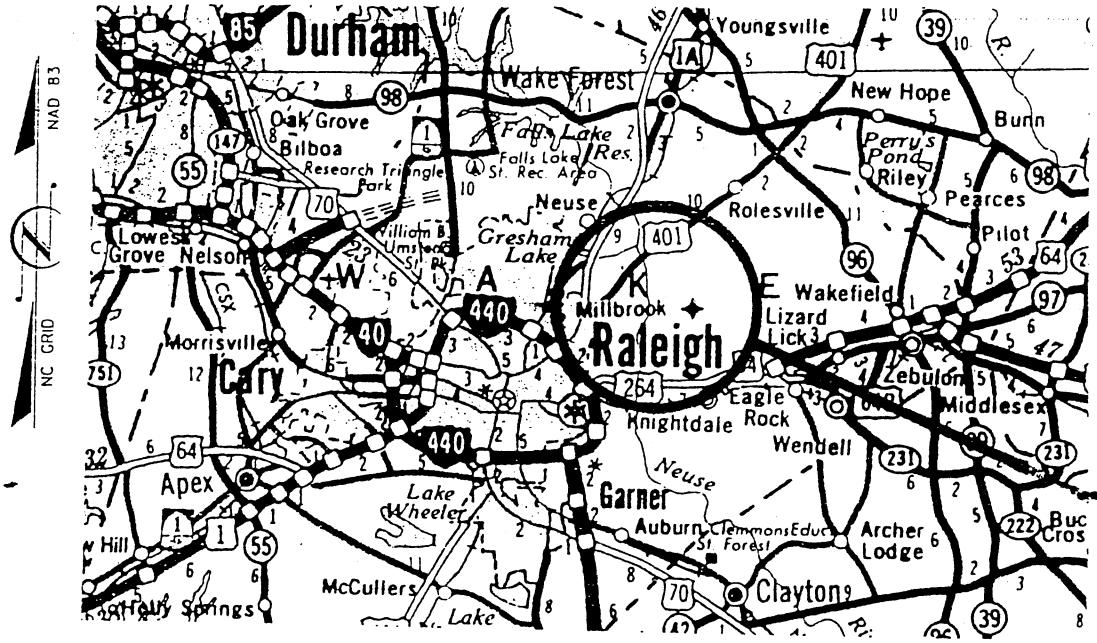
Sincerely,

Deborah D. Anderson
In-Lieu Fee Administrator

cc: Cyndi Karoly, Wetlands/401 Unit
John Hennessy, Wetlands/401 Unit
Eric Alsmeyer, USACOE-Raleigh
Steve Mitchell, DWQ Regional Office-Raleigh
File



PORTION OF WAKE COUNTY MAP



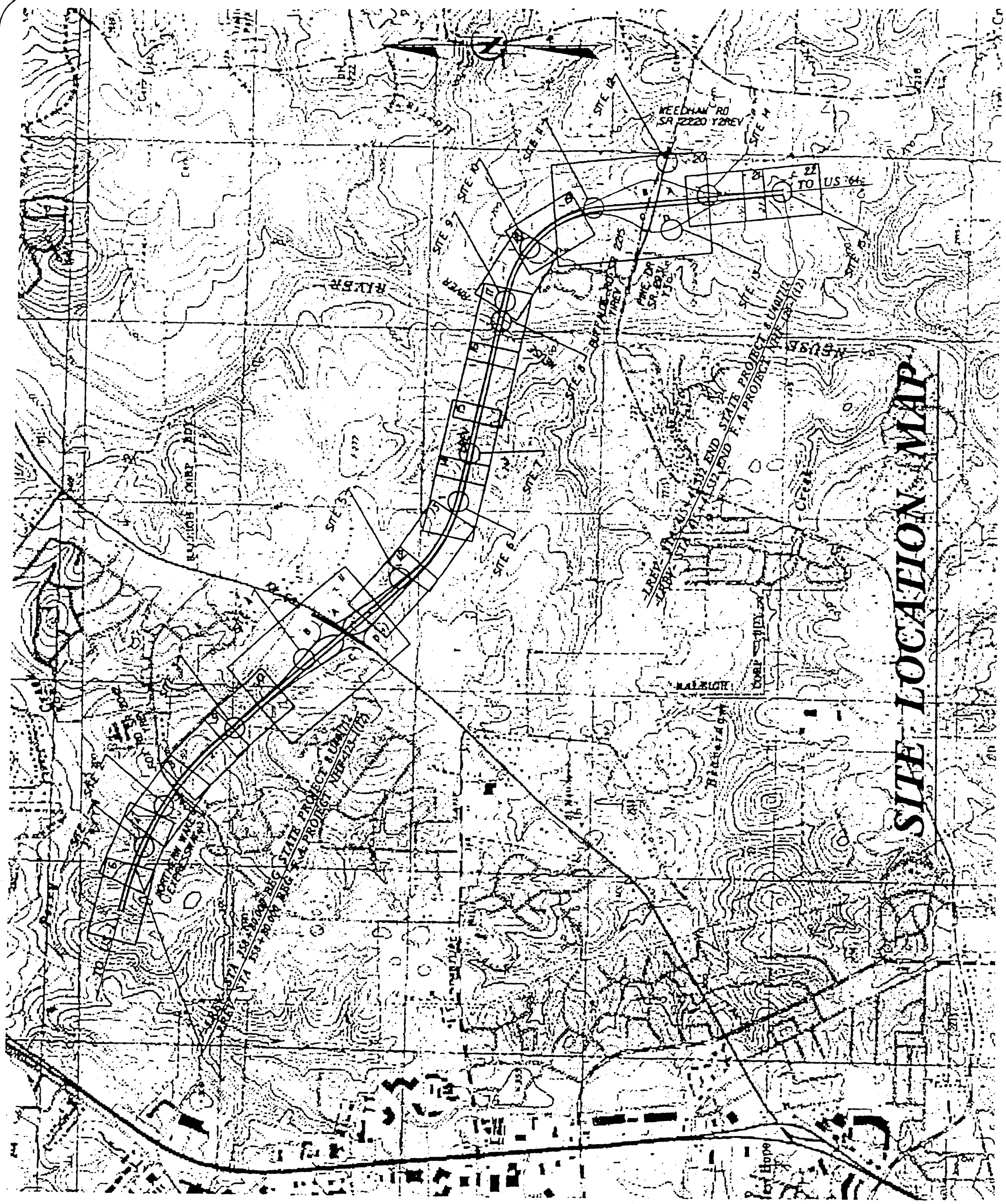
PORTION OF STATE MAP

METRIC

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

SCALE AS SHOWN 6/24/02 SHEET 1 OF 90



METRIC

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY

8.U401727 (R-2000F)

NORTH RALEIGH OUTER LOOP

SCALE AS SHOWN 6/24/02 SHEET 2 OF 90

LEGEND

WLB — WETLAND BOUNDARY

WETLAND

DENOTES FILL IN WETLAND

DENOTES FILL IN SURFACE WATER

DENOTES FILL IN SURFACE WATER (POND)

DENOTES TEMPORARY FILL IN WETLAND

DENOTES EXCAVATION IN WETLAND

DENOTES TEMPORARY FILL IN SURFACE WATER

DENOTES MECHANIZED CLEARING

FLOW DIRECTION

TB — TOP OF BANK

WE — EDGE OF WATER

C — PROP. LIMIT OF CUT

F — PROP. LIMIT OF FILL

PROP. RIGHT OF WAY

NG — NATURAL GROUND

PL — PROPERTY LINE

TDE — TEMP. DRAINAGE EASEMENT

PDE — PERMANENT DRAINAGE EASEMENT

EAB — EXIST. ENDANGERED ANIMAL BOUNDARY

EPB — EXIST. ENDANGERED PLANT BOUNDARY

WATER SURFACE

LIVE STAKES

BOULDER

COIR FIBER ROLLS

5 — ADJACENT PROPERTY OWNER OR PARCEL NUMBER

PROPOSED BRIDGE

PROPOSED BOX CULVERT

PROPOSED PIPE CULVERT

(DASHED LINES DENOTE EXISTNG STRUCTURES)

SINGLE TREE

WOODS LINE

DRAINAGE INLET

ROOTWAD

VANE

RIP RAP

RIP RAP ENERGY DISSIPATOR BASIN

BUFFER ZONE — BUFFER ZONE

METRIC

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

5 0 10
SCALE

6/24/02

SHEET 3 OF 90

10-16-01
09:41:42 AM
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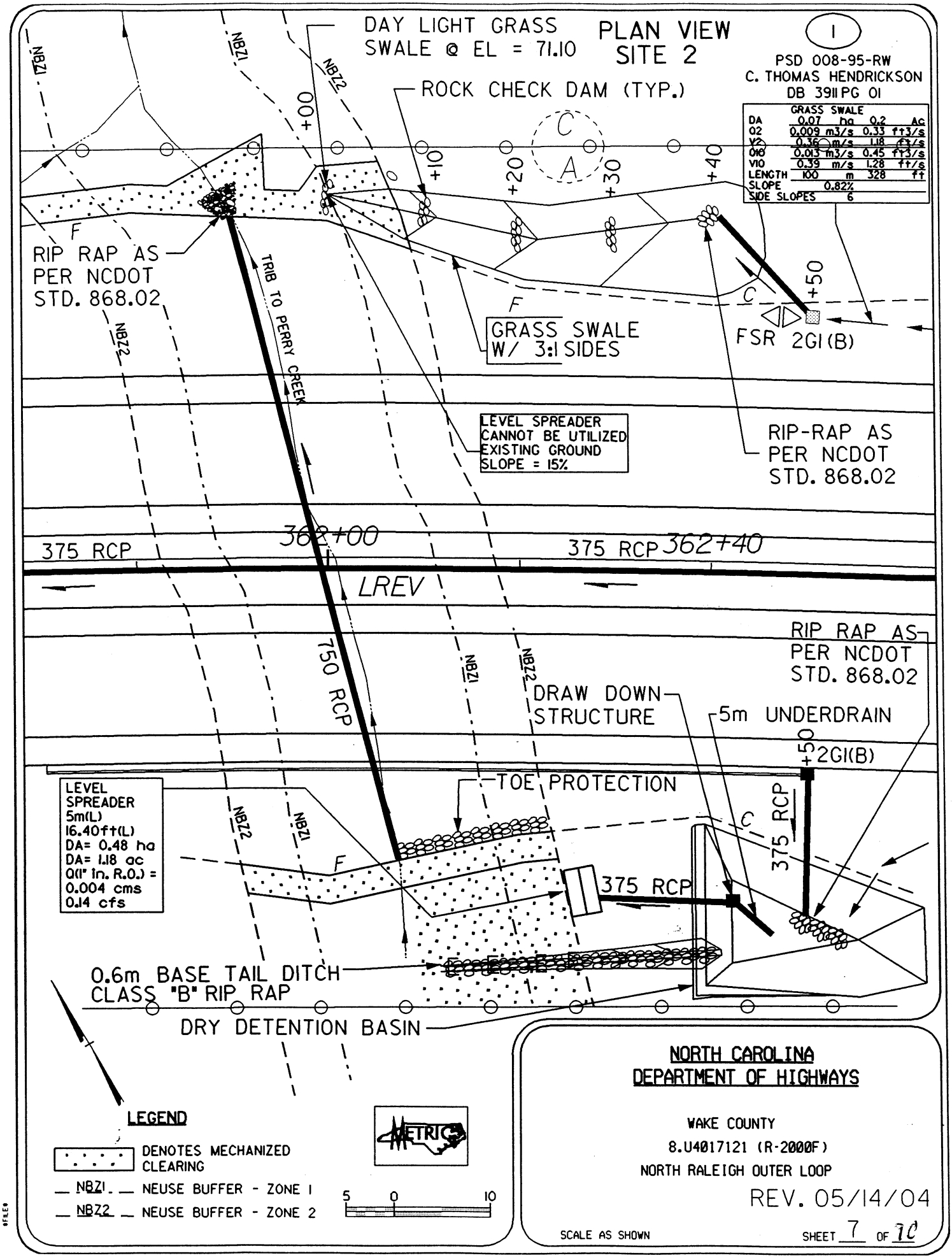
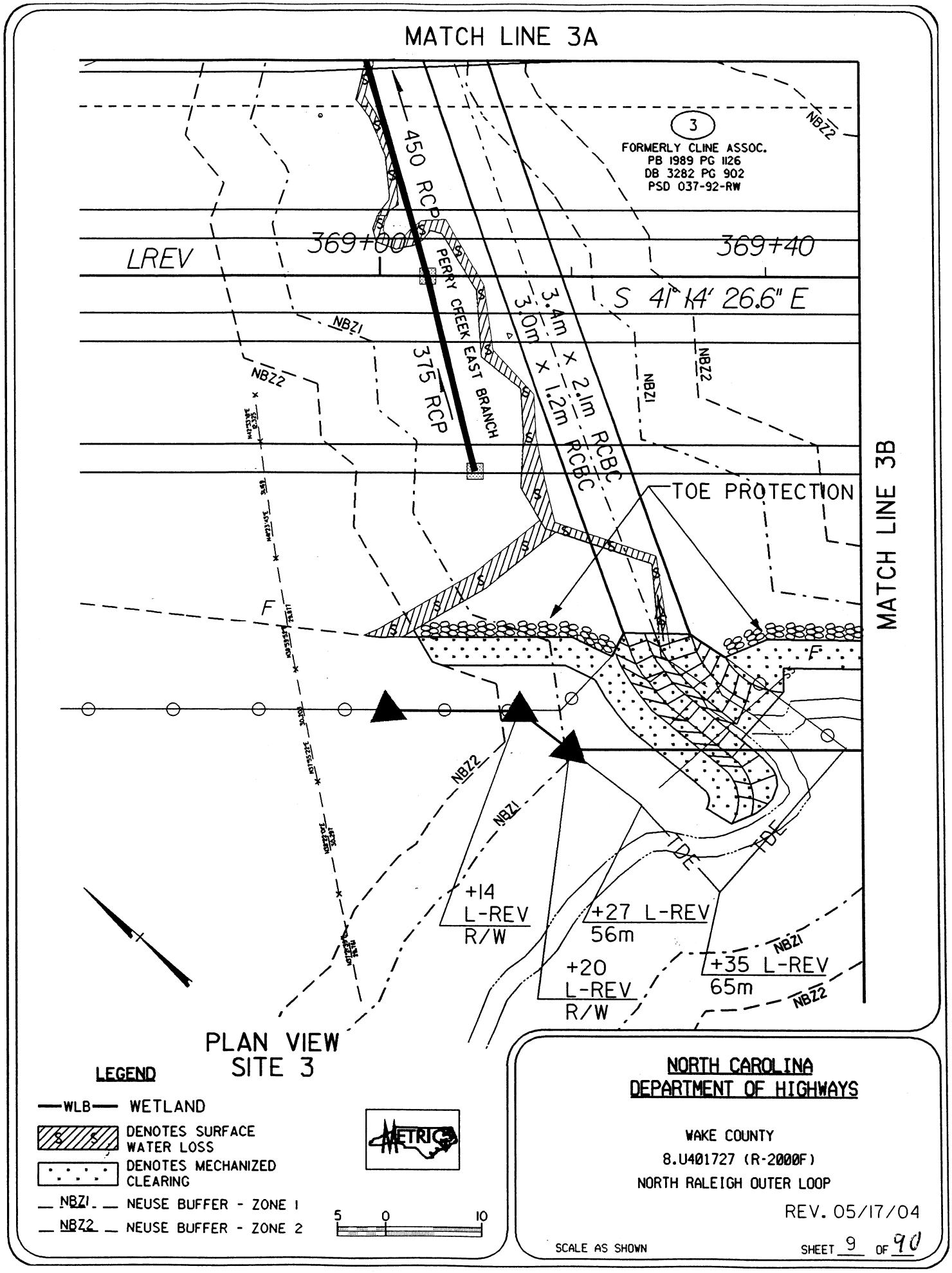
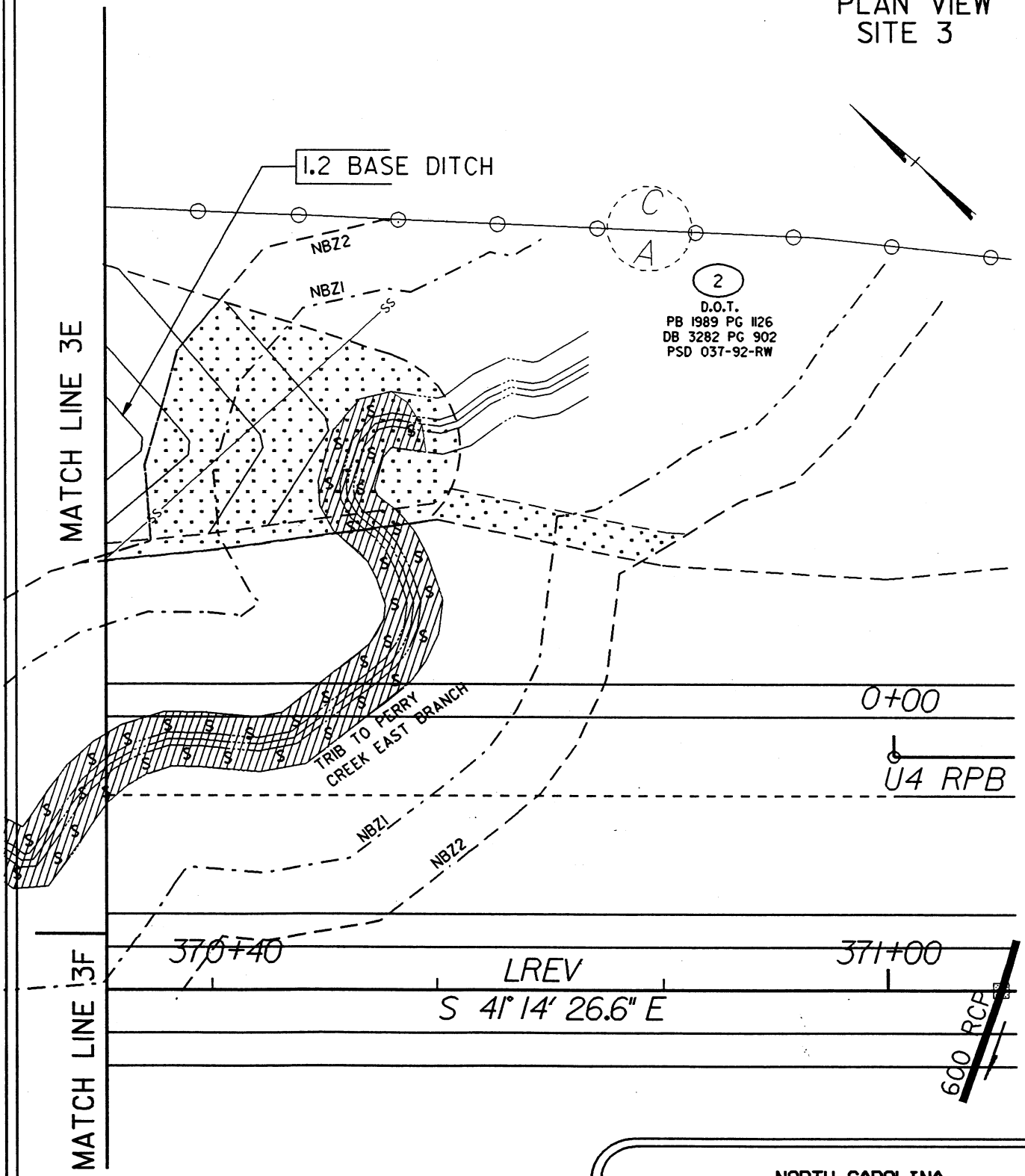

DAY LIGHT GRASS SWALE @ EL = 71.10
PLAN VIEW SITE 2
1
PSD 008-95-RW
C. THOMAS HENDRICKSON
DB 3911 PG 01
GRASS SWALE
DA 0.07 ha 0.2 Ac
Q2 0.009 m3/s 0.33 ft3/s
V2 0.36 m/s 1.18 ft/s
Q10 0.013 m3/s 0.45 ft3/s
V10 0.39 m/s 1.28 ft/s
LENGTH 100 m 328 ft
SLOPE 0.82%
SIDE SLOPES 6
ROCK CHECK DAM (TYP.)
RIP RAP AS PER NCDOT STD. 868.02
TRIB TO PERRY CREEK
GRASS SWALE W/ 3:1 SIDES
FSR 2GI(B)
LEVEL SPREADER CANNOT BE UTILIZED EXISTING GROUND SLOPE = 15%
RIP-RAP AS PER NCDOT STD. 868.02
375 RCP
362+00
362+40
LREV
750 RCP
DRAW DOWN STRUCTURE
5m UNDERDRAIN
TOE PROTECTION
LEVEL SPREADER 5m(L) 16.40ft(L) DA= 0.48 ha DA= 1.18 ac Q(1" in. R.O.) = 0.004 cms 0.14 cfs
0.6m BASE TAIL DITCH CLASS "B" RIP RAP
DRY DETENTION BASIN
NBZ1
NBZ2
LEGEND
DENOTES MECHANIZED CLEARING
NBZ1 NEUSE BUFFER - ZONE 1
NBZ2 NEUSE BUFFER - ZONE 2
METRIC
5 0 10
NORTH CAROLINA DEPARTMENT OF HIGHWAYS
WAKE COUNTY
8.U4017121 (R-2000F)
NORTH RALEIGH OUTER LOOP
REV. 05/14/04
SCALE AS SHOWN
SHEET 7 OF 10


MATCH LINE 3A
3
FORMERLY CLINE ASSOC.
PB 1989 PG 1126
DB 3282 PG 902
PSD 037-92-RW
450 RCP
375 RCP
PERRY CREEK EAST BRANCH
3.4m x 2.1m RCBC
3.0m x 1.2m RCBC
LREV
369+00
369+40
L S 41° 14' 26.6" E
NBZ1
NBZ2
TOE PROTECTION
MATCH LINE 3B
+14 L-REV R/W
+27 L-REV 56m
+20 L-REV R/W
+35 L-REV 65m
TOE
PLAN VIEW
SITE 3
LEGEND
WLB WETLAND
DENOTES SURFACE WATER LOSS
DENOTES MECHANIZED CLEARING
NBZ1 NEUSE BUFFER - ZONE 1
NBZ2 NEUSE BUFFER - ZONE 2
METRIC
5 0 10
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP
REV. 05/17/04
SCALE AS SHOWN
SHEET 9 OF 90

PLAN VIEW
SITE 3



LEGEND

- WLB — WETLAND
- DENOTES SURFACE WATER LOSS
- DENOTES MECHANIZED CLEARING
- NBZ1 — NEUSE BUFFER - ZONE 1
- NBZ2 — NEUSE BUFFER - ZONE 2

METRIC

5 0 10

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

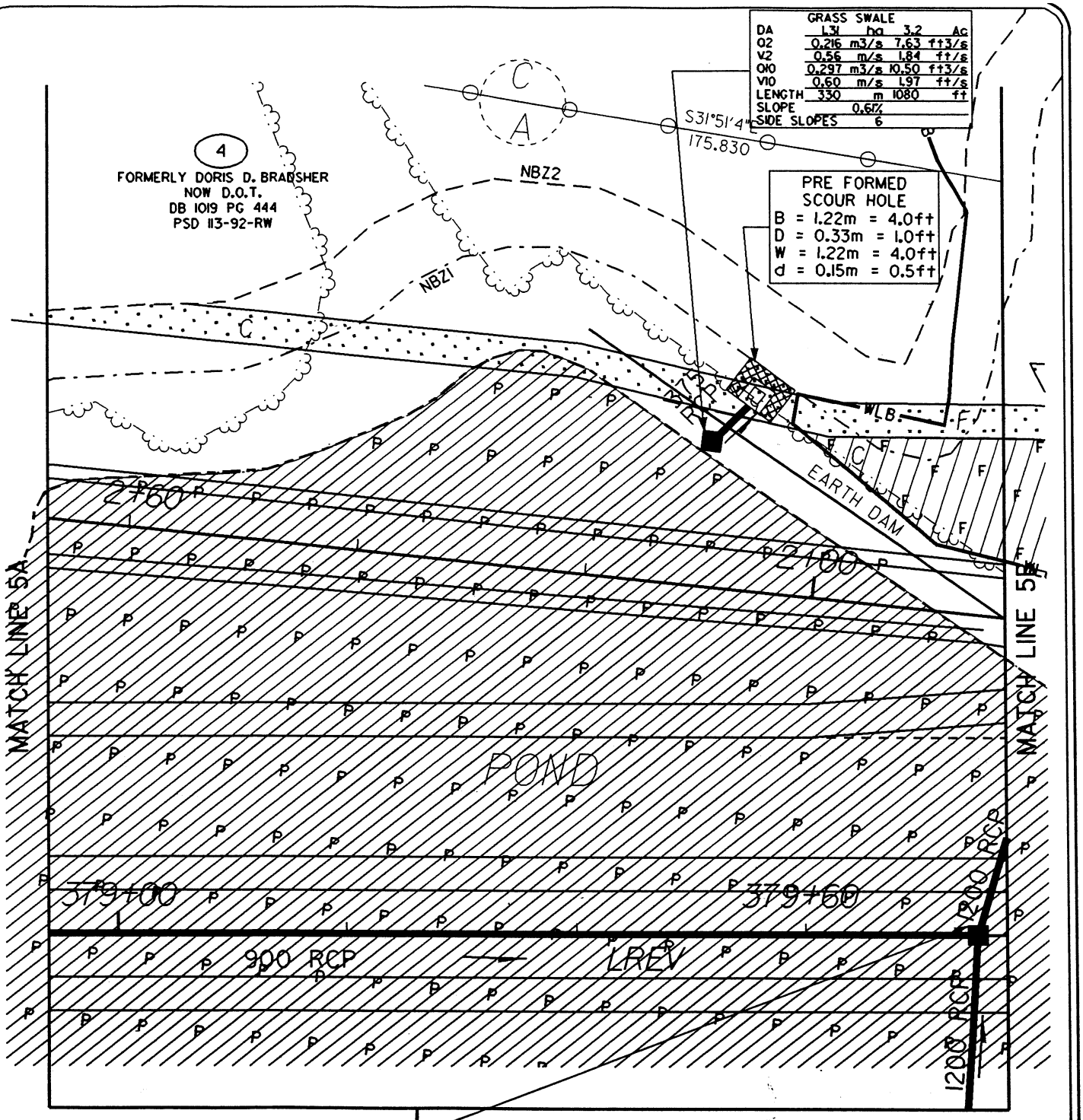
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 05/05/04

SCALE AS SHOWN

SHEET 14 OF 90

FILE



PLAN VIEW
SITE 5

GRASS SWALE

DA	0.07	ha	0.2 Ac
Q2	0.014	m3/s	0.49 ft3/s
V2	0.41	m/s	1.34 ft/s
Q10	0.019	m3/s	0.67 ft3/s
V10	0.44	m/s	1.44 ft/s
LENGTH	100	m	328 ft
SLOPE	1.65%		0.82%
SIDE SLOPES	6		

LEGEND

—WLB— WETLAND

DENOTES SURFACE WATER LOSS (POND)

DENOTES FILL IN WETLAND

DENOTES MECHANIZED CLEARING

NBZ1 NEUSE BUFFER - ZONE 1

NBZ2 NEUSE BUFFER - ZONE 2

METRIC

5 0 10

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY

8.U401727 (R-2000F)

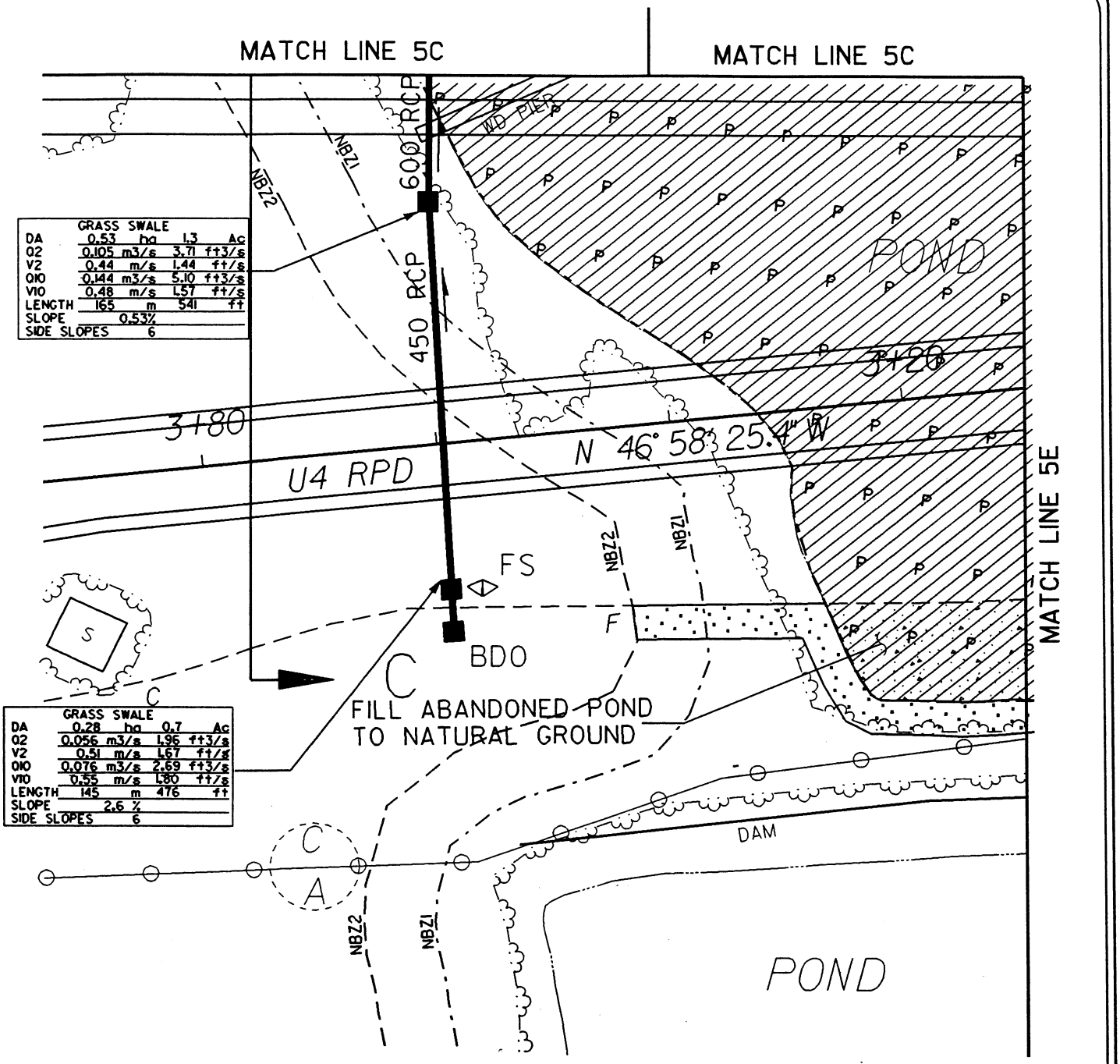
NORTH RALEIGH OUTER LOOP

Rev. 05/05/04

SCALE AS SHOWN

SHEET 21 OF 90

$FILE$



PLAN VIEW
SITE 5

LEGEND

- DENOTES SURFACE WATER LOSS (POND)
- DENOTES MECHANIZED CLEARING
- NBZ1 NEUSE BUFFER - ZONE 1
- NBZ2 NEUSE BUFFER - ZONE 2

METRIC

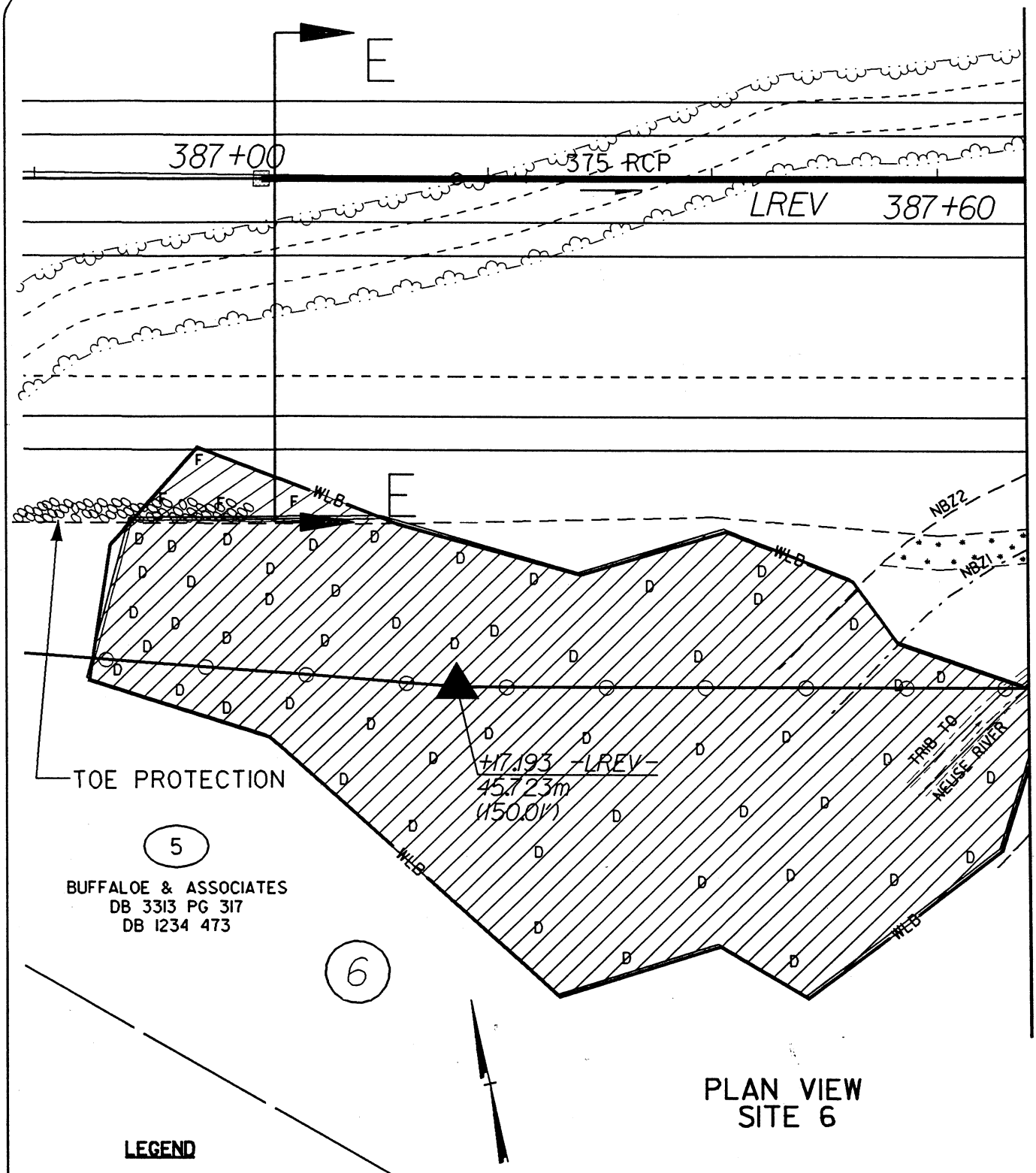
5 0 10

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP
REV. 05/05/04

SCALE AS SHOWN

SHEET 23 OF 90



PLAN VIEW
SITE 6

LEGEND

—WLB— WETLAND

D/D DENOTES DRAINED WETLAND

F/F DENOTES FILL IN WETLAND

DENOTES MECHANIZED CLEARING

NBZ1 NEUSE BUFFER - ZONE 1

NBZ2 NEUSE BUFFER - ZONE 2

METRIC

5 0 10

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

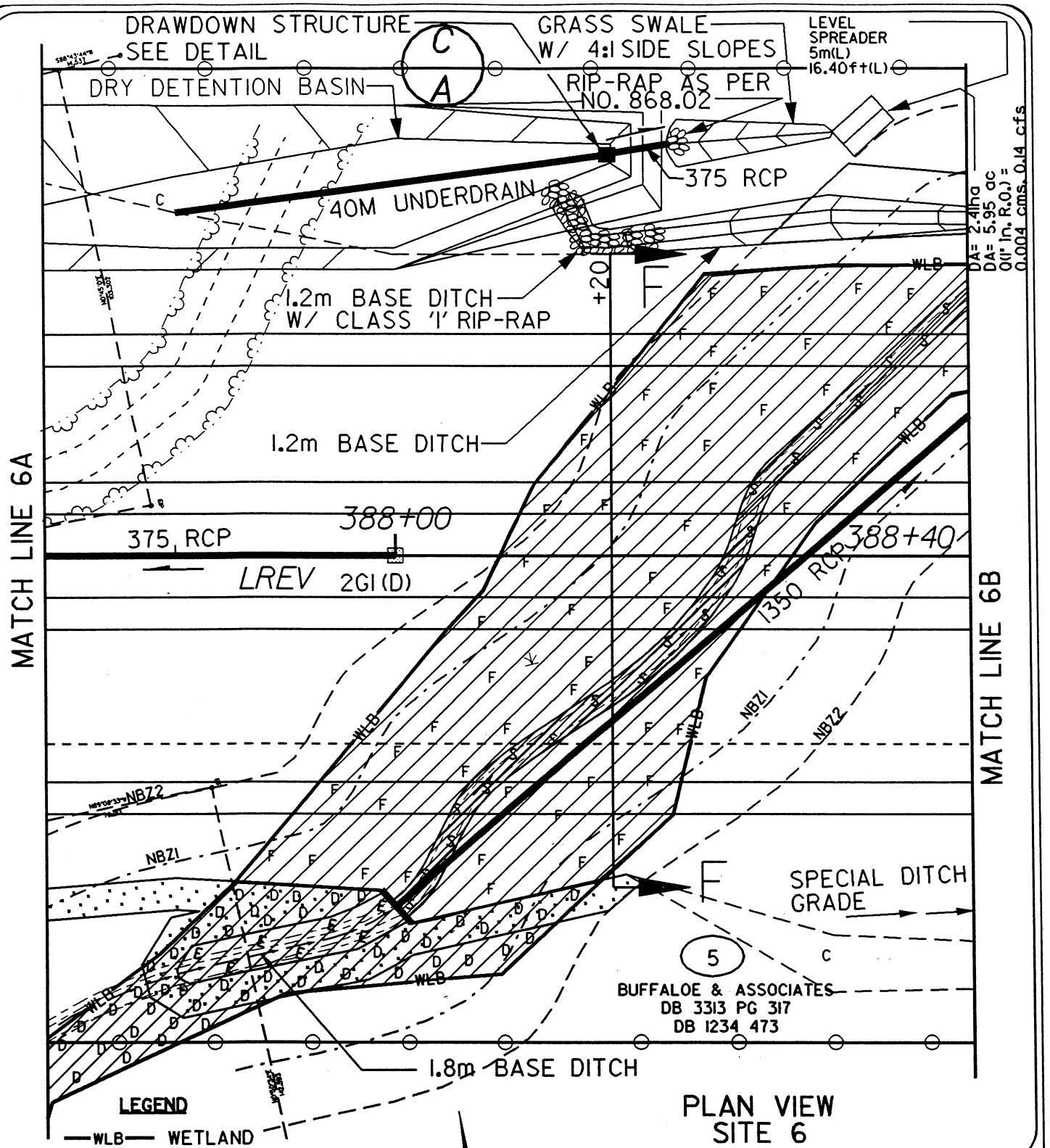
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 05/05/04

SCALE AS SHOWN

SHEET 29 OF 90

$FILE$



PLAN VIEW
SITE 6

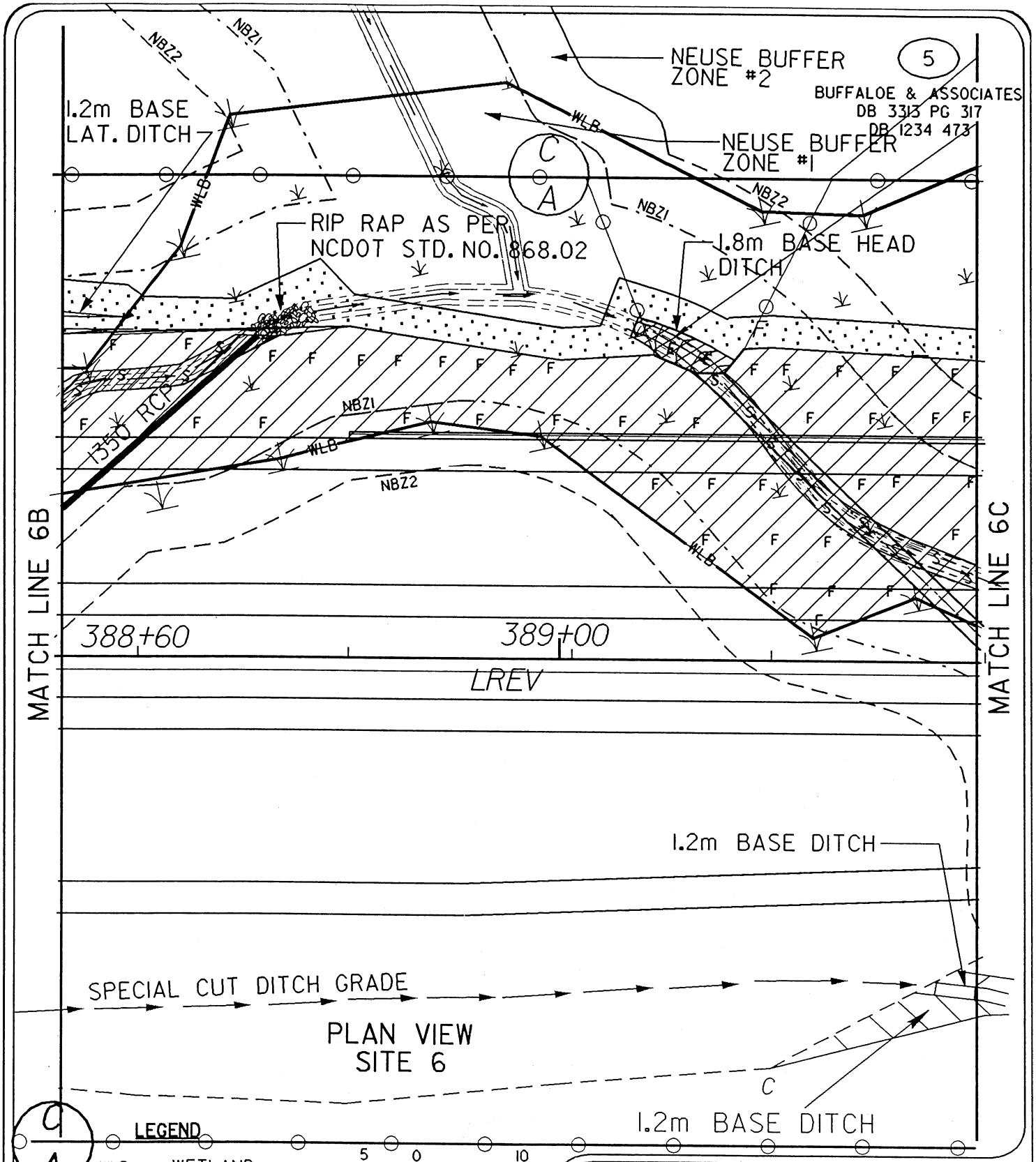
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 05/14/04

SCALE AS SHOWN

SHEET 30 OF 90



NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

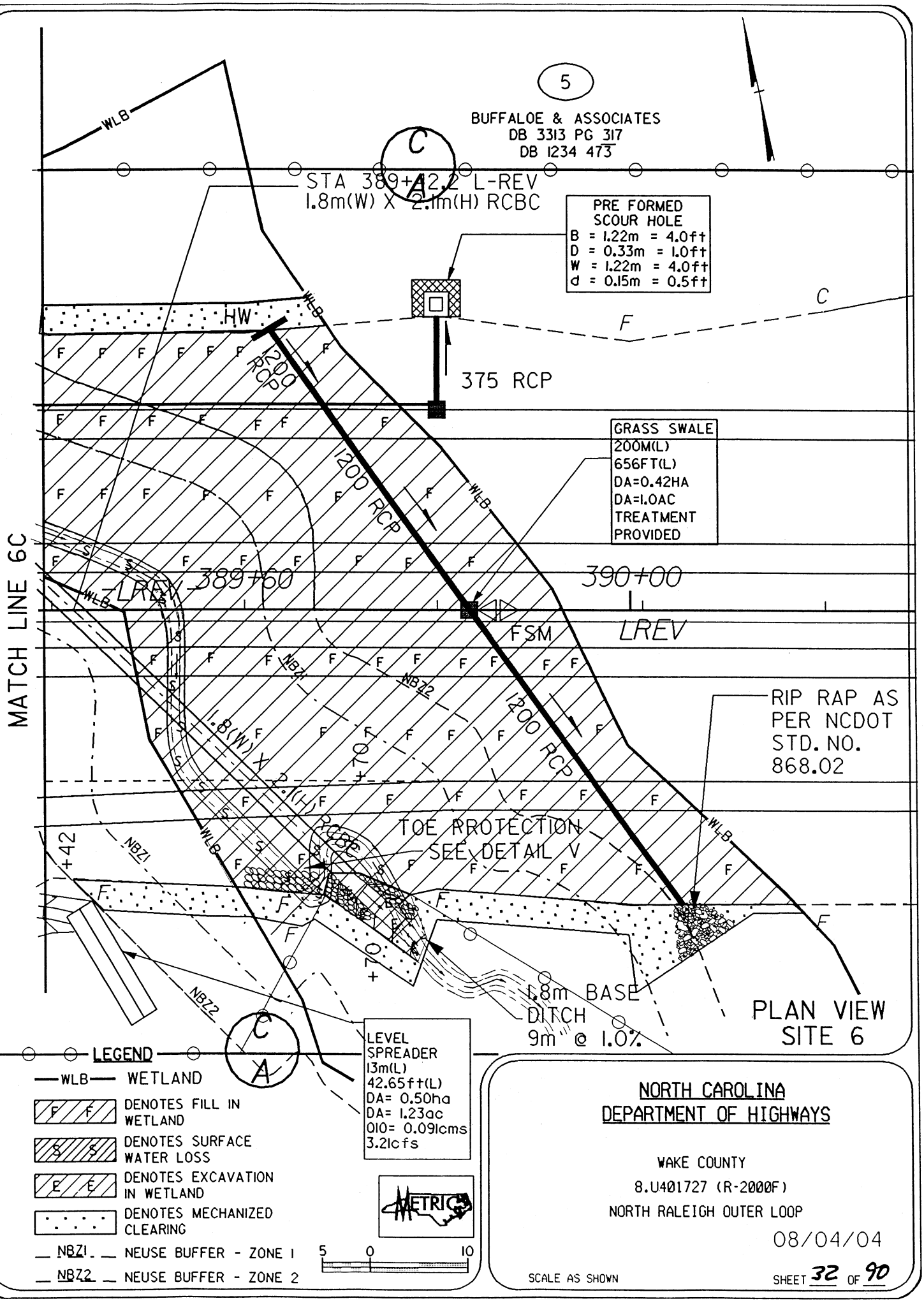
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

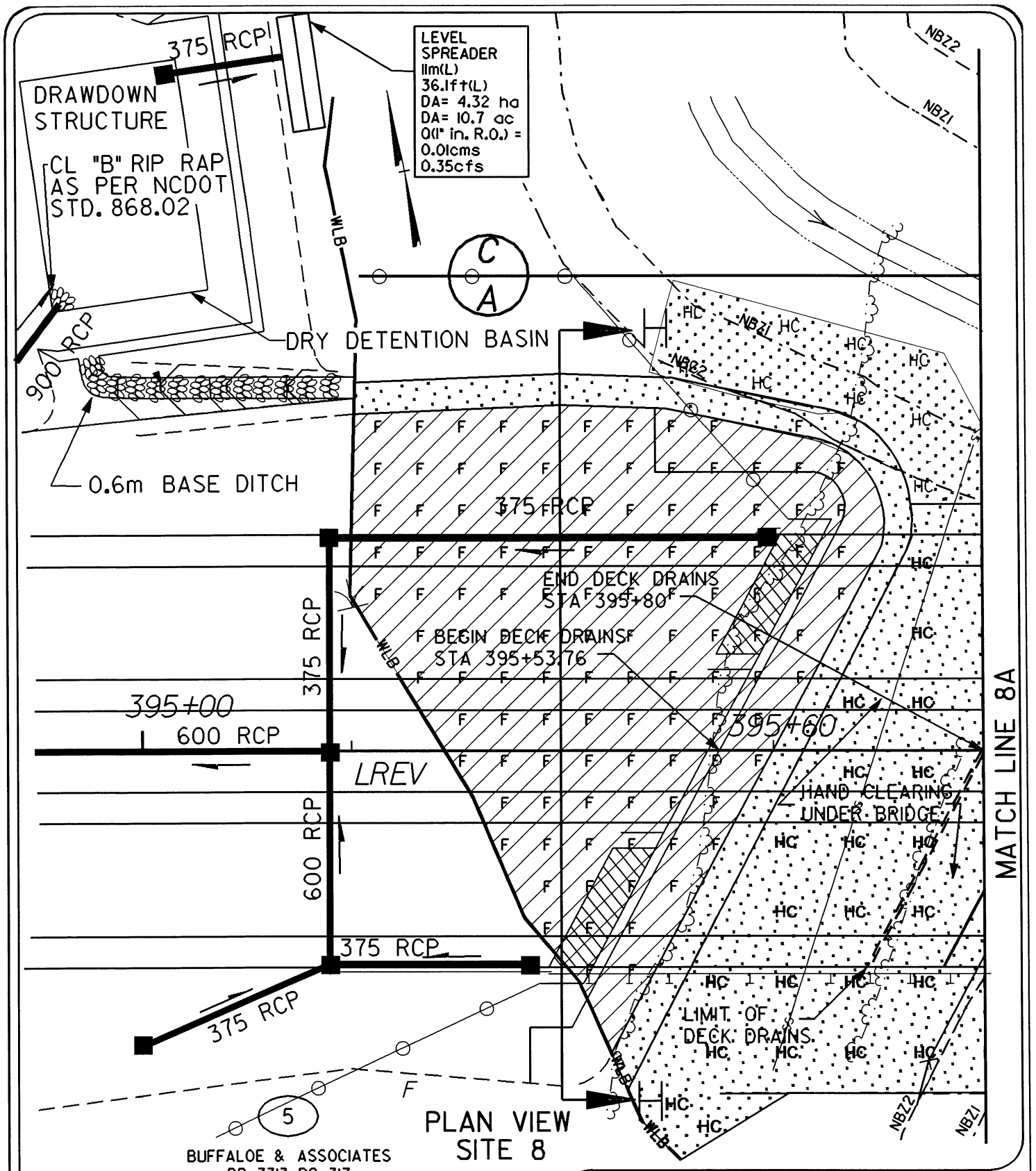
REV. 08/04/04

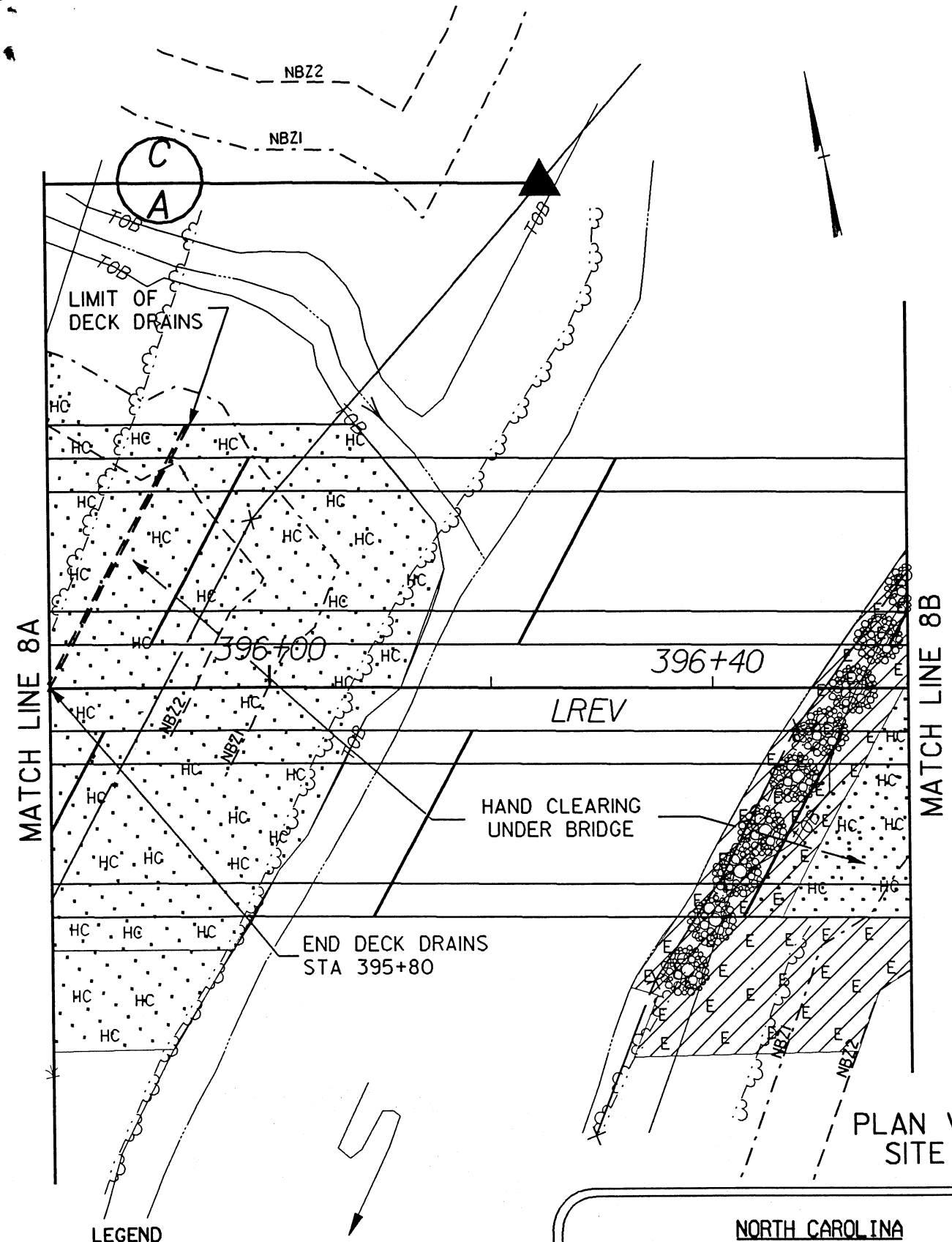
SCALE AS SHOWN

SHEET 31 OF 90

$DATE$
$TIME$
$FILE$


5
BUFFALOE & ASSOCIATES
DB 3313 PG 317
DB 1234 473
STA 389+42.2 L-REV
1.8m(W) X 2.1m(H) RCBC
PRE FORMED
SCOUR HOLE
B = 1.22m = 4.0ft
D = 0.33m = 1.0ft
W = 1.22m = 4.0ft
d = 0.15m = 0.5ft
375 RCP
1200 RCP
GRASS SWALE
200M(L)
656FT(L)
DA=0.42HA
DA=1.0AC
TREATMENT
PROVIDED
MATCH LINE 6C
389+60
390+00
LREV
FSM
RIP RAP AS
PER NCDOT
STD. NO.
868.02
TOE PROTECTION
SEE DETAIL V
1.8m BASE
DITCH
9m @ 1.0%
PLAN VIEW
SITE 6
LEVEL
SPREADER
13m(L)
42.65ft(L)
DA= 0.50ha
DA= 1.23ac
Q10= 0.091cms
3.21cfs
LEGEND
WETLAND
DENOTES FILL IN WETLAND
DENOTES SURFACE WATER LOSS
DENOTES EXCAVATION IN WETLAND
DENOTES MECHANIZED CLEARING
NBZ1 NEUSE BUFFER - ZONE 1
NBZ2 NEUSE BUFFER - ZONE 2
METRIC
5 0 10
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP
08/04/04
SCALE AS SHOWN
SHEET 32 OF 90


375 RCP
DRAWDOWN STRUCTURE
CL "B" RIP RAP AS PER NCDOT STD. 868.02
LEVEL SPREADER
11m(L)
36.1ft(L)
DA= 4.32 ha
DA= 10.7 ac
Q(1" in. R.O.) =
0.01cms
0.35cfs
WLB
C
A
NBZ2
NBZ1
DRY DETENTION BASIN
900 RCP
0.6m BASE DITCH
375 RCP
END DECK DRAINS
STA 395+80
BEGIN DECK DRAINS
STA 395+53.76
375 RCP
395+00
600 RCP
LREV
600 RCP
395+60
HAND CLEARING UNDER BRIDGE
375 RCP
375 RCP
LIMIT OF DECK DRAINS
MATCH LINE 8A
HC
F
5
PLAN VIEW
SITE 8
BUFFALOE & ASSOCIATES
DB 3313 PG 317
DB 1234 473
LEGEND
WLB WETLAND
F F DENOTES FILL IN WETLAND
HC HC DENOTES HAND CLEARING
DENOTES MECHANIZED CLEARING
NBZ1 NEUSE BUFFER - ZONE 1
NBZ2 NEUSE BUFFER - ZONE 2
METRIC
5 0 10
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP
REV. 07/07/04
SCALE AS SHOWN
SHEET 41 OF 90



LEGEND

- HC . . HC — DENOTES HAND CLEARING
- E / E — DENOTES EXCAVATION IN RIPARIAN BUFFER ZONES
- NBZI — NEUSE BUFFER - ZONE 1
- NBZ2 — NEUSE BUFFER - ZONE 2

METRIC

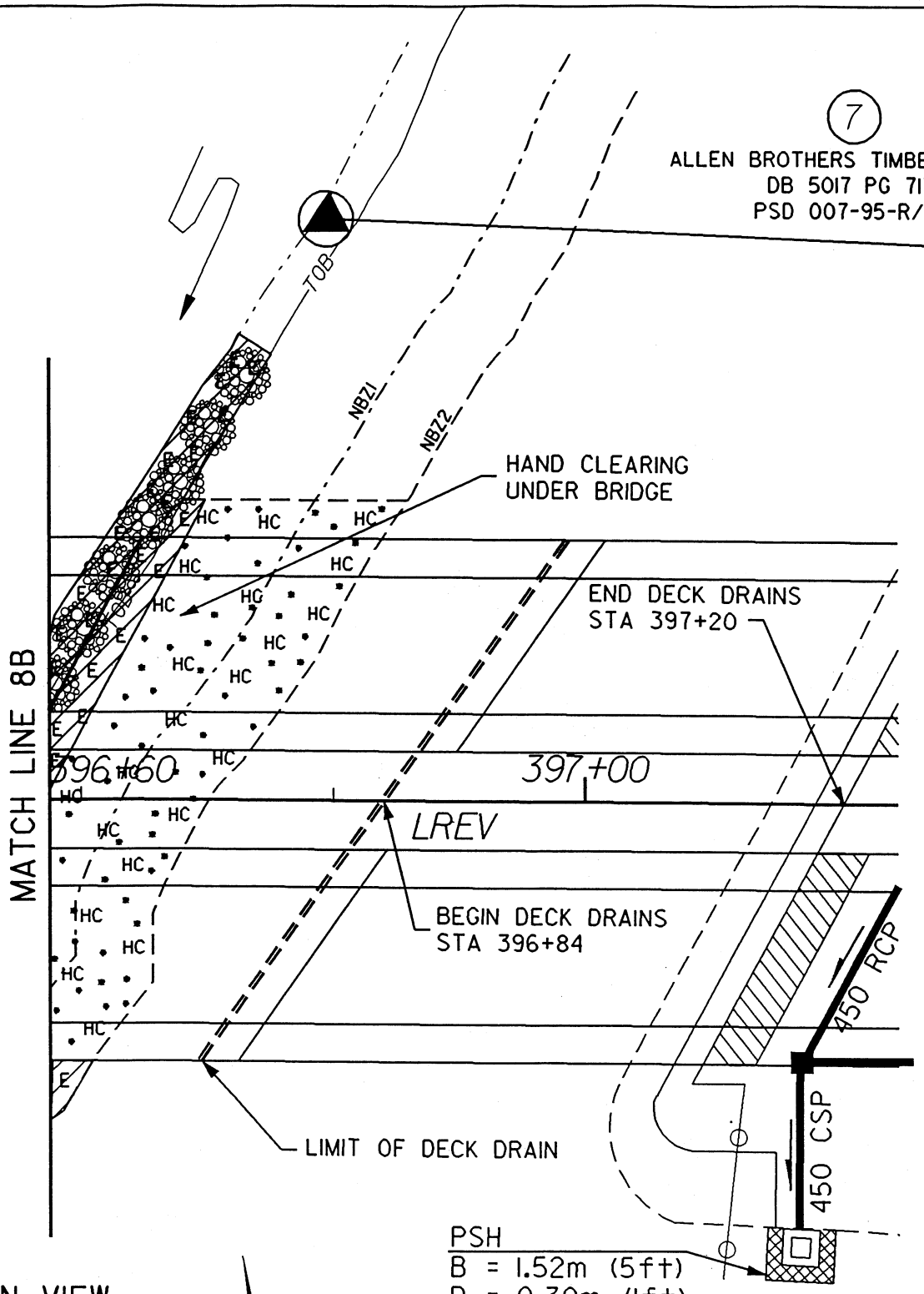
5 0 10

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 07/19/04

SHEET 42 OF 90



PLAN VIEW
SITE 8

LEGEND

- E / E — DENOTES EXCAVATION IN RIPARIAN BUFFER ZONES
- HC . HC — DENOTES HAND CLEARING
- NBZ1 — NEUSE BUFFER - ZONE 1
- NBZ2 — NEUSE BUFFER - ZONE 2

METRIC

5 0 10

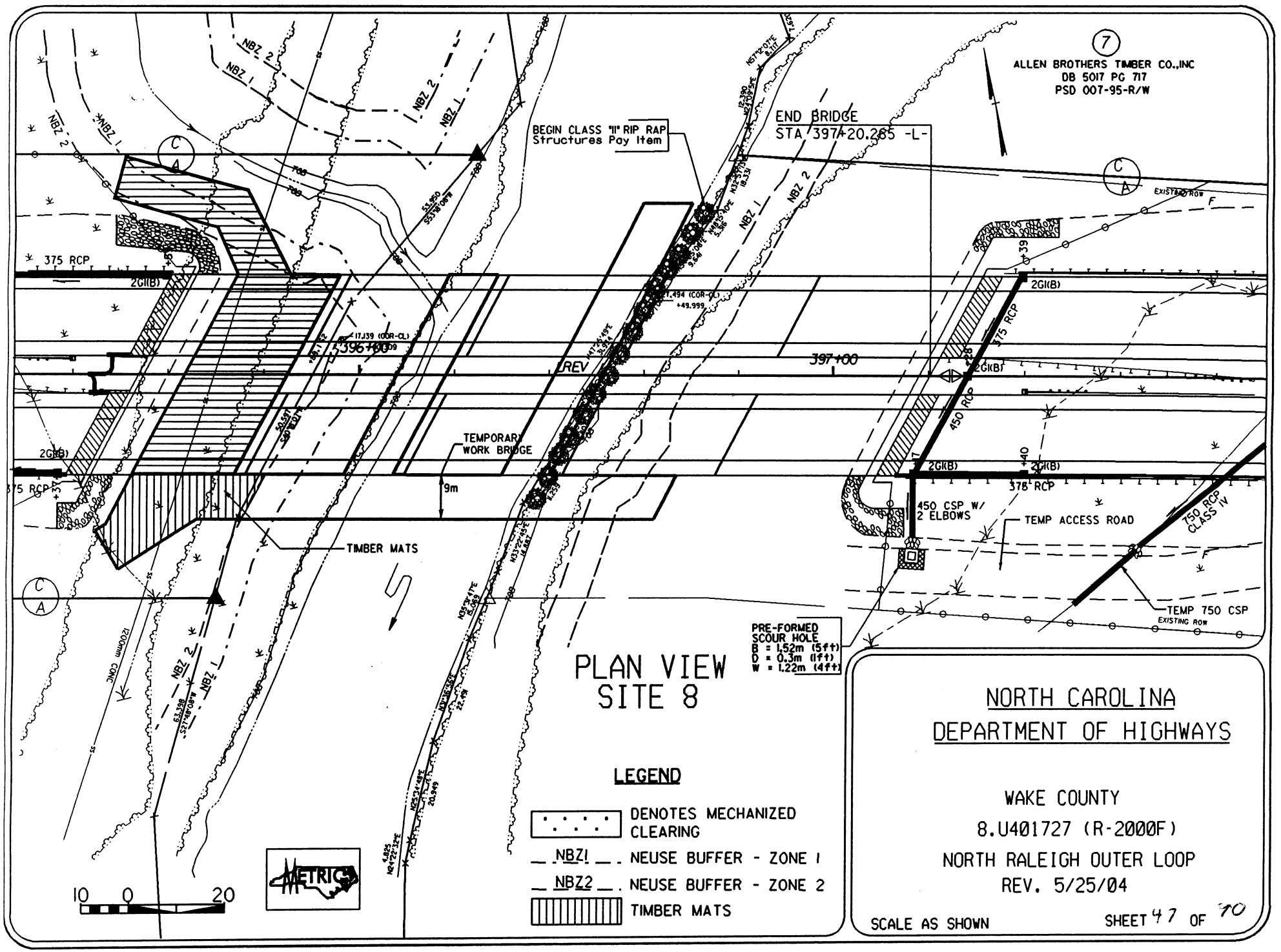
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 07/19/04

SHEET 43 OF 90

DATE
TIME
FILE



PLAN VIEW
SITE 8

LEGEND

- DENOTES MECHANIZED CLEARING
- NBZ1 . NEUSE BUFFER - ZONE 1
- NBZ2 . NEUSE BUFFER - ZONE 2
- TIMBER MATS

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY

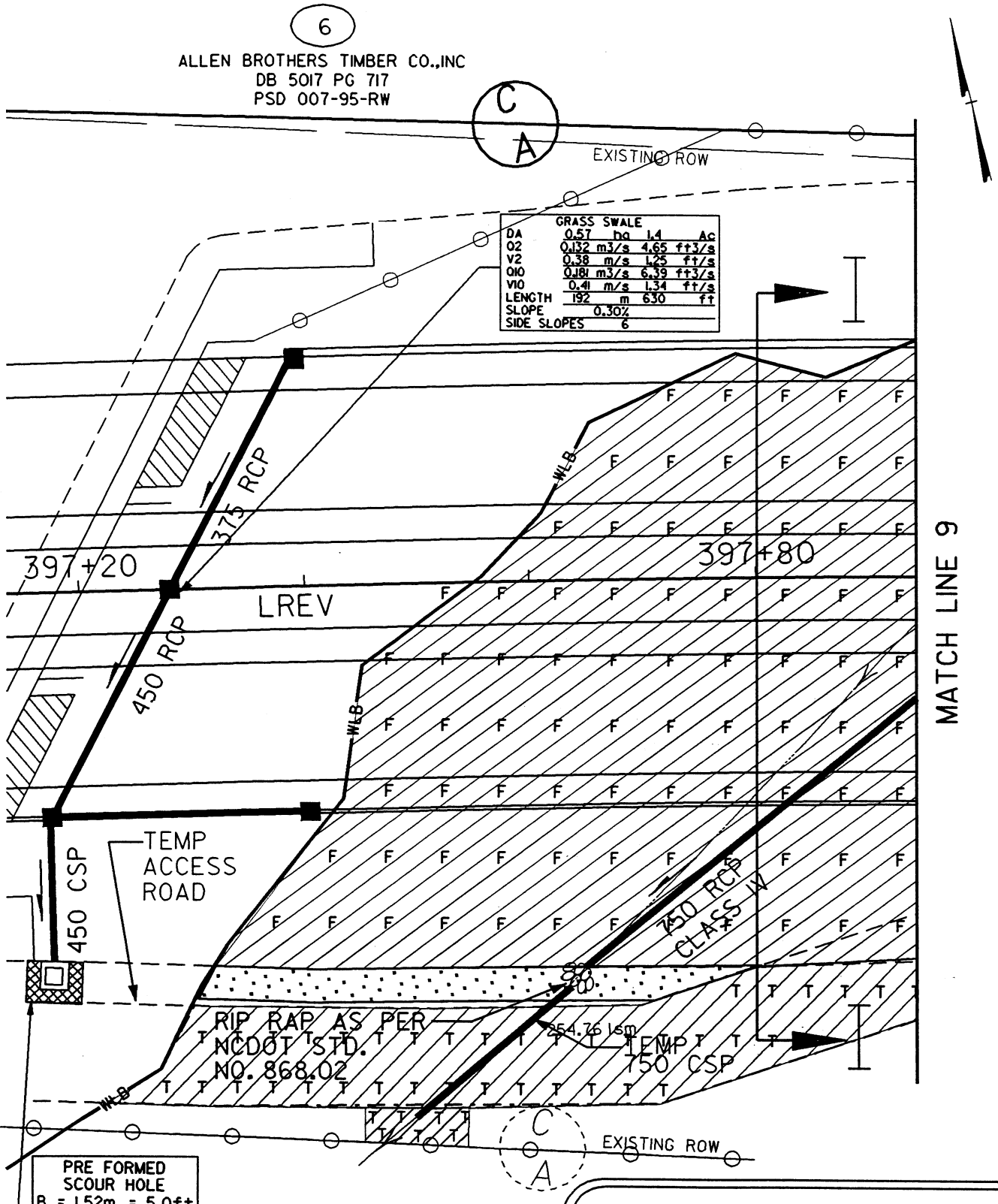
8.U401727 (R-2000F)

NORTH RALEIGH OUTER LOOP

REV. 5/25/04

SCALE AS SHOWN

SHEET 47 OF 70



PRE FORMED SCOUR HOLE
B = 1.52m = 5.0ft
D = 0.33m = 1.0ft
W = 1.22m = 4.0ft
d = 0.15m = 0.5ft

PLAN VIEW SITE 9

LEGEND

—WLB— WETLAND

F F DENOTES FILL IN WETLAND

T T DENOTES TEMPORARY FILL IN WETLAND

DENOTES MECHANIZED CLEARING

METRIC

5 0 10

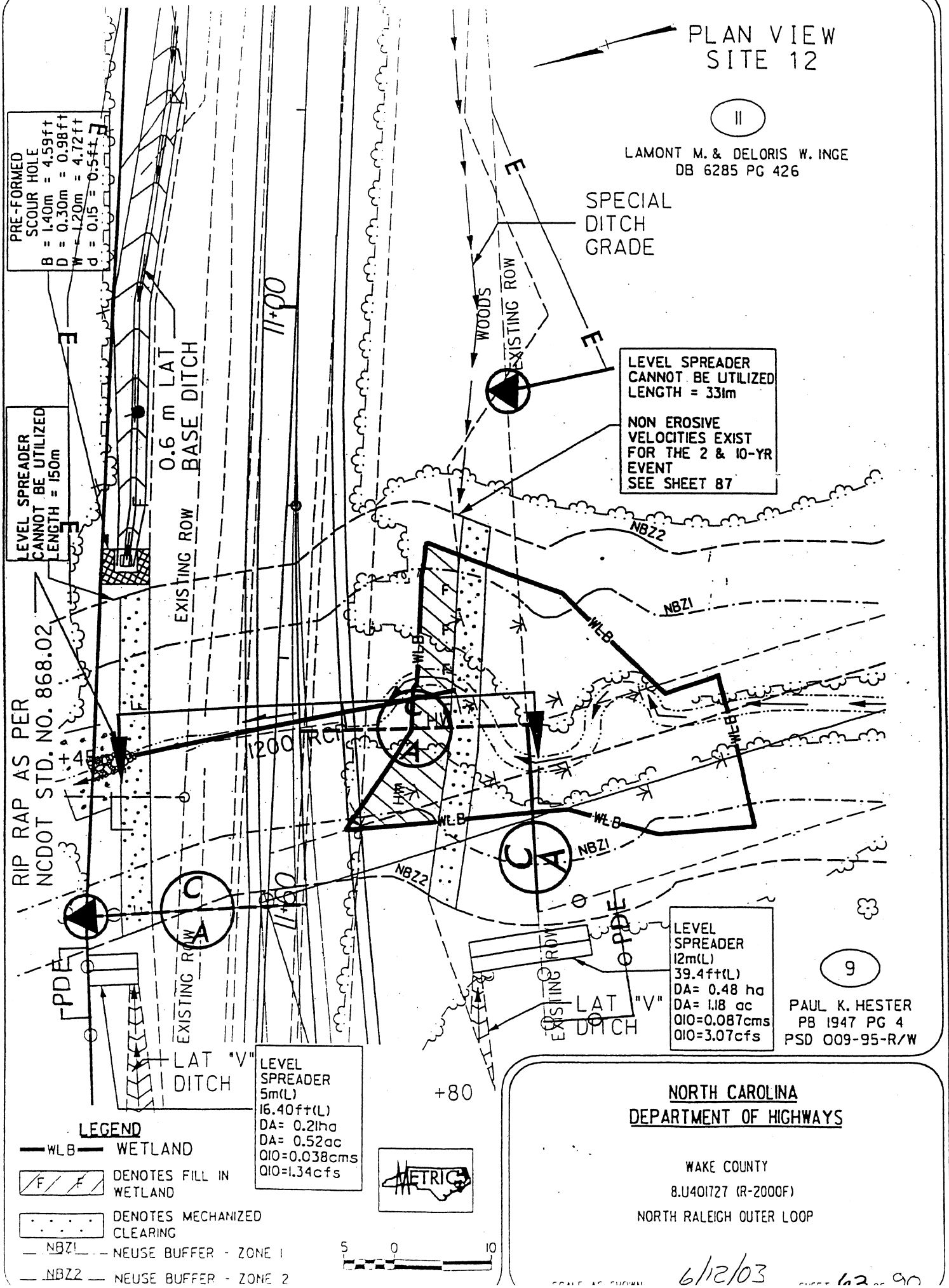
NORTH CAROLINA DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

REV. 05/17/04

SCALE AS SHOWN

SHEET 48 OF 90


PLAN VIEW
SITE 12
II
LAMONT M. & DELORIS W. INGE
DB 6285 PG 426
SPECIAL DITCH GRADE
PRE-FORMED SCOUR HOLE
B = 1.40m = 4.59ft
D = 0.30m = 0.98ft
W = 1.20m = 4.72ft
d = 0.15 = 0.5ft
LEVEL SPREADER CANNOT BE UTILIZED LENGTH = 150m
LEVEL SPREADER CANNOT BE UTILIZED LENGTH = 331m
NON EROSIVE VELOCITIES EXIST FOR THE 2 & 10-YR EVENT SEE SHEET 87
0.6 m LAT BASE DITCH
EXISTING ROW
WOODS
11+00
12+00
+45
+80
RIP RAP AS PER NCDOT STD. NO. 868.02
1200 RCP
PDE
LAT "V" DITCH
LEVEL SPREADER 5m(L) 16.40ft(L) DA= 0.21ha DA= 0.52ac Q10=0.038cms Q10=1.34cfs
LEVEL SPREADER 12m(L) 39.4ft(L) DA= 0.48 ha DA= 1.18 ac Q10=0.087cms Q10=3.07cfs
9
PAUL K. HESTER
PB 1947 PG 4
PSD 009-95-R/W
NBZ1
NBZ2
WL-B
LEGEND
WETLAND
DENOTES FILL IN WETLAND
DENOTES MECHANIZED CLEARING
NEUSE BUFFER - ZONE 1
NEUSE BUFFER - ZONE 2
METRIC
5 0 10
NORTH CAROLINA
DEPARTMENT OF HIGHWAYS
WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP
6/12/03
SHEET 43 OF 90

R-2000F PERMIT MODIFICATION IMPACTS

SITE	PROJECT STATION	STRUCTURE TYPE	WETLAND IMPACTS				SURFACE WATER IMPACTS						FILL / EXCAVATION IN BUFFERS		
			FILL IN WETLANDS (acre)	TEMPORARY FILL IN WETLANDS (acre)	EXCAVATION IN WETLANDS (acre)	MECHANIZED CLEARING IN WETLANDS (METHOD) (acre)	FILL IN SURFACE WATERS (NATURAL) (acre)	FILL IN SURFACE WATERS (POND) (acre)	TEMP FILL IN SW (acre)	LENGTH OF EXISTING CHANNEL IMPACTED (ft)	RELOCATED CHANNEL (ft)	ENCLOSED CHANNEL (ft)	ZONE 1 (acre)	ZONE 2 (acre)	MECH CLEAR (acre)
2	361+95 L-REV ORG.	750 RCP											0.357	0.209	0.069
2	361+95 L-REV ADD.	750 RCP											0.0022 E	0.0022 E	0.062
2	361+95 L-REV NEW	750 RCP											0.358	0.213	0.131
3	369+80 L-REV ORG.		0.166			0.018	0.253			779	459	279	1.169	0.729	0.357
3	369+80 L-REV ADD.														0.015
3	369+80 L-REV NEW														0.638
5	378+60 L-REV ORG.	1200 RCP	0.069		0.158	0.038	0.017	2.60943283		164			3.480	0.425	0.181
5	378+60 L-REV ADD.	1200 RCP													0.002
5	378+60 L-REV NEW	1200 RCP													0.183
6	387+00 L-REV ORG.	1350 RCP 1.8 x 2.1 RCBC	1.347		0.674	0.102	0.099			447	69	360	1.002	0.318	0.132
6	387+00 L-REV ADD.	1350 RCP 1.8 x 2.1 RCBC											-0.004	-0.006	0.009
6	387+00 L-REV NEW	1350 RCP 1.8 x 2.1 RCBC											0.998	0.312	0.245
8	395+40 L-REV ORG.	Neuse	0.465	0.208 **		0.076 *							0.000		
8	395+40 L-REV ADD.	Neuse		0.121 **									0.166 E		
8	395+40 L-REV NEW	Neuse		0.329 **									0.166 E		
8	395+40 L-REV ORG.	Trib													0.007
8	395+40 L-REV ADD.	Trib		0.084 **											
8	395+40 L-REV NEW	Trib		0.084 **											
9	397+80 L-REV ORG.	750 RCP	1.228	0.158		0.063									
9	397+80 L-REV ADD.	750 RCP		0.008											
9	397+80 L-REV NEW	750 RCP		0.166											

* ADDITIONAL 0.62 ACRE HAND CLEARED, NOT A JURISDICTIONAL ACTION. AN ADDITIONAL 0.09 AC. WILL BE HAND CLEARED FOR THE EXTENSION OF THE TIMBER MAT IN WETLANDS AND BUFFERS. NEW TOTAL HAND CLEARING = 0.71 AC.
** TEMPORARY IMPACT FOR TIMBER MATS IN WETLANDS
ALLOWABLE IMPACTS FOR TIMBER MATS IN RIPARIAN BUFFERS: ZONE 1 = 0.027 ACRE ZONE 2 = 0.057 ACRE E= Excavation

sheet 76 of 90

Revised
8/6/04

R-2000F PERMIT MODIFICATION
BUFFER IMPACTS

SITE	PROJECT STATION	STRUCTURE TYPE	MECH CLEAR ZONE 1 (acre)	MECH CLEAR ZONE 2 (acre)	WETLAND MECH CLEAR ZONE 1 (acre)	WETLAND MECH CLEAR ZONE 2 (acre)
2	361+95 L-REV ORG.	750 RCP	0.042	0.027		
2	361+95 L-REV CHG.	750 RCP	0.037	0.024		
2	361+95 L-REV NEW	750 RCP	0.079	0.052		
3	369+80 L-REV ORG.		0.446	0.177	0.006	0.006
3	369+80 L-REV CHG.		0.008	0.007	-	-
3	369+80 L-REV NEW		0.452	0.185	-	-
5	378+60 L-REV ORG.	1200 RCP	0.139	0.042	0.032	0.007
5	378+60 L-REV CHG.	1200 RCP	0.002	-	-	-
5	378+60 L-REV NEW	1200 RCP	0.141	-	-	-
6	387+00 L-REV ORG.	1350 RCP 1.8 x 2.1 RCBC	0.174	0.062	0.134	0.024
6	387+00 L-REV CHG.	1350 RCP 1.8 x 2.1 RCBC	0.002	0.006	-	-
6	387+00 L-REV NEW	1350 RCP 1.8 x 2.1 RCBC	0.175	0.069	-	-
8	395+40 L-REV ORG.	Neuse	0.268 ***	0.165 ***	0.106 ***	0.081 ***
8	395+40 L-REV CHG.	Neuse	-0.109 ***	-0.023 ***	-	-
8	395+40 L-REV NEW	Neuse	0.190 ***	-	-	-
8	395+40 L-REV ORG.	Trib	0.000	0.007	0.000	0.007
8	395+40 L-REV CHG.	Trib	-	-	-	-
8	395+40 L-REV NEW	Trib	-	-	-	-
8	395+40 L-REV ORG.	Trib	0.006 ***	0.033 ***	0.006 ***	0.033 ***
8	395+40 L-REV CHG.	Trib	0.027 ***	0.057 ***	0.027 ***	0.057 ***
8	395+40 L-REV NEW	Trib	0.032 ***	0.091 ***	0.032 ***	0.091 ***

*** HAND CLEARING - NOT A JURISDICTIONAL ACTION

Revised
7/13/04

R-2000F PERMIT MODIFICATION IMPACTS

SITE	PROJECT STATION	STRUCTURE TYPE	WETLAND IMPACTS				SURFACE WATER IMPACTS						FILL / EXCAVATION IN BUFFERS		
			FILL IN WETLANDS (ha)	TEMPORARY FILL IN WETLANDS (ha)	EXCAVATION IN WETLANDS (ha)	MECHANIZED CLEARING IN WETLANDS (METHOD) (ha)	FILL IN SURFACE WATERS (NATURAL) (ha)	FILL IN SURFACE WATERS (POND) (ha)	TEMP FILL IN SW (ha)	LENGTH OF EXISTING CHANNEL IMPACTED (m)	RELOCATED CHANNEL (m)	ENCLOSED CHANNEL (m)	ZONE 1 (ha)	ZONE 2 (ha)	MECH CLEAR (ha)
2	361+95 L-REV ORG.	750 RCP											0.144	0.085	0.028
2	361+95 L-REV ADD.	750 RCP											0.0009 E	0.0009 E	0.025
2	361+95 L-REV NEW	750 RCP											0.145	0.086	0.053
3	369+80 L-REV ORG.		0.067			0.010	0.102			323	140	85	0.613	0.295	0.252
3	369+80 L-REV ADD.														0.006
3	369+80 L-REV NEW														0.258
5	378+60 L-REV ORG.	1200 RCP	0.028		0.064	0.016	0.007	1.056		50			1.408	0.172	0.073
5	378+60 L-REV ADD.	1200 RCP													0.001
5	378+60 L-REV NEW	1200 RCP													0.074
6	387+00 L-REV ORG.	1350 RCP 1.8 x 2.1 RCBC	0.545		0.280	0.079	0.040			217	21	178	0.405	0.232	0.095
6	387+00 L-REV ADD.	1350 RCP 1.8 x 2.1 RCBC											-0.002	-0.002	0.004
6	387+00 L-REV NEW	1350 RCP 1.8 x 2.1 RCBC											0.403	0.230	0.099
8	395+40 L-REV ORG.	Neuse	0.188	0.084 **		0.031 *							0.000		
8	395+40 L-REV ADD.	Neuse		0.049 **									0.067 E		
8	395+40 L-REV NEW	Neuse		0.133 **									0.067 E		
8	395+40 L-REV ORG.	Trib													0.003
8	395+40 L-REV ADD.	Trib		0.034 **											
8	395+40 L-REV NEW	Trib		0.034 **											
9	397+80 L-REV ORG.	750 RCP	0.497	0.064		0.025									
9	397+80 L-REV ADD.	750 RCP		0.003											
9	397+80 L-REV NEW	750 RCP		0.067											

* ADDITIONAL 0.25 HA HAND CLEARED, NOT A JURISDICTIONAL ACTION. AN ADDITIONAL 0.037 HA WILL BE HAND CLEARED FOR THE EXTENSION OF THE TIMBER MAT IN WETLANDS AND BUFFERS. NEW TOTAL HAND CLEARING = 0.287 HA
** TEMPORARY IMPACT FOR TIMBER MATS IN WETLANDS
ALLOWABLE IMPACTS FOR TIMBER MATS IN RIPARIAN BUFFERS: ZONE 1 = 0.011 HA ZONE 2 = 0.023 HA

sheet 76B of 90

Revised

8/6/04

R-2000F PERMIT MODIFICATION
BUFFER IMPACTS

SITE	PROJECT STATION	STRUCTURE TYPE	MECH CLEAR ZONE 1 (ha)	MECH CLEAR ZONE 2 (ha)	WETLAND MECH CLEAR ZONE 1 (ha)	WETLAND MECH CLEAR ZONE 2 (ha)
2	361+95 L-REV ORG.	750 RCP	0.017	0.011		
2	361+95 L-REV CHG.	750 RCP	0.015	0.010		
2	361+95 L-REV NEW	750 RCP	0.032	0.021		
3	369+80 L-REV ORG.		0.180	0.072	0.002	0.002
3	369+80 L-REV CHG.		0.003	0.003	-	-
3	369+80 L-REV NEW		0.183	0.075	-	-
5	378+60 L-REV ORG.	1200 RCP	0.056	0.017	0.013	0.003
5	378+60 L-REV CHG.	1200 RCP	0.001	-	-	-
5	378+60 L-REV NEW	1200 RCP	0.057	-	-	-
6	387+00 L-REV ORG.	1350 RCP 1.8 x 2.1 RCBC	0.070	0.025	0.054	0.010
6	387+00 L-REV CHG.	1350 RCP 1.8 x 2.1 RCBC	0.001	0.003	-	-
6	387+00 L-REV NEW	1350 RCP 1.8 x 2.1 RCBC	0.071	0.028	-	-
8	395+40 L-REV ORG.	Neuse	0.108 ***	0.067 ***	0.043 ***	0.033 ***
8	395+40 L-REV CHG.	Neuse	-0.044 ***	-0.009 ***	-	-
8	395+40 L-REV NEW	Neuse	0.077 ***	-	-	-
8	395+40 L-REV ORG.	Trib	0.000	0.003	0.000	0.003
8	395+40 L-REV CHG.	Trib	-	-	-	-
8	395+40 L-REV NEW	Trib	-	-	-	-
8	395+40 L-REV ORG.	Trib	0.002 ***	0.014 ***	0.002 ***	0.014 ***
8	395+40 L-REV CHG.	Trib	0.011 ***	0.023 ***	0.011 ***	0.023 ***
8	395+40 L-REV NEW	Trib	0.013 ***	0.037 ***	0.013 ***	0.037 ***

*** HAND CLEARING - NOT A JURISDICTIONAL ACTION

sheet 160 of 190

Revised

7/13/04

R-2000F Wake Co. Affected Buffer Areas — Site # 12

Date: 6/11/2003
Dsn. By: RKW
Check: RKW

Discharge is considered to be treated if it meets the following criteria:
100 ft. of grass swale for every 1 acre of drainage area. AND
2 yr. velocity is less than or equal to 2 ft./sec.

				Total D.A.		Required length for treatment		Actual	Channel	Side	Treated	Q2	Q2 vel.	Q10	Q10 vel.	Treatment	
SHT.	Structure	Station	Type	ha	(ac)	(ft.)	(m.)	Length (m)	Slope (m/m)	Slopes	Discharge?	cfs	fps	cfs	fps	Provided	Remarks
20		11+20L Y1	DITCH	2.00	4.9	494.2	151	151 *Exist	0.01	3	YES	11.65	1.78	16.02	1.93	Wetlands	
20		11+28R Y1	DITCH	0.90	2.2	222.4	68	126	0.048	6	YES	5.24	1.93	7.21	2.09	GS & PSH	
20		11+60L Y1R	DITCH	0.48	1.2	118.6	36	55	0.058	6	YES	2.80	1.78	3.85	1.93	LS	
21		11+60R Y1R	DITCH	0.21	0.5	51,9	16	35	0.074	6	YES	1.22	1.59	1.68	1.72	LS	

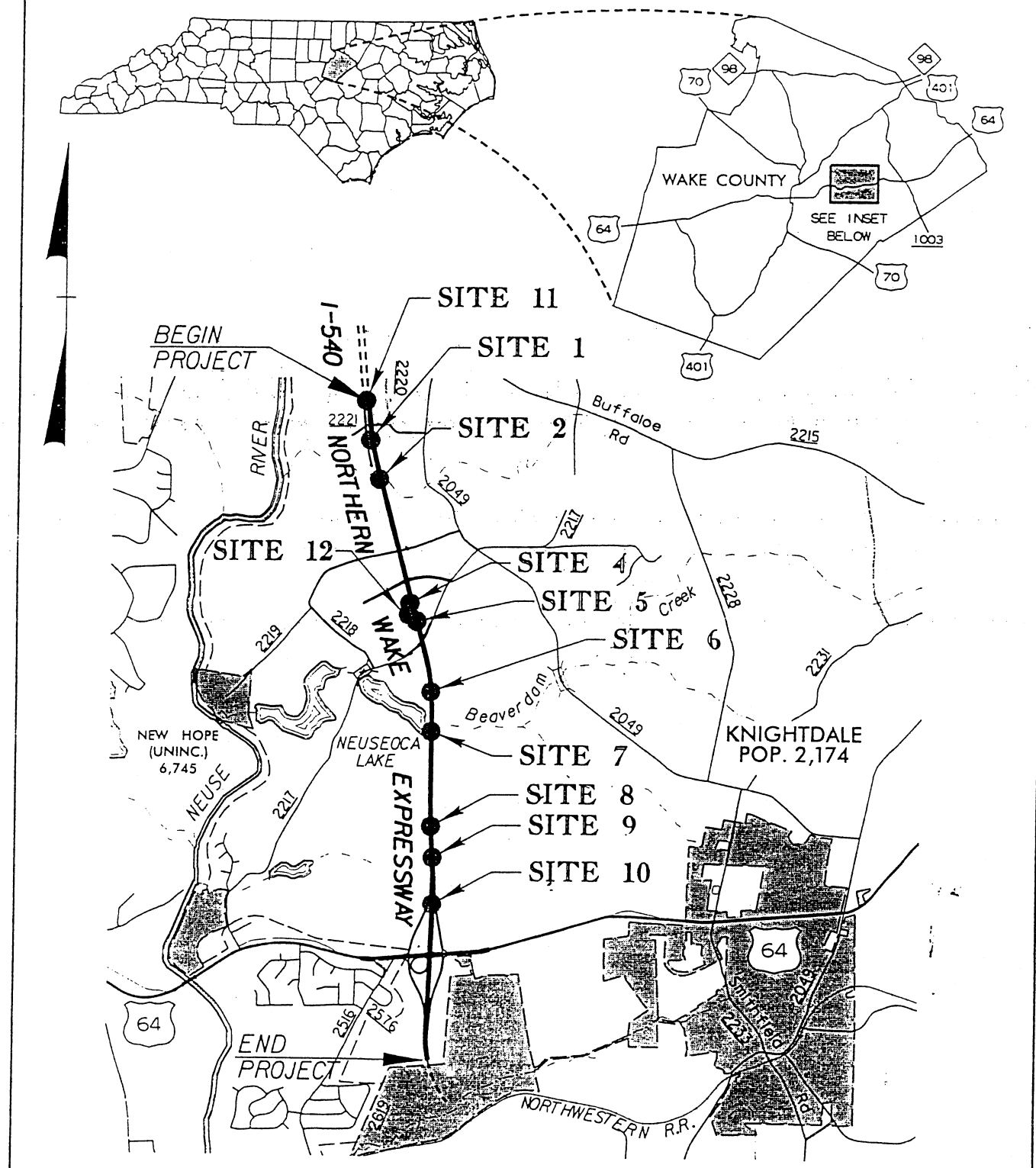
2GI = 2 GRATED INLET
SBG = SHOULDER BERM GUTTER
CB = CATCH BASIN
DDB = DRY DETENTION BASIN
B = BASIN
GS = GRASS SWALE

BDOS = BERM DRAINAGE OUTLET STRUCTURE
OTCB = OPEN THROAT CATCH BASIN
OPEN = OPEN END PIPE
PSH = PRE FORMED SCOUR HOLE
LS = LEVEL SPREADER
*EXIST = EXISTING DITCH LENGTH INCLUDED
151m = 120m OF PROPOSED SWALE + 31m OF EXISTING ROADWAY SWALE

NORTH CAROLINA
DEPARTMENT OF HIGHWAYS

WAKE COUNTY
8.U401727 (R-2000F)
NORTH RALEIGH OUTER LOOP

SCALE AS SHOWN 6/12/03 SHEET 87 OF 90



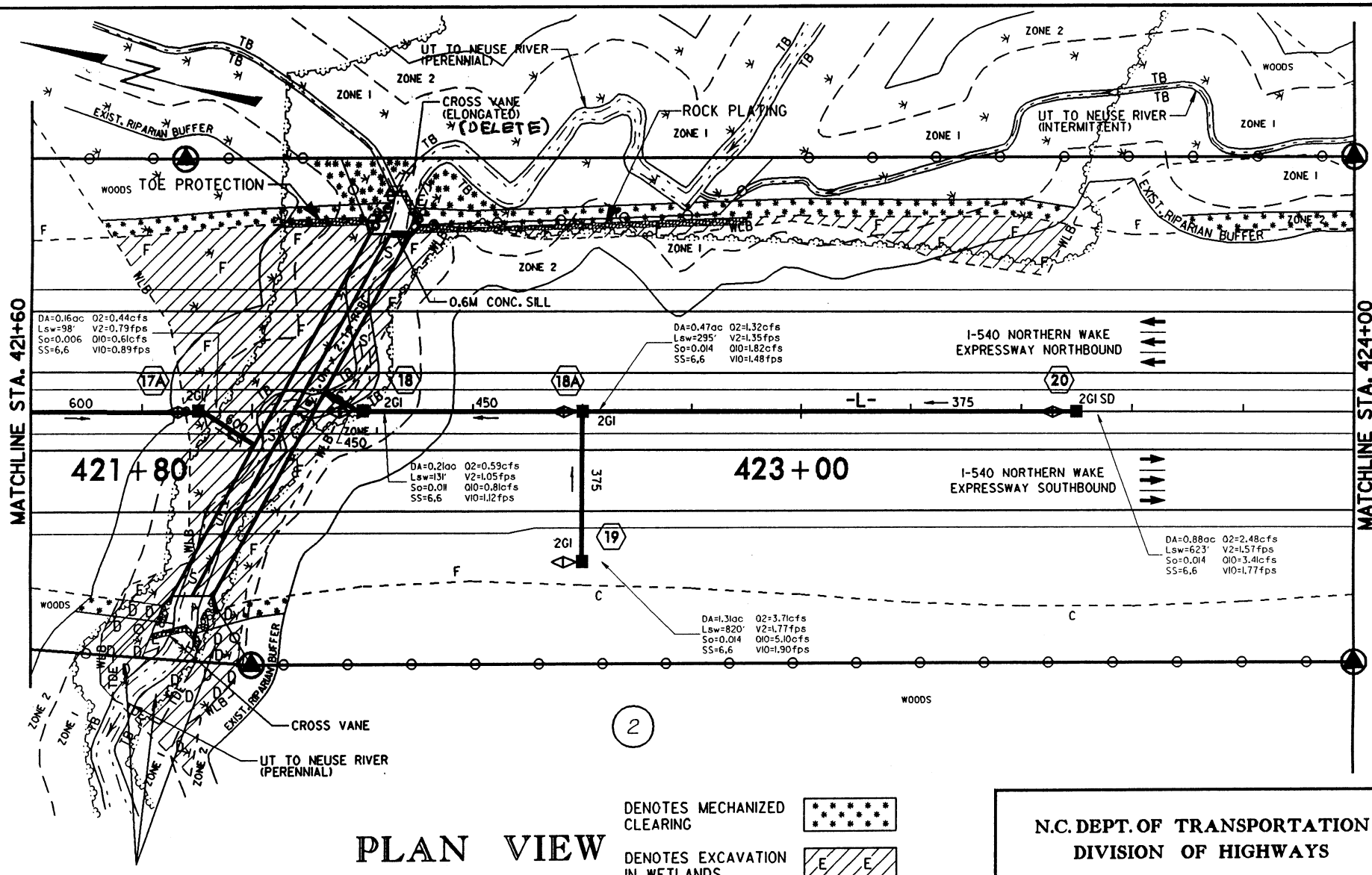
N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 1 OF 50

10/29/02



PLAN VIEW
SITE 2

THE PORTION OF THE WETLAND BOUNDARY FROM THE MECHANIZED CLEARING LINE OUT TO THE C/A FENCE INCLUDING THE LIMITS OF THE TDE ARE ACCOUNTED FOR AS IMPACTS TO BUFFER ZONE ONE. (0.021ha)

10 0 20

DENOTES MECHANIZED CLEARING

DENOTES EXCAVATION IN WETLANDS

DENOTES FILL IN WETLANDS

DENOTES FILL IN SURFACE WATERS

DENOTES DRAINED WETLANDS

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

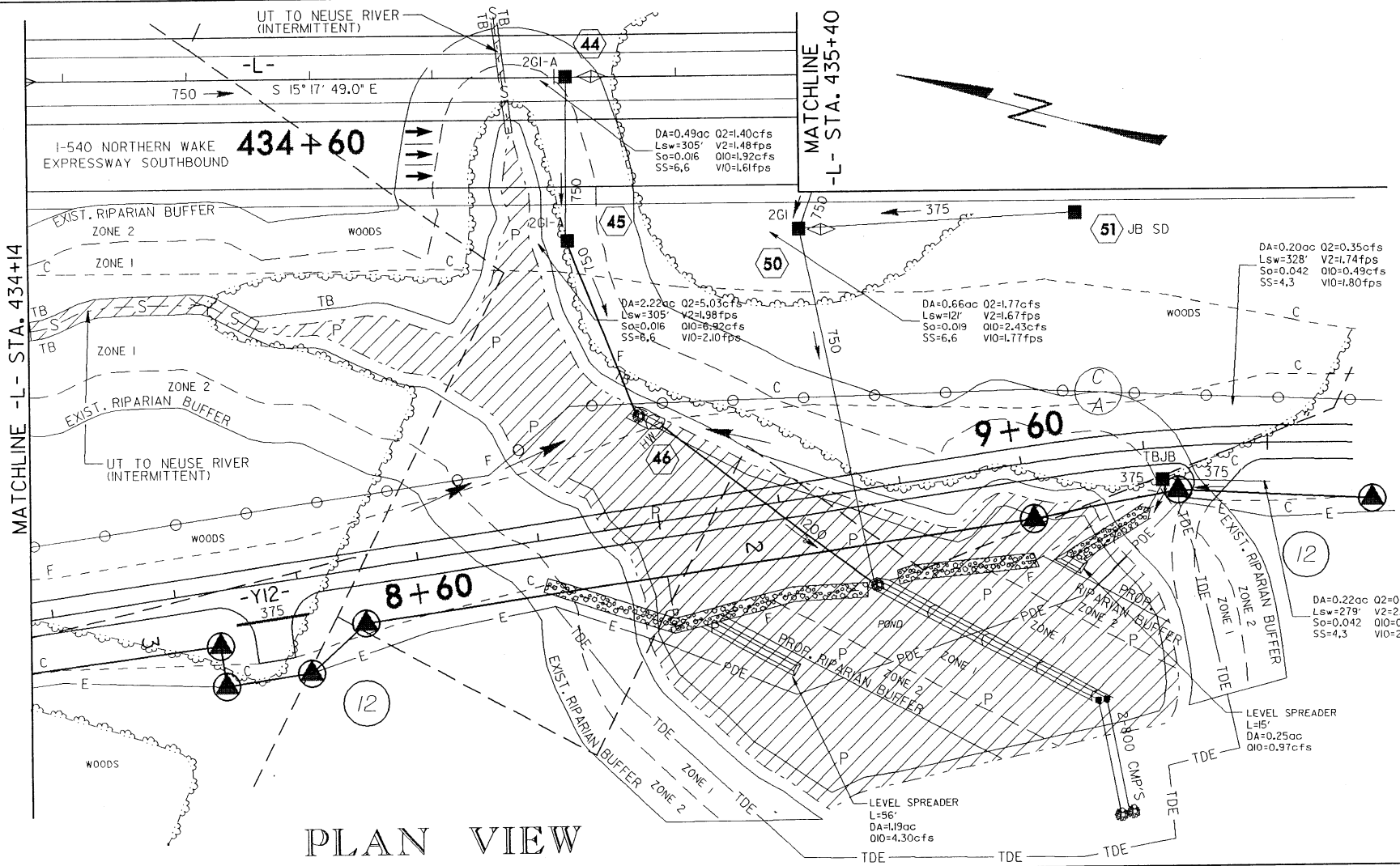
WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

Rev.

SHEET 9 OF 30

05/27/04



PLAN VIEW
SITE 12

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

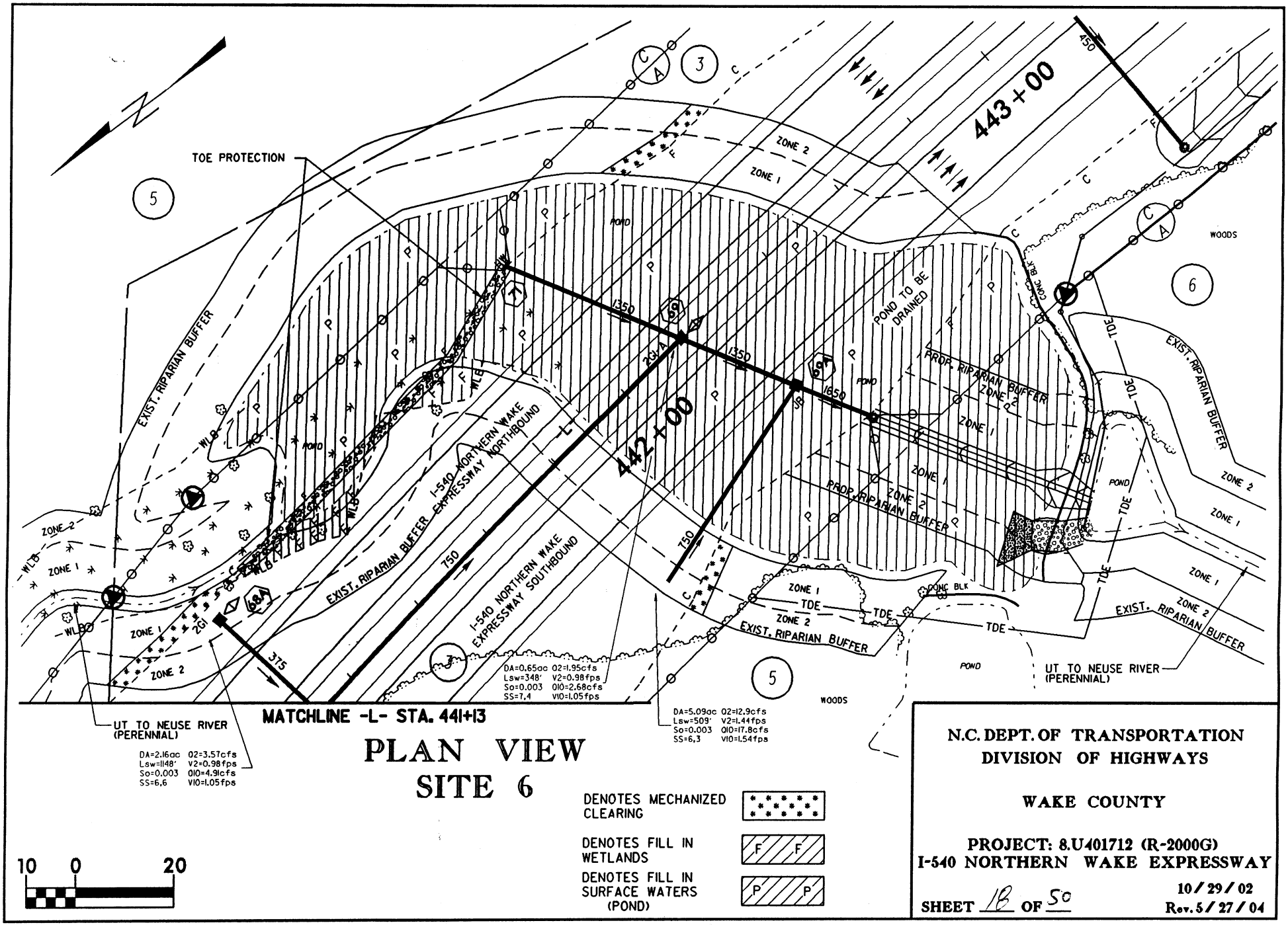
WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 14 OF 50

10/29/02

REVISED 3/4/04
REVISED 9/21/04



PLAN VIEW
SITE 6

DENOTES MECHANIZED CLEARING

DENOTES FILL IN WETLANDS

DENOTES FILL IN SURFACE WATERS (POND)

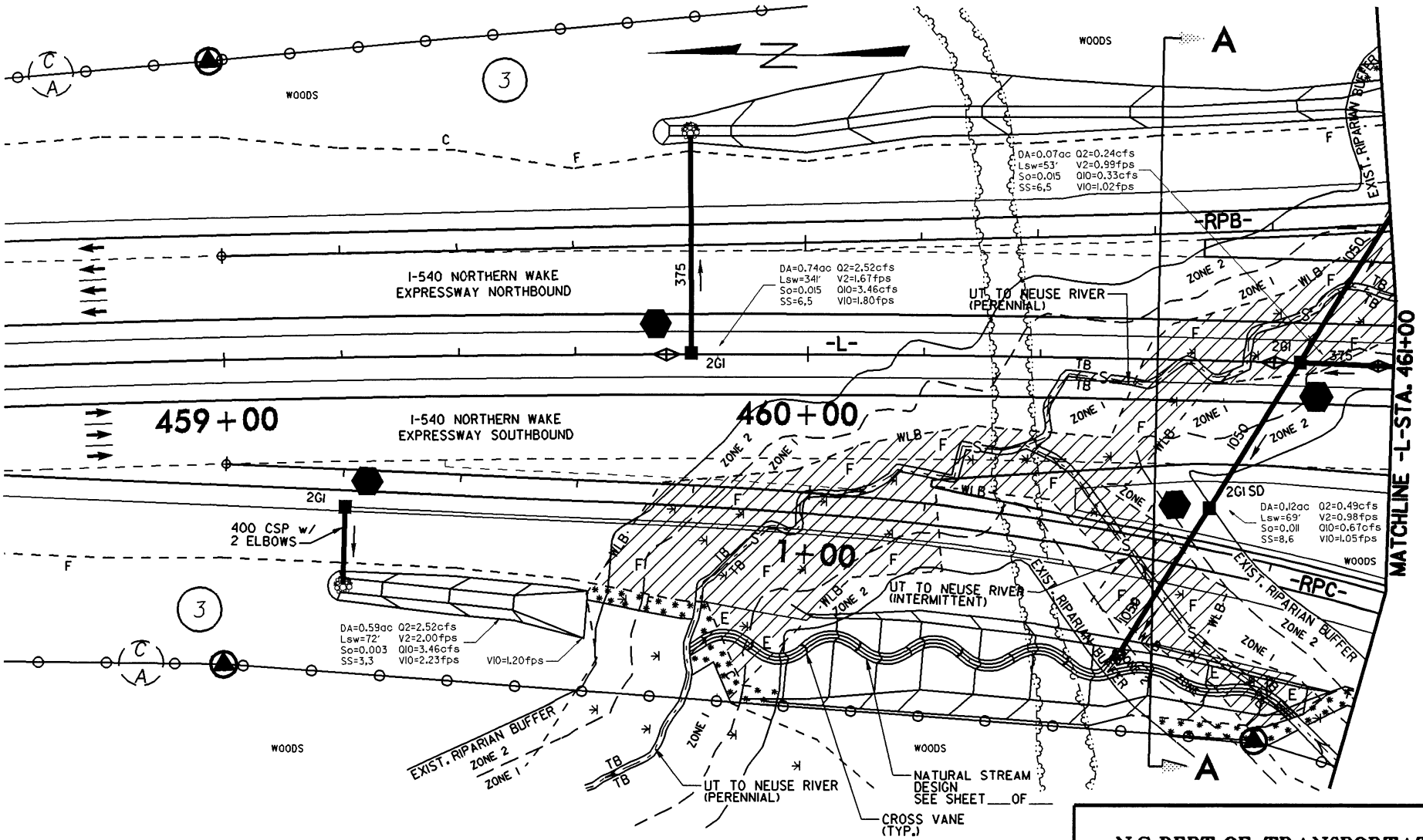
N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 18 OF 50

10/29/02
Rev. 5/27/04



PLAN VIEW
SITE 10

DENOTES MECHANIZED CLEARING

DENOTES FILL IN WETLANDS

DENOTES EXCAVATION IN WETLANDS

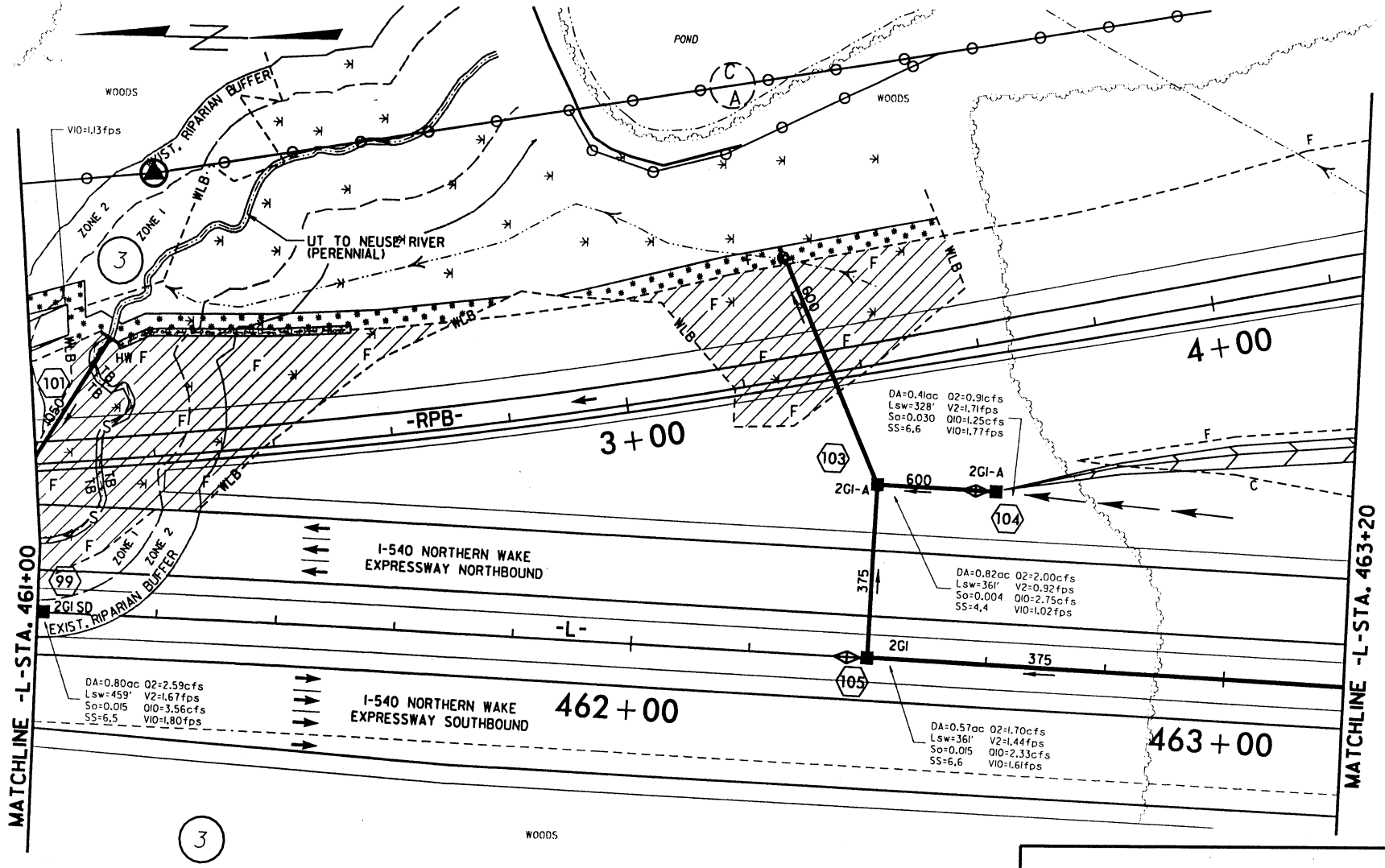
DENOTES FILL IN SURFACE WATERS

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 31 OF 50 **09/16/04**



PLAN VIEW
SITE 10

10 0 20

DENOTES MECHANIZED CLEARING

DENOTES FILL IN WETLANDS

DENOTES FILL IN SURFACE WATERS

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

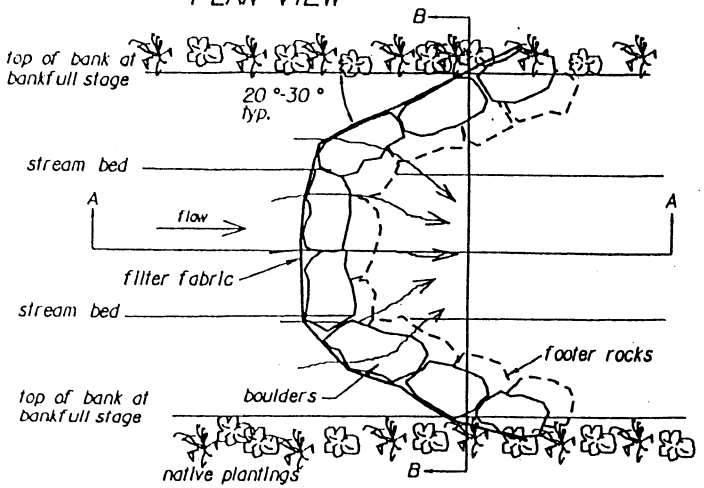
PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 32 OF 50

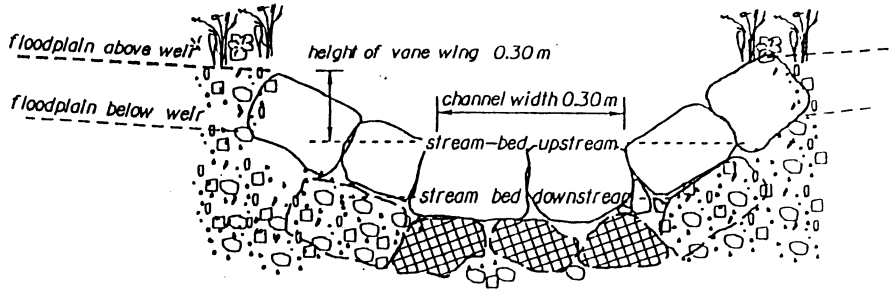
REV 1/14/04
10/29/02

CROSS VANE ROCK WEIR DETAIL

PLAN VIEW



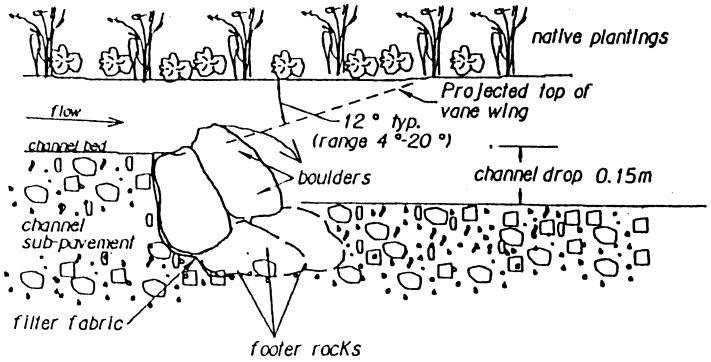
SECTION B-B



Note: Boulders should be native stone or shot rock, angular and oblong with axis approximately 0.30m in length

Note: Rocks should fit tightly.
Trim filter fabric flush with top of rocks.
When drop between upstream floodplain and downstream flood plain exceeds 0.3m, a boulder sill is recommended in the floodplain.

SECTION A-A



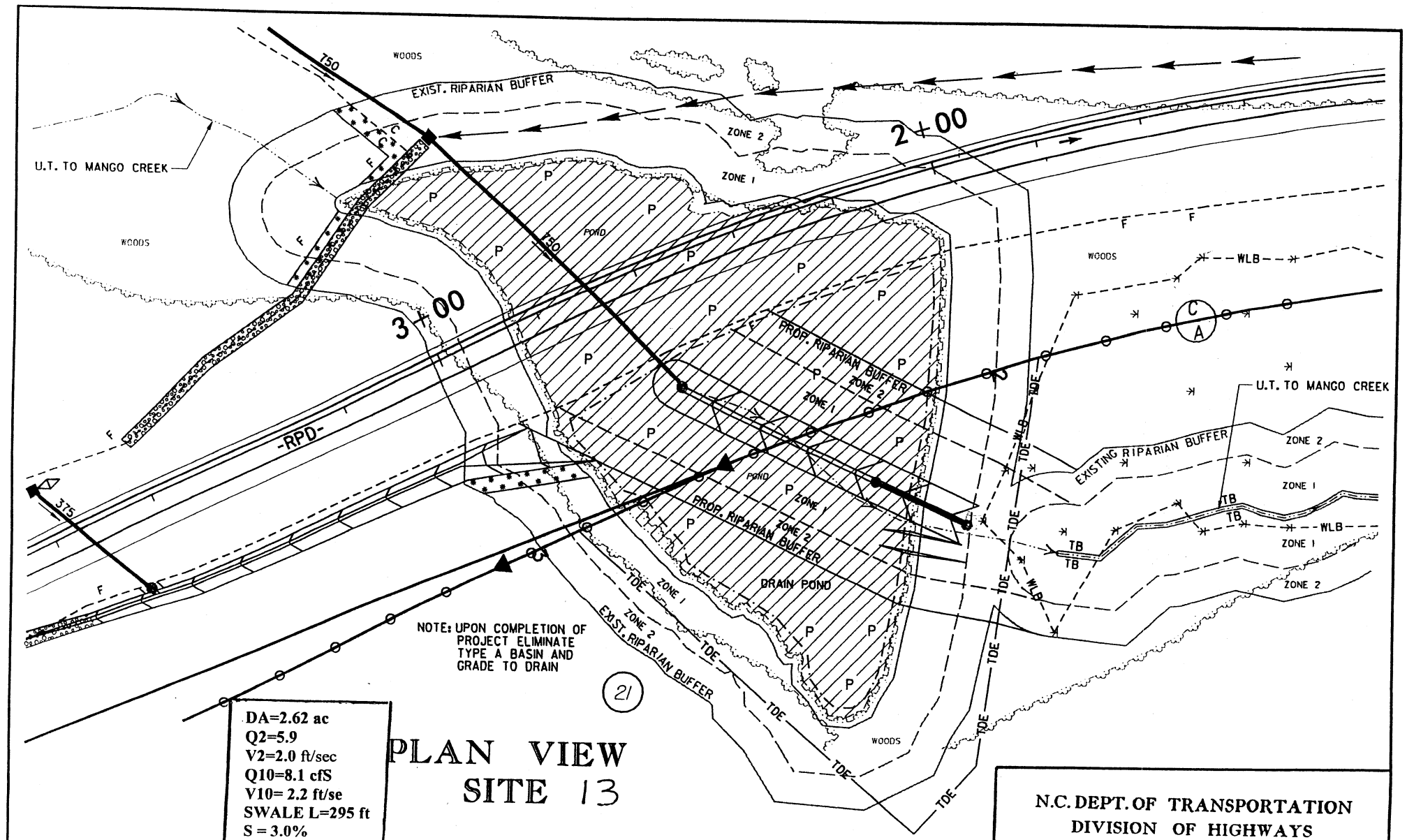
SITE 10

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 39 OF 50 8/27/03



PLAN VIEW
SITE 13

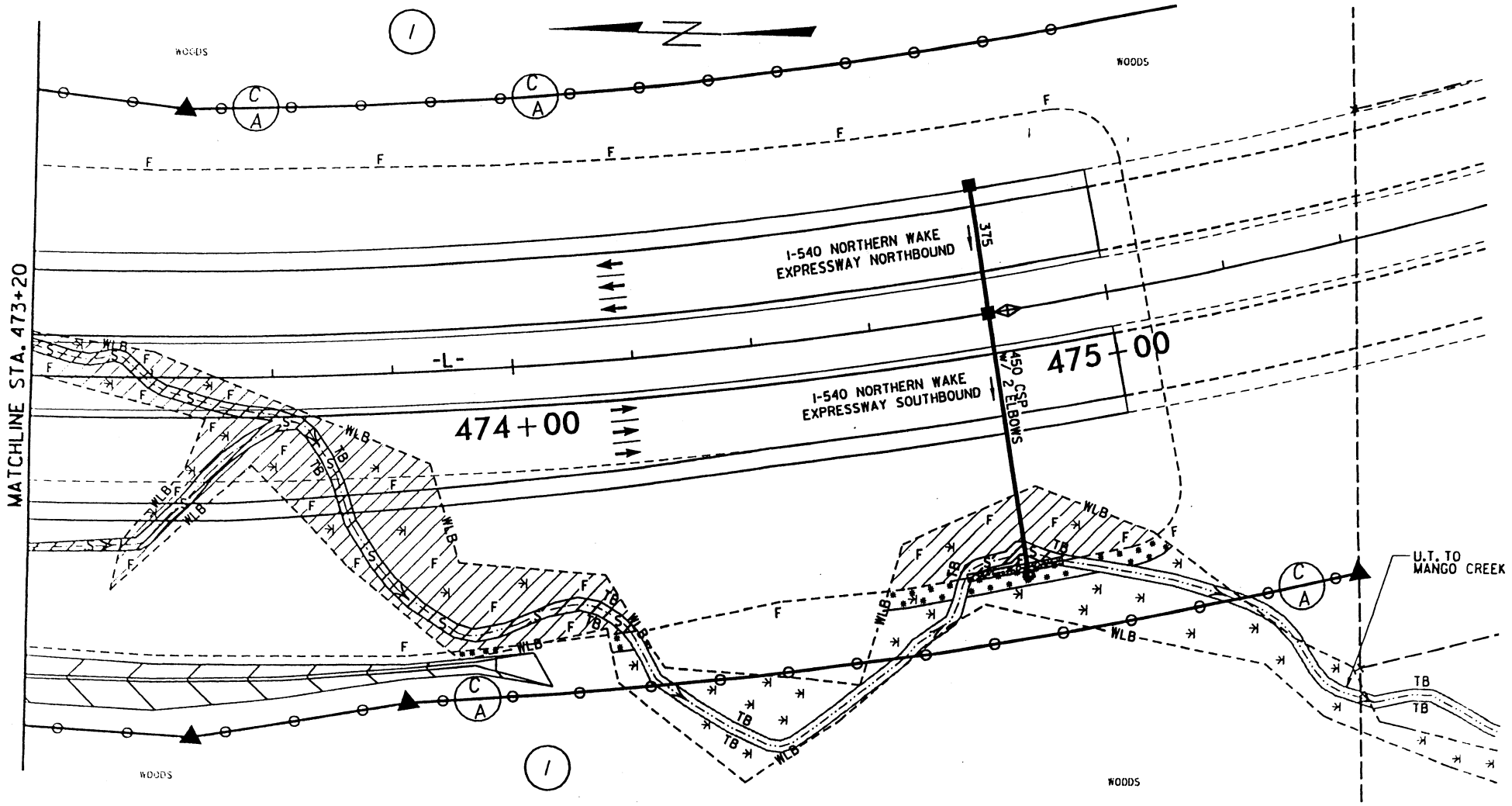
N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 39a OF 50

7/3/03



PLAN VIEW
SITE 14

DENOTES MECHANIZED CLEARING

DENOTES FILL IN WETLANDS

DENOTES FILL IN SURFACE WATERS

10 0 20

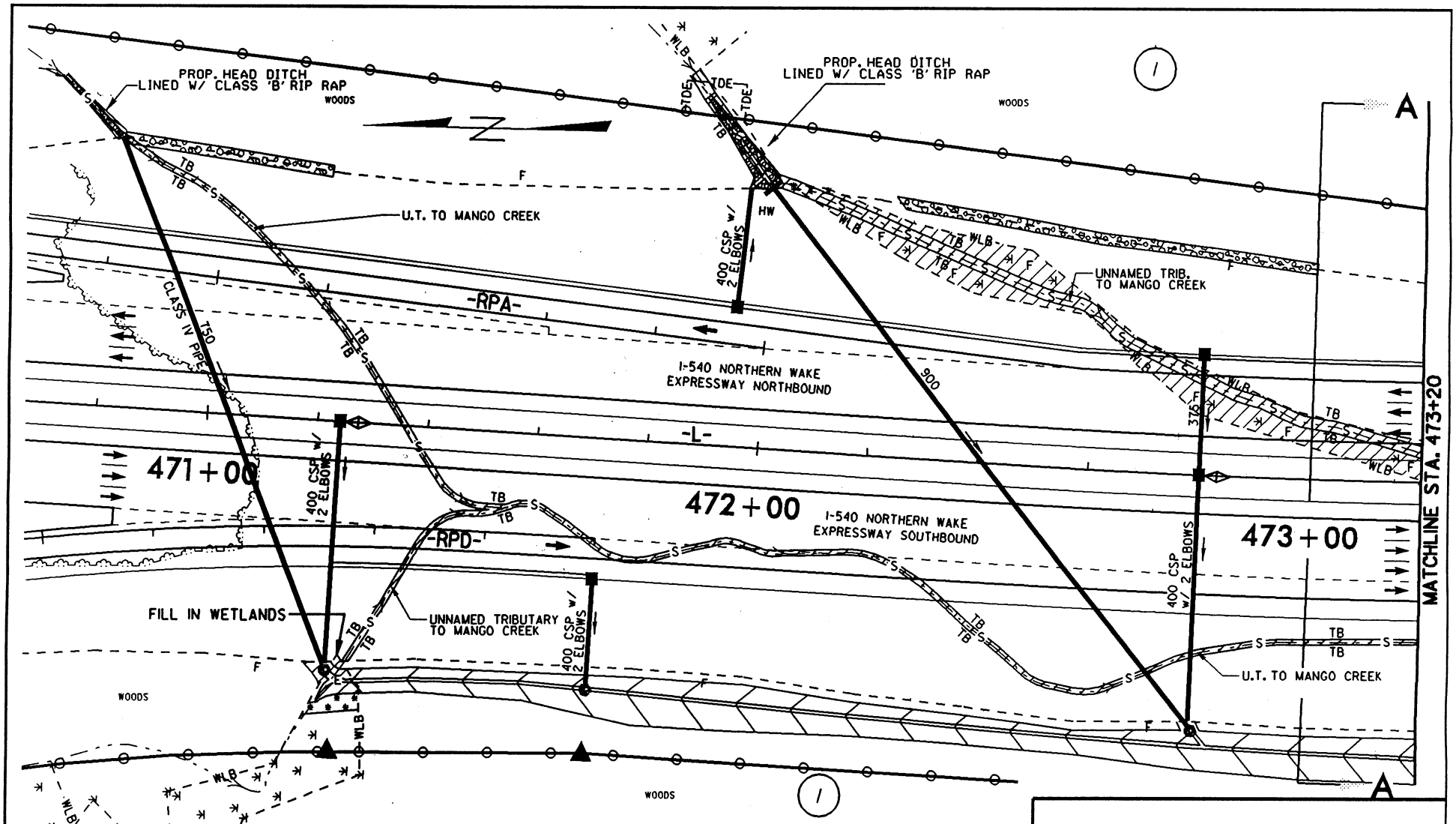
N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPRESSWAY

SHEET 396 OF 50

7/3/03



PLAN VIEW
SITE 14

DENOTES MECHANIZED CLEARING

DENOTES EXCAVATION IN WETLANDS

DENOTES FILL IN WETLANDS

DENOTES FILL IN SURFACE WATERS

10 0 20

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT:

REV. 05/14/04

SHEET 39C **OF** 50

7/3/03

IMPACT SUMMARY

			WETLAND IMPACTS					SURFACE WATER IMPACTS						BUFFER IMPACTS		
Site No.	Station (From / To)	Structure Size	Fill In Wetlands (ha)	Temp. Fill In Wetlands (ha)	Excavation In Wetlands (ha)	Isolated Wetland (ha)	Mechanized Clearing (Method III) (ha)	Fill In SW (Natural) (ha)	Fill In SW (Pond) (ha)	Temp. Fill In SW (ha)	Existing Channel Impacted (m)	Relocated Channel (m)	Enclosed Channel (m)	Zone 1 (ha)	Zone 2 (ha)	Mechanized Clearing (Method III) (ha)
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Approved Site Impacts	0.251 [1]	—	0.013	—	0.057	0.035	—	—	85.2	—	73.3	0.188	0.164	0.004
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Additional Site Impacts	—	—	—	—	—	—	—	—	—	—	—	—	—	0.038
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Total Revised Site Impacts	—	—	—	—	—	—	—	—	—	—	—	—	—	0.042
6	-L- 441+33L / -L- 422+78L	1350, 1650 Approved Site Impacts	0.013	—	—	—	0.002	—	0.852	—	—	—	—	0.374	0.263	0.021
6	-L- 441+33L / -L- 422+78L	1350, 1650 Additional Site Impacts	0.010	—	—	—	—	—	—	—	—	—	—	—	—	—
6	-L- 441+33L / -L- 422+78L	1350, 1650 Total Revised Site Impacts	0.023	—	—	—	—	—	—	—	—	—	—	—	—	—

[1] - This quantity contains 0.039 ha. of "Drained Wetlands".

Note: The additional 0.038 ha of mechanized clearing is exactly the same for wetlands and buffers.
For mitigation purposes, 0.038 ha should be used for the additional wetland mitigation since wetlands take precedence over buffers.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712
NCDOT T.I.P. NO: R-2000G

Rev
5/26/04

IMPACT SUMMARY

			WETLAND IMPACTS					SURFACE WATER IMPACTS						BUFFER IMPACTS		
Site No.	Station (From / To)	Structure Size	Fill In Wetlands (acre)	Temp. Fill In Wetlands (acre)	Excavation In Wetlands (acre)	Isolated Wetland (acre)	Mechanized Clearing (Method III) (acre)	Fill In SW (Natural) (acre)	Fill In SW (Pond) (acre)	Temp. Fill In SW (acre)	Existing Channel Impacted (ft)	Relocated Channel (ft)	Enclosed Channel (ft)	Zone 1 (acre)	Zone 2 (acre)	Mechanized Clearing (Method III) (acre)
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Approved Site Impacts	0.620 [1]	—	0.032	—	0.141	0.086	—	—	279.5	—	240.5	0.465	0.405	0.010
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Additional Site Impacts		—	—	—	0.094	—	—	—	—	—	—	—	—	0.094
2	-L- 421+85L / -L- 423+51L	2 @ 3.0 x 2.1 RCBC Total Revised Site Impacts		—	—	—	0.235	—	—	—	—	—	—	—	—	0.104
6	-L- 441+33L / -L- 422+78L	1350, 1650 Approved Site Impacts	0.032	—	—	—	0.005	—	2.105	—	—	—	—	0.924	0.650	0.052
6	-L- 441+33L / -L- 422+78L	1350, 1650 Additional Site Impacts	0.025	—	—	—	—	—	—	—	—	—	—	—	—	—
6	-L- 441+33L / -L- 422+78L	1350, 1650 Total Revised Site Impacts	0.057	—	—	—	—	—	—	—	—	—	—	—	—	—

[1] - This quantity contains 0.096 acre of "Drained Wetlands".

Note: The additional 0.094 acre of mechanized clearing is exactly the same for wetlands and buffers.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712
NCDOT T.I.P. NO: R-2000G

SHEET 40 A OF 50

Rev. 5/26/2004

IMPACT SUMMARY

Site No.	Station (From / To)	Structure Size	WETLAND IMPACTS: Fill In Wetlands (ha)	Temp. Fill In Wetlands (ha)	Excavation In Wetlands (ha)	Isolated Wetland (ha)	Mechanized Clearing (Method III) (ha)	SURFACE WATER IMPACTS: Fill In SW (Natural) (ha)	Fill In SW (Pond) (ha)	Temp. Fill In SW (ha)	Existing Channel Impacted (m)	Relocated Channel (m)	Enclosed Channel (m)	BUFFER IMPACTS: Zone 1 (ha)	Zone 2 (ha)	Mechanized Clearing (Method III) (ha)
9	-L- 456+64L / -L- 457+47R	1 @ 2.7 x 2.1 RCBC	0.185	—	—	—	0.007	—	0.212	—	—	—	—	0.155	0.100	0.015
10	-L- 459+61R / -L- 462+94R	1050, 750	0.607	—	0.042	0.092	0.085	0.045	—	—	388.2	95.0	158.5	0.601	0.364	0.030
13	Y5 RPA 4+17R/ Y5 RPA 4+41L	600	—	—	—	—	—	0.004	—	—	67.9	—	43.3	—	—	—
	Y5 RPD 2+00R Y5 RPD3+04 L	750	—	—	—	—	—	—	0.562	—	—	—	—	0.372	0.278	0.018
14	-L- 471+20R/ -L- 474+17R	1 @ 750, 1 @ 900	0.171	—	0.003	—	0.004	0.092	—	—	624.700	—	221.5	—	—	—
	-L- 474+57R/ -L- 475+22R	—	0.035	0.006	—	—	0.012	0.004	—	0.003	18.000	—	—	—	—	—
SHEET SUB TOTALS:			0.998	0.006	0.045	0.092	0.108	0.145	0.774	0.003	1098.8	95.0	423.300	1.128	0.742	0.062
PROJECT TOTALS:			2.423	0.006	0.274	0.092	0.327	0.224	2.550	0.003	1815.2	95.0	820.100	3.256	2.231	0.398

DENOTES DRAINING OF POND IMPACT.

DENOTES NO DEFINED CHANNEL.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712
NCDOT T.I.P. NO: R-2000G

7/3/03

NCDOT Project No. 8.U401712

T.I.P. No. R-2000G

Wake County, NC

I-540 Northern Wake Expressway

NATURAL STREAM DESIGN
UNNAMED TRIBUTARY TO THE NEUSE RIVER

Right of -L- Project Station 460+30

Prepared by:

TranSite Consulting Engineers, Inc.

1300 Paddock Drive, Suite G-10

Raleigh, NC 27609

NATURAL STREAM DESIGN

UNNAMED TRIBUTARY TO THE NEUSE RIVER

Right of -L- Project Station 460+30

The construction of I-540 (Northern Wake Expressway) from South of SR 2215 (Buffaloe Road) to South of US 64E, near Knightdale will require that a portion of an unnamed tributary to the Neuse River be relocated right of -L- Project Station 460+30. The proposed stream will be 85 meters (279') in length starting right of -L- Sta. 460+53 at the outlet of the proposed 750mm (30") RCP and continue downstream intersecting the existing stream right of -L- Sta. 459+80. The proposed stream is designed according to "Natural Channel" design principles proposed by Dave Rosgen.

This unnamed tributary to the Neuse River drains 19.4 hectares (47.9 acres) in eastern Wake County. Existing land use in the area is predominantly agricultural with some low density residential and commercial along existing US 64. Based on the Wake County Land Use Plan, future land uses within the drainage basin are expected to be commercial along US 64 with the remainder of the area low to medium density residential.

There is no hydraulic data available on this stream. Discharges were estimated using procedures outlined in The North Carolina Department of Transportation Metric Guidelines for Drainage Studies dated January 1995.

EXISTING STREAM

Two reaches of the existing stream were surveyed in detail to determine its morphological characteristics. Those characteristics include bankfull discharge, width, depth and area. The first reach surveyed was 50 meters (164') in length located upstream of a small confluence and downstream of an existing farm pond. The second reach surveyed was 60 meters (197') in length located just downstream of a soil road and 450mm (18") RCP. These reaches were chosen since they are portions of the stream that

will be lost due to construction of the proposed roadway. Normal flows in both stream reaches are controlled by the aforementioned farm pond. Of the total 19.4 hectare (47.9 acre) drainage area, 14.3 hectares (35.3 acres) drain through the 0.38 hectare (0.94 acre) pond. Due to the small size of the drainage area, it was determined that the NC Stream Restoration Institute's regional equations were not applicable to this site.

Based on the field survey data gathered, both stream reaches were classified as E5 streams. Pebble counts were not conducted for either stream reach since the bed material was found to be a fine to medium sand. The HEC-RAS computer model was used to determine the hydraulic characteristics of the stream such as velocity, shear stress and stream power. As a result the upstream pond and the relatively short distance to the area of concern, sediment loads in the stream are greatly reduced over what would be normally expected.

REFERENCE REACH

The proposed stream design is based on parameters from the existing stream reach and the reference stream reach for Sal's Branch. Due to the difference between the drainage area size of the existing reach and Sal's Branch, the ratios from Sal's Branch were primarily used in conjunction with the data from the existing reach to ensure that our design falls within the range of an E5b stream. Sal's Branch is located is western Wake County with a drainage area of 128 acres and a Rosgen Stream Classification of E4. Design and morphological data for the Existing, Reference and Proposed Streams are shown in "Morphological Measurement Table".

PROPOSED STREAM

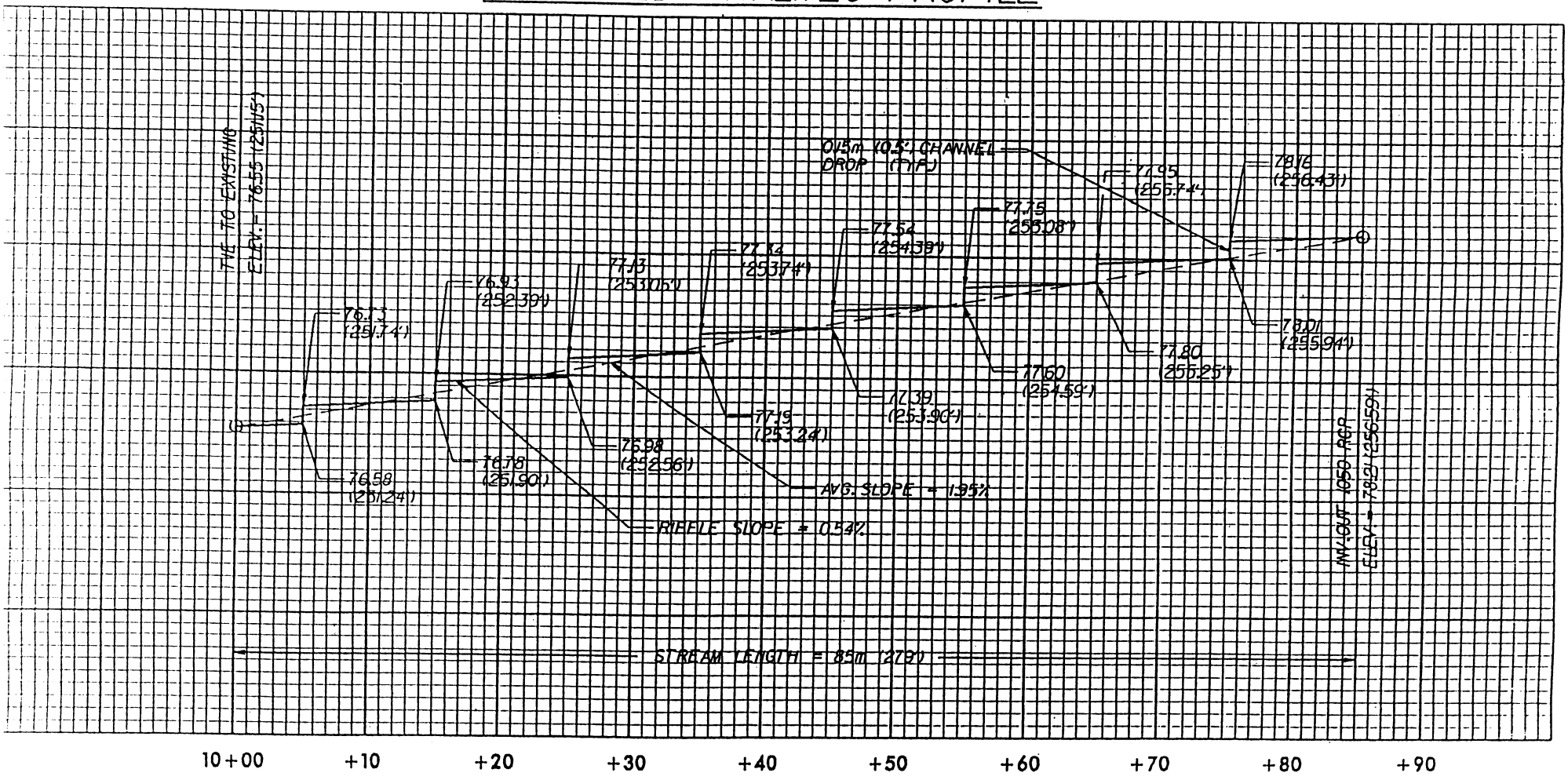
The proposed stream was designed to have an E5b classification. The gradient for the proposed stream is controlled upstream by the outlet elevation of the proposed 1050mm

(42") RCP right of -L- Sta. 460+53 and downstream by the tie to the existing stream right of -L- Sta. 459+80. The proposed stream was designed to have an average bankfull depth of 0.30m (1.0') and an average pool depth of 0.45m (1.5'). While these depths are greater than those of the existing stream, they provide a channel section that is reasonable to construct, stabilize and maintain. In addition to excavating the proposed stream, a flood prone area will also be excavated. This area will serve as a flood plain for the stream as well as provide hydraulic connectivity for a wetland cut off by the proposed roadway. Proposed stream bank stabilization is shown on the attached detail sheet and will be grass with coir fiber matting along the entire length of both banks. The flood prone area and other disturbed areas will stabilized with native woody vegetation. The streambed will match the characteristics of the existing channel. To aid in stability and reduce the stream gradient, cross vane rock weirs with 0.15m (0.5') channel drops will be placed in the lower third of each glide.

SEDIMENT TRANSPORT ANALYSIS

The proposed stream has a bankfull stream power of 0.25 lb/ft-s and a shear stress of 0.17 lb/ft^2 as compared to 0.46 lb/ft-s and 0.24 lb/ft^2 for the existing stream. While these values are greater than those of the existing stream, they indicate that the proposed stream will transport the current sediment load without aggrading or degrading the streambed or banks. Additionally, 2-yr and 10-yr velocities and shear stresses were evaluated and found to be within acceptable limits.

PROPOSED THALWEG PROFILE



NOTE: ELEVATIONS IN ( ) ARE IN FEET. ALL OTHER STATION AND ELEVATION DATA IS IN METERS.

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)
I-540 NORTHERN WAKE EXPWY.

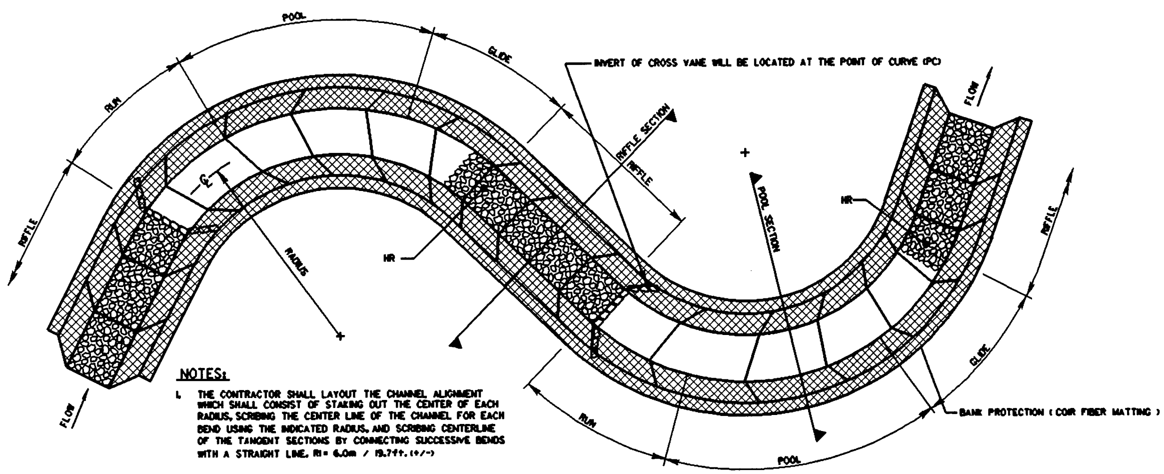
SHEET 48A OF 50

8/27/03

Appendix B

Morphological Measurement Table
R-2000G, Wake Co.

Variables	Existing Channel	Proposed Reach	USGS Station	Reference Reach Sal's Branch
1. Stream Type	E5	E5b	N/A	E4
2. Drainage Area (D.A.)	14.3 ha / 35.3 ac	19.4 ha / 47.9 ac	-	128 ac
3. Bankfull Width (W_{bkf})	0.76 m / 2.49 ft	1.80 m / 6.00 ft	-	8.7 ft
4. Bankfull Mean Depth (d_{bkf})	0.13 m / 0.43 ft	0.20 m / 0.67 ft	-	1.2 ft
5. Width/Depth Ratio (W_{bkf}/d_{bkf})	5.84	9.00	-	7.30
6. Bankfull Cross-Sectional Area (A_{bkf})	0.10 m^2 / 1.08 ft^2	0.37 m^2 / 4.00 ft^2	-	10.4 ft^2
7. Bankfull Mean Velocity (V_{bkf})	0.60 m/s / 1.97ft/s	0.44 m/s / 1.44 ft/s	-	3.8 ft/s
8. Bankfull Discharge (Q_{bkf})	0.06 m^3/s / 2.12 ft^3/s	0.16 m^3/s / 5.7 ft^3/s	-	40.0 ft^3/s
9. Bankfull Max Depth (d_{mbkf})	0.15 m / 0.49 ft	0.30 m / 1.00 ft	-	2.4 ft
10. Width of Floodprone Area (W_{fpa})	6.1 m / 20.0 ft (avg.)	10.9 m / 35.9 ft (avg.)	-	33.0 ft
11. Entrenchment Ratio (W_{fpa}/W_{bkf})	8.03	6.06	-	3.30
12. Meander Length (L_m)	16.7 m / 54.8 ft (avg.)	18.0 m / 59.1 ft	-	47.0 ft
13. Ratio of Meander Length to Bankfull Width (L_m/W_{bkf})	21.97	10.00	-	5.40
14. Radius of Curvature (R_c)	1.84 m / 6.04 ft	6.00 m / 19.68 ft	-	12 ft -35 ft
15. Ratio of Radius of Curvature to Bankfull Width (R_c/W_{bkf})	2.41	3.33	-	1.2 - 3.5
16. Belt Width (W_{blt})	4.3 m / 14.1 ft (avg.)	5.0 m / 16.4 ft	-	28 ft - 41 ft
17. Meander Width Ratio (W_{blt}/W_{bkf})	5.64	3.13	-	2.8 - 4.1
18. Sinuosity (K) (stream length/valley length)	1.25	1.26	-	1.70
19. Valley Slope (VS)	1.11%	2.46%	-	2.80%
20. Average Slope (CS)	0.89%	1.95%	-	1.60%
21. Pool Slope	0.86%	0.00%	-	0.00%
22. Ratio of Pool Slope to Average Slope	0.79	0.00	-	0.00
23. Maximum Pool Depth (dp_{max})	0.15 m / 0.49 ft	0.45 m / 1.50 ft	-	2.2
24. Ratio of Pool Depth to Average Bankfull Depth (dp/d_{bkf})	2.38	2.25	-	4.0
25. Pool Width (W_p)	0.78 m / 2.56 ft	2.70 m / 8.86 ft	-	8 - 11
26. Ratio of Pool Width to Bankfull Width (W_p/W_{bkf})	1.03	1.50	-	0.8 - 1.1
27. Pool to Pool Spacing	10.5 m / 34.4 ft (avg.)	9.0 m / 29.5 ft	-	38 - 48
28. Ratio of Pool to Pool Spacing to Bankfull Width	13.81	5.00	-	3.8 - 4.8
29. Ratio of Lowest Bnk Height to Bankfull Height (or Max Bankfull Depth) (Bh_{low}/d_{mbkf})	0.54	0.67	-	-

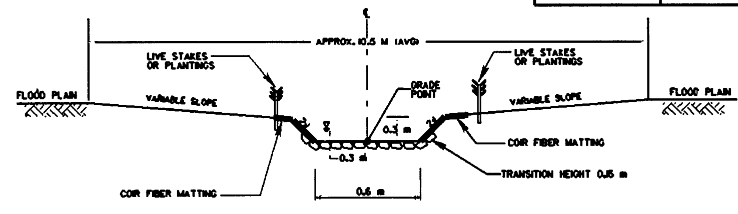


NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT WHICH SHALL CONSIST OF STAKING OUT THE CENTER OF EACH RADIUS, SCRIBING THE CENTER LINE OF THE CHANNEL FOR EACH BEND USING THE INDICATED RADIUS, AND SCRIBING CENTERLINE OF THE TANGENT SECTIONS BY CONNECTING SUCCESSIVE BENDS WITH A STRAIGHT LINE. R= 6.0m / 19.7ft. (+/-)
2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO AVOID CERTAIN OBSTACLES. APPROVAL BY THE ENGINEER OF THE STAKE-OUT ALIGNMENT SHALL BE REQUIRED PRIOR TO INITIATION OF THE CONSTRUCTION OF THE CHANNEL.
3. LOCATE INVERT OF ROCK CROSS VANES AT THE POINT OF CURVE (PC)

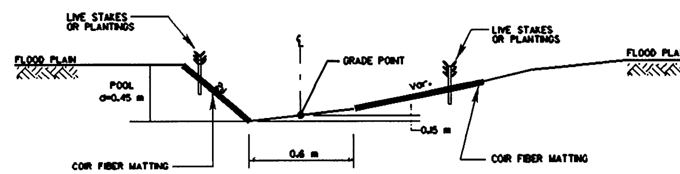
TYPICAL PLAN

NOT TO SCALE



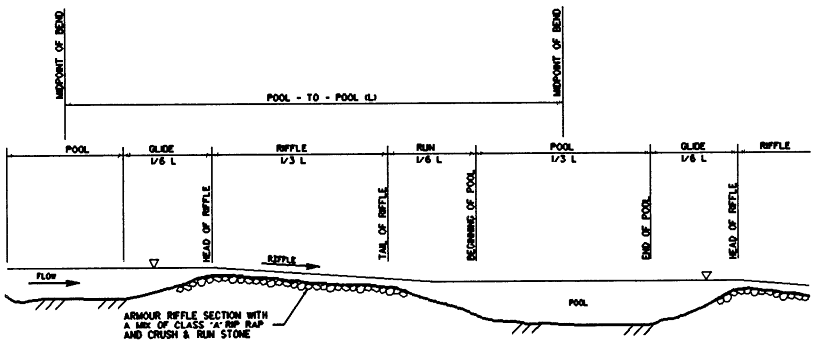
TYPICAL RIFFLE SECTION

NOT TO SCALE



TYPICAL POOL SECTION

NOT TO SCALE



NOTES:

1. THE POOL TO POOL SPACING (L) SHALL BE MEASURED AS THE DISTANCE FROM THE MIDPOINT OF THE UPSTREAM BEND TO THE MIDPOINT OF THE DOWNSTREAM BEND.
2. REFER TO MORPHOLOGICAL MEASUREMENT TABLE AND PLAN SHEET FOR DIMENSIONS. NOTE THAT POOL TO POOL SPACING VARIES.

TYPICAL PROFILE

NOT TO SCALE

MORPHOLOGICAL MEASUREMENT TABLE

VARIABLES	EXISTING CHANNEL	PROPOSED REACH	USGS STATION	REFERENCE REACH
1) STREAM TYPE	E5	E5b	-	E4
2) DRAINAGE AREA	14.3 ha / 35.3 ac	16.4 ha / 41.0 ac	-	128 ac
3) BANKFULL WIDTH	0.76 m / 2.49 ft	1.83 m / 6.00 ft	-	6.7 ft
4) BANKFULL MEAN DEPTH	0.13 m / 0.43 ft	0.20 m / 0.67 ft	-	1.2 ft
5) WIDTH/ DEPTH RATIO	5.84	9.00	-	7.30
6) BANKFULL CROSS-SECTIONAL AREA	0.10 sq m / 1.08 sq ft	0.37 sq m / 4.00 sq ft	-	10.4 sq ft
7) BANKFULL MEAN VELOCITY	0.60 m/s / 1.97 fps	0.44 m/s / 1.44 fps	-	3.8 fps
8) BANKFULL DISCHARGE, cfs	0.06 cms / 2.12 cfs	0.16 cms / 5.7 cfs	-	40 cfs
9) BANKFULL MAX. DEPTH	0.15 m / 0.49 ft	0.30 m / 1.00 ft	-	2.4 ft
10) WIDTH OF FLOODPRONE AREA	6.1m / 20.0 ft (avg.)	10.9 m / 35.8 ft (avg.)	-	33.0 ft
11) ENTRENCHMENT RATIO	8.03	6.00	-	3.3
12) MEANDER LENGTH	16.7 m / 54.8 ft (avg.)	18.0 m / 59.1 ft	-	47.0 ft
13) RATIO OF MEANDER LENGTH TO BANKFULL WIDTH	21.97	10.00	-	5.40
14) RADIUS OF CURVATURE	1.84 m / 6.04 ft	6.00 m / 19.68 ft	-	12 ft - 36 ft
15) RATIO OF RADIUS OF CURVATURE TO BANKFULL WIDTH	2.4	3.33	-	1.2 - 3.6
16) BELT WIDTH	4.3 m / 14.1 ft (avg.)	5.0 m / 16.4 ft	-	28 ft - 41 ft
17) MEANDER WIDTH RATIO	5.64	3.13	-	2.8 - 4.1
18) SINUOSITY STREAM LENGTH/VALLEY LENGTH	1.26	1.26	-	1.70
19) VALLEY SLOPE	1.11%	2.40%	-	2.80%
20) AVERAGE SLOPE	0.89%	1.90%	-	1.60%
21) POOL SLOPE	0.88%	0.00%	-	0.00%
22) RATIO OF POOL SLOPE TO AVERAGE SLOPE	0.79	0.00	-	0.00
23) MAXIMUM POOL DEPTH	0.15 m / 0.49 ft	0.45 m / 1.50 ft	-	2.2
24) RATIO OF POOL DEPTH TO AVERAGE BANKFULL DEPTH	2.38	2.25	-	4.0
25) POOL WIDTH	0.78 m / 2.56 ft	2.70 m / 8.86 ft	-	8 - 11
26) RATIO OF POOL WIDTH TO BANKFULL WIDTH	1.03	1.50	-	.8 - 1.1
27) POOL TO POOL SPACING	10.5 m / 34.4 ft (avg.)	9.0m / 29.5 ft	-	30 - 48
28) RATIO OF POOL TO POOL SPACING TO BANKFULL WIDTH	13.8	5.00	-	3.8 - 4.8
29) RATIO OF LOWEST BANK HEIGHT TO BANKFUL HGT. (= MAX BANKFULL DEPTH)	0.84	0.67	-	-

SITE 10

NCDOT

DIVISION OF HIGHWAYS

WAKE COUNTY

PROJECT: 8.U401712 (R-2000G)

I-540 NORTHERN WAKE EXPWY

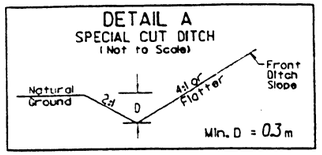
Rev.

SHEET 50 **OF** 50 **09/16/04**

PROJECT REFERENCE NO.	SHEET NO.
R-2000F	2-M
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

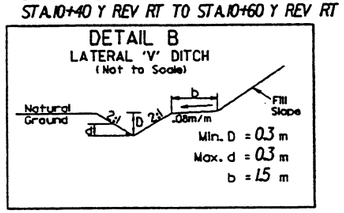
METRIC

DETAIL A
SPECIAL CUT DITCH
(Not to Scale)



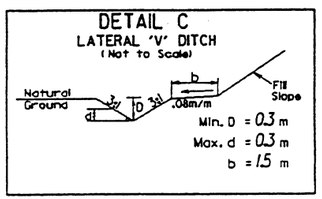
STA 13+35 LT TO 13+70 LT -Y-REV.
STA 362+50 LT TO 363+50 LT
STA 362+50 RT TO 363+40 RT
STA 367+00 LT TO 367+20 LT
STA.11+00 Y REV LT TO STA.11+50 LT Y REV
STA 383+40 RT TO 385+00 RT
STA 372+50 LT TO 373+70 LT
STA 373+00 RT TO 375+00 RT
STA 3+60 RT RP C TO 4+60 RT SPUR C
STA.2+20 B RP A LT TO STA.2+60 B RP A LT
STA.3+20 B RP D LT TO STA.3+40 B RP D LT
STA.409+00 LT TO STA.409+80 LT
STA.410+60 LT TO 411+00 LT
STA.410+80 RT TO 411+20 RT
STA.10+40 Y2REV LT TO STA.10+71Y2REV LT
STA.0+60 B RP A RT TO STA.2+40 B RP A RT
STA.2+00 B RP D RT TO STA.2+40 B RP D RT
STA.10+11Y2 REV LT TO STA.10+40 Y2 REV LT
STA.10+40 Y REV RT TO STA.10+60 Y REV RT

DETAIL B
LATERAL 'V' DITCH
(Not to Scale)



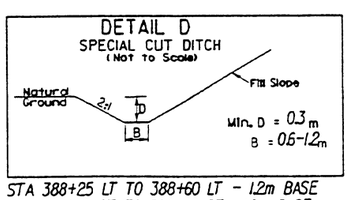
STA.11+65 YIREV RT TO STA.12+00 YIREV RT
STA.11+70 YIREV LT TO STA.11+80 YIREV LT
STA.11+25 Y2REV LT TO STA.11+40 Y2REV LT
STA.11+07 Y2REV RT TO STA.11+20 Y2REV RT

DETAIL C
LATERAL 'V' DITCH
(Not to Scale)



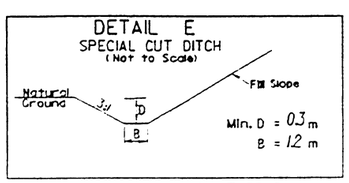
STA 362+00 LT TO 362+40 LT

DETAIL D
SPECIAL CUT DITCH
(Not to Scale)



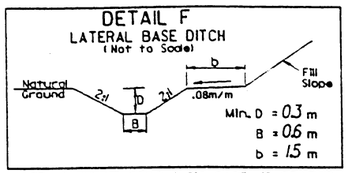
STA 388+25 LT TO 388+60 LT - 1.2m BASE
STA.388+40 RT TO 389+42 RT - 1.2m BASE
STA.3+60 U4RP D LT TO STA.5+00 U4RP D LT - 0.6m BASE

DETAIL E
SPECIAL CUT DITCH
(Not to Scale)



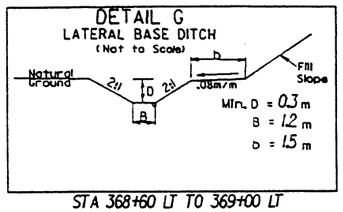
STA 2+96 LT TO 4+82 LT RP B

DETAIL F
LATERAL BASE DITCH
(Not to Scale)



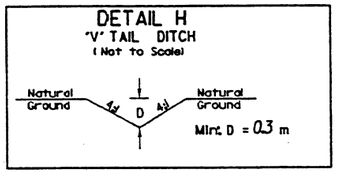
STA 5+20 LT SPUR D TO 6+05 LT SPUR D

DETAIL G
LATERAL BASE DITCH
(Not to Scale)



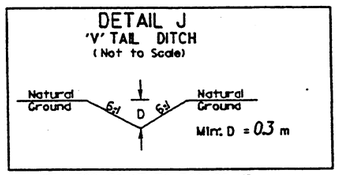
STA 368+60 LT TO 369+00 LT
STA.369+20 LT TO 370+55 LT
STA.370+40 RT TO 370+64 RT

DETAIL H
'V' TAIL DITCH
(Not to Scale)



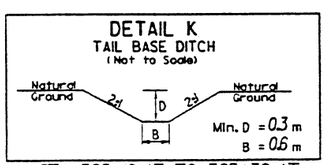
STA.388+25 LT TO 388+40 LT
STA.415+45 RT TO 415+80 RT (end of project)

DETAIL J
'V' TAIL DITCH
(Not to Scale)



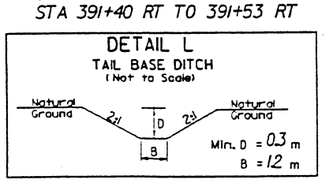
STA 368+50 LT TO 368+68 LT

DETAIL K
TAIL BASE DITCH
(Not to Scale)



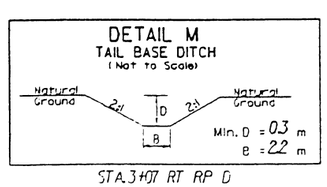
STA 385+10 LT TO 385+30 LT
STA 391+40 RT TO 391+53 RT

DETAIL L
TAIL BASE DITCH
(Not to Scale)



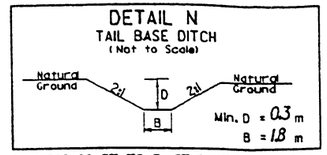
STA.13+00 RT SER.

DETAIL M
TAIL BASE DITCH
(Not to Scale)



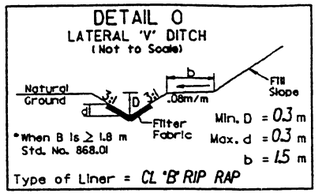
STA.3+07 RT RP D

DETAIL N
TAIL BASE DITCH
(Not to Scale)



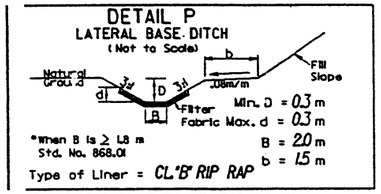
STA.388+00 RT TO EXIST.CHANNEL (head ditch)
STA.389+10 LT TO EXIST.CHANNEL (head ditch)
STA.389+75 RT TO EXIST.CHANNEL (tail ditch)

DETAIL O
LATERAL 'V' DITCH
(Not to Scale)



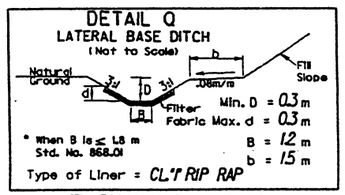
STA 358+80 RT TO 358+92 RT

DETAIL P
LATERAL BASE DITCH
(Not to Scale)



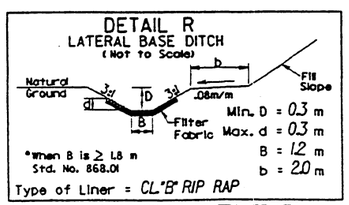
STA.395+00 LT TO STA.395+20 LT

DETAIL Q
LATERAL BASE DITCH
(Not to Scale)



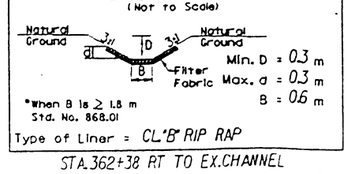
STA 368+10 LT TO 368+60 LT
STA.369+93 RT TO 370+40 RT
STA.398+20 RT TO STA.398+70 RT

DETAIL R
LATERAL BASE DITCH
(Not to Scale)



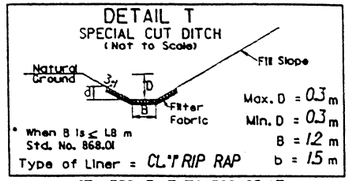
STA.369+20 LT TO 370+55 LT

DETAIL S
BASE TAIL DITCH
(Not to Scale)



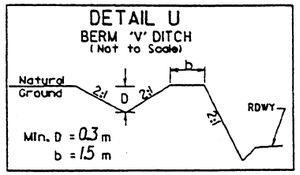
STA.362+38 RT TO EX.CHANNEL

DETAIL T
SPECIAL CUT DITCH
(Not to Scale)



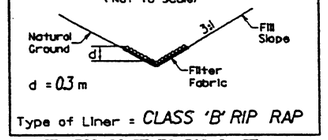
STA 388+17 LT TO 388+25 LT

DETAIL U
BERM 'V' DITCH
(Not to Scale)



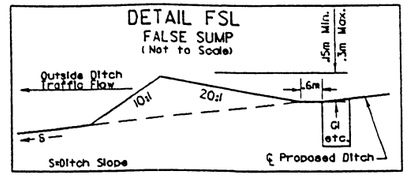
STA 363+70 RT TO 365+20 RT
STA.391+05 LT TO STA.391+57 LT
STA.0+40 B RP A RT TO STA 0+80 B RP A RT
STA.1+90 B RP A RT TO STA 2+40 B RP A RT
STA.413+40 TO STA.415+45 LT
STA.3+60 U4 RP D LT TO STA.4+70 U4 RP D LT

DETAIL V
TOE PROTECTION
(Not to Scale)

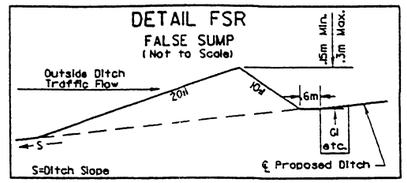


STA 362+06 RT TO 362+24 RT
STA 369+02 RT TO 369+24 RT
STA 369+35 RT TO 369+91 RT
STA 386+20 RT TO 387+00 RT
STA 388+61 RT TO 389+67 RT

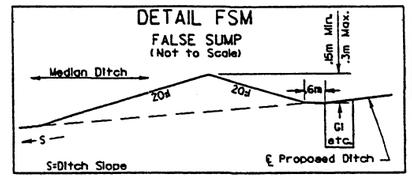
DETAIL FSL
FALSE SUMP
(Not to Scale)



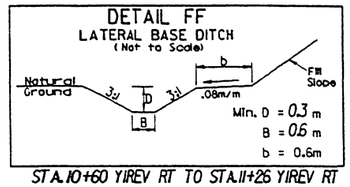
DETAIL FSR
FALSE SUMP
(Not to Scale)



DETAIL FSM
FALSE SUMP
(Not to Scale)

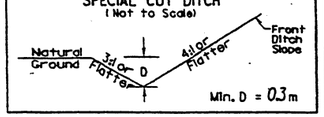


DETAIL FF
LATERAL BASE DITCH
(Not to Scale)



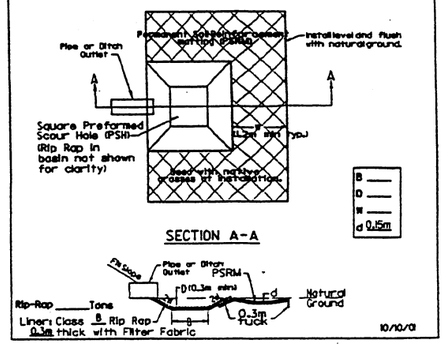
STA.10+60 YIREV RT TO STA.11+26 YIREV RT

DETAIL AA
SPECIAL CUT DITCH
(Not to Scale)

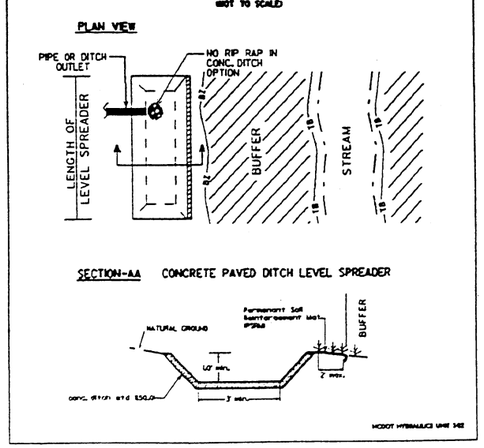


STA.10+00 YIREV LT TO STA.11+20 YIREV LT

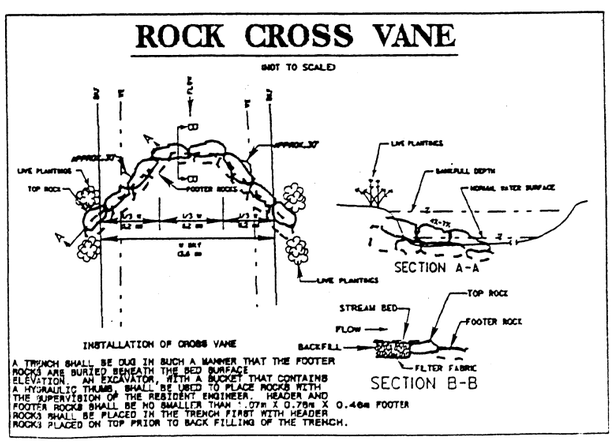
PREFORMED SCOUR HOLE WITH LEVEL SPREADER APRON
DETAIL Y
PLAN VIEW

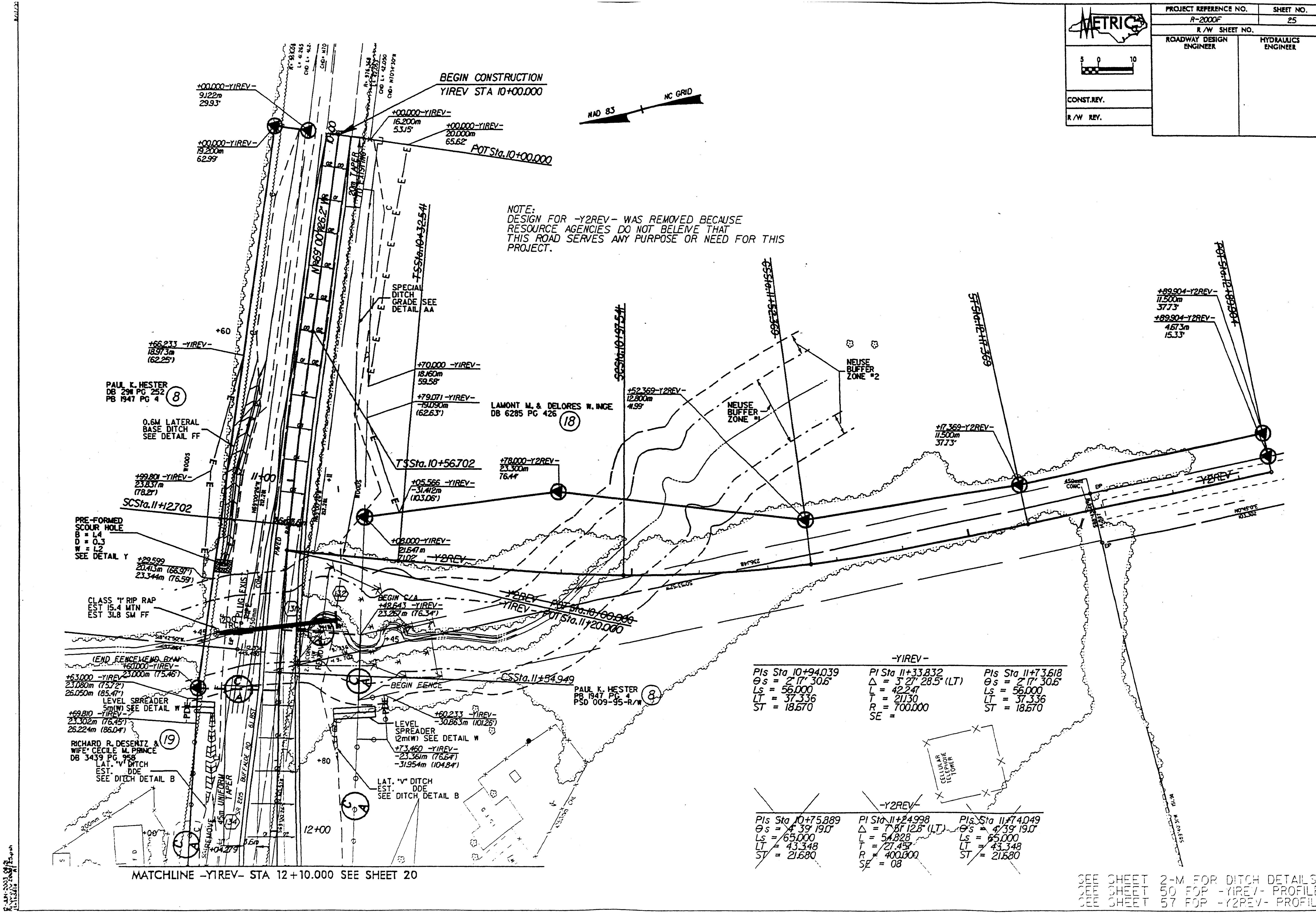


LEVEL SPREADER DETAIL W
(NOT TO SCALE)



ROCK CROSS VANE
(NOT TO SCALED)




PROJECT REFERENCE NO. R-2000F
SHEET NO. 25
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
METRIC
CONST. REV.
R/W REV.
NAD 83
NC GRID
BEGIN CONSTRUCTION
YIREV STA 10+00.000
POT Sta. 10+00.000
NOTE:
DESIGN FOR -Y2REV- WAS REMOVED BECAUSE RESOURCE AGENCIES DO NOT BELEIVE THAT THIS ROAD SERVES ANY PURPOSE OR NEED FOR THIS PROJECT.
SPECIAL DITCH GRADE SEE DETAIL AA
PAUL K. HESTER
DB 2911 PG 252
PB 1947 PG 4
LAMONT M. & DELORES W. INGE
DB 6285 PG 426
0.6M LATERAL BASE DITCH SEE DETAIL FF
NEUSE BUFFER ZONE #2
NEUSE BUFFER ZONE #1
TS Sta. 10+56.702
SC Sta. 11+12.702
PRE-FORMED SCOUR HOLE
B = 1.4
D = 0.3
W = 1.2
SEE DETAIL Y
CLASS "I" RIP RAP
EST 15.4 MTN
EST 31.8 SM FF
BEGIN C/A
-YIREV- POT Sta. 11+20.000
CS Sta. 11+54.949
BEGIN FENCE
LEVEL SPREADER 5m(W) SEE DETAIL W
LEVEL SPREADER 12m(W) SEE DETAIL W
PAUL K. HESTER
PB 1947 PG 4
PSD 009-95-R/W
RICHARD R. DESENTZ & WIFE CECILE M. PRINCE
DB 3439 PG 958
LAT. "V" DITCH EST. DDE SEE DITCH DETAIL B
CELLULAR TELEPHONE TOWER
-YIREV-
PIs Sta 10+94.039
θs = 2° 17' 30.6"
Ls = 56.000
LT = 37.336
ST = 18.670
PI Sta 11+33.832
Δ = 3° 27' 28.5" (LT)
L = 42.247
T = 21.130
R = 700.000
SE =
PIs Sta 11+73.618
θs = 2° 17' 30.6"
Ls = 56.000
LT = 37.336
ST = 18.670
-Y2REV-
PIs Sta 10+75.889
θs = 4° 39' 19.0"
Ls = 65.000
LT = 43.348
ST = 21.680
PI Sta 11+24.998
Δ = 7° 51' 12.8" (LT)
L = 54.828
T = 27.457
R = 400.000
SE = .08
PIs Sta 11+74.049
θs = 4° 39' 19.0"
Ls = 65.000
LT = 43.348
ST = 21.680
MATCHLINE -Y1REV- STA 12+10.000 SEE SHEET 20
SEE SHEET 2-M FOR DITCH DETAILS
SEE SHEET 50 FOR -YIREV- PROFILE
SEE SHEET 57 FOR -Y2REV- PROFILE

PROJECT REFERENCE NO.	SHEET NO.
R-2000F	X-87

2.5 0 2.5 5

METRIC

50 40 30 20 10 0 10 20 30 40 50

80

10+80.000

80

80

10+60.000

80

80

10+40.000

80

80

10+20.000

80

10+00.000

85

85

9+80.000

85

50 40 30 20 10 0 10 20 30 40 50

-Y1REV-

PROJECT REFERENCE NO.	SHEET NO.
R-2000F	X-88

2.5 0 2.5 5

METRIC

50 40 30 20 10 0 10 20 30 40 50

12+20.000

12+00.000

11+80.000

11+60.000

11+40.000

11+20.000

11+00.000

-YTREV-