STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

April 28, 2008

U. S. Army Corps of Engineers
151 Patton Avenue
Room 208
Asheville, NC 28801-5006

ATTN: Mr. David Baker
NCDOT Coordinator

Dear Sir:

Subject: **Clean Water Act Nationwide Permits 13 and 23 application** for replacement of Bridge No. 12 on SR 1329 (Warlick Road) over Boylston Creek, Federal Aid No. BRZ-1329(4), State Project No. 8.2952801, Henderson County, Division 14, TIP No. B-4148. WBS Element No. 33497.1.1.

Please see the enclosed Pre-Construction Notification, permit drawings, design plans and Rapanos jurisdictional determination form for the subject project. A Programmatic Categorical Exclusion (PCE) was completed in July 2006 for this project and distributed shortly thereafter. Additional copies are available upon request. The North Carolina Department of Transportation (NCDOT) proposes to replace the 31-foot Bridge No. 12 with a single span cored slab bridge of approximately 55 feet in length. The new structure will be built on the same alignment as the existing bridge. During construction, traffic will be routed to an offsite detour. There will be a total of 26 feet of permanent impacts to Boylston Creek and 0.02 acre of permanent impact due to fill in two linear wetlands.

IMPACTS TO WATERS OF THE UNITED STATES

General Description: There is one impacted jurisdictional stream on the project site: Boylston Creek. This water resource is located in the French Broad River Basin (subbasin 04-03-03, Hydrological Cataloguing Unit 06010105). The North Carolina Division of Water Quality (NCDWQ) index number for the Boylston Creek is 6-52-(6.5).

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.DOH.DOT.STATE.NC.US

LOCATION:
2728 CAPITOL BOULEVARD
PARKER LINCOLN BUILDING, SUITE 168
RALEIGH NC 27699

Boylston Creek is classified by the Division of Water Quality as a **WS-IV** water body. Neither High Quality Waters (HQW), Water Supplies (WS-I or WS-II), Outstanding Resource Waters (ORW) nor waters listed on the 303 (d) list occur in the project area or within 1.0 mile downstream of waters in the project area. The average baseflow width of Boylston Creek is approximately 20 feet. Average depth is approximately 1-2 feet.

Permanent Impacts: There will be a total of 26 feet of permanent impacts to Boylston Creek at Site 3. There impacts encompass two ditches that will have Class 1 rip rap placed where they enter Boylston Creek. Rip rap will be used along the bank, to control erosion at these sites. An additional 0.02 acres of permanent impact will occur due to fill in two linear wetlands (Site 1, Site 2). These wetlands are the current ditches on the southeastern portion of SR 1329. Because of highway design standards, these ditches will be filled and relocated away from the roadway.

Temporary Impacts: There will be no temporary impacts associated with this project.

Bridge Demolition: Bridge No. 12 is constructed of timber and steel. Therefore, it is unlikely that there will be any temporary fill resulting from bridge demolition.

Utility Impacts: There will be no impacts to jurisdictional waters due to utilities.

FEDERALLY PROTECTED SPECIES

Plants and animals with federal classifications of Endangered, Threatened, Proposed Endangered and Proposed Threatened are protected under provisions of Section 7 and Section 9 of the Endangered Species Act of 1973, as amended. As of January 31, 2008 the United States Fish and Wildlife Service (USFWS) list 7 species under federal protection for Henderson County (Table 1). The oyster mussel has been removed from the list since the PCE was completed. A survey for Appalachian elktoe and oyster mussel was conducted on April 29, 2004. The survey results indicated that freshwater mussels were not present in the surveyed reach of Boylston Creek and were unlikely to occur due to the heavy sediment loading. A survey for the protected plant species was conducted in 2004 and found that no suitable habitat existed within the study area. The NC Natural Heritage database of rare species and unique habitats was reviewed in March 2008. There is no documentation of federally listed species or unique habitats occurring within 1 mile of the project area.

Table 1. Species Under Federal Protection in Henderson County

Common Name	Scientific Name	Federal Status	Habitat	Biological Conclusion
Bog turtle	*Clemmys muhlenbuergii*	T (S/A)	No	Not required
Appalachian elktoe	*Alasmidonta raveneliana*	E	No	No Effect
Bunched arrowhead	*Sagittaria fasciculata*	E	No	No Effect
Mountain sweet pitcher plant	*Sarracenia jonesii*	E	No	No Effect
Small-whorled pogonia	*Isotria medioloides*	T	No	No Effect
Swamp pink	*Helonias bullata*	T	No	No Effect
White irisette	*Sisyrinchium dichotomum*	E	No	No Effect

AVOIDANCE, MINIMIZATION AND MITIGATION

Avoidance and Minimization:
Avoidance examines all appropriate and practicable possibilities of averting impacts to "Waters of the United States". The NCDOT is committed to incorporating all reasonable and practicable design features to avoid and minimize jurisdictional impacts, and to provide full compensatory mitigation of all remaining, unavoidable jurisdictional impacts; minimization measures were incorporated as part of the project design.

- Best Management Practices will be followed for this project as outlined in "NCDOT's Best Management Practices for Construction and Maintenance Activities".
- Best Management Practices will be used during demolition of the existing bridge.
- Use of a single span structure.
- There will be no deck drains allowed to discharge directing into Boylston Creek.
- Use of offsite detour.

In Section D/Other Agency Comments of the PCE it was stated that sediment and erosion control measures should adhere to design standards for sensitive watersheds. There measures will not be used for this project because Boylston Creek carries no special aquatic classifications.

Mitigation:
Permanent impacts for this project are 26 feet due to bank stabilization and 0.02 acre of permanent fill in two linear wetlands. Because the minimal impacts associated with this project and no special aquatic classifications, no mitigation is proposed. No loss of "Waters of the United States" will occur with this project.

SCHEDULE

The project schedule calls for a January 20, 2009 Let date with a date of availability on March 2, 2009. The review date for the project is December 2, 2008.

REGULATORY APPROVALS

Section 404 Permit: It is anticipated that impacts relating to use of rip rap for bank stabilization will be authorized under Section 404 Nationwide Permit No. 13 (Bank Stabilization). Permanent fill to the two linear wetlands is anticipated to be authorized under Section 404 Nationwide Permit No. 23 (Approved Categorical Exclusion). We therefore request the issuance of Nationwide Permits 13 and 23 for these activities.

Section 401 Permit: We anticipate 401 General Certification Nos. 3689 and 3701 will apply to this project. All general WQC conditions will be adhered to during project construction. Therefore, in accordance with 15A NCAC 2H, Section .0500(a) and 15A NCAC 2B.0200 we are providing two copies of this application to the North Carolina Department of Environmental and Natural Resources, Division of Water Quality, for their records.

This project is located in a trout county, therefore comments from the North Carolina Wildlife Resources Commission (NCWRC) will be required prior to authorization by the Corps of Engineers. By copy of this letter and attachment, NCDOT hereby requests NCWRC review. NCDOT requests that NCWRC forward their comments to the Corps of Engineers and the NCDOT within 30 calendar days of receipt of this application.

Thank you for your assistance with this project. If you have any questions or need additional information please contact Jason Dilday at jldilday@dot.state.nc.us or (919) 715-5535. The application will be posted at http://207.4.62.65/PDEA/PermApps/.

Sincerely,

E. L. Lusk

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

CC:
W/attachment
- Mr. Brian Wrenn, NCDWQ (2 Copies)
- Ms. Marella Buncick, USFWS
- Ms. Marla Chambers, NCWRC
- Mr. Harold Draper, TVA

W/o attachment (see website for attachments)
- Dr. David Chang, P.E., Hydraulics
- Mr. Victor Barbour, P.E., Project Services Unit
- Mr. Greg Perfetti, P.E., Structure Design
- Mr. Mark Staley, Roadside Environmental
- Mr. J. B. Setzer, P.E. (Div. 14), Division Engineer
- Mr. Mark Davis (Div. 14), DEO
- Mr. Jay Bennett, P.E., Roadway Design
- Mr. Majed Alghandour, P. E., Programming and TIP
- Mr. Art McMillan, P.E., Highway Design
- Mr. Scott McLendon, USACE, Wilmington
- Ms. Natalie Lockhart, PDEA Project Planning Engineer

Office Use Only: Form Version March 05

USACE Action ID No. _____ **DWQ No.** _____

(If any particular item is not applicable to this project, please enter "Not Applicable" or "N/A".)

I. Processing

1. Check all of the approval(s) requested for this project:
   - ☒ Section 404 Permit
   - ☐ Section 10 Permit
   - ☒ 401 Water Quality Certification
   - ☐ Riparian or Watershed Buffer Rules
   - ☐ Isolated Wetland Permit from DWQ
   - ☐ Express 401 Water Quality Certification

2. Nationwide, Regional or General Permit Number(s) Requested: Nationwide 13 & 23

3. If this notification is solely a courtesy copy because written approval for the 401 Certification is not required, check here: ☒

4. If payment into the North Carolina Ecosystem Enhancement Program (NCEEP) is proposed for mitigation of impacts, attach the acceptance letter from NCEEP, complete section VIII, and check here: ☐

5. If your project is located in any of North Carolina's twenty coastal counties (listed on page 4), and the project is within a North Carolina Division of Coastal Management Area of Environmental Concern (see the top of page 2 for further details), check here: ☐

II. Applicant Information

1. Owner/Applicant Information
   Name: Gregory J. Thorpe, Ph.D., Environmental Management Director
   Mailing Address: 1598 Mail Service Center
   _____
   _____
   _____
   Telephone Number: (919) 733-3141 Fax Number: (919) 733-9794
   E-mail Address: jldilday@dot.state.nc.us

2. Agent/Consultant Information (A signed and dated copy of the Agent Authorization letter must be attached if the Agent has signatory authority for the owner/applicant.)
   Name: _____
   Company Affiliation: _____
   Mailing Address: _____
   _____
   _____
   _____
   Telephone Number: _____ Fax Number: _____
   E-mail Address: _____

III. Project Information

Attach a **vicinity map** clearly showing the location of the property with respect to local landmarks such as towns, rivers, and roads. Also provide a detailed **site plan** showing property boundaries and development plans in relation to surrounding properties. Both the vicinity map and site plan must include a scale and north arrow. The specific footprints of all buildings, impervious surfaces, or other facilities must be included. If possible, the maps and plans should include the appropriate USGS Topographic Quad Map and NRCS Soil Survey with the property boundaries outlined. Plan drawings, or other maps may be included at the applicant's discretion, so long as the property is clearly defined. For administrative and distribution purposes, the USACE requires information to be submitted on sheets no larger than 11 by 17-inch format; however, DWQ may accept paperwork of any size. DWQ prefers full-size construction drawings rather than a sequential sheet version of the full-size plans. If full-size plans are reduced to a small scale such that the final version is illegible, the applicant will be informed that the project has been placed on hold until decipherable maps are provided.

1. Name of project: Bridge 12 over Boylston Creek on SR 1329 (Warlick Road)

2. T.I.P. Project Number or State Project Number (NCDOT Only): B-4148

3. Property Identification Number (Tax PIN): N/A

4. Location
   County: Henderson Nearest Town: Etowah
   Subdivision name (include phase/lot number): N/A
   Directions to site (include road numbers/names, landmarks, etc.): SR 1329, Warlick Road

5. Site coordinates (For linear projects, such as a road or utility line, attach a sheet that separately lists the coordinates for each crossing of a distinct waterbody.)
   Decimal Degrees (6 digits minimum): 35'21'55" °N -82'34'50" °W

6. Property size (acres): N/A

7. Name of nearest receiving body of water: Boylston Creek

8. River Basin: French Broad River Basin
   (Note – this must be one of North Carolina's seventeen designated major river basins. The River Basin map is available at http://h2o.enr.state.nc.us/admin/maps/.)

9. Describe the existing conditions on the site and general land use in the vicinity of the project at the time of this application: Agriculture and minor forested communities.

10. Describe the overall project in detail, including the type of equipment to be used: Bridge No. 12 will be replaced with a single span cored slab bridge approximately 55 feet in length using standard bridge demolition and construction equipment.

11. Explain the purpose of the proposed work: In 1998, when the timber bridge was programmed, the bridge had a sufficiency rating of 38.8 out of 100 and was both structurally deficient and functionally obsolete. Since that time, temporary crutch work and repairs have been done which resulted in the current rating of 70.2 out of 100. Because the crutch work is temporary, the bridge is still structurally deficient as well as functionally obsolete.

IV. Prior Project History

If jurisdictional determinations and/or permits have been requested and/or obtained for this project (including all prior phases of the same subdivision) in the past, please explain. Include the USACE Action ID Number, DWQ Project Number, application date, and date permits and certifications were issued or withdrawn. Provide photocopies of previously issued permits, certifications or other useful information. Describe previously approved wetland, stream and buffer impacts, along with associated mitigation (where applicable). If this is a NCDOT project, list and describe permits issued for prior segments of the same T.I.P. project, along with construction schedules. N/A

V. Future Project Plans

Are any future permit requests anticipated for this project? If so, describe the anticipated work, and provide justification for the exclusion of this work from the current application.
N/A

VI. Proposed Impacts to Waters of the United States/Waters of the State

It is the applicant's (or agent's) responsibility to determine, delineate and map all impacts to wetlands, open water, and stream channels associated with the project. Each impact must be listed separately in the tables below (e.g., culvert installation should be listed separately from riprap dissipater pads). Be sure to indicate if an impact is temporary. All proposed impacts, permanent and temporary, must be listed, and must be labeled and clearly identifiable on an accompanying site plan. All wetlands and waters, and all streams (intermittent and perennial) should be shown on a delineation map, whether or not impacts are proposed to these systems. Wetland and stream evaluation and delineation forms should be included as appropriate. Photographs may be included at the applicant's discretion. If this proposed impact is strictly for wetland or stream mitigation, list and describe the impact in Section VIII below. If additional space is needed for listing or description, please attach a separate sheet.

1. Provide a written description of the proposed impacts: 26 feet of permanent impacts to Boylston Creek due to the placement of class 1 riprap at two ditches where they enter the creek (Site 3). 0.02 acres of permanent impact due to fill in two linear wetlands (Site 1, Site 2).

2. Individually list wetland impacts. Types of impacts include, but are not limited to mechanized clearing, grading, fill, excavation, flooding, ditching/drainage, etc. For dams, separately list impacts due to both structure and flooding.

Wetland Impact Site Number (indicate on map)	Type of Impact	Type of Wetland (e.g., forested, marsh, herbaceous, bog, etc.)	Located within 100-year Floodplain (yes/no)	Distance to Nearest Stream (linear feet)	Area of Impact (acres)
Site 1	Permanent fill	Herbaceous	Yes	0	0.01
Site 2	Permanent fill	Herbaceous	Yes	0	0.01
Total Wetland Impact (acres)					0.02

3. List the total acreage (estimated) of all existing wetlands on the property: 0.08 acre

4. Individually list all intermittent and perennial stream impacts. Be sure to identify temporary impacts. Stream impacts include, but are not limited to placement of fill or culverts, dam construction, flooding, relocation, stabilization activities (e.g., cement walls, rip-rap, crib walls, gabions, etc.), excavation, ditching/straightening, etc. If stream relocation is proposed, plans and profiles showing the linear footprint for both the original and relocated streams must be included. To calculate acreage, multiply length X width, then divide by 43,560.

Stream Impact Number (indicate on map)	Stream Name	Type of Impact	Perennial or Intermittent?	Average Stream Width Before Impact	Impact Length (linear feet)	Area of Impact (acres)
Site 3	Boylston Creek	Perm	Perennial	20 ft	26	<0.01
Total Permanent Stream Impact (by length and acreage)					26	<0.01

5. Individually list all open water impacts (including lakes, ponds, estuaries, sounds, Atlantic Ocean and any other water of the U.S.). Open water impacts include, but are not limited to fill, excavation, dredging, flooding, drainage, bulkheads, etc.

Open Water Impact Site Number (indicate on map)	Name of Waterbody (if applicable)	Type of Impact	Type of Waterbody (lake, pond, estuary, sound, bay, ocean, etc.)	Area of Impact (acres)
No Impacts				
Total Open Water Impact (acres)				0

6. List the cumulative impact to all Waters of the U.S. resulting from the project:

Stream Impact (acres):	<0.01 (permanent)
Wetland Impact (acres):	0.02
Open Water Impact (acres):	0
Total Impact to Waters of the U.S. (acres)	0.02 (permanent)
Total Stream Impact (linear feet):	26 (permanent)

7. Isolated Waters
   Do any isolated waters exist on the property? ☐ Yes ☒ No
   Describe all impacts to isolated waters, and include the type of water (wetland or stream) and the size of the proposed impact (acres or linear feet). Please note that this section only applies to waters that have specifically been determined to be isolated by the USACE.

8. Pond Creation
   If construction of a pond is proposed, associated wetland and stream impacts should be included above in the wetland and stream impact sections. Also, the proposed pond should be described here and illustrated on any maps included with this application.
   Pond to be created in (check all that apply): ☐ uplands ☐ stream ☐ wetlands
   Describe the method of construction (e.g., dam/embankment, excavation, installation of draw-down valve or spillway, etc.):
   Proposed use or purpose of pond (e.g., livestock watering, irrigation, aesthetic, trout pond, local stormwater requirement, etc.):
   Current land use in the vicinity of the pond:
   Size of watershed draining to pond:_____ Expected pond surface area:_____

VII. Impact Justification (Avoidance and Minimization)

Specifically describe measures taken to avoid the proposed impacts. It may be useful to provide information related to site constraints such as topography, building ordinances, accessibility, and financial viability of the project. The applicant may attach drawings of alternative, lower-impact site layouts, and explain why these design options were not feasible. Also discuss how impacts were minimized once the desired site plan was developed. If applicable, discuss construction techniques to be followed during construction to reduce impacts.Traffic will be placed on a temporary offsite detour. NCDOT Best Management Practices will be implemented during all phases of construction and demolition. Replacement bridge will be a spanning structure.

VIII. Mitigation

DWQ - In accordance with 15A NCAC 2H .0500, mitigation may be required by the NC Division of Water Quality for projects involving greater than or equal to one acre of impacts to freshwater wetlands or greater than or equal to 150 linear feet of total impacts to perennial streams.

USACE – In accordance with the Final Notice of Issuance and Modification of Nationwide Permits, published in the Federal Register on January 15, 2002, mitigation will be required when necessary to ensure that adverse effects to the aquatic environment are minimal. Factors including size and type of proposed impact and function and relative value of the impacted aquatic resource will be considered in determining acceptability of appropriate and practicable mitigation as proposed. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland and/or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferable in the same watershed.

If mitigation is required for this project, a copy of the mitigation plan must be attached in order for USACE or DWQ to consider the application complete for processing. Any application lacking a required mitigation plan or NCEEP concurrence shall be placed on hold as incomplete. An applicant may also choose to review the current guidelines for stream restoration in DWQ's Draft Technical Guide for Stream Work in North Carolina, available at http://h2o.enr.state.nc.us/ncwetlands/strmgide.html.

1. Provide a brief description of the proposed mitigation plan. The description should provide as much information as possible, including, but not limited to: site location (attach directions and/or map, if offsite), affected stream and river basin, type and amount (acreage/linear feet) of mitigation proposed (restoration, enhancement, creation, or preservation), a plan view, preservation mechanism (e.g., deed restrictions, conservation easement, etc.), and a description of the current site conditions and proposed method of construction. Please attach a separate sheet if more space is needed.

   There is 26 feet of permanent stream impact to Boylston Creek due to bank stabilization and not considered a loss of "Waters of the U.S." 0.02 acre of permanent impact will occur to an adjacent wetland. Mitigation is not proposed for this project due to the minimal impacts and no special aquatic classification for this system.

2. Mitigation may also be made by payment into the North Carolina Ecosystem Enhancement Program (NCEEP). Please note it is the applicant's responsibility to contact the NCEEP at (919) 715-0476 to determine availability, and written approval from the NCEEP indicating

that they are will to accept payment for the mitigation must be attached to this form. For additional information regarding the application process for the NCEEP, check the NCEEP website at http://h2o.enr.state.nc.us/wrp/index.htm. If use of the NCEEP is proposed, please check the appropriate box on page five and provide the following information:

Amount of stream mitigation requested (linear feet): 0
Amount of buffer mitigation requested (square feet): 0
Amount of Riparian wetland mitigation requested (acres): 0
Amount of Non-riparian wetland mitigation requested (acres): 0
Amount of Coastal wetland mitigation requested (acres): 0

IX. Environmental Documentation (required by DWQ)

1. Does the project involve an expenditure of public (federal/state/local) funds or the use of public (federal/state) land? Yes ☒ No ☐

2. If yes, does the project require preparation of an environmental document pursuant to the requirements of the National or North Carolina Environmental Policy Act (NEPA/SEPA)? Note: If you are not sure whether a NEPA/SEPA document is required, call the SEPA coordinator at (919) 733-5083 to review current thresholds for environmental documentation. Yes ☒ No ☐

3. If yes, has the document review been finalized by the State Clearinghouse? If so, please attach a copy of the NEPA or SEPA final approval letter. Yes ☒ No ☐

X. Proposed Impacts on Riparian and Watershed Buffers (required by DWQ)

It is the applicant's (or agent's) responsibility to determine, delineate and map all impacts to required state and local buffers associated with the project. The applicant must also provide justification for these impacts in Section VII above. All proposed impacts must be listed herein, and must be clearly identifiable on the accompanying site plan. All buffers must be shown on a map, whether or not impacts are proposed to the buffers. Correspondence from the DWQ Regional Office may be included as appropriate. Photographs may also be included at the applicant's discretion.

1. Will the project impact protected riparian buffers identified within 15A NCAC 2B .0233 (Neuse), 15A NCAC 2B .0259 (Tar-Pamlico), 15A NCAC 02B .0243 (Catawba) 15A NCAC 2B .0250 (Randleman Rules and Water Supply Buffer Requirements), or other (please identify_____)? Yes ☐ No ☒

2. If "yes", identify the square feet and acreage of impact to each zone of the riparian buffers. If buffer mitigation is required calculate the required amount of mitigation by applying the buffer multipliers.

Zone*	Impact (square feet)	Multiplier	Required Mitigation
1		3 (2 for Catawba)	

2		1.5	
Total			

* Zone 1 extends out 30 feet perpendicular from the top of the near bank of channel; Zone 2 extends an additional 20 feet from the edge of Zone 1.

3. If buffer mitigation is required, please discuss what type of mitigation is proposed (i.e., Donation of Property, Riparian Buffer Restoration / Enhancement, or Payment into the Riparian Buffer Restoration Fund). Please attach all appropriate information as identified within 15A NCAC 2B .0242 or .0244, or .0260. N/A

XI. Stormwater (required by DWQ)

Describe impervious acreage (existing and proposed) versus total acreage on the site. Discuss stormwater controls proposed in order to protect surface waters and wetlands downstream from the property. If percent impervious surface exceeds 20%, please provide calculations demonstrating total proposed impervious level. Stormwater will be controlled from the structure and adjacent road.

XII. Sewage Disposal (required by DWQ)

Clearly detail the ultimate treatment methods and disposition (non-discharge or discharge) of wastewater generated from the proposed project, or available capacity of the subject facility.
N/A

XIII. Violations (required by DWQ)

Is this site in violation of DWQ Wetland Rules (15A NCAC 2H .0500) or any Buffer Rules?
Yes ☐ No ☒

Is this an after-the-fact permit application? Yes ☐ No ☒

XIV. Cumulative Impacts (required by DWQ)

Will this project (based on past and reasonably anticipated future impacts) result in additional development, which could impact nearby downstream water quality? Yes ☐ No ☒
If yes, please submit a qualitative or quantitative cumulative impact analysis in accordance with the most recent North Carolina Division of Water Quality policy posted on our website at http://h2o.enr.state.nc.us/ncwetlands. If no, please provide a short narrative description:
This project is limited to a bridge replacement. No indirect or cumulative impacts are anticipated.

XV. Other Circumstances (Optional):

It is the applicant's responsibility to submit the application sufficiently in advance of desired construction dates to allow processing time for these permits. However, an applicant may choose to list constraints associated with construction or sequencing that may impose limits on work schedules (e.g., draw-down schedules for lakes, dates associated with Endangered and Threatened Species, accessibility problems, or other issues outside of the applicant's control).

N/A

E. L. Lusk 4.28.08

Applicant/Agent's Signature **Date**

(Agent's signature is valid only if an authorization letter from the applicant is provided.)

Boylston Creek

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: B-4148 (Replacement of Bridge No. 12 on SR 1329)

C. PROJECT LOCATION AND BACKGROUND INFORMATION:
State:NC County/parish/borough: Henderson City: Etowah
Center coordinates of site (lat/long in degree decimal format): Lat. 35.37° **N**, Long. -82.58° **W**.
Universal Transverse Mercator:
Name of nearest waterbody: Boylston Creek
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: French Broad River
Name of watershed or Hydrologic Unit Code (HUC): 06010105
☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☐ Office (Desk) Determination. Date:
☐ Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]
☐ Waters subject to the ebb and flow of the tide.
☐ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.
Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
      ☐ TNWs, including territorial seas
      ☐ Wetlands adjacent to TNWs
      ☒ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
      ☐ Non-RPWs that flow directly or indirectly into TNWs
      ☒ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
      ☐ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
      ☐ Impoundments of jurisdictional waters
      ☐ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
      Non-wetland waters: 600 linear feet: 8-20 width (ft) and/or acres.
      Wetlands: 0.08 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **1987 Delineation Manual**
      Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]
   ☐ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
   Explain: .

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. **TNW**
   Identify TNW: .

   Summarize rationale supporting determination: .

2. **Wetland adjacent to TNW**
   Summarize rationale supporting conclusion that wetland is "adjacent": .

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. **Characteristics of non-TNWs that flow directly or indirectly into TNW**

   (i) General Area Conditions:
   Watershed size: **Pick List**
   Drainage area: **Pick List**
   Average annual rainfall: inches
   Average annual snowfall: inches

   (ii) Physical Characteristics:
   (a) Relationship with TNW:
   ☐ Tributary flows directly into TNW.
   ☐ Tributary flows through **Pick List** tributaries before entering TNW.

   Project waters are **Pick List** river miles from TNW.
   Project waters are **Pick List** river miles from RPW.
   Project waters are **Pick List** aerial (straight) miles from TNW.
   Project waters are **Pick List** aerial (straight) miles from RPW.
   Project waters cross or serve as state boundaries. Explain: .

   Identify flow route to TNW[5]: .
   Tributary stream order, if known: .

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.
[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

(b) General Tributary Characteristics (check all that apply):

Tributary is:
- ☐ Natural
- ☐ Artificial (man-made). Explain: .
- ☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
- Average width: feet
- Average depth: feet
- Average side slopes: **Pick List.**

Primary tributary substrate composition (check all that apply):
- ☐ Silts
- ☐ Sands
- ☐ Concrete
- ☐ Cobbles
- ☐ Gravel
- ☐ Muck
- ☐ Bedrock
- ☐ Vegetation. Type/% cover:
- ☐ Other. Explain: .

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: .
Presence of run/riffle/pool complexes. Explain: .
Tributary geometry: **Pick List**
Tributary gradient (approximate average slope): %

(c) Flow:

Tributary provides for: **Pick List**
Estimate average number of flow events in review area/year: **Pick List**
Describe flow regime: .
Other information on duration and volume: .

Surface flow is: **Pick List.** Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .
- ☐ Dye (or other) test performed: .

Tributary has (check all that apply):
- ☐ Bed and banks
- ☐ OHWM[6] (check all indicators that apply):
  - ☐ clear, natural line impressed on the bank
  - ☐ changes in the character of soil
  - ☐ shelving
  - ☐ vegetation matted down, bent, or absent
  - ☐ leaf litter disturbed or washed away
  - ☐ sediment deposition
  - ☐ water staining
  - ☐ other (list):
  - ☐ the presence of litter and debris
  - ☐ destruction of terrestrial vegetation
  - ☐ the presence of wrack line
  - ☐ sediment sorting
  - ☐ scour
  - ☐ multiple observed or predicted flow events
  - ☐ abrupt change in plant community
- ☐ Discontinuous OHWM.[7] Explain: .

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):
- ☐ High Tide Line indicated by:
  - ☐ oil or scum line along shore objects
  - ☐ fine shell or debris deposits (foreshore)
  - ☐ physical markings/characteristics
  - ☐ tidal gauges
  - ☐ other (list):
- ☐ Mean High Water Mark indicated by:
  - ☐ survey to available datum;
  - ☐ physical markings;
  - ☐ vegetation lines/changes in vegetation types.

(iii) Chemical Characteristics:

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: .
Identify specific pollutants, if known: .

---

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

- ☐ Riparian corridor. Characteristics (type, average width): .
- ☐ Wetland fringe. Characteristics: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain: .

Wetland quality. Explain: .

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain: .

Surface flow is: **Pick List**

Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .

- ☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

- ☐ Directly abutting
- ☐ Not directly abutting
  - ☐ Discrete wetland hydrologic connection. Explain: .
  - ☐ Ecological connection. Explain: .
  - ☐ Separated by berm/barrier. Explain: .

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List.**

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: .

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

- ☐ Riparian buffer. Characteristics (type, average width): .
- ☐ Vegetation type/percent cover. Explain: .
- ☐ Habitat for:
  - ☐ Federally Listed species. Explain findings: .
  - ☐ Fish/spawn areas. Explain findings: .
  - ☐ Other environmentally-sensitive species. Explain findings: .
  - ☐ Aquatic/wildlife diversity. Explain findings: .

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately ( ) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)

Summarize overall biological, chemical and physical functions being performed: .

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: .

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   - ☐ TNWs: linear feet width (ft), Or, acres.
   - ☐ Wetlands adjacent to TNWs: acres.

2. **RPWs that flow directly or indirectly into TNWs.**
   - ☒ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: Boylston Creek and its UT have NCDWQ stream rating scores greater than 30.
   - ☐ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☒ Tributary waters: **600** linear feet **8-20** width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

3. **Non-RPWs[8] that flow directly or indirectly into TNWs.**
☐ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .

4. **Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.**
☒ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
☒ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: **Wetlands drain directly into Boylston Creek.**

☐ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: **0.08** acres.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**
☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**
☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. **Impoundments of jurisdictional waters.[9]**
As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.
☐ Demonstrate that impoundment was created from "waters of the U.S.," or
☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]
☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

---

[8]See Footnote # 3.
[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.
[10] **Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.***

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: .
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):
☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☐ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
☐ Other: (explain, if not covered above): .

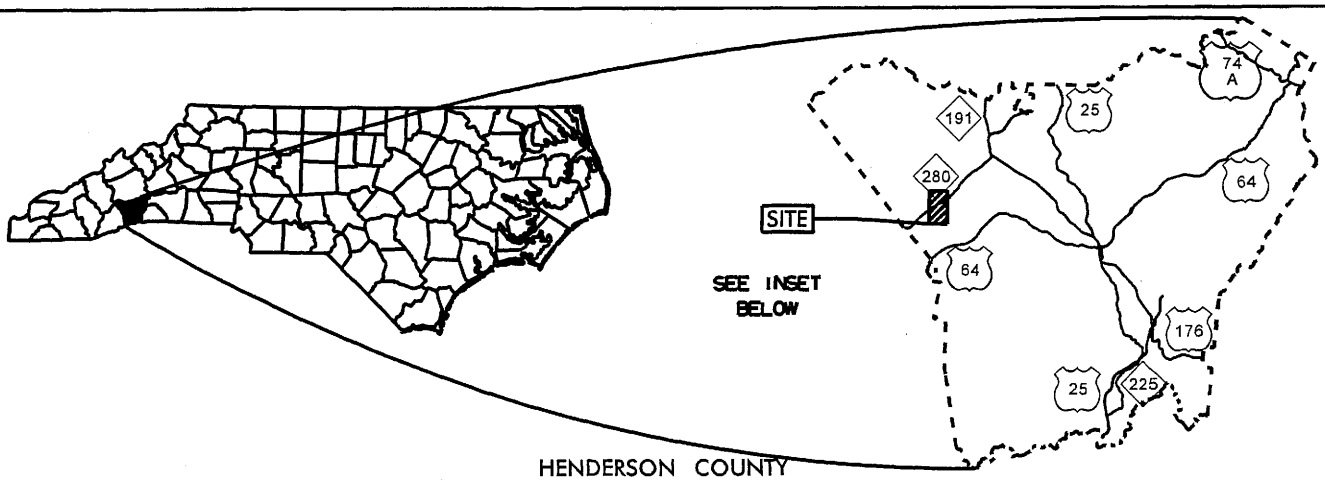
Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

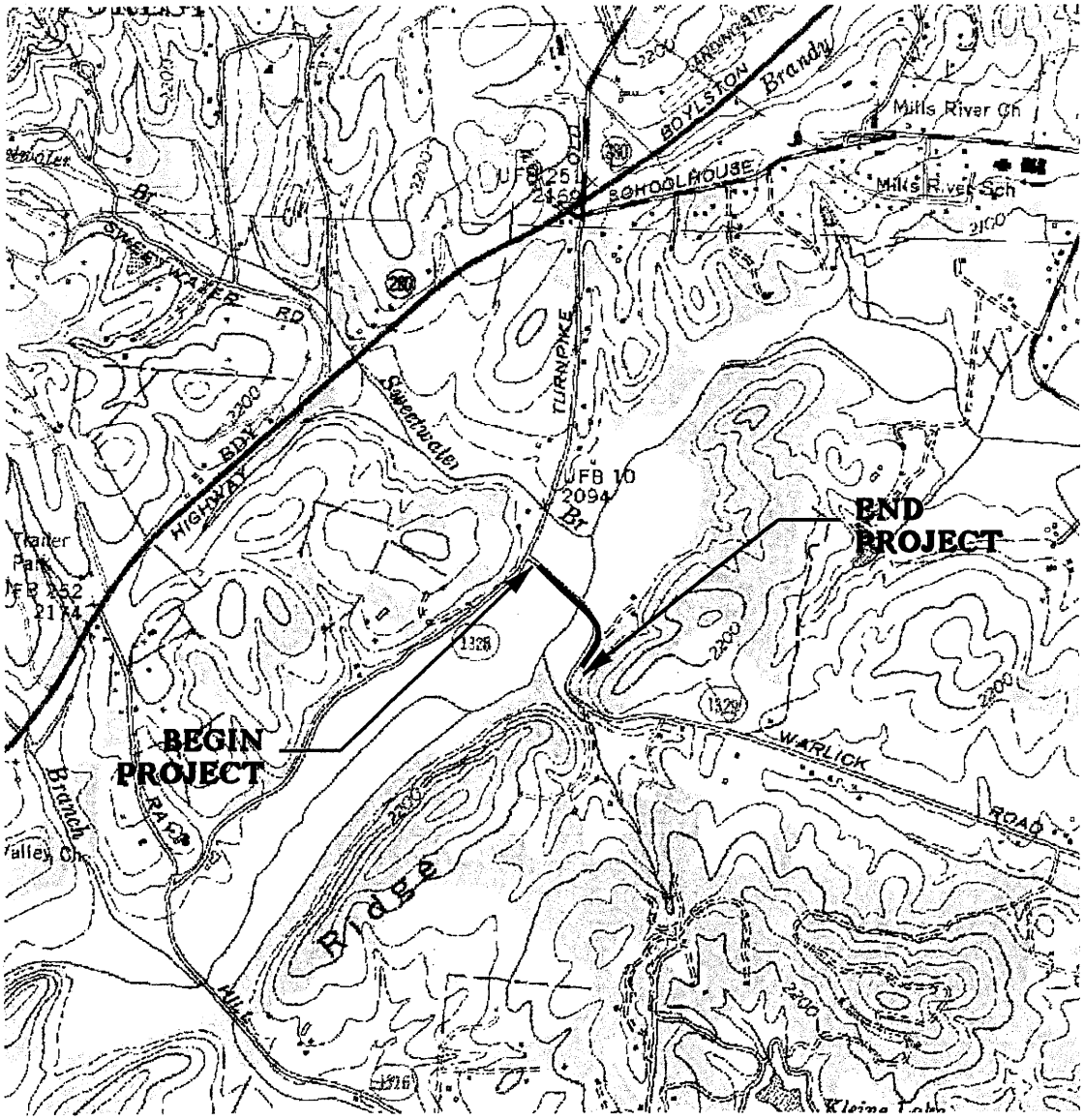
Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☐ Lakes/ponds: acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):
☐ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☐ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
☐ USGS NHD data.
☐ USGS 8 and 12 digit HUC maps.
☐ U.S. Geological Survey map(s). Cite scale & quad name: .
☐ USDA Natural Resources Conservation Service Soil Survey. Citation: .
☐ National wetlands inventory map(s). Cite name: .
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
☐ Photographs: ☐ Aerial (Name & Date): .
or ☐ Other (Name & Date): .
☐ Previous determination(s). File no. and date of response letter: .
☐ Applicable/supporting case law: .
☐ Applicable/supporting scientific literature: .
☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .





WETLAND IMPACTS VICINITY MAP

N.C. DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
HENDERSON COUNTY

PROJECT: 33497.1.1 (B–4148)
BRIDGE NO. 12 OVER
BOYLSTON CREEK ON SR 1329
(WARLICK ROAD)

SHEET 1 OF 8 3–14–08

PROPERTY OWNERS

NAMES AND ADDRESSES

PARCEL NO.	NAMES	ADDRESSES
2	ROBERT CONROY	P.O. BOX 549 HORSE SHOE, NC 28742
3	BAYNARD HICKS	1015 MISSOURI BREAKS LANE THERMOPOLIIS, WY 82443

NCDOT

DIVISION OF HIGHWAYS

HENDERSON COUNTY

PROJECT: 33497.1.1 (B-4148)
BRIDGE NO. 12 OVER
BOYLSTON CREEK ON SR 1329
(WARLICK ROAD)

WETLAND PERMIT IMPACT SUMMARY

Site No.	Station (From/To)	Structure Size / Type	WETLAND IMPACTS: Permanent Fill In Wetlands (ac)	Temp. Fill In Wetlands (ac)	Excavation in Wetlands (ac)	Mechanized Clearing in Wetlands (ac)	Hand Clearing in Wetlands (ac)	SURFACE WATER IMPACTS: Permanent SW impacts (ac)	Temp. SW impacts (ac)	Existing Channel Impacts Permanent (ft)	Existing Channel Impacts Temp. (ft)	Natural Stream Design (ft)
1	16+79/17+22 -L- LT		0.01									
2	16+06/17+74 -L- RT		0.01									
3	15+63/16+00 -L- LT & RT	Embankment Rip Rap						<.01		26		
TOTALS:			0.02					<.01		26		

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

HENDERSON COUNTY
PROJECT: 33498.1.1 (B-4148)

SHEET 3 of 8 3/14/2008

ATN Revised 3/31/05

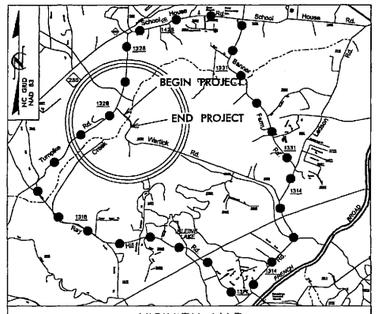
09/08/99

TIP PROJECT: B-4148

CONTRACT:

$$$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$
$$$$$USERNAME$$$$

See Sheet 1-A For Index of Sheets



VICINITY MAP

DETOUR ROUTE

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HENDERSON COUNTY

LOCATION: BRIDGE NO. 12 OVER BOYLSTON CREEK ON SR 1329 (WARLICK ROAD)

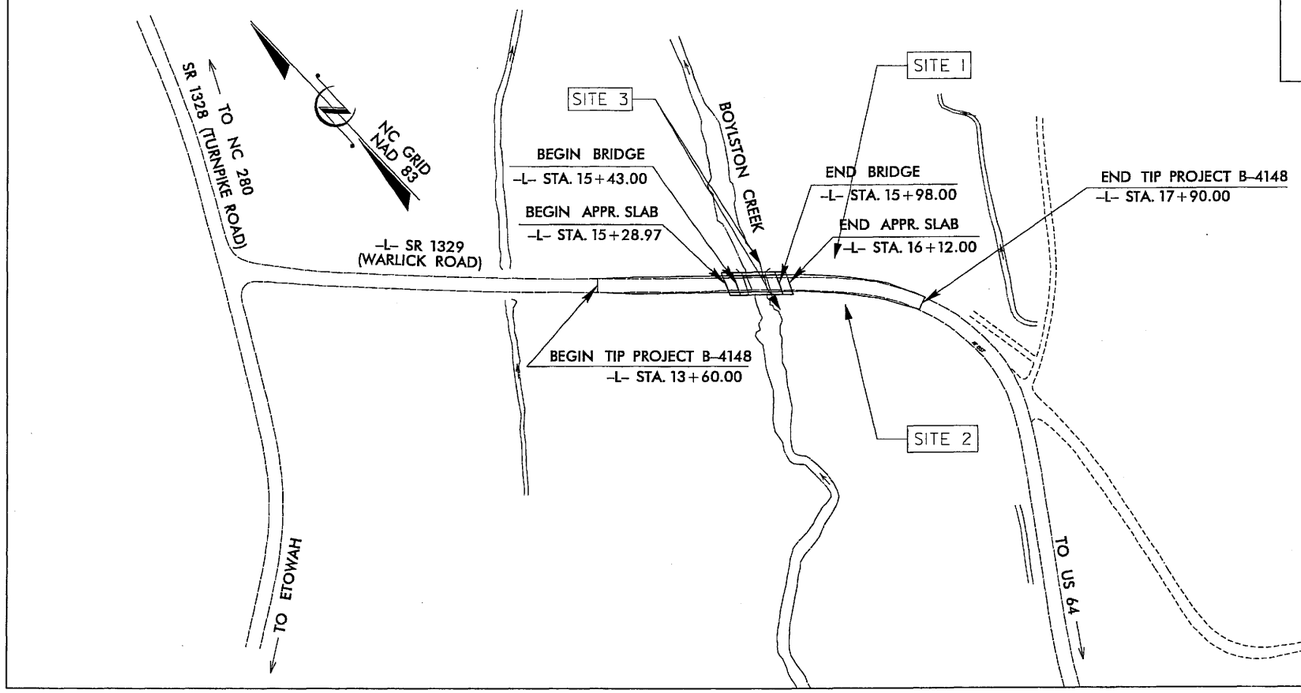
TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4148	1	

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
33497.1.1	BRZ-1329(4)	P.E.
33497.2.1	BRZ-1329(4)	R/W

Permit Drawing
Sheet 4 of 8

4



WETLAND/ STREAM IMPACTS

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

Clearing on this project shall be performed to the limits established by method II.

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

5 2.5 0 5 10
PROFILE (VERTICAL)

DESIGN DATA

ADT 2009 = 700
ADT 2030 = 1400
DHV = 10%
D = 60%
T = 3% (1% TTST + 2% DUALS)
V = 50 MPH
FUNCT. CLASS = RURAL LOCAL
* DESIGN EXCEPTION REQUIRED FOR SAG/CREST K VALUE AND VERTICAL CURVE SSD

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-4148 = 0.071 MI
LENGTH STRUCTURE TIP PROJECT B-4148 = 0.010 MI
TOTAL LENGTH OF TIP PROJECT B-4148 = 0.081 MI

Prepared In the Office of:
VAUGHN & MELTON
1318-F PATTON AVE.
ASHEVILLE NC, 28806
FOR THE NORTH CAROLINA DIVISION OF HIGHWAYS

2006 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
JANUARY 18, 2008

LETTING DATE:
JANUARY 20, 2009

REECE SCHULER, PE
PROJECT ENGINEER

AARON CARVER, PE
PROJECT DESIGN ENGINEER

NCDOT CONTACT:
DOUG TAYLOR, PE
PROJECT ENGINEER - ROADWAY DESIGN

HYDRAULICS ENGINEER

SIGNATURE: *P.E.*

ROADWAY DESIGN ENGINEER

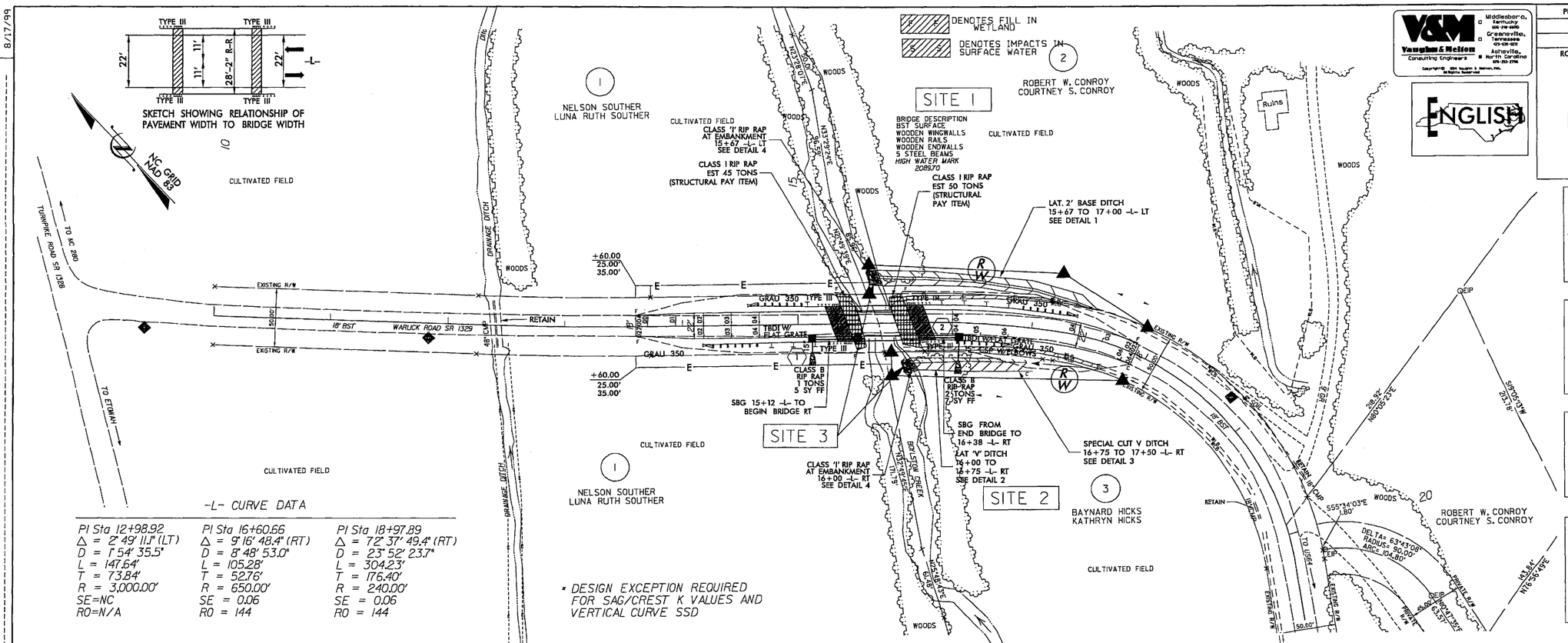
SIGNATURE: *P.E.*

DIVISION OF HIGHWAYS STATE OF NORTH CAROLINA

P.E.
STATE HIGHWAY DESIGN ENGINEER

8/17/99

REVISIONS



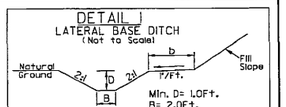
V&M Vaughan & Melton Consulting Engineers — Middlesboro, Kentucky 606-248-5000; Greeneville, Tennessee 423-638-4171; Asheville, North Carolina 828-253-3796

PROJECT REFERENCE NO.	SHEET NO.
B-4148	4
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

ENGLISH

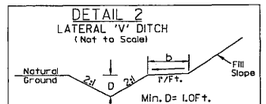
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

DETAIL 1
LATERAL BASE DITCH
(Not to Scale)



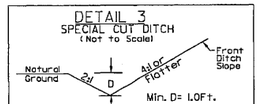
Min. D= 1.0Ft.
B= 2.0Ft.
b= 5.0Ft.
DDE = 137 CY
FROM STA. 15+67 TO STA. 17+00 -L- LT.

DETAIL 2
LATERAL 'V' DITCH
(Not to Scale)



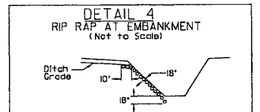
Min. D= 1.0Ft.
b= 5.0Ft.
DDE = 108 CY
FROM STA. 16+00 TO STA. 16+75 -L- RT.

DETAIL 3
SPECIAL CUT DITCH
(Not to Scale)

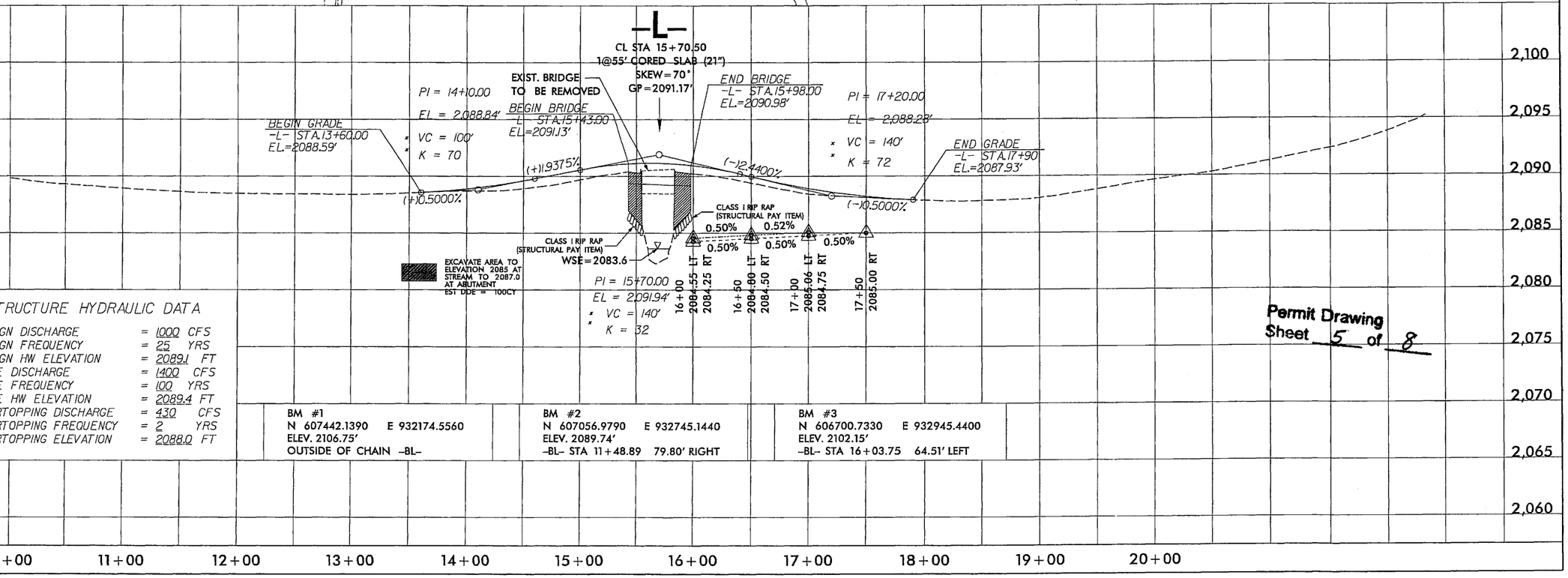


Min. D= 1.0Ft.
FROM STA. 16+75 TO STA. 17+50 -L- RT.

DETAIL 4
RIP RAP AT EMBANKMENT
(Not to Scale)



Est. 8 Tons Each
Type of Liner= Class I Rip-Rap
STA. 15+67 -L- LT
STA. 16+00 -L- RT.



STRUCTURE HYDRAULIC DATA

DESIGN DISCHARGE	= 1000	CFS
DESIGN FREQUENCY	= 25	YRS
DESIGN HW ELEVATION	= 2089.1	FT
BASE DISCHARGE	= 1400	CFS
BASE FREQUENCY	= 100	YRS
BASE HW ELEVATION	= 2089.4	FT
OVERTOPPING DISCHARGE	= 430	CFS
OVERTOPPING FREQUENCY	= 2	YRS
OVERTOPPING ELEVATION	= 2088.0	FT

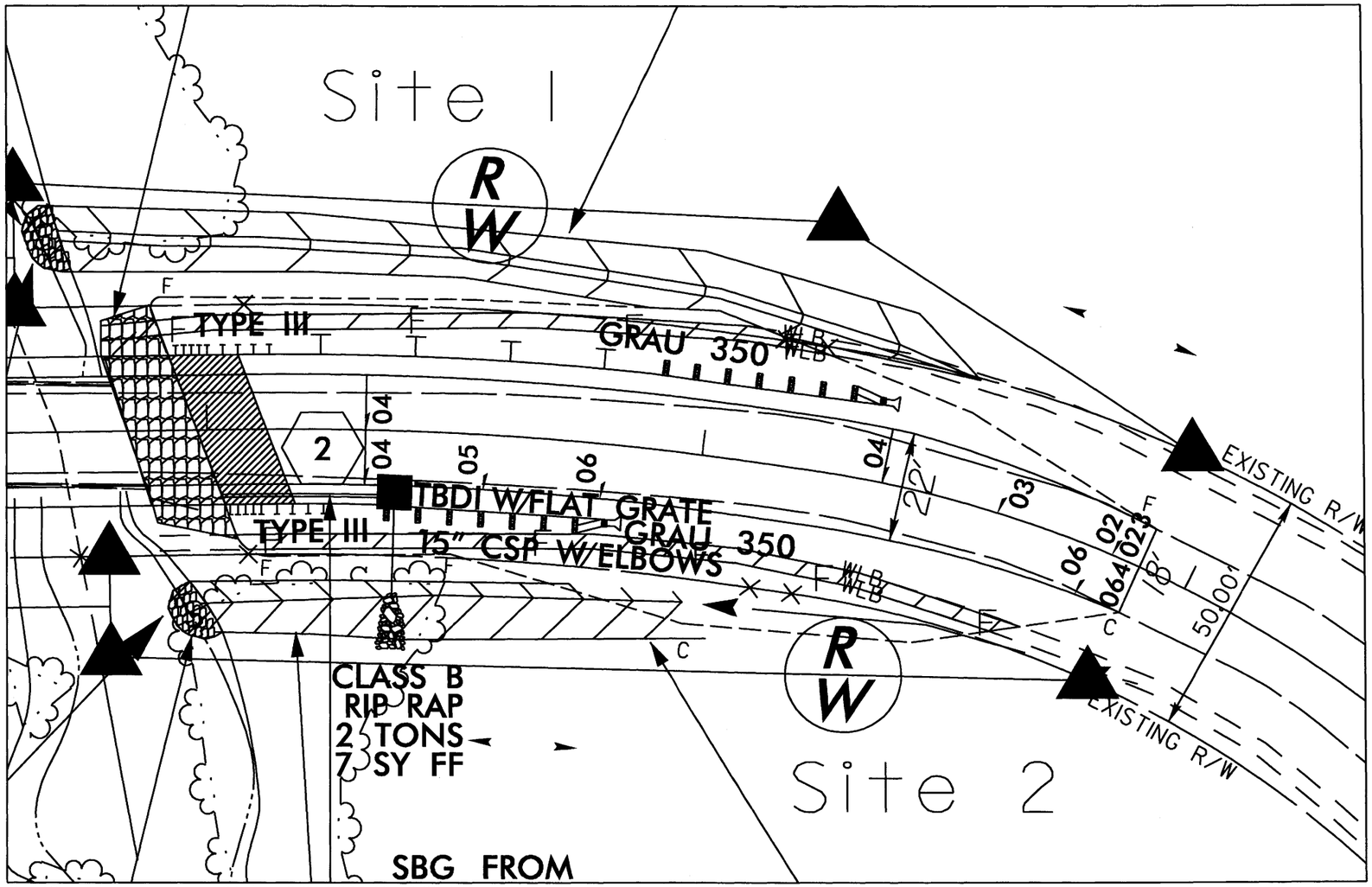
BM #1
N 607442.1390 E 932174.5560
ELEV. 2106.75'
OUTSIDE OF CHAIN -BL-

BM #2
N 607056.9790 E 932745.1440
ELEV. 2089.74'
-BL- STA 11+48.89 79.80' RIGHT

BM #3
N 606700.7330 E 932945.4400
ELEV. 2102.15'
-BL- STA 16+03.75 64.51' LEFT

Permit Drawing
Sheet 5 of 8

SYSTIMES
USERNAME



B4148_Hyd_prm_wet_psh04.dgn 3/24/2008 10:19:22 AM

Permit Drawing
Sheet 6 of 8

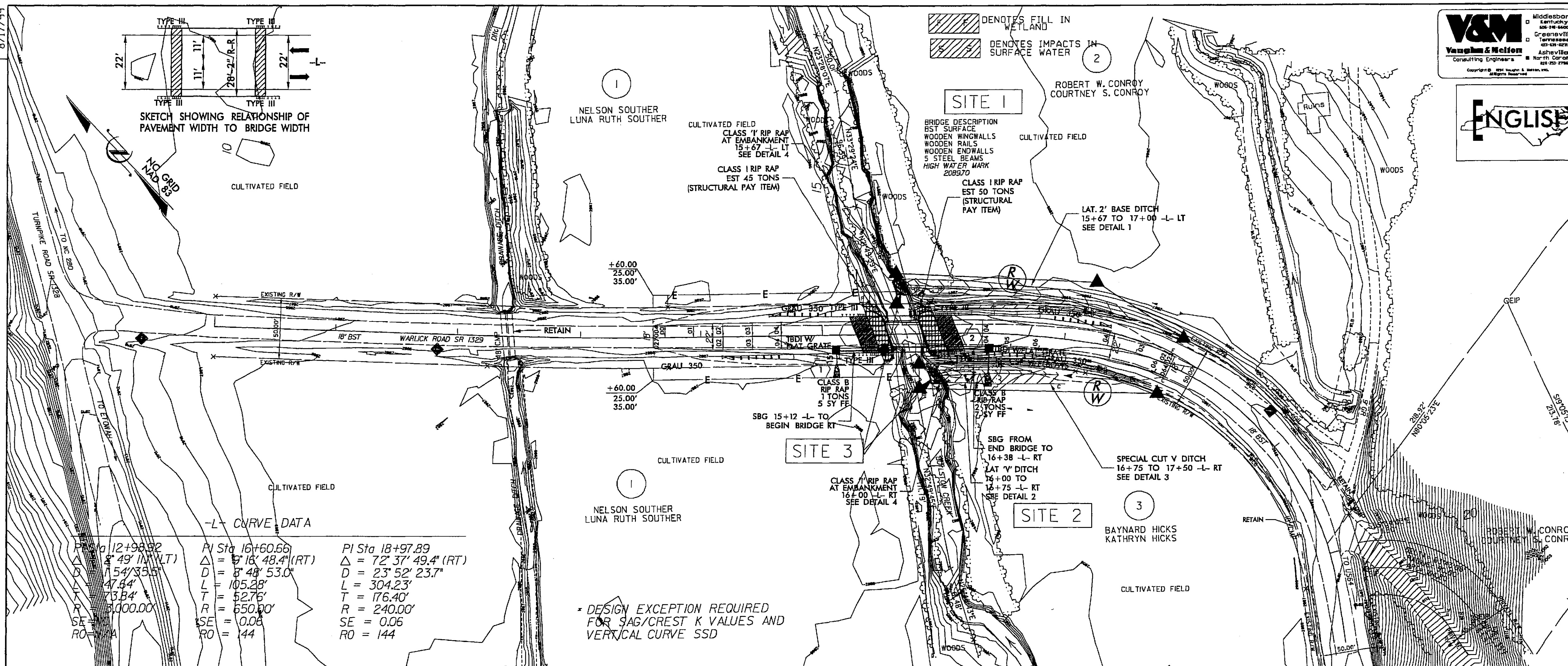
PROJECT REFERENCE NO.	SHEET NO.
B-4148	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

ENGLISH

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

8/17/99

REVISIONS



-L- CURVE DATA

PI Sta 12+98.92	PI Sta 16+60.66	PI Sta 18+97.89
Δ = 2° 49' 11" (LT)	Δ = 9° 16' 48.4" (RT)	Δ = 72° 37' 49.4" (RT)
D = 1° 54' 35.5"	D = 8° 48' 53.0"	D = 23° 52' 23.7"
L = 147.64'	L = 105.28'	L = 304.23'
T = 73.84'	T = 52.76'	T = 176.40'
R = 3,000.00'	R = 650.00'	R = 240.00'
SE = NC	SE = 0.06	SE = 0.06
RO = N/A	RO = 144	RO = 144

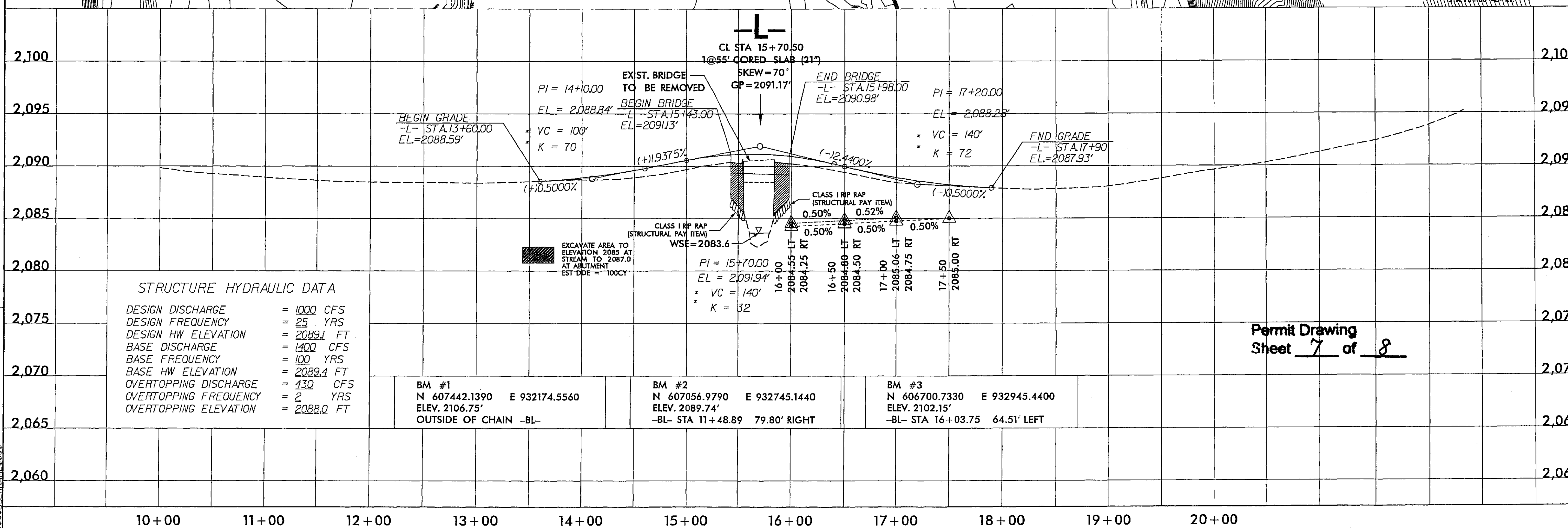
* DESIGN EXCEPTION REQUIRED FOR SAG/CREST K VALUES AND VERTICAL CURVE SSD

DETAIL 1
LATERAL BASE DITCH (Not to Scale)
Natural Ground; 2:1; D; 2:1; B; b; 1"/Ft.; Fill Slope
Min. D= 1.0Ft. B= 2.0Ft. b= 5.0Ft.
DDE = 137 CY
FROM STA. 15+67 TO STA. 17+00 -L- LT.

DETAIL 2
LATERAL 'V' DITCH (Not to Scale)
Natural Ground; 2:1; D; 2:1; b; 1"/Ft.; Fill Slope
Min. D= 1.0Ft. b= 5.0Ft.
DDE = 108 CY
FROM STA. 16+00 TO STA. 16+75 -L- RT.

DETAIL 3
SPECIAL CUT DITCH (Not to Scale)
Natural Ground; 2:1; D; 4:1 or Flatter; Front Ditch Slope
Min. D= 1.0Ft.
FROM STA. 16+75 TO STA. 17+50 -L- RT.

DETAIL 4
RIP RAP AT EMBANKMENT (Not to Scale)
Ditch Grade; 10'; 18"
Est. 8 Tons Each
Type of Liner= Class I Rip-Rap
STA. 15+67 -L- LT
STA. 16+00 -L- RT.



STRUCTURE HYDRAULIC DATA

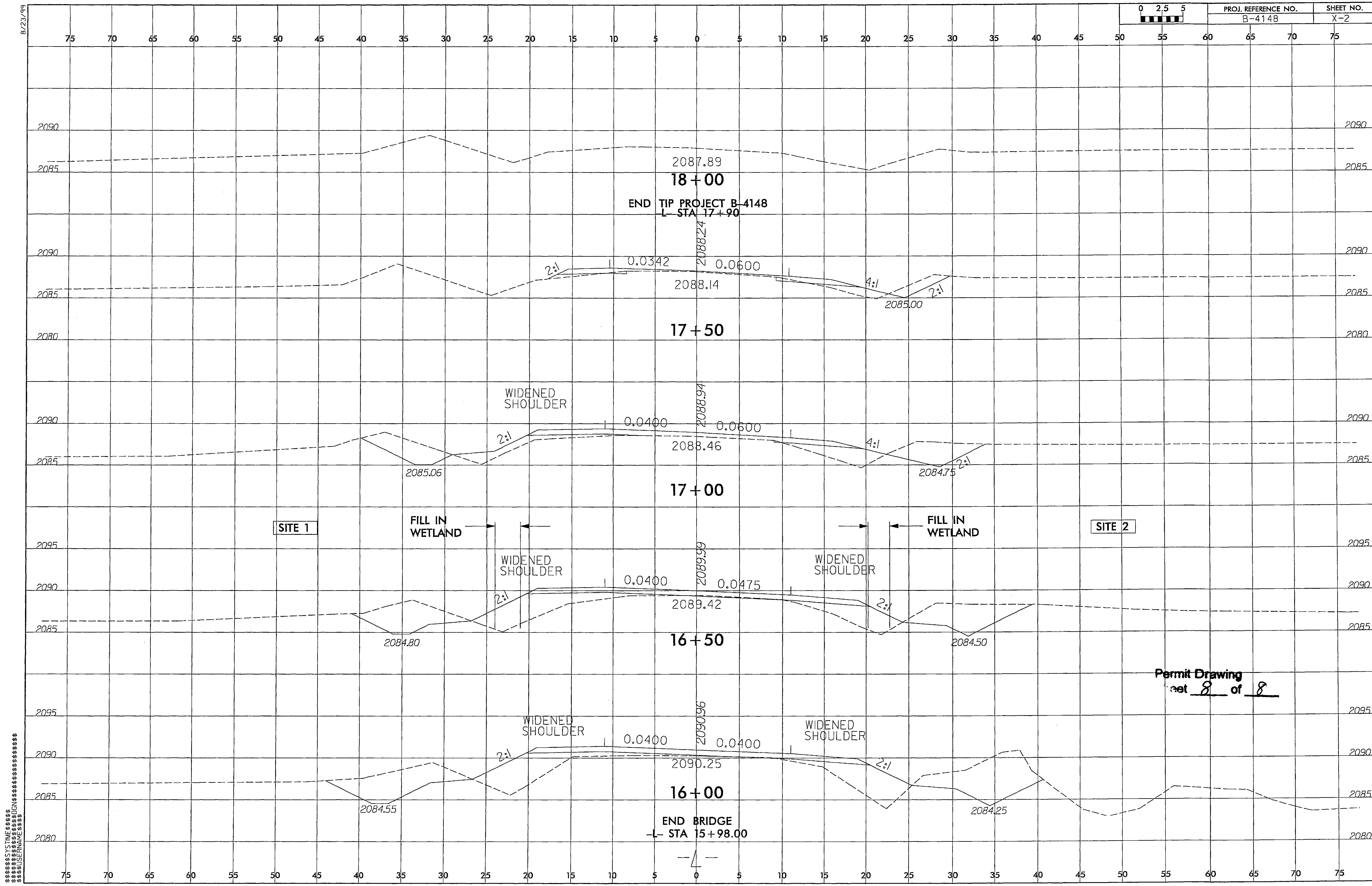
DESIGN DISCHARGE	= 1000 CFS
DESIGN FREQUENCY	= 25 YRS
DESIGN HW ELEVATION	= 2089.1 FT
BASE DISCHARGE	= 1400 CFS
BASE FREQUENCY	= 100 YRS
BASE HW ELEVATION	= 2089.4 FT
OVERTOPPING DISCHARGE	= 430 CFS
OVERTOPPING FREQUENCY	= 2 YRS
OVERTOPPING ELEVATION	= 2088.0 FT

BM #1	BM #2	BM #3
N 607442.1390 E 932174.5560	N 607056.9790 E 932745.1440	N 606700.7330 E 932945.4400
ELEV. 2106.75'	ELEV. 2089.74'	ELEV. 2102.15'
OUTSIDE OF CHAIN -BL-	-BL- STA 11+48.89 79.80' RIGHT	-BL- STA 16+03.75 64.51' LEFT

Permit Drawing
Sheet 7 of 8

$$$$$$SYSTIME$$$$$
$$$$$$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$
$$$$$$USERNAME$$$$

PROJ. REFERENCE NO.	SHEET NO.
B-4148	X-2



09/08/09

TIP PROJECT: B-4148

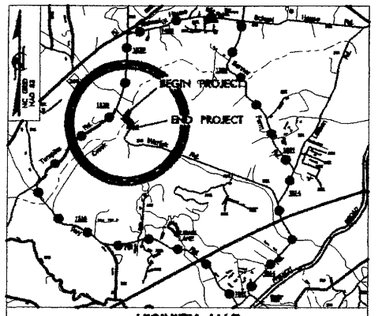
CONTRACT:

$$$$$$SYSTIME$$$$$$

$$$$$$DGN$$$$$$

$$$$$$USERNAME$$$$$$

See Sheet 1-A For Index of Sheets



VICINITY MAP

DETOUR ROUTE

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HENDERSON COUNTY

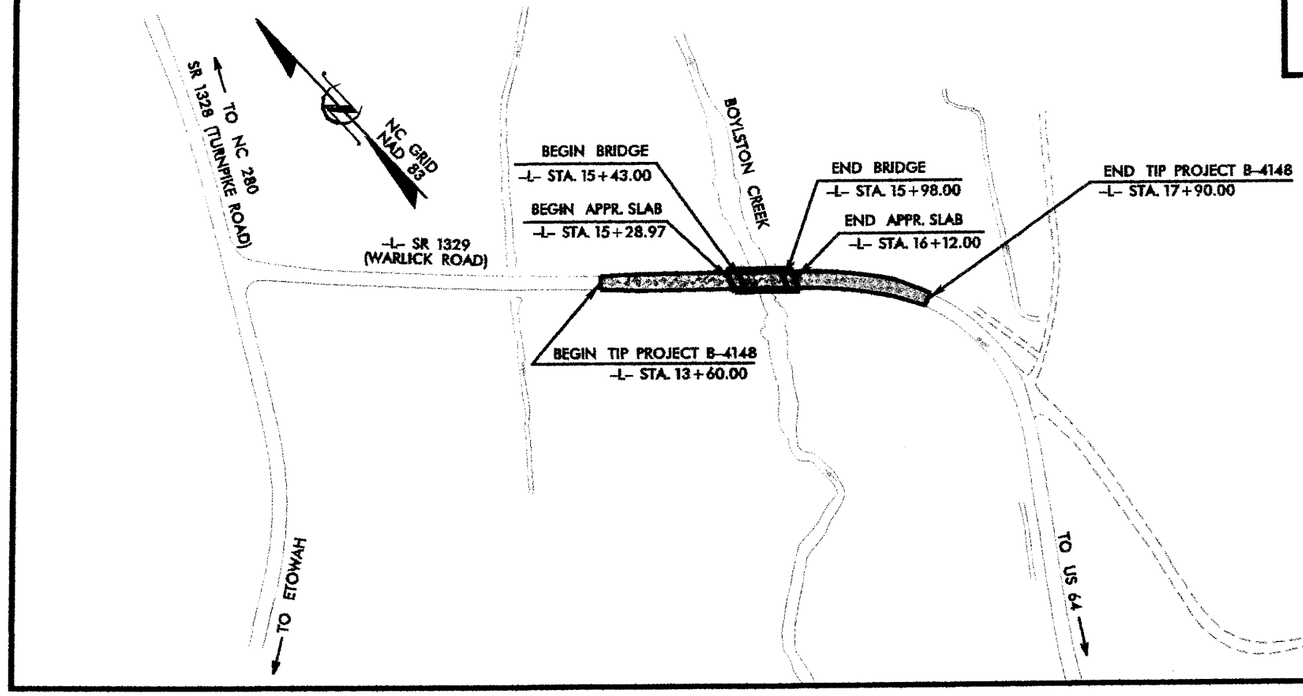
LOCATION: BRIDGE NO. 12 OVER BOYLSTON CREEK ON SR 1329 (WARLICK ROAD)

TYPE OF WORK: GRADING, DRAINAGE, PAVING AND STRUCTURE

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4148	1	

STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION
33497.1.1	BRZ-1329(4)	P.E.
33497.2.1	BRZ-1329(4)	R/W

4



Clearing on this project shall be performed to the limits established by method II.

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

5 2.5 0 5 10
PROFILE (VERTICAL)

DESIGN DATA

ADT 2009 = 700
ADT 2030 = 1400
DHV = 10%
D = 60%
T = 3% (1% TTST + 2% DUALS)
V = 50 MPH
FUNCT. CLASS = RURAL LOCAL
* DESIGN EXCEPTION REQUIRED FOR SAG/CREST K VALUE AND VERTICAL CURVE SSD

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-4148 = 0.071 MI
LENGTH STRUCTURE TIP PROJECT B-4148 = 0.010 MI
TOTAL LENGTH OF TIP PROJECT B-4148 = 0.081 MI

Prepared in the Office of:
VAUGHN & MELTON
1318-F PATTON AVE.
ASHEVILLE NC, 28806
FOR THE NORTH CAROLINA DIVISION OF HIGHWAYS

2006 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: JANUARY 18, 2008

LETTING DATE: JANUARY 20, 2009

REECE SCHULER, PE
PROJECT ENGINEER

AARON CARVER, PE
PROJECT DESIGN ENGINEER

NCDOT CONTACT:
DOUG TAYLOR, PE
PROJECT ENGINEER - ROADWAY DESIGN

HYDRAULICS ENGINEER

SIGNATURE: P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: P.E.

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

P.E.
STATE HIGHWAY DESIGN ENGINEER

3/15/06

Note: Not to Scale

****S.U.E. = Subsurface Utility Engineering***

PROJECT REFERENCE NO.	SHEET NO.
B-448	1-B

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL PLAN SHEET SYMBOLS

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — EPM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — EWLB
- Proposed Wetland Boundary — PWLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign
- Well
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Swamp Marsh
- Proposed Lateral, Tail, Head Ditch — Flow
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line
- Proposed Right of Way Line with Iron Pin and Cap Marker
- Proposed Right of Way Line with Concrete or Granite Marker
- Existing Control of Access
- Proposed Control of Access
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Utility Easement — PUE

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Proposed Wheel Chair Ramp Curb Cut — WCC
- Curb Cut for Future Wheel Chair Ramp — CCFR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line — W
- Designated U/G Water Line (S.U.E.*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — T
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter — G
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

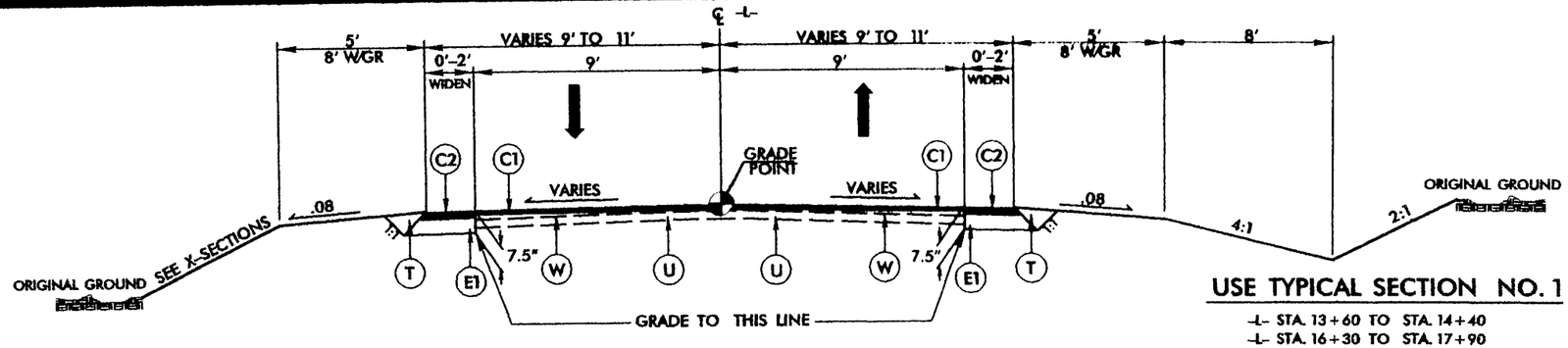
- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

PROJECT REFERENCE NO.	SHEET NO.
B-4148	2
ROADWAY DESIGN ENGINEER	PAVEMENT DESIGN ENGINEER

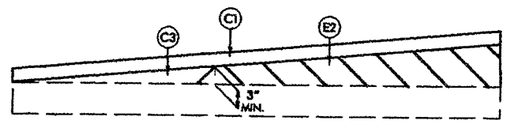
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



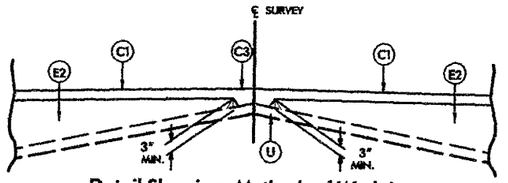
TYPICAL SECTION NO. 1

USE TYPICAL SECTION NO. 1

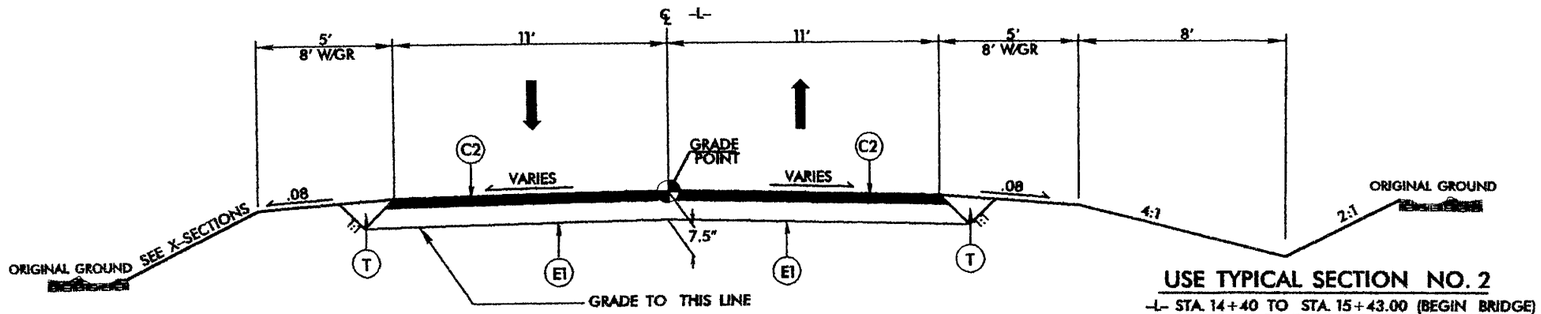
-L- STA. 13+60 TO STA. 14+40
-L- STA. 16+30 TO STA. 17+90



Wedging Detail



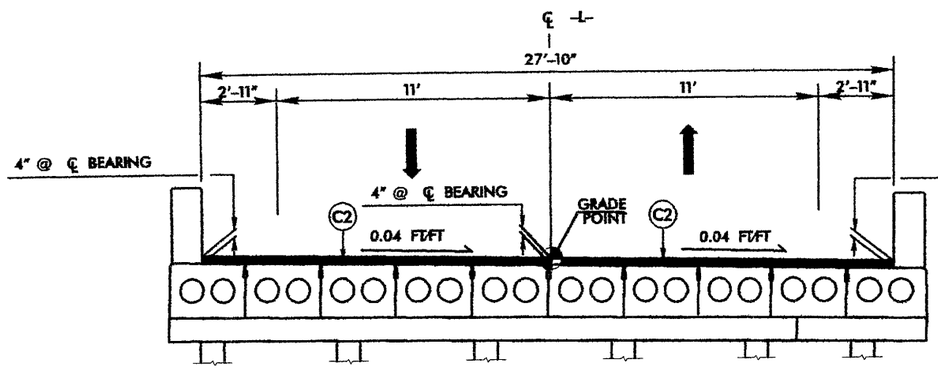
Detail Showing Method of Wedging



TYPICAL SECTION NO. 2

USE TYPICAL SECTION NO. 2

-L- STA. 14+40 TO STA. 15+43.00 (BEGIN BRIDGE)
-L- STA. 15+98.00 (END BRIDGE) TO STA. 16+30



Detail of Asphalt Wearing Surface on Bridge

TYPICAL SECTION NO. 3

USE TYPICAL SECTION NO. 3

-L- STA. 15+43.00 (BEGIN BRIDGE) TO
-L- STA. 15+98.00 (END BRIDGE)

C1	PROP. APPROX. 1¼" ASPHALT CONCRETE SURFACE COURSE, TYPE SF9.5A, AT AN AVERAGE RATE OF 137.5 LBS. PER SQ. YD.
C2	PROP. APPROX. 2½" ASPHALT CONCRETE SURFACE COURSE, TYPE SF9.5A, AT AN AVERAGE RATE OF 137.5 LBS. PER SQ. YD. IN EACH OF TWO LAYERS.
C3	PROP. VAR. DEPTH ASPHALT CONCRETE SURFACE COURSE, TYPE SF9.5A, AT AN AVERAGE RATE OF 110 LBS. PER SQ. YD. PER 1" DEPTH. TO BE PLACED IN LAYERS NOT TO EXCEED 1½" IN DEPTH.
E1	PROP. APPROX. 5" ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 570 LBS. PER SQ. YD.
E2	PROP. VAR. DEPTH ASPHALT CONCRETE BASE COURSE, TYPE B25.0B, AT AN AVERAGE RATE OF 114 LBS. PER SQ. YD. PER 1" DEPTH.
T	EARTH MATERIAL.
U	EXISTING PAVEMENT.
W	VARIABLE DEPTH ASPHALT PAVEMENT (SEE WEDGING DETAIL FOR RESURFACING).

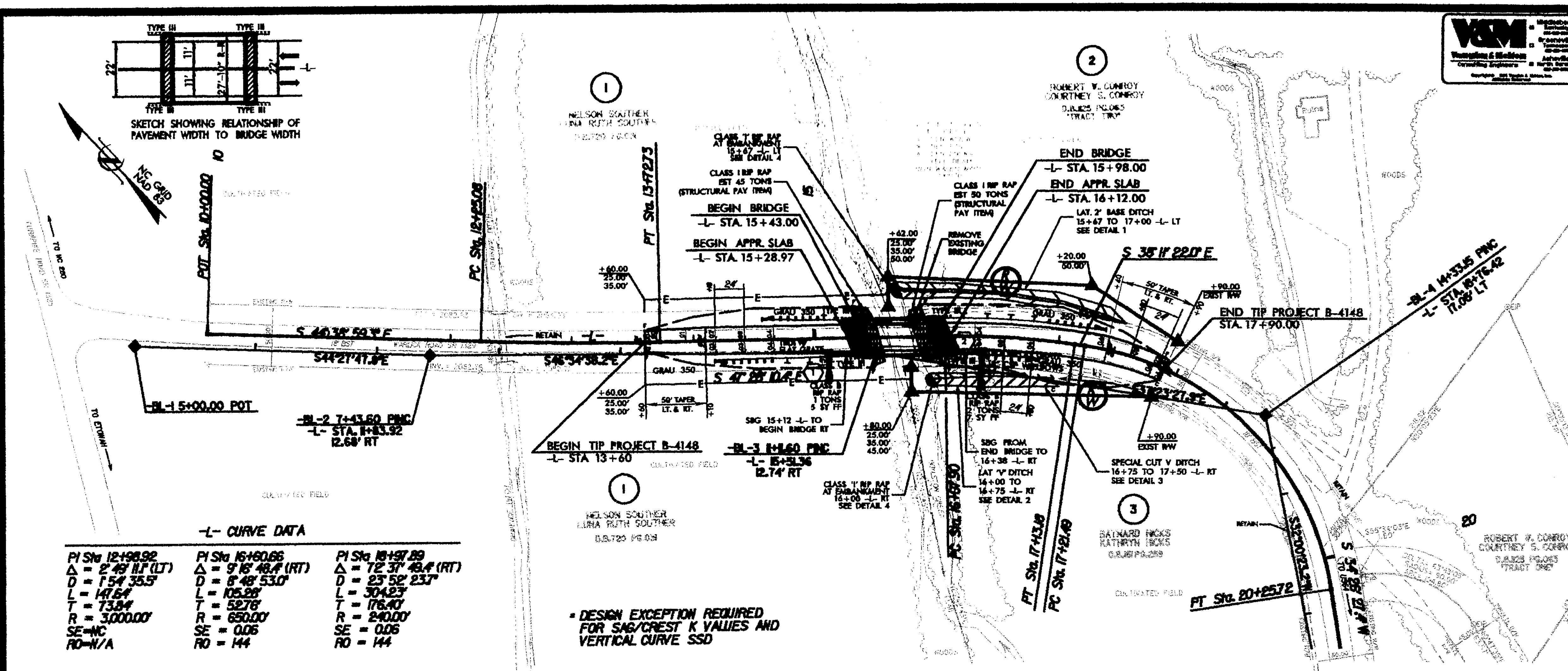
NOTE: PAVEMENT EDGE SLOPES ARE 1:1 UNLESS SHOWN OTHERWISE

6/2/99

$$$$$$$$SYSTIME$$$$$$$$
$$$$$$$$DGN$$$$$$$$

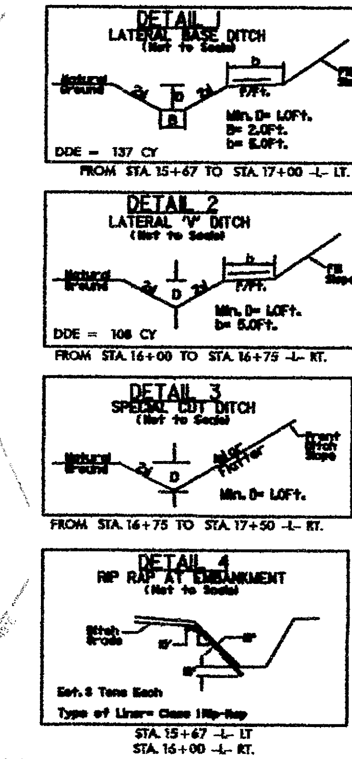
PROJECT REFERENCE NO.	SHEET NO.
B-4148	4
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

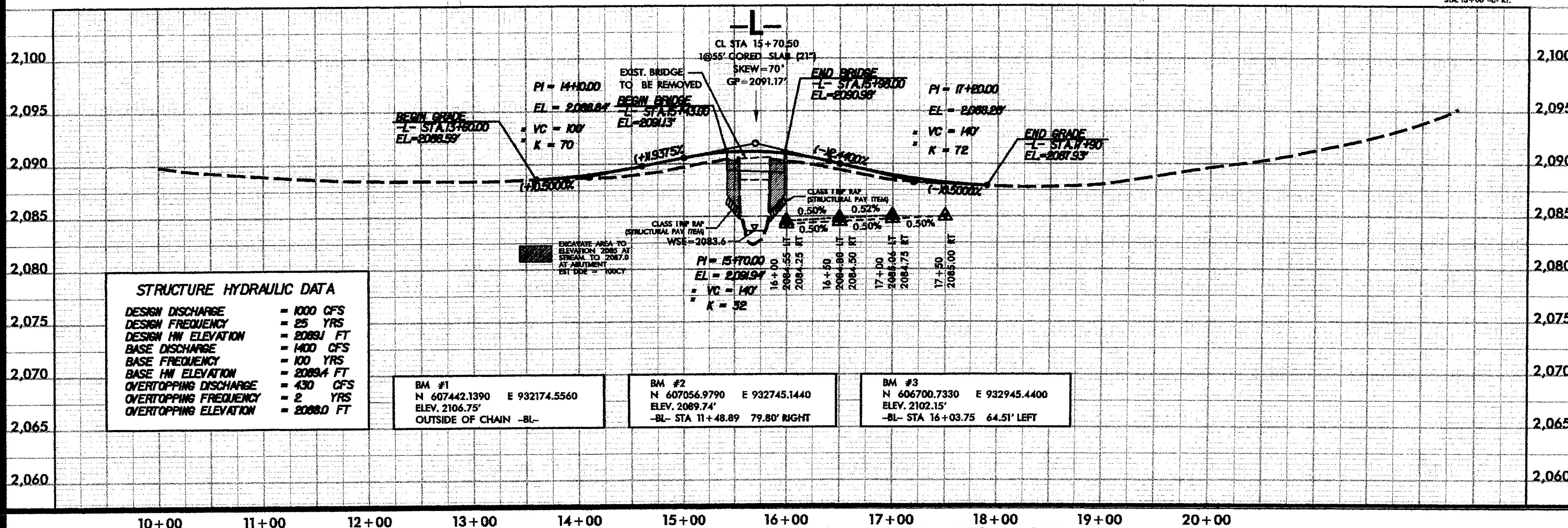
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION



-L- CURVE DATA

PI Sta 12+98.92	PI Sta 16+60.66	PI Sta 18+97.89
Δ = 2° 49' 11.1" (LT)	Δ = 9° 16' 48.4" (RT)	Δ = 72° 37' 49.4" (RT)
D = 1° 54' 35.5"	D = 8° 48' 53.0"	D = 23° 52' 23.7"
L = 147.64'	L = 105.28'	L = 304.23'
T = 73.84'	T = 52.78'	T = 176.40'
R = 3,000.00'	R = 650.00'	R = 240.00'
SE=NC	SE = 0.06	SE = 0.06
RO=N/A	RO = 144	RO = 144





STRUCTURE HYDRAULIC DATA

DESIGN DISCHARGE	= 1000 CFS
DESIGN FREQUENCY	= 25 YRS
DESIGN HW ELEVATION	= 2089.1 FT
BASE DISCHARGE	= 1400 CFS
BASE FREQUENCY	= 100 YRS
BASE HW ELEVATION	= 2089.4 FT
OVERTOPPING DISCHARGE	= 430 CFS
OVERTOPPING FREQUENCY	= 2 YRS
OVERTOPPING ELEVATION	= 2088.0 FT

BM #1
N 607442.1390 E 932174.5560
ELEV. 2106.75'
OUTSIDE OF CHAIN -BL-

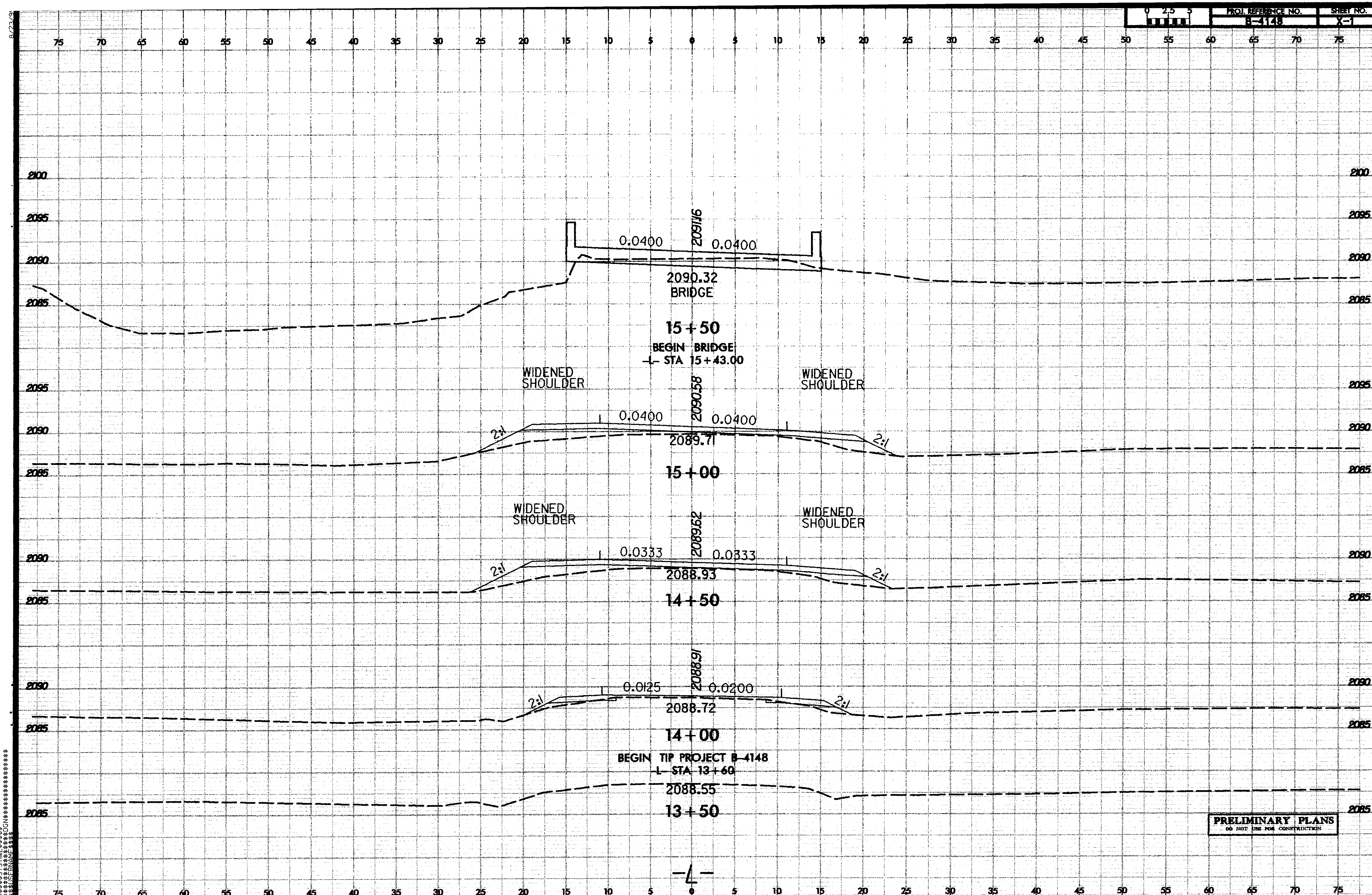
BM #2
N 607056.9790 E 932745.1440
ELEV. 2089.74'
-BL- STA 11+48.89 79.80' RIGHT

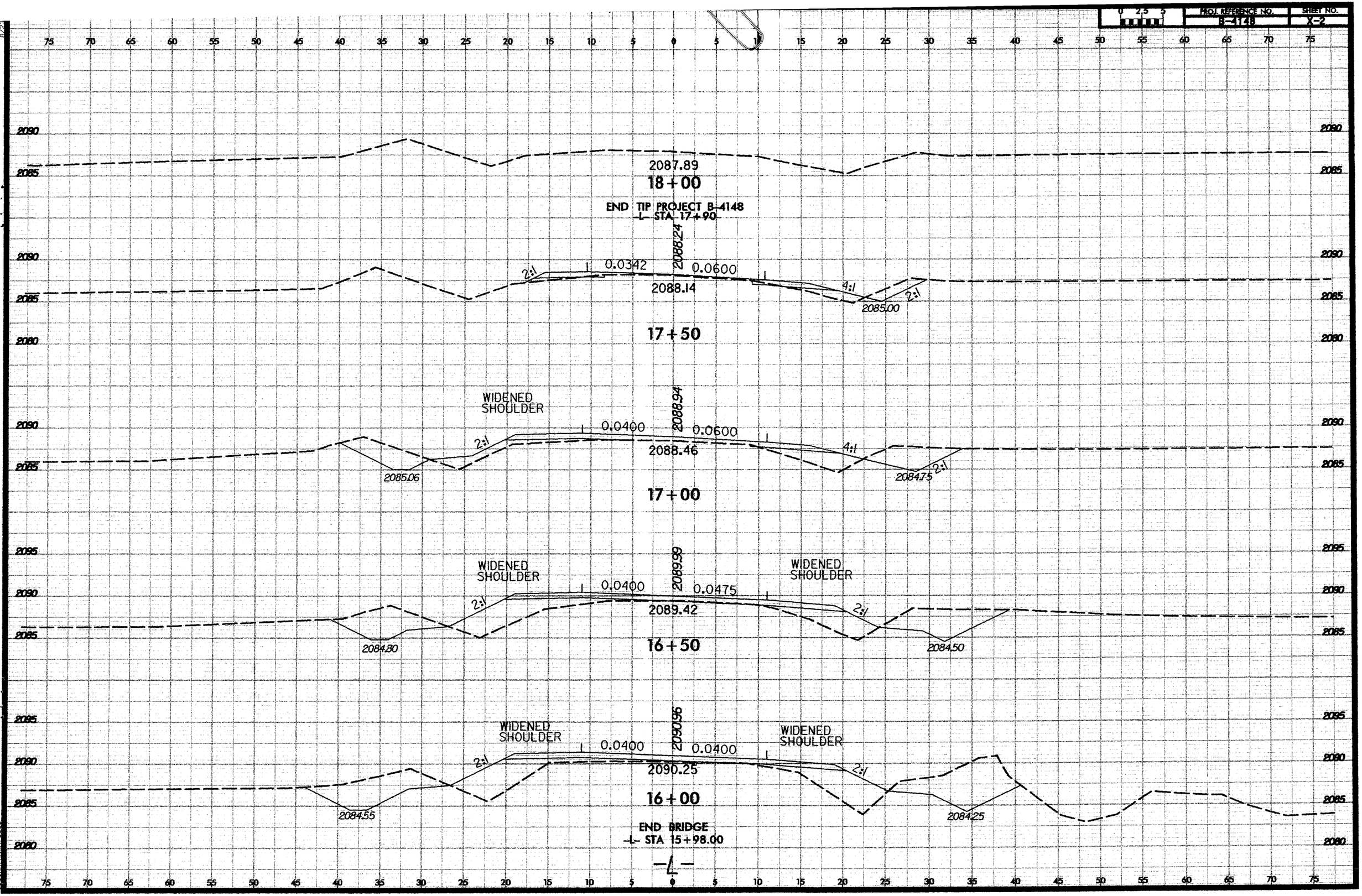
BM #3
N 606700.7330 E 932945.4400
ELEV. 2102.15'
-BL- STA 16+03.75 64.51' LEFT

REVISIONS

8/17/99

$$$$$$SYSTIME$$$$$$ $$$$$$$$$$DGN$$$$$$$$$$$$$$$$ $$$$$$USERNAME$$$$$$


PROJ. REFERENCE NO.
B-4148
SHEET NO.
X-1
0 2.5 5
2091.16
0.0400
0.0400
2090.32
BRIDGE
15+50
BEGIN BRIDGE
-L- STA 15+43.00
WIDENED SHOULDER
WIDENED SHOULDER
2090.58
0.0400
0.0400
2:1
2:1
2089.71
15+00
WIDENED SHOULDER
WIDENED SHOULDER
2089.62
0.0333
0.0333
2:1
2:1
2088.93
14+50
2088.91
0.0125
0.0200
2:1
2:1
2088.72
14+00
BEGIN TIP PROJECT B-4148
-L- STA 13+60
2088.55
13+50
-L-
PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION
$$$$$$SYSTIME$$$$$
$$$$$$USERNAME$$$$$
$$$$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$


75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
2090
2085
2080
2095
2087.89
18+00
END TIP PROJECT B-4148
-L- STA 17+90
2088.24
0.0342
0.0600
2088.14
2:1
4:1
2:1
2085.00
17+50
WIDENED SHOULDER
2088.94
0.0400
0.0600
2088.46
2:1
4:1
2:1
2085.06
2084.75
17+00
2089.99
WIDENED SHOULDER
WIDENED SHOULDER
0.0400
0.0475
2089.42
2:1
2:1
2084.80
2084.50
16+50
2090.96
WIDENED SHOULDER
WIDENED SHOULDER
0.0400
0.0400
2090.25
2:1
2:1
2084.55
2084.25
16+00
END BRIDGE
-L- STA 15+98.00

CATEGORICAL EXCLUSION ACTION CLASSIFICATION FORM

TIP Project No.	**B-4148**
State Project No.	**8.2952801**
W.B.S. No.	**33497.1.1**
Federal Project No.	**BRZ-1329(4)**

A. Project Description:

The purpose of this project is to replace Henderson County Bridge No. 12 on SR 1329 (Warlick Road) over Boylston Creek. Bridge No. 12 is 31 feet long. The replacement structure will be a bridge approximately 60 feet long providing a minimum 30 feet clear deck width. The bridge will include two 12-foot lanes and 3-foot offsets. The roadway grade of the new structure will be approximately the same as the existing structure.

The approach roadway will extend approximately 420 feet from the northwest end of the new bridge and 270 feet from the southeast end of the new bridge. The approaches will be widened to include a 24-foot pavement width providing two 12-foot lanes. Five-foot grass shoulders will be provided on each side (8-foot shoulders where guardrail is included). The roadway will be designed as a Rural Local Route with a 60 mile per hour design speed.

Traffic will be detoured off-site during construction (see Figure 1).

B. Purpose and Need:

In 1998, when the timber bridge was programmed, the bridge had a sufficiency rating of 38.8 out of 100 and was both structurally deficient and functionally obsolete. Since that time, temporary crutch work and repairs have been done which resulted in the current rating of 70.2 out of 100. Because the crutch work is temporary, the bridge is still structurally deficient as well as functionally obsolete and therefore still eligible for FHWA's Bridge Replacement Program. The 45-year-old timber bridge is approaching the end of its useful life.

C. Proposed Improvements:

Circle one or more of the following Type II improvements which apply to the project:

1. Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes (e.g., parking, weaving, turning, climbing).

    a. Restoring, Resurfacing, Rehabilitating, and Reconstructing pavement (3R and 4R improvements)
    b. Widening roadway and shoulders without adding through lanes
    c. Modernizing gore treatments

d. Constructing lane improvements (merge, auxiliary, and turn lanes)
e. Adding shoulder drains
f. Replacing and rehabilitating culverts, inlets, and drainage pipes, including safety treatments
g. Providing driveway pipes
h. Performing minor bridge widening (less than one through lane)
i. Slide Stabilization
j. Structural BMP's for water quality improvement

2. Highway safety or traffic operations improvement projects including the installation of ramp metering control devices and lighting.

a. Installing ramp metering devices
b. Installing lights
c. Adding or upgrading guardrail
d. Installing safety barriers including Jersey type barriers and pier protection
e. Installing or replacing impact attenuators
f. Upgrading medians including adding or upgrading median barriers
g. Improving intersections including relocation and/or realignment
h. Making minor roadway realignment
i. Channelizing traffic
j. Performing clear zone safety improvements including removing hazards and flattening slopes
k. Implementing traffic aid systems, signals, and motorist aid
l. Installing bridge safety hardware including bridge rail retrofit

3. Bridge rehabilitation, reconstruction, or replacement or the construction of grade separation to replace existing at-grade railroad crossings.

a. Rehabilitating, reconstructing, or replacing bridge approach slabs
b. Rehabilitating or replacing bridge decks
c. Rehabilitating bridges including painting (no red lead paint), scour repair, fender systems, and minor structural improvements
d. Replacing a bridge (structure and/or fill)

4. Transportation corridor fringe parking facilities.

5. Construction of new truck weigh stations or rest areas.

6. Approvals for disposal of excess right-of-way or for joint or limited use of right-of-way, where the proposed use does not have significant adverse impacts.

7. Approvals for changes in access control.

8. Construction of new bus storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and located on or near a street with adequate capacity to handle anticipated bus and support vehicle traffic.

9. Rehabilitation or reconstruction of existing rail and bus buildings and ancillary facilities where only minor amounts of additional land are required and there is not a substantial increase in the number of users.

10. Construction of bus transfer facilities (an open area consisting of passenger shelters, boarding areas, kiosks and related street improvements) when located in a commercial area or other high activity center in which there is adequate street capacity for projected bus traffic.

11. Construction of rail storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and where there is no significant noise impact on the surrounding community.

12. Acquisition of land for hardship or protective purposes, advance land acquisition loans under section 3(b) of the UMT Act. Hardship and protective buying will be permitted only for a particular parcel or a limited number of parcels. These types of land acquisition qualify for a CE only where the acquisition will not limit the evaluation of alternatives, including shifts in alignment for planned construction projects, which may be required in the NEPA process. No project development on such land may proceed until the NEPA process has been completed.

13. Acquisition and construction of wetland, stream and endangered species mitigation sites.

14. Remedial activities involving the removal, treatment or monitoring of soil or groundwater contamination pursuant to state or federal remediation guidelines.

D. Special Project Information:

Estimated Costs:

Structure	$ 189,000
Roadway Approaches	$ 150,420
Detour Structure and Approaches	- 0 -
Structure Removal	$ 13,020
Misc. & Mob.	$ 98,560
Eng. & Contingencies	$ 74,000
Total Construction Cost	**$ 525,000**
Right-of-way Costs	$ 73,000
Total Project Cost	**$ 598,000**

Estimated Traffic:

Current	-	700 vpd
Year 2025	-	1300 vpd
TTST	-	1%
Dual	-	2%

Accidents: Traffic Engineering has evaluated a recent three year period and found three accidents occurring in the vicinity of the project. None were associated with the geometry of the bridge or its approach roadways.

Design Exceptions: A horizontal design exception is required. The existing curve located on the southeast end of the bridge has a design speed of 30 mph.

Bridge Demolition: Bridge No. 12 is constructed entirely of timber and steel and should be possible to remove with no resulting debris in the water based on standard demolition practices.

Alternatives Discussion:

No Build – The no build alternative would result in eventually closing the road which is unacceptable given the volume of traffic served by SR 1329.

Rehabilitation – The bridge was constructed in 1961 and the timber materials within the bridge are reaching the end of their useful life. Rehabilitation would require replacing the timber components which would constitute effectively replacing the bridge.

Offsite Detour – Bridge No. 12 will be replaced on the existing alignment. Traffic will be detoured offsite (see Figure 1) during the construction period. NCDOT Guidelines for Evaluation of Offsite Detours for Bridge Replacement Projects considers multiple project variables beginning with the additional time traveled by the average road user resulting from the offsite detour. The offsite detour for this project would include SR 1314 (Ladson Rd.), SR 1331 (Banner Farm Rd.), SR 1426 (School House Rd.), NC 280, SR 1316 (Ray Hill Rd.) and SR 1328 (Turnpike Rd.) This detour was chosen because Bridge No. 182 located on Turnpike Road just north of the intersection with Warlick Road has a posting of 19 tons single vehicle and 26 tons TTST and Bridge No. 9 located on SR 1316 has a posting of 24 tons. The detour for the average road user would result in 6.0 minutes additional travel time (3.3 miles additional travel). Up to a twelve-month duration of construction is expected on this project.

Based on the Guidelines, the criteria above indicate that the preference of an offsite detour but with now stronger evaluation of other project variables. In this case, the Henderson County Fire Marshal's Office along with Henderson County Schools Transportation has indicated that an offsite detour is acceptable and that services can be adequately re-routed

during construction. The NCDOT Division 14 concurs in these recommendations.

Onsite Detour – An onsite detour was not evaluated due to the presence of an acceptable offsite detour.

New Alignment – Given that the alignment for SR 1329 is acceptable, a new alignment was not considered as an alternative.

Other Agency Comments:

The **U.S. Fish & Wildlife Service** in standardized letters provided a request that they prefer any replacement structure to be a spanning structure.

The **N.C. Wildlife Resources Commission** stated that Boylston Creek is classified as WS-IV. Several federal and state listed species have been reported in adjacent watersheds. Surveys, including a mussel survey in Boylston Creek, are recommended. Sediment and erosion control measures should adhere to the design standards for sensitive watersheds.

Response: A mussel survey was performed on April 29, 2004. The survey results indicate that freshwater mussels are not present in the surveyed reach of Boylston Creek. It is unlikely that the oyster mussel or the Appalachian elktoe occur in the project area, mostly due to the heavy sediment loading in this stretch of the creek.

The **Division of Water Quality** stated that there are 30-foot vegetated buffer requirements in WS waters in addition to the requirements to minimize storm water runoff and maximize use of BMP's.

Response: 30-foot vegetated buffers will be included in the project commitments.

Tennessee Valley Authority requested to be on the distribution list for meeting minutes and have the opportunity to comment on the project as it develops. If the level of review is elevated to an Environmental Assessment, please include TVA as a Cooperating Agency in the Federal Highway Administration's NEPA review. TVA needs to be contacted if a formal consultation under the Endangered Species Act or memoranda of agreement under Section 106 of the National Historic Preservation Act is required. This project may require Section 26a approval.

Response: A Section 26a permit is not anticipated on this project. TVA will review final plans to verify this determination.

The **Eastern Band of Cherokee Indians Tribal Historic Preservation Officer** accepted consulting party status for this project. The EBCI THPO feels there is little to no probability of encountering tribal resources of concern with this

project. However, to be certain they requested quad maps of the site area and any cultural resources reports generated for this project.

Response: There were no cultural resources reports required.

The **Army Corps of Engineers** had no special concerns for this project.

Public Involvement:

A letter was sent by the Location & Surveys Unit to all property owners affected directly by this project. Property owners were invited to comment. No comments have been received to date.

E. Threshold Criteria

The following evaluation of threshold criteria must be completed for Type II actions

ECOLOGICAL		YES	NO
(1)	Will the project have a substantial impact on any unique or important natural resource?		X
(2)	Does the project involve habitat where federally listed endangered or threatened species may occur?	X	
(3)	Will the project affect anadromous fish?		X
(4)	If the project involves wetlands, is the amount of permanent and/or temporary wetland taking less than one-tenth (1/10) of an acre and have all practicable measures to avoid and minimize wetland takings been evaluated?	X	
(5)	Will the project require the use of U. S. Forest Service lands?		X
(6)	Will the quality of adjacent water resources be adversely impacted by proposed construction activities?		X
(7)	Does the project involve waters classified as Outstanding Water Resources (OWR) and/or High Quality Waters (HQW)?		X
(8)	Will the project require fill in waters of the United States in any of the designated mountain trout counties?		X*
(9)	Does the project involve any known underground storage tanks (UST's) or hazardous materials sites?		X

PERMITS AND COORDINATION		YES	NO
(10)	If the project is located within a CAMA county, will the project significantly affect the coastal zone and/or any "Area of Environmental Concern" (AEC)?		X
(11)	Does the project involve Coastal Barrier Resources Act resources?		X
(12)	Will a U. S. Coast Guard permit be required?		X
(13)	Will the project result in the modification of any existing regulatory floodway?		X

		YES	NO
(14)	Will the project require any stream relocations or channel changes?		X
	SOCIAL, ECONOMIC, AND CULTURAL RESOURCES	**YES**	**NO**
(15)	Will the project induce substantial impacts to planned growth or land use for the area?		X
(16)	Will the project require the relocation of any family or business?		X
(17)	Will the project have a disproportionately high and adverse human health and environmental effect on any minority or low-income population?		X
(18)	If the project involves the acquisition of right of way, is the amount of right of way acquisition considered minor?	X	
(19)	Will the project involve any changes in access control?		X
(20)	Will the project substantially alter the usefulness and/or land use of adjacent property?		X
(21)	Will the project have an adverse effect on permanent local traffic patterns or community cohesiveness?		X
(22)	Is the project included in an approved thoroughfare plan and/or Transportation Improvement Program (and is, therefore, in conformance with the Clean Air Act of 1990)?	X	
(23)	Is the project anticipated to cause an increase in traffic volumes?		X
(24)	Will traffic be maintained during construction using existing roads, staged construction, or on-site detours?	X	
(25)	If the project is a bridge replacement project, will the bridge be replaced at its existing location (along the existing facility) and will all construction proposed in association with the bridge replacement project be contained on the existing facility?	X	
(26)	Is there substantial controversy on social, economic, or environmental grounds concerning the project?		X
(27)	Is the project consistent with all Federal, State, and local laws relating to the environmental aspects of the project?	X	
(28)	Will the project have an "effect" on structures/properties eligible for or listed on the National Register of Historic Places?		X

(29)	Will the project affect any archaeological remains which are important to history or pre-history?		X
(30)	Will the project require the use of Section 4(f) resources (public parks, recreation lands, wildlife and waterfowl refuges, historic sites, or historic bridges, as defined in Section 4(f) of the U. S. Department of Transportation Act of 1966)?		X
(31)	Will the project result in any conversion of assisted public recreation sites or facilities to non-recreation uses, as defined by Section 6(f) of the Land and Water Conservation Act of 1965, as amended?		X
(32)	Will the project involve construction in, across, or adjacent to a river designated as a component of or proposed for inclusion in the National System of Wild and Scenic Rivers?		X

F. Additional Documentation Required for Unfavorable Responses in Part E

Response to Question 2: The project area was surveyed for the oyster mussel and the Appalachian elktoe April 29, 2004. The survey results indicate that freshwater mussels are not present in the surveyed reach of Boylston Creek. It is unlikely that the oyster mussel or the Appalachian elktoe occur in the project area, mostly due to the heavy sediment loading in this stretch of the creek. It was concluded that project construction would have "No Effect" on these two species.

Response to Question 8: While this project is in a designated trout county, the stream does not support trout. There should be no bents or fill in the stream.

G. CE Approval

TIP Project No.	**B-4148**
State Project No.	**8.2952801**
W.B.S. No.	**33497.1.1**
Federal Project No.	**BRZ-1329(4)**

Project Description:

The purpose of this project is to replace Henderson County Bridge No. 12 on SR 1329 (Warlick Road) over Boylston Creek. Bridge No. 12 is 31 feet long. The replacement structure will be a bridge approximately 60 feet long providing a minimum 30 feet clear deck width. The bridge will include two 12-foot lanes and 3-foot offsets. The roadway grade of the new structure will be approximately the same as the existing structure.

The approach roadway will extend approximately 420 feet from the northwest end of the new bridge and 270 feet from the southeast end of the new bridge. The approaches will be widened to include an 24-foot pavement width providing two 12-foot lanes. Five-foot grass shoulders will be provided on each side (8-foot shoulders where guardrail is included). The roadway will be designed as a Rural Local Route with a 60 mile per hour design speed.

Traffic will be detoured off-site during construction (see Figure 1).

Categorical Exclusion Action Classification:

____ TYPE II(A)
_X_ TYPE II(B)

Approved:

6/28/06 Date — Bridge Project Development Engineer
Project Development & Environmental Analysis Branch

6/28/06 Date — Project Engineer
Project Development & Environmental Analysis Branch

6/28/06 Date — Project Planning Engineer
Project Development & Environmental Analysis Branch

For Type II(B) projects only:

7/3/06 Date — John F. Sullivan, III, PE, Division Administrator
Federal Highway Administration

PROJECT COMMITMENTS

Replacement of Bridge No. 12
on SR 1329 (Warlick Road) over Boylston Creek
Henderson County
Federal-Aid No. BRZ-1329(4)
State Project No. 8.2952801
T.I.P. No. B-4148

Commitments Developed Through Project Development and Design

Structure Design / TVA Permit

The proposed project is located in the Tennessee Valley Authority's (TVA) Land Management District. If the bridge is replaced along existing alignment, as proposed, an approval under Section 26a of the TVA Act will not be needed. However, TVA will review final bridge design plans to confirm this determination.

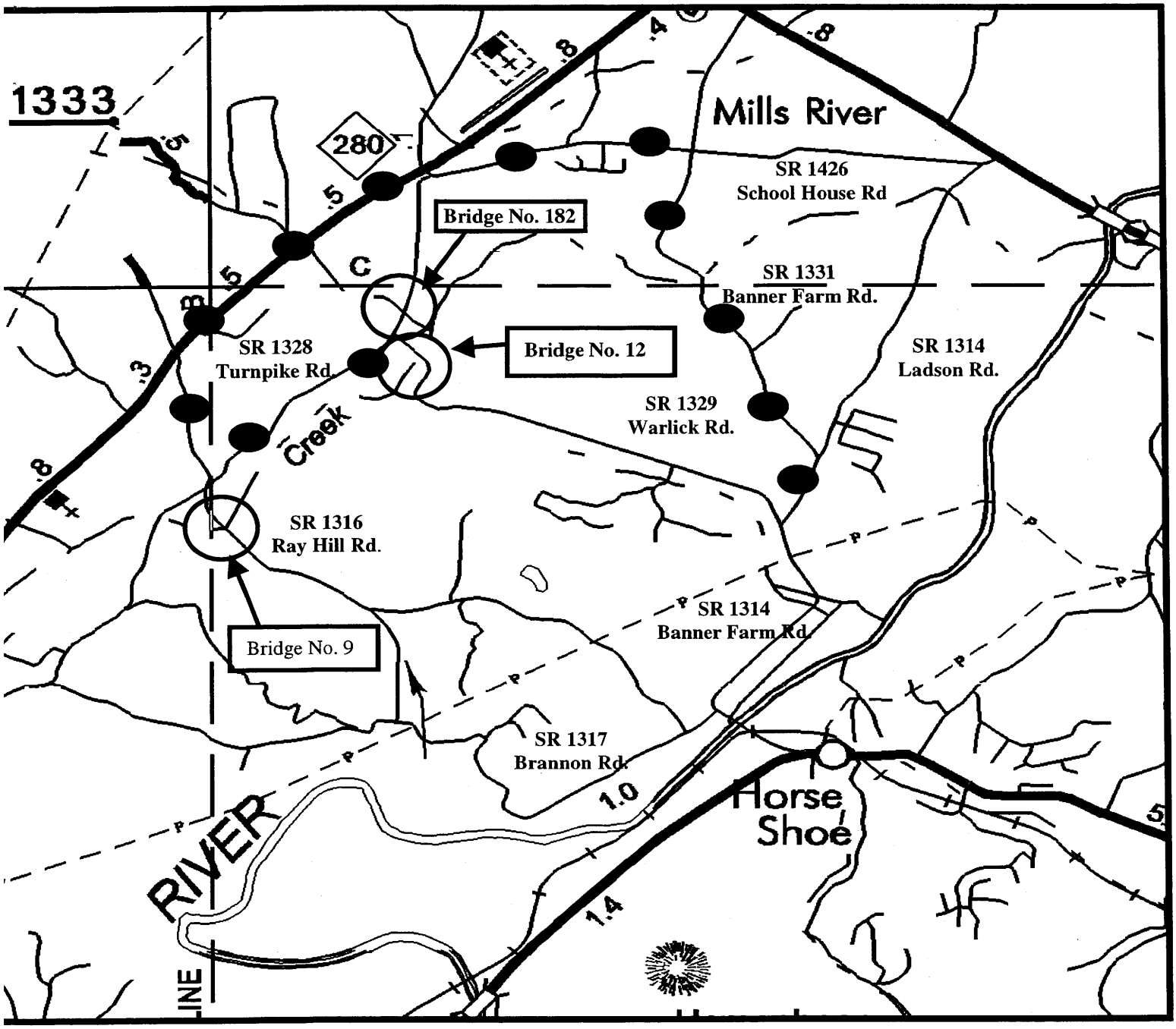
Division Fourteen Construction, Resident Engineer's Office – Offsite Detour

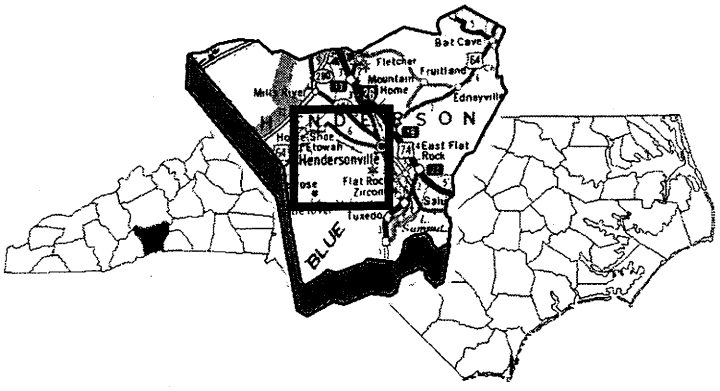
In order to allow Henderson County Emergency Services time to prepare for road closure, the NCDOT Resident Engineer will notify Henderson County EMS at (828) 697-4728 of the bridge removal 30 days prior to road closure.

In order to allow Henderson County Schools time to prepare for road closure, the NCDOT Resident Engineer will notify the School Transportation Director at (828) 697-4754 of the bridge removal 30 days prior to road closure.

PDEA Natural Environment Unit - Bridge Demolition

The entire bridge is constructed of timber and steel. Therefore, it is unlikely that there will be any temporary fill resulting from bridge demolition.



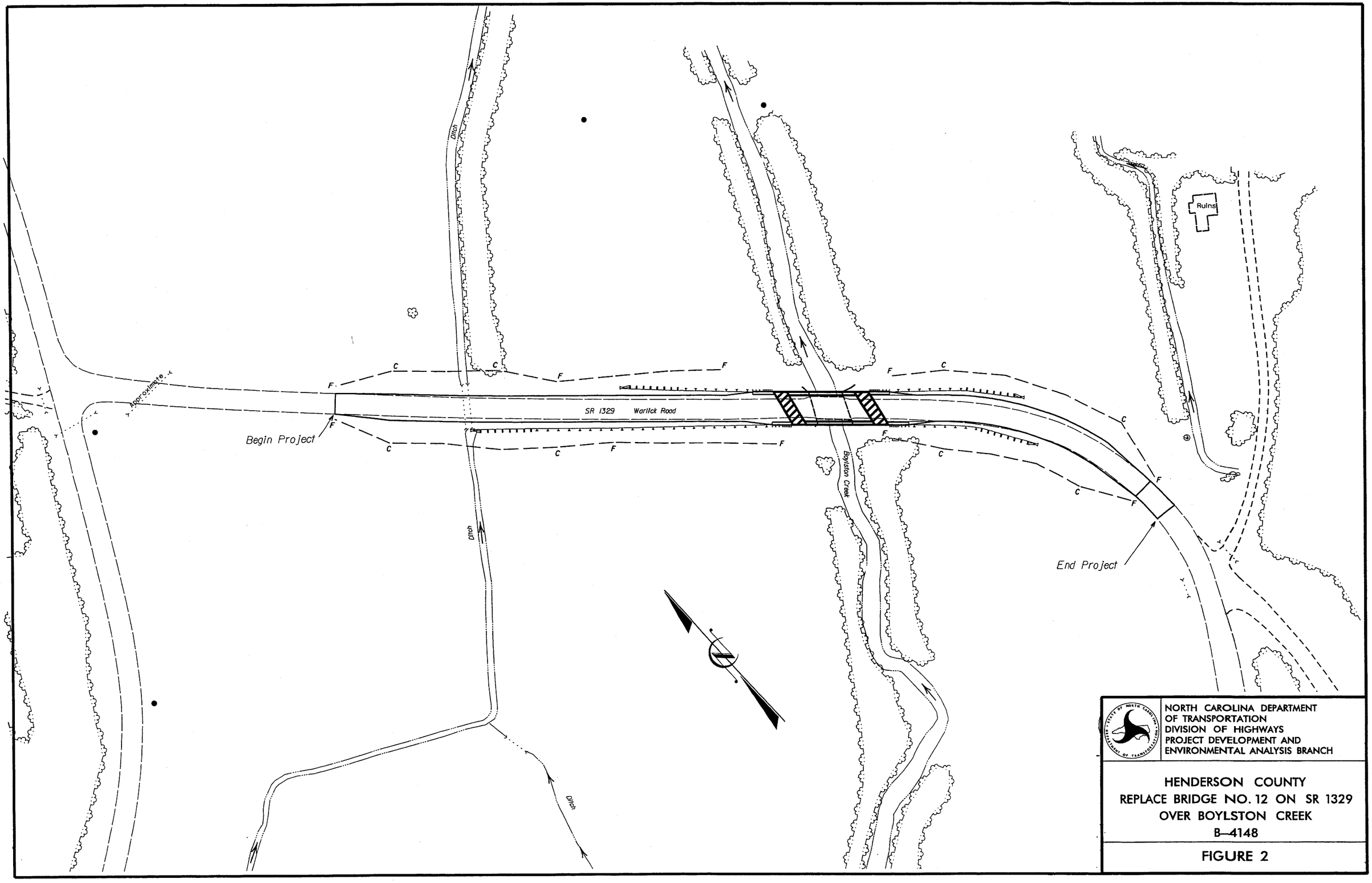


STUDIED DETOUR

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT & ENVIRONMENTAL ANALYSIS BRANCH

HENDERSON COUNTY
REPLACE BRIDGE NO. 12 ON SR 1329
OVER BOYLSTON CREEK
B-4148

Figure 1



NORTH CAROLINA DEPARTMENT
OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT AND
ENVIRONMENTAL ANALYSIS BRANCH

HENDERSON COUNTY
REPLACE BRIDGE NO. 12 ON SR 1329
OVER BOYLSTON CREEK
B-4148

FIGURE 2

File

North Carolina Department of Cultural Resources
State Historic Preservation Office

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary
Office of Archives and History

Division of Historical Resources
David L. S. Brook, Director

March 4, 2004

MEMORANDUM

TO: Greg Thorpe, Ph.D., Director
Project Development and Environmental Analysis Branch
NCDOT Division of Highways

FROM: David Brook DSB for David Brook

SUBJECT: Replacement of Bridge No. 12 on SR 1329 over Boylston Creek
Henderson County, ER03-0942

Thank you for your letter of February 3, 2004, concerning the above project.

We have reviewed the additional materials you have submitted to us and find that there are no historic properties located in the project area. Therefore, we have no further comment on this project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above referenced tracking number.

cc: ✓ Mary Pope Furr, NCDOT
Robin Hancock, NCDOT

North Carolina Department of Cultural Resources
State Historic Preservation Office
David L. S. Brook, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary
Office of Archives and History

Division of Historical Resources

October 28, 2003

MEMORANDUM

TO: Greg Thorpe, Ph.D., Director
Project Development and Environmental Analysis Branch
NCDOT Division of Highways

FROM: David Brook for David Brook

SUBJECT: Replacement of Bridge No. 12 on SR 1329 over Boylston Creek, B-4148, Henderson County, ER03-0942

On September 4, 2003, Sarah McBride, our preservation specialist for transportation projects met with the North Carolina Department of Transportation (NCDOT) staff for a meeting of the minds concerning the above project. We reported on our available information on historic architectural and archaeological surveys and resources along with our recommendations. DOT provided aerial photographs at the meeting.

Based on our review of the photographs and the information discussed at the meeting, we offer our preliminary comments regarding this project.

In terms of historic architectural resources, we are aware of no historic structures located within the areas of potential effect. However, we are unable to make a recommendation until we receive photographs of any structures over fifty years old located within the project area.

There are no recorded archaeological sites within the proposed project area. Based on our present knowledge of the area, it is unlikely that any archaeological resources which may be eligible for listing in the National Register of Historic Places will be affected by the project construction. We, therefore, recommend that no archaeological investigation be conducted in connection with this project.

Having provided this information, we look forward to receipt of either a Categorical Exclusion or Environmental Assessment which indicates how NCDOT addressed our comments.

NATURAL SYSTEMS REPORT

Replacement of Bridge No. 12
SR 1329 over Boylston Creek

Henderson County, North Carolina
(B-4148)
(State Project No. 8.2952801)
(Federal Aid No. BRZ-1329[4])

Prepared for:

The North Carolina Department of Transportation
Raleigh, North Carolina

March 2003

EXECUTIVE SUMMARY

Proposed replacement of Bridge No. 12 (TIP No. B-4148) on the SR 1329 (Warlick Road) crossing Boylston Creek in Henderson County, NC.

INTRODUCTION

The project proposes replacement of Bridge No. 12 on SR 1329 (Warlick Road) over Boylston Creek. The project area is approximately 30.2 acres (12.2 hectares) in size and includes sections of Boylston Creek, Sweetwater Branch, and two unnamed tributaries to Boylston Creek. Land use consists of agricultural land, undeveloped forest land, and some residential areas. The project is within the Broad Basin ecoregion of the Blue Ridge physiographic province, approximately 2120.0 to 2200.0 feet (646.2 to 670.6 meters) NGVD. Approximately 3.4 acres (1.4 hectares) (10 percent) of the project area is underlain by hydric Toxaway soils. Codorus soils make up approximately 16.8 acres (6.8 hectares) (50 percent) of the project area. Codorus soils are not on the hydric soils list for Henderson County, but they do contain inclusions of Toxaway soils in depressions (SCS 1980, USDA 1996).

PHYSICAL CHARACTERISTICS

Water Resources

The project area is located within N.C. Division of Water Quality (DWQ) sub-basin 04-03-03 of the French Broad River Basin (DWQ 2000A). This area is part of USGS accounting unit 06010105 of the Tennessee Region. The section of Boylston Creek crossed by the subject bridge has been assigned Stream Index Number 6-52-(6.5) by DWQ, and Sweetwater Branch has been assigned Stream Index Number 6-52-11 by DWQ (1998). The unnamed tributaries to Boylston Creek have not been assigned an index number by DWQ.

The Best Usage Classification for Boylston Creek and Sweetwater Branch is **WS-IV** (DWQ 2000A). No watershed Critical Area (**CA**) occurs within 1.0 mile (1.6 kilometers) of the project area. No Watershed Critical Areas or water resources classified as High Quality Waters, Water Supplies (**WS-I** or **WS-II**), or Outstanding Resource Waters (**ORW**) are located within 1.0 mile (1.6 kilometers) of the project area. Boylston Creek and Sweetwater Branch are not listed as impaired on the DWQ Draft 2000 303(d) list (DWQ 2000B).

Biotic Resources

Three distinct plant communities were identified within the project area: Piedmont/Low Mountain Alluvial Forest, Mesic Mixed Hardwood Forest (Piedmont Subtype), and maintained/disturbed land. A summary of plant community areas is presented in the following table.

Plant community coverage within the project area.

Plant Community	Area Acres (Hectares)
Piedmont/Low Mountain Alluvial Forest	2.2 (0.9)
Mixed Mesic Hardwood Forest (Piedmont Subtype)	8.9 (3.6)
Maintained/disturbed land	19.0 (7.7)

JURISDICTIONAL TOPICS

Surface Waters and Wetlands

Boylston Creek and Sweetwater Branch are considered jurisdictional surface waters under Section 404 of the Clean Water Act. Based on field investigations, the project area also contains other jurisdictional surface waters and wetlands. Areas of these systems within the project area are summarized in the following table.

Jurisdictional Type	Cowardin Classification	Linear Distance	Area	DWQ Rating
Boylston Creek	R3UB1/2	440.6 (134.3)	-	-
Sweetwater Branch	R3UB1/2	421.2 (128.4)	-	-
UT to Boylston Creek No. 1	R3UB2/3	205.7 (62.7)	-	-
UT to Boylston Creek No. 2	R3UB1/2	679.0 (207.0)	-	-
Wetland No. 1	PSS1F	-	0.29 (0.12)	49
Wetland No. 2	PFO1H	-	0.02 (0.01)	43
Wetland No. 3	PFO1H	-	0.03 (0.01)	43
Wetland No. 4	PEM1F	-	0.27 (0.11)	35
Farm Pond	PUB2/3h	-	0.38 (0.15)	22
	Total	1746.5 (532.3)	0.99 (0.40)	

During project construction, Bridge No. 12 will be dismantled without dropping portions of the structure into Boylston Creek. Therefore, no temporary fill from bridge demolition is expected to be placed in waters of the United States. This project is located in a N.C Wildlife Resources Commission (WRC) trout county; therefore, WRC may require a moratorium for instream construction from October 15 to April 15. This project may be classified as Case 2, where in-water work moratoriums or restrictions are required beyond those outlined in Best Management Practices for Protection of Surface Waters.

Permits

This project may be processed as a Categorical Exclusion (CE) under Federal Highway Administration (FHWA) guidelines. The COE has made available Nationwide Permit (NWP) 23 for CEs due to minimal impacts to waters of the U.S. expected with bridge construction. NWP

33 may be used for temporary access and dewatering within waters of the United States. However, authorization for jurisdictional area impacts through the use of these permits will require written notice to DWQ. DWQ has made available General 401 Water Quality Certifications for these NWPs. In the event that NWPs will not suffice, impacts attributed to bridge replacement and associated approach improvements may qualify under General Bridge Permit (GP) 031 issued by the Wilmington COE District. DWQ has made available a General 401 Water Quality Certification for GP 031. Notification to the Washington COE office is required if this general permit is utilized.

The proposed project is located in the Tennessee Valley Authority's (TVA) Land Management District. A permit pursuant to Section 26a of the TVA Act is required for all construction or development involving streams or floodplains in the Tennessee River drainage basin.

Federally Protected Species

Species with the federal classification of Endangered, Threatened, or officially Proposed for such listing are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Eight federally protected species are listed for Henderson County (February 24, 2003 FWS list). These are presented in the following table.

Common Name	Scientific Name	Status
Bog turtle*	*Clemmys muhlenbergii*	T (S/A)
Appalachian elktoe	*Alasmidonta raveneliana*	E
Oyster mussel**	*Epioblasma capsaeformis*	E
Swamp pink	*Helonias bullata*	T
Small-whorled pogonia	*Isotria medeoloides*	T
Bunched arrowhead	*Sagittaria fasciculata*	E
Mountain sweet pitcher plant	*Sarracenia jonesii*	E
White irisette	*Sisyrinchium dichotomum*	E

* Threatened due to Similarity of Appearance: resembles in appearance a threatened species that enforcement personnel would have substantial difficulty in differentiating between the listed and unlisted species. The bog turtle has this listing due to similarity of appearance to the northern bog turtle, which is listed as federally threatened.

** Historic occurrence in county - last seen in Henderson County more than 50 years ago.

Bog Turtle

The bog turtle is listed as T(S/A) due to its similarity of appearance to another rare species listed for protection. T (S/A) species are not subject to Section 7 consultation and a biological conclusion for this species is not required. The project area contains no suitable habitat for bog turtle.

Appalachian elktoe
BIOLOGICAL CONCLUSION: **UNRESOLVED**

There is potential habitat for the Appalachian elktoe within the project area. Both Boylston Creek and Sweetwater Branch, as well as one unnamed tributary, have well-oxygenated riffle areas with sand and gravel substrate among cobbles and boulders as well as moderate flow and clear water. Therefore, a survey for this species is recommended.

Oyster mussel
BIOLOGICAL CONCLUSION: **UNRESOLVED**

There is potential habitat for the oyster mussel within the project area. Boylston Creek and Sweetwater Branch, as well as one of the unnamed tributaries, have well-oxygenated riffle areas with sand and gravel substrate among cobbles and boulders as well as moderate flow. Therefore, a survey for this species is recommended.

Swamp pink
BIOLOGICAL CONCLUSION: **UNRESOLVED**

There are three wetlands in the project area, two of which are seeps that may provide habitat for swamp pink. The edges of the streams, unnamed tributaries and ditches that are constantly saturated may also provide habitat for the species. Based on the habitat types within the project area, surveys should be completed for swamp pink during the optimal survey window (April to May).

Small-whorled pogonia
BIOLOGICAL CONCLUSION: **UNRESOLVED**

The project area contains mixed pine-deciduous forest along stream banks. There are also several wooded slopes, some of which have a large amount of white pine, a species commonly associated with small-whorled pogonia. Based on the habitat types within the project area, surveys should be completed for the small whorled pogonia during the optimal survey window (mid May to early July).

Bunched arrowhead
BIOLOGICAL CONCLUSION: **UNRESOLVED**

The project contains three wetland areas with shallow water. These may provide habitat for bunched arrowhead. A survey for this species is recommended. Based on the habitat types within the project area, surveys should be completed for bunched arrowhead during the optimal survey window (mid May to July).

Mountain sweet pitcher plant
BIOLOGICAL CONCLUSION: **UNRESOLVED**

The project contains three wetland areas with shallow water. These may provide habitat for mountain sweet pitcher plant. A survey for this species is recommended. Based on the habitat types within the project area, surveys should be completed for mountain sweet pitcher plant during the optimal survey window (April to October).

White irisette
BIOLOGICAL CONCLUSION: **UNRESOLVED**

The project area contains a southwest-facing slope with disturbed areas caused by maintenance for SR 1328 (Old Turnpike Road) and for driveways. These areas may provide habitat for white irisette. A survey for this species is recommended.

CONCLUSIONS

The project area contains 1.55 acres (0.63 hectares) of jurisdictional areas that could potentially be impacted by the proposed project. Permits likely to be required for this project area include a Section 404 NWP No. 23 and No. 33 along with their corresponding Section 401 Water Quality Certifications.

Since the project is located in a designated "Trout" county, the authorization of a nationwide permit by the COE is conditional upon the concurrence of the WRC. The proposed project is located in the TVA Land Management District; therefore, a permit pursuant to Section 26a of the TVA Act is required for all construction or development involving streams or floodplains in the Tennessee River drainage basin.

Construction of a replacement bridge within the footprint of the existing Bridge No. 12 is recommended to minimize impacts to wetlands, plant communities, and fisheries resources.

NATURAL SYSTEMS REPORT

Replacement of Bridge No. 12
SR 1329 over Boylston Creek

Henderson County, North Carolina
(B-4148)
(State Project No. 8.2952801)
(Federal Aid No. BRZ-1329[4])

Prepared for:

The North Carolina Department of Transportation
Raleigh, North Carolina

Prepared by:

EcoScience

ECOSCIENCE CORPORATION
1101 Haynes Street, Suite 101
Raleigh, NC 27604
Tel (919) 828-3433 Fax (919) 828-3518

March 2003

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Replacement of Bridge No. 12
SR 1329 over Boylston Creek
Henderson County, North Carolina
(B-4148)

1.0 INTRODUCTION

1.1 Project Description

The North Carolina Department of Transportation (NCDOT) proposes to replace Bridge No. 12 located on North Carolina State Road 1329 (Warlick Road) over Boylston Creek in Henderson County, North Carolina (Figure 1).

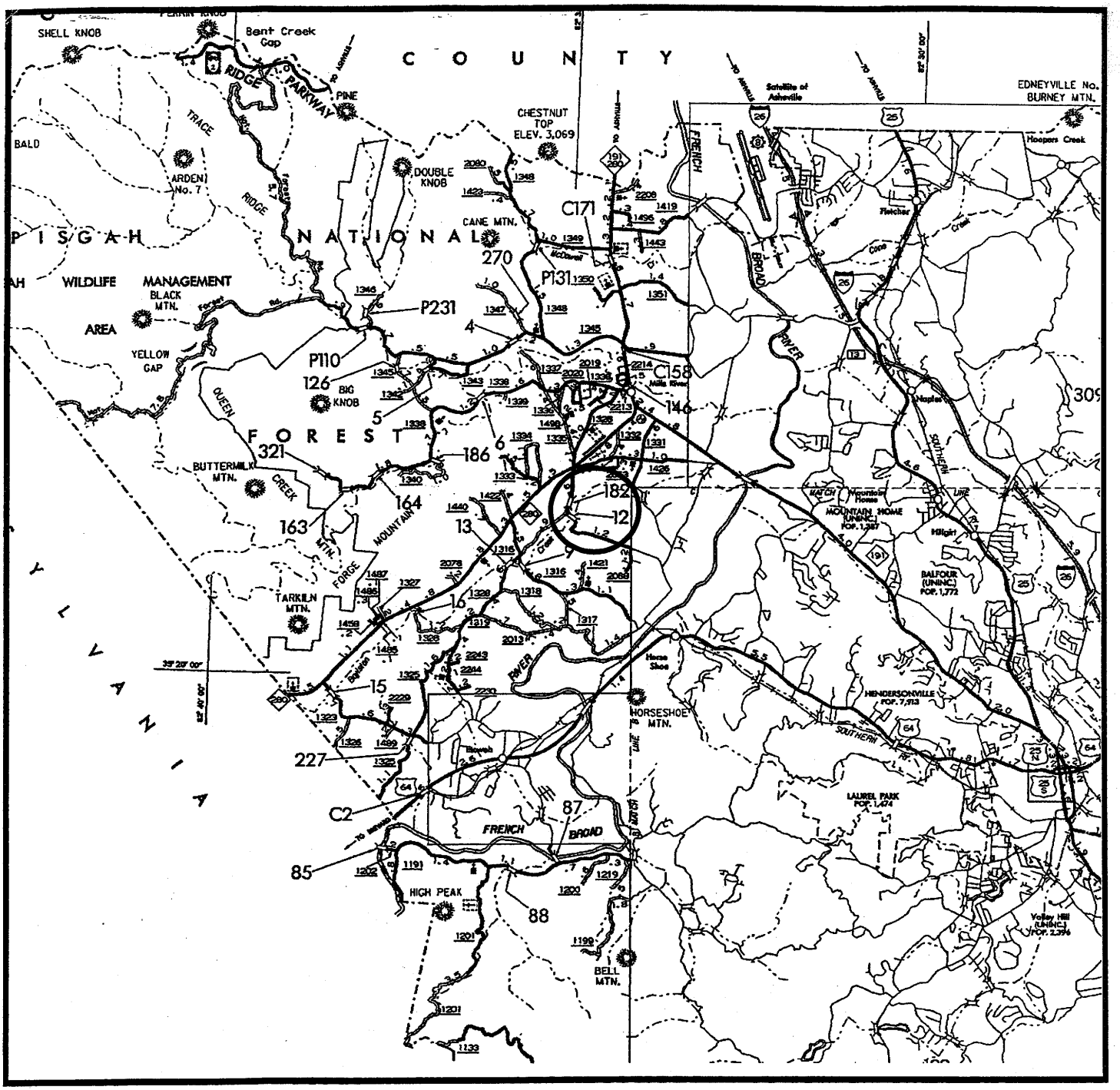
The project area is located in Henderson County at the intersection of SR 1328 (Old Turnpike Road) and SR 1329 (Warlick Road), approximately 7.6 miles (12.2 kilometers) northwest of Hendersonville, NC (Figure 1). The project area (Figure 2) extends 1) along SR 1328 approximately 600.0 feet (182.8 meters) northeast and 700.0 feet (213.4 meters) southwest of the intersection and 2) along SR 1329 approximately 2100.0 feet (640.1 meters) southeast of the intersection. Width of the project area ranges from approximately 350.0 feet (106.7 meters) along SR 1328 to 1000.0 feet (304.8 meters) along SR 1329.

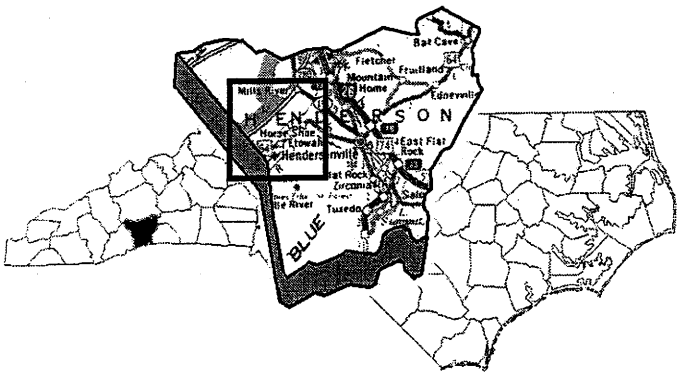
Bridge No. 12 is located along SR 1329 at Boylston Creek. The project area includes the channel, floodplains, slopes, and uplands adjacent to Boylston Creek as well as Sweetwater Branch and two unnamed tributaries (UT) to Boylston Creek (Figure 2). On the east and west banks of Boylston Creek, a broad, flat floodplain rises gradually to surrounding uplands. Land use within the project area includes Piedmont/Low Mountain Alluvial Forest, Mesic Mixed Hardwood Forest, and maintained/disturbed land

Bridge No. 12 is a two-lane structure with an approximate overall length of 30.0 feet (9.2 meters) and a deck width of approximately 20.0 feet (6.1 meters). The deck is approximately 6.0 feet (1.8 meters) above the streambed. The superstructure is composed of a timber deck on I-beams and the substructure consists of end bents with timber caps and piles. There are no bents in the stream. Bridge No. 12 will be dismantled without dropping portions of the structure into Boylston Creek. Therefore, no temporary fill from bridge demolition is expected to be placed in waters of the United States.

1.2 Purpose

The purpose of this study is to provide an evaluation of biological resources in the immediate area of potential project impact (project area). Specifically, the tasks performed for this study include 1) an assessment of biological features within the project area including descriptions of vegetation, wildlife, protected species, wetlands, and water quality; and 2) a delineation of Section 404 jurisdictional areas and subsequent survey of jurisdictional boundaries utilizing Trimble XRS Differential Global Positioning System (DGPS) technology with reported sub-meter accuracy.

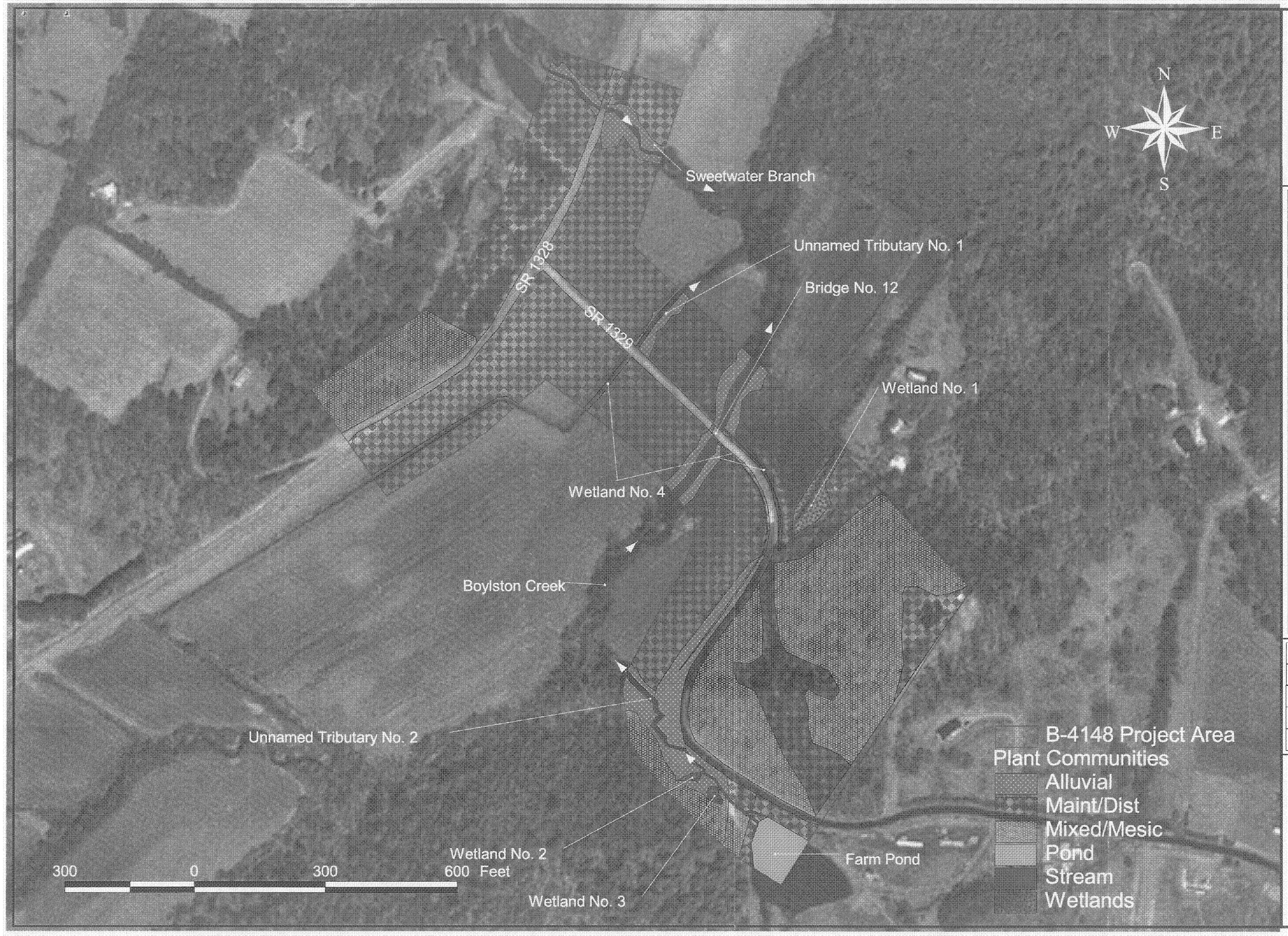




NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
PROJECT DEVELOPMENT & ENVIRONMENTAL ANALYSIS BRANCH

HENDERSON COUNTY
REPLACE BRIDGE NO. 12 ON SR 1329
OVER BOYLSTON CREEK
B-4148

Figure 1



EcoScience
1101 Haynes Street, Suite 101
Raleigh, North Carolina 27604
Ph: 919 828 3433
Fax: 919 828 3518

Figure 2 B-4148 Henderson County

Replacement of Bridge No. 12 SR 1329 over Boylston Creek

State Project No. 8.2952801

Federal Aid No. BRZ-1329[4]

Prepared for: The North Carolina Department of Transportation Raleigh, North Carolina

Client: NCDOT
Project: 02-113.08
Date: March 2003
Drawn By: CLF
Checked By: CLF

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

1.3 Methods

Materials and research data in support of this investigation have been derived from a number of sources including applicable U.S. Geological Survey (USGS) topographic mapping (Horse Shoe, NC 7.5 minute quadrangle, 1974), U.S. Fish and Wildlife Service (FWS) National Wetlands Inventory (NWI) mapping, and recent aerial photography (scale: 1:2500) furnished by NCDOT.

Bridge No. 12 was visited on January 9, 2003. The project area was walked and visually surveyed for significant features. For purposes of field surveys, the project area has been defined by the NCDOT (Figure 2). Special concerns evaluated in the field include 1) potential habitat for protected species and 2) wetlands and water quality protection in Boylston Creek.

Plant community descriptions are based on a classification system utilized by North Carolina Natural Heritage Program (NHP) (Schafale and Weakley 1990). When appropriate, community classifications were modified to better reflect field observations. Vascular plant names generally follow nomenclature found in Radford *et al.* (1968), with adjustments made to reflect more current nomenclature (Kartesz 1998). Jurisdictional areas were evaluated using the three-parameter approach following U.S. Army Corps of Engineers (COE) delineation guidelines (DOA 1987). Wetland jurisdictional areas were characterized according to a classification scheme established by Cowardin *et al.* (1979) and A Field Guide To North Carolina Wetlands (DEM 1996). Habitat used by terrestrial wildlife and aquatic organisms, as well as expected population distributions, were determined through field observations, evaluation of available habitat, and supportive documentation (Webster *et al.* 1985, Potter *et al.* 1980, Martof *et al.* 1980, Rohde *et al.* 1994, Menhinick 1991, Palmer and Braswell 1995). Water quality information for area streams and tributaries was derived from available sources (DWQ 2000A, DWQ 2000B). Quantitative sampling was not undertaken to support existing data.

The most current U.S. Fish and Wildlife Service (FWS) listing of federally protected species with ranges which extend into Henderson County (February 24, 2003 FWS list) is included in this report. In addition, NHP records documenting the presence of federally or state listed species were consulted before commencing the field investigation. Significant Aquatic Endangered Species Habitats proposed by the Wildlife Resources Commission (WRC) (June 13, 1995 listing) were consulted to determine the presence of Proposed Critical Habitats for aquatic species.

1.4 Qualifications

EcoScience Corporation (ESC) biologists Corri Faquin, Ben Brazell, Shay Garriock, and Carol Aron conducted the fieldwork for this investigation. Ms. Faquin is a Project Scientist with three years of experience in the environmental field. Ms. Faquin has a bachelor's degree in natural resources, ecosystem assessment and a bachelor's degree in biological sciences from North Carolina State University. Professional expertise includes wetland and stream mitigation searches, jurisdictional area delineations, plant and wildlife identification, community mapping, protected species surveys, environmental permitting, and environmental document preparation.

Mr. Brazell is a Project Scientist with three years of experience in the environmental field. Mr. Brazell has a bachelor's degree in natural resources (ecosystem assessment) from North Carolina State University, and has conducted field research for forest health assessments, habitat suitability indices for various wildlife species, and watershed and wetland delineation. Professional expertise includes wetland and stream mitigation, jurisdictional area delineations, stream and riparian buffer determinations, plant and wildlife identification and community mapping, protected species surveys, and environmental document preparation.

Mr. Garriock is a Project Scientist with six years of experience in the environmental field. Mr. Garriock has a bachelor's degree in wildlife biology from Virginia Polytechnic and State University, and has conducted field research and species inventories involving small mammals, songbirds, reptiles, amphibians, fish, freshwater mussels, and aquatic and terrestrial invertebrates. Professional expertise includes jurisdictional area delineations, stream and riparian buffer determinations, plant and wildlife identification and community mapping, protected species surveys, and environmental document preparation.

Ms. Aron is a Project Scientist with three years of experience in the environmental field. Ms. Aron has a bachelor's degree in biological sciences from Mount Holyoke College and a master's degree in applied ecology from Indiana University. Research experience includes work on dark-eyed juncos, black-capped chickadees, and European honeybees. Professional expertise includes wetland delineations, stream determinations, community identification and mapping, protected species surveys, and environmental document preparation.

1.5 Definitions of Area Terminology

Definitions for descriptions used in this report are as follows: **Project Area** generally denotes the area bounded by proposed construction limits; however, since alternatives have not yet been selected, the **Project Area** describes the area encompassing approximately 30.0 acres (12.2 hectares) along SR 1328 and SR 1329; **Project Vicinity** describes an area extending 0.5 mile (0.8 kilometer) on all sides of the project area; and **Project Region** is equivalent to an area represented by a 7.5 minute USGS topographic quadrangle map with the project occupying the central position.

2.0 PHYSICAL RESOURCES

2.1 Physiography and Soils

The project area is located in the Broad Basin ecoregion of the Blue Ridge region. This region is characterized by intermountain basins with low mountains, rolling foothills, and moderately broad mountain valleys. Surficial material and bedrock is primarily Quaternary to Tertiary sandy, silty, and clayey saprolite with some rock outcrops and joint-block boulders. Other materials include quartz-rich saprolite, Precambrian gneiss, schist, amphibolite, and quartzite. In the southwest, metasandstone, metasiltstone, schist, metaconglomerate, quartzite, and slate are common. The Blue Ridge region tends to have less bouldery colluvium and more saprolite than nearby regions. The Broad Basin ecoregion has less moisture, lower elevations, and less

relief than the nearby ecoregions. Soils tend to be deep, well-drained, and loamy to clayey Ultisols (Griffith *et al.* 2002).

The project area is located within and adjacent to the floodplain of Boylston Creek. Within the project area, the floodplain is flat and approximately 1000.0 feet (304.8 meters) in width. Elevations in the project area range from approximately 2050.0 to 2200.0 feet (624.8 to 670.6 meters) (National Geodetic Vertical Datum (NGVD) (USGS Horse Shoe, NC quadrangle, 1974).

The Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service (SCS), indicates that Toxaway silt loam (*Cumulic Humaquepts*), Codorus loam (*Fluvaquentic Dystrochrepts*), Delanco loam (*Aquic Hapludults*), and Talladega silt loam (*Ruptic-Lithic-Entic Hapludults*) occur within the project area (SCS 1980).

The Toxaway series consists of very poorly drained, moderately permeable soils formed in alluvial deposits. This series occurs on portions of the Boylston Creek floodplain within the project area. Toxaway soils are considered to be hydric in Henderson County (USDA 1996).

The Codorus series consists of moderately well drained to somewhat poorly drained, moderately permeable soils formed in alluvium containing medium to large amounts of mica. This series occurs within the project area on the floodplains of Boylston Creek and the unnamed tributaries to Boylston Creek. Codorus soils in Henderson County are non hydric but may have inclusions of the hydric Toxaway soils in depressions (USDA 1996).

The Delanco series consists of moderately well drained, moderately permeable soils formed in alluvium containing medium to large amounts of mica. This series occurs on portions of the Boylston Creek floodplain within the project area. This series is considered to be non hydric in Henderson County (USDA 1996).

The Talladega series consists of well-drained, moderately permeable soils formed in material weathered mostly from schist. This series occurs on side slopes the Boylston Creek floodplain within the project area. Talladega soils are considered to be non hydric in Henderson County (USDA 1996).

2.2 Water Resources

The project area is located within N.C. Division of Water Quality (DWQ) sub-basin 04-03-03 of the French Broad River Basin (DWQ 2000A). This area is part of USGS accounting unit 06010105 of the Tennessee Region. The section of Boylston Creek crossed by the subject bridge has been assigned Stream Index Number 6-52-(6.5) by the N.C. Division of Water Quality (DWQ 1998). The section of Sweetwater Branch within the project area has been assigned Stream Index Number 6-52-11 by the DWQ (1998).

On the day of the site visit, Boylston Creek (Figure 2) was approximately 20.0 feet (6.1 meters) wide and 1.0 to 2.0 feet (0.3 to 0.6 meter) deep at Bridge No. 12. The water was relatively clear with moderate flow. The substrate was primarily cobble-boulder with some areas of sand. The

ordinary high water mark (the line on the shore indicating the normal fluctuations of water) was approximately 25.0 feet (7.6 meters) wide. The banks were steep and approximately 2.0 feet (0.6 meter) above the water level.

Sweetwater Branch (Figure 2) crosses the northeastern arm of the project area prior to joining Boylston Creek. Sweetwater Branch was approximately 4.0 to 5.0 feet (1.2 to 1.5 meters) wide, and from 0.5 to 1.0 foot (0.2 to 0.3 meter) deep on the day of the site visit. The stream was clear with moderate flow and the substrate was primarily gravel and sand with some silt. There was a small floodplain associated with this stream with an ordinary high water mark approximately 15.0 feet (4.6 meters) wide. The banks were steep and approximately 4.5 feet (1.4 meters) above the water level.

Unnamed Tributary (UT) No. 1 (Figure 2) to Boylston Creek is located north of Bridge No. 12. UT No. 1 is an intermittent to perennial stream with a riffle-pool system with poor sinuosity that is fed by a vegetated drainage ditch through agricultural land (Figure 2, Wetland No. 4). The channel appears to have been dredged in the past. UT No. 1 was approximately 5.5 feet (1.5 meters) wide and from 1.0 to 2.0 feet (0.3 to 0.6 meter) deep on the day of the site visit. The water was relatively clear, with moderate flow. The substrate was primarily sand and gravel with some areas of silt. The ordinary high water mark was approximately 7.0 feet (2.1 meters) wide. The banks were approximately 3.0 feet (0.9 meter) above the water level and undercut.

Unnamed Tributary No. 2 (Figure 2) to Boylston Creek is located near the southern edge of the project area. The tributary varied from approximately 2.0 to 3.0 feet (0.6 to 0.9 meter) wide in the project area with a depth of 0.5 to 1.0 foot (0.2 to 0.3 meter) on the day of the site visit. The water was slightly cloudy with moderate flow. The substrate was primarily composed of silt and gravel. The ordinary high water mark was approximately 8.0 feet (2.4 meters) wide. The banks were steep and approximately 4.0 feet (1.2 meters) above the water surface. UT No. 2 is impounded within the project area, forming a man-made pond.

Classifications are assigned to waters of the State of North Carolina based on the existing or contemplated best usage of various streams or segments of streams in the basin. A best usage classification of **WS-IV** has been assigned to this section of Boylston Creek and the entire reach of Sweetwater Branch. This classification also applies to UTs in the project area. This classification is for water supplies that are generally in moderately to highly developed watersheds. Class **WS-IV** uses include waters used as sources of water supply for drinking, culinary, or food processing purposes. No designated High Quality Waters (**HQW**), Outstanding Resource Waters (**ORW**), Water Supply I (**WS-I**), or Water Supply II (**WS-II**) waters occur within 1.0 mile (1.6 kilometers) of the project area. No watershed Critical Area (**CA**) occurs within 1.0 mile (1.6 kilometers) of the project area (DWQ 1998).

The DWQ (previously known as the Division of Environmental Management, Water Quality Section [DEM]) has initiated a whole-basin approach to water quality management for the 17 river basins within the state. Water quality samples taken in 1997 indicated **Good-Fair** water quality based on benthic macroinvertebrate samples conducted on Boylston Creek approximately 2.0 miles (3.2 kilometers) downstream of the project area. Boylston Creek has a use support rating of **Fully Supporting** in the vicinity of the project area. Sweetwater Branch

has not been tested for water quality or use support rating. French Broad River subbasin 04-03-03 supports no major and eight minor dischargers. Permitted flow is 0.023 million gallons per day (11.7 million liters per day) for the minor dischargers. Minor discharges originate from agricultural and forestry operations and a growing component of small towns. No major dischargers are located on Boylston Creek or Sweetwater Branch upstream of the project area (DWQ 2000A).

The 303(d) list comes out every even year with a listing of all known impaired waterbodies in North Carolina. Boylston Creek and Sweetwater Branch are not listed as impaired on the DWQ Draft 2000 303(d) list (DWQ 2000B).

Boylston Creek is located in a WRC trout county; therefore, the WRC may require a moratorium for instream construction from October 15 to April 15. Tall fescue is not suitable for erosion controls along stream banks and within 25.0 feet (7.6 meters) of trout buffers.

Temporary construction impacts due to erosion and sedimentation will be minimized through implementation of a stringent erosion control schedule and the use of Best Management Practices (BMPs). The contractor will follow contract specifications pertaining to erosion control measures as outlined in 23 CFR 650 Subpart B and Article 107-13 entitled "Control of Erosion, Siltation, and Pollution" (NCDOT, Specifications for Roads and Structures). These measures include the use of dikes, berms, silt basins, and other containment measures to control runoff; elimination of construction staging areas in floodplains and adjacent to waterways; re-seeding of herbaceous cover on disturbed sites; management of chemicals (herbicides, pesticides, de-icing compounds) with potential negative impacts on water quality; and avoidance of direct discharges into steams by catch basins and roadside vegetation.

The proposed bridge replacement will allow for continuation of pre-project stream flows in Boylston Creek, thereby protecting the integrity of this waterway. In order to minimize impacts to water resources, NCDOT Best Management Practices (BMPs) for the Protection of Surface Waters will be strictly enforced during the entire life of the project. Due to the composition of the Boylston Creek streambed, sediment curtains should be utilized when feasible to minimize potential water quality degradation as a result of bridge replacement.

During project construction, Bridge No. 12 will be dismantled without dropping portions of the structure into Boylston Creek. The superstructure is composed of a timber deck on I-beams and the substructure consists of end bents with timber caps and piles. There are no bents in the stream. Bridge No. 12 will be dismantled without dropping portions of the structure into Boylston Creek. Therefore, no temporary fill from bridge demolition is expected to be placed in waters of the United States. NCDOT will coordinate with various resource agencies during project planning to ensure that all concerns regarding bridge demolition are resolved.

3.0 BIOTIC RESOURCES

3.1 Terrestrial Communities

3.1.1 Plant communities

Three distinct plant communities were identified within the project area: Piedmont/Low Mountain Alluvial Forest, Mixed Mesic Hardwood Forest (Piedmont subtype), and maintained/disturbed land. These plant communities are described below, beginning at the Boylston Creek channel and progressing to the uplands.

Piedmont/Low Mountain Alluvial Forest – Within the project area, a Piedmont/Low Mountain Alluvial Forest, similar to that described in Schafale and Weakley (1990), occurs along the streams and some of the ditches in an approximately 10.0-foot (3.1-meter) wide swath. These areas have a fairly well-developed canopy and very dense shrub and herb layers. This community shows evidence of disturbance, with relatively small tree diameters and a large number of exotic species in the shrub and vine layers. The area has probably been logged within the last 30 to 50 years. The Piedmont/Low Mountain Alluvial Forest canopy includes black willow (*Salix nigra*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), tag alder (*Alnus serrulata*), tulip poplar (*Liriodendron tulipifera*), and river birch (*Betula nigra*). The sub-canopy/shrub layer consists of Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*) and smooth sumac (*Rhus glabra*) saplings. The herb layer consists of Christmas fern (*Polystichum acrostichoides*), with Japanese honeysuckle (*Lonicera japonica*), poison ivy (*Toxicodendron radicans*), and common greenbrier (*Smilax rotundifolia*) making up the vine layer.

Piedmont/Low Mountain Alluvial Forest includes two small, hillside seepage wetlands (Figure 2, Wetland No. 2 and 3) occurring at the base of side slopes. These wetlands receive groundwater flow from the adjacent side slope and are semi-permanently to permanently inundated. Vegetation includes spicebush (*Lindera benzoin*), possum-haw viburnum (*Viburnum nudum*), tag alder, and smartweed (*Polygonum* sp.)

Mesic Mixed Hardwood Forest (Piedmont Subtype) – A mesic mixed hardwood forest occurs on fairly steep slopes at the northern and southern ends of the project area. This community is similar to the Mesic Mixed Hardwood Forest (Piedmont Subtype) described in Schafale and Weakley (1990), although the presence of early successional trees such as white pine (*Pinus strobus*) and fairly diverse exotic shrub, herb, and vine layers suggest disturbance within the last 50 to 75 years. Disturbance may have been more recent on the south-facing slope, as white pine and other exotics are more prevalent there. Both slopes have a closed canopy, but the south-facing slope has a less-developed understory. On the north-facing slope, the understory largely consists of mountain laurel (*Kalmia latifolia*) and rhododendron (*Rhododendron maximum*), which are absent on the south-facing slope.

The canopy layer includes white pine, tag alder, hawthorn (*Crataegus* sp.), white oak (*Quercus alba*), southern red oak (*Q. falcata*), Virginia pine (*Pinus virginiana*), tulip poplar, Chinese privet, sourwood (*Oxydendrum arboreum*), and eastern hemlock (*Tsuga canadensis*). Understory

trees include Virginia pine, eastern hemlock, black locust (*Robinia pseudoacacia*), flowering dogwood (*Cornus florida*), and Chinese privet. The shrub layer consists of American holly (*Ilex opaca*), multiflora rose, blackberry (*Rubus* sp.), mountain laurel, rhododendron, and dog hobble (*Leucothoe fontanesiana*). The herb layer consists of Christmas fern, club moss (*Lycopodium* sp.), and dog hobble. The vine layer was primarily composed of common greenbrier.

Maintained/disturbed land – Most of the project area is maintained/disturbed habitat, with a large amount of the land in agricultural use, most recently planted in corn. There is also a maintained/disturbed community along road shoulders and field borders. No canopy trees occur in this community, but sapling and shrub species include red maple (*Acer rubrum*), winged sumac (*Rhus copallina*), multiflora rose, and blackberry. The herb layer consists of goldenrod (*Solidago* sp.), camphorweed (*Heterotheca subaxillaris*), common mullein (*Verbascum blattaria*), and a number of grass species. The field edges are probably mowed or otherwise maintained every few years, allowing a thick shrub, herb and vine layer, but halting the development of a mature forest community.

Vegetated wetlands (Figure 2, Wetland No. 1 and 4) occurring in agricultural lands of the Boylston Creek floodplain are semi-permanently to permanently flooded and maintained regularly. Wetland No. 1 is a small, wet meadow adjacent to an agricultural ditch; Wetland No. 4 includes ditches through row crop land and along SR 1329. These wetlands support emergent herbaceous vegetation in the channel as well as mesic herbaceous and shrub species on the banks. Associated species are soft rush (*Juncus effusus*), cattail (*Typha latifolia*), seedbox (*Ludwigia alternifolia*), goldenrods, sedges (*Carex* spp.), smartweed (*Polygonum* sp.), mallow (*Hibiscus* sp.), black willow, and tag alder.

3.1.2 Faunal Communities

During the field survey, evidence of white-tailed deer (*Odocoileus virginianus*), Virginia opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), and eastern cotton-tail (*Sylvilagus floridanus*) were observed within the project area. Bird species that were identified during the field survey include song sparrow (*Melospiza melodia*), eastern towhee (*Pipilo erythrophthalmus*), common crow (*Corvus brachyrhynchos*), northern cardinal (*Cardinalis cardinalis*), tufted titmouse (*Baeolophus bicolor*), Carolina chickadee (*Pocile carolinensis*), blue jay (*Cyanocitta cristata*), mockingbird (*Mimus polyglottas*), and gray catbird (*Dumetella carolinensis*). No reptiles, amphibians, mollusks, or arthropods were observed.

Hardwood forested woodlands within the project area have a closed and stratified canopy providing food and nesting habitat for southern flying squirrel (*Glaucomys volans*), gray fox (*Urocyon cinereoargenteus*), red bat (*Lasiurus borealis*), red-bellied woodpecker (*Melanerpes carolinus*), blue-gray gnatcatcher (*Polioptila caerulea*), ruby-crowned kinglet (*Regulus calendula*), common flicker (*Colaptes auratus*), great crested flycatcher (*Myiarchus crinitus*), and wood thrush (*Hylocichla mustelina*). The forest floor supports a duff layer that provides moisture and cover for small mammals and amphibian species such as white-footed mouse (*Peromyscus leucopus*), hairy-tailed mole (*Parascalops breweri*), American toad (*Bufo americana*) and slimy salamander (*Plethodon glutinosus*).

The project area's woodland-agricultural land matrix is expected to support a diversity of wildlife species associated with woodland edges and adjacent open lands. Mammal species common to these areas are Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), eastern harvest mouse (*Reithrodontomys humulis*), least shrew (*Cryptotis parva*), meadow vole (*Microtus pennsylvanicus*), eastern mole (*Scalopus aquaticus*), and red fox (*Vulpes vulpes*). Bird species associated with open lands and old fields are American kestrel (*Falco sparverius*), field sparrow (*Spizella pusilla*), eastern bluebird (*Sialia sialis*), prairie warbler (*Dendroica discolor*), yellow-rumped warbler (*Dendroica coronata*), purple finch (*Carpodacus purpureus*), and eastern towhee (*Pipilo erythrophthalmus*). Agricultural fields and early successional areas also provide habitat for a number of reptilian species such as eastern box turtle (*Terrapene carolina*), eastern hognose snake (*Heterodon platyrhinos*), black rat snake (*Elaphe obsoleta*), and eastern garter snake (*Thamnophis sirtalis*).

Forested riparian corridor such as that along Boylston Creek is selected by a variety of wildlife including mink (*Mustela vision*), cotton mouse (*Peromyscus gossypinus*), racoon, opossum, yellow warbler (*Dendroica petechia*), orchard oriole (*Icterus spurius*), belted kingfisher (*Ceryle alcyon*), northern cricket frog (*Acris gryllus*), gray treefrog (*Hyla versicolor*), marbled salamander (*Ambystoma opacum*), and Carolina anole (*Anolis carolinensis*).

3.2 Aquatic Communities

Boylston Creek and Sweetwater Branch provide suitable habitat for aquatic and semi-aquatic reptiles including river cooter (*Pseudemys concinna*), painted turtle (*Chrysemys picta*), eastern musk turtle (*Sternotherus odoratus*), rainbow snake (*Farancia erytrogramma*), northern water snake (*Nerodia sipedon*), and banded water snake (*Nerodia fasciata*). Typical amphibian species for this habitat include eastern newt (Notophthalmus viridescens), green frog (Rana clamitans), southern leopard frog (*R. sphenocephala*), and southeastern chorus frog (*Pseudacris feriarum*).

No sampling was undertaken in Boylston Creek to determine fishery potential. Species which may be present within Boylston Creek include eastern silvery minnow (*Hybognathus regius*), golden shiner (*Notemigonus crysoleucas*), creek chub (*Semotilus atromaculatus*), white catfish (*Ameiurus catus*), redfin pickerel (*Esox americanus*), and black crappie (*Pomoxis nigromaculatus*).

3.3 Summary of Anticipated Impacts

Plant community areas (Figure 2) are estimated based on the amount of each plant community present within the project area. A summary of plant communities within the project area is presented in Table 1.

No significant habitat fragmentation is expected as a result of project activities since potential improvements will be restricted to adjoining roadside margins. Construction noise and associated disturbances will have short-term impacts on avifauna and migratory wildlife

movement patterns. Impacts associated with turbidity and suspended sediments resulting from bridge replacement will be minimized through the use of sediment curtains and the implementation of stringent erosion control measures.

Table 1. Project area plant communities. Areas are given in acres (hectares)

Plant Community	Area
Piedmont/Low Mountain Alluvial Forest	2.2 (0.9)
Mesic Mixed Hardwood Forest (Piedmont Subtype)	8.9 (3.6)
Maintained / disturbed land	19.0 (7.7)
Total	30.0 (12.2)

4.0 JURISDICTIONAL TOPICS

4.1 Waters of the United States

Surface waters within the embankments of Boylston Creek are subject to jurisdictional consideration under Section 404 of the Clean Water Act as "waters of the United States" (33 CFR section 328.3). Jurisdictional areas delineated in support of this project are quantified in Table 2.

Based on NWI mapping, Boylston Creek is a permanently flooded, upper perennial stream with an unknown bottom (R3OWH). During the field visit, Boylston Creek was determined to be an upper perennial stream system with an unconsolidated bottom of cobble, gravel, and sand and permanently flooded (R3UB1/2).

Sweetwater Branch is not characterized on NWI mapping; however, during the field visit Sweetwater Branch was determined to be a permanently flooded, upper perennial, riverine system with unconsolidated bottom of cobble, gravel, and sand (R3UB1/2).

The UT No. 1 to Boylston Creek (Figure 2) is not characterized on NWI mapping; however, during the field UT No. 1 was determined to be a permanently flooded, upper perennial stream with an unconsolidated bottom of sand and mud (R3UB2/3).

The UT No. 2 to Boylston Creek (Figure 2) is not characterized on NWI mapping; however, during the field UT No. 2 was determined to be a permanently flooded, upper perennial stream with an unconsolidated bottom of cobble, gravel, and sand (R3UB1/2).

Vegetated wetlands are defined by the presence of three primary criteria: hydric soils, hydrophytic vegetation, and evidence of hydrology at or near the surface for a portion (12.5 percent) of the growing season (DOA 1987). Vegetated wetlands adjacent to jurisdictional surface waters are subject to jurisdictional consideration under Section 404 of the Clean Water Act as "waters of the United States" (33 CFR Section 328.3). Five jurisdictional wetlands

(agricultural drainage ditches, hillside seepage, wet meadow, and a manmade pond) were found in the project area. No wetlands are shown on the NWI mapping for the area, but Cowardin *et al.* (1979) listings were assigned to wetlands during the field visit.

Table 2. Linear distance or area of jurisdictional areas within the project area. Linear distance is expressed in feet (meters) and area is expressed in acres (hectares). Stream and wetland numbers refer to Figure 2.

Jurisdictional Type	Cowardin Classification	Linear Distance	Area	DWQ Rating
Boylston Creek	R3UB1/2	440.6 (134.3)	-	-
Sweetwater Branch	R3UB1/2	421.2 (128.4)	-	-
UT to Boylston Creek No. 1	R3UB2/3	205.7 (62.7)	-	-
UT to Boylston Creek No. 2	R3UB1/2	679.0 (207.0)	-	-
Wetland No. 1	PSS1F	-	0.29 (0.12)	49
Wetland No. 2	PFO1H	-	0.02 (0.01)	43
Wetland No. 3	PFO1H	-	0.03 (0.01)	43
Wetland No. 4	PEM1F	-	0.27 (0.11)	35
Farm Pond	PUB2/3h	-	0.38 (0.15)	22
	Total	1746.5 (532.3)	0.99 (0.40)	

The largest wetland (Figure 2, Wetland No. 1) was found in the eastern side of the project and is characterized as a maintained, wet meadow dominated by herbs and grasses with fringing shrubs. Hydrophytic vegetation in the area includes black willow, soft rush, and some sedge species (*Carex* spp.). Wetland No. 1 occurs on Talladega soils with a low chroma, indicating long periods of inundation. Also, the wetland had areas of standing water on the day of the site visit and appeared to be semi-permanently flooded. This wetland is not depicted on NWI mapping, but during the field visit was characterized as a palustrine, shrub-scrub, broad-leaved deciduous, semi-permanently flooded wetland (PSS1F).

Two small wetlands (Figure 2, Wetland No. 2 and 3) are located in seeps of the UT No. 2 to Boylston Creek. Both wetlands occur on Toxaway soils and support hydrophytic vegetation including smartweed, spicebush, tag alder, and mosses. Other wetland indicators include low-chroma soils and areas of standing water. These wetlands are not depicted on NWI mapping, but during the field visit were characterized as palustrine, forested, broad-leaved deciduous, permanently flooded wetlands (PFO1H).

Man-made drainage ditches adjacent to SR 1329 and southwest of Bridge No. 12 were determined to be jurisdictional wetlands (Figure 2, Wetland No. 4). These features occur on Codorus soils and exhibit hydric soils, hydrophytic wetland vegetation, and evidence of wetland hydrology. The ditches were inundated on the day of the site visit and supported cattails, black willow, tag alder, and soft rush. These ditches are not depicted on NWI mapping, but during the field visit were determined to be palustrine, emergent, permanently flooded wetlands with persistent vegetation (PEM1H).

A portion of a farm pond is located within the southern end of the project area (Figure 2). The pond, which drains into the UT No. 2 to Boylston Creek, can be characterized by an unconsolidated bottom of sand and mud. The pond is not depicted on NWI mapping, but during the field visit was determined to be an impounded, palustrine system with an unconsolidated bottom of sand/mud (PUB2/3h).

This project is located in a N.C Wildlife Resources Commission (WRC) trout county; therefore, WRC may require a moratorium for instream construction from October 15 to April 15. Therefore, this project may be classified as Case 2, where in-water work moratoriums or restrictions will be required beyond those outlined in Best Management Practices for Protection of Surface Waters.

4.2 Permit Issues

4.2.1 Permits

This project may be processed as a Categorical Exclusion (CE) under Federal Highway Administration (FHWA) guidelines. The COE has made available Nationwide Permit (NWP) 23 for CEs due to minimal impacts to waters of the U.S. expected with bridge construction. NWP 33 may be used for temporary access and dewatering within waters of the United States. However, authorization for jurisdictional area impacts through the use of these permits will require written notice to DWQ. DWQ has made available General 401 Water Quality Certifications for these NWPs. In the event that NWPs will not suffice, impacts attributed to bridge replacement and associated approach improvements may qualify under General Bridge Permit (GP) 031 issued by the Wilmington COE District. DWQ has made available a General 401 Water Quality Certification for GP 031. Notification to the Washington COE office is required if this general permit is utilized.

The proposed project is located in the Tennessee Valley Authority's (TVA) Land Management District. A permit pursuant to Section 26a of the TVA Act is required for all construction or development involving streams or floodplains in the Tennessee River drainage basin.

4.2.2 Mitigation

The USACE has adopted through the Council on Environmental Quality (CEQ) a wetland mitigation policy which embraces the concept of "no net loss of wetlands" and sequencing. The purpose of this policy is to restore and maintain the chemical, biological and physical integrity of waters of the United States, and specifically wetlands. Mitigation of wetland impacts has been defined by the CEQ to include: avoiding impacts (to wetlands), minimizing impacts, rectifying impacts, reducing impacts over time and compensating for impacts (40 CFR 1508.20). Each of these three aspects (avoidance, minimization and compensatory mitigation) must be considered sequentially.

Avoidance mitigation examines all appropriate and practicable possibilities of averting impacts to waters of the United States. According to a 1990 Memorandum of Agreement (MOA) between the EPA and the USACE, in determining "appropriate and practicable" measures to

offset unavoidable impacts, such measures should be appropriate to the scope and degree of those impacts and practicable in terms of cost, existing technology and logistics in light of overall project purposes.

Minimization includes the examination of appropriate and practicable steps to reduce the adverse impacts to waters of the United States. Implementation of these steps will be required through project modifications and permit conditions. Minimization typically focuses on decreasing the footprint of the proposed project through the reduction to median widths, right-of-way widths, fill slopes and/or road shoulder widths. All efforts will be made to decrease impacts to surface waters.

Compensatory mitigation is not normally considered until anticipated impacts to waters of the United States have been avoided and minimized to the maximum extent possible. It is recognized that "no net loss of wetlands" functions and values may not be achieved in each and every permit action. In accordance with 15A NCAC 2H .0506(h), NCDWQ may require compensatory mitigation for projects with greater to or equal than 1.0 ac (0.45 ha) of impacts to jurisdictional wetlands or greater than or equal to 150 linear ft (46 linear m) of total perennial stream impacts. Furthermore, in accordance with 67 FR 2020, 2092; January 15, 2002, the USACE requires compensatory mitigation when necessary to ensure that adverse effects to the aquatic environment are minimal. The size and type of proposed project impact and function and value of the impacted aquatic resource are factors considered in determining acceptability of appropriate and practicable compensatory mitigation. Appropriate and practicable compensatory mitigation is required for unavoidable adverse impacts which remain after all appropriate and practicable minimization has been required. Compensatory actions often include restoration, preservation and enhancement, and creation of waters of the United States. Such actions should be undertaken first in areas adjacent to or contiguous to the discharge site.

Mitigation opportunities exist within the project area. Most of the Boylston Creek floodplain is currently in agricultural use in areas that were likely to have been converted from wetlands. Ditches throughout the Boylston Creek floodplain in the project area are actively draining ground hydrology from surrounding agricultural fields where hydric soils are mapped to occur, and thus potential for wetland restoration/creation are apparent. Mitigation opportunities also exist as vegetative buffer enhancement along Boylston Creek, Sweetwater Branch, and the two unnamed tributaries to Boylston Creek.

4.3 Protected Species

Species with the federal classification of Endangered, Threatened, Threatened due to Similarity of Appearance (T [S/A]), or officially Proposed for such listing are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The term "Endangered Species" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range," and the term "Threatened Species" is defined as "any species which is likely to become an Endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. 1532). The term "Threatened due to Similarity of Appearance" is defined as a species which is not "Endangered" or "Threatened," but "closely resembles an Endangered or Threatened species" (16 U.S.C. 1532). Federally

protected species listed for Henderson County (February 24, 2003 FWS list) are presented in Table 3.

Table 3. Federally Protected Species listed for Henderson County (February 24, 2003 FWS list)

Common Name	Scientific Name	Status
Bog turtle	*Clemmys muhlenbergii*	T(S/A)
Appalachian elktoe	*Alasmidonta raveneliana*	E
Oyster mussel*	*Epioblasma capsaeformis*	E
Swamp pink	*Helonias bullata*	T
Bunched arrowhead	*Sagittaria fasciculata*	E
Mountain sweet pitcher plant	*Sarracenia jonesii*	E
Small-whorled pogonia	*Isotria medeoloides*	T
White irisette	*Sisyrinchium dichotomum*	E

* Historic record - last seen in Henderson County more than 50 years ago

***Clemmys muhlenbergii* (Bog turtle)**
Threatened due to similarity of appearance
Family: Emydidae
Date Listed: May 1, 1997

The bog turtle is a small turtle reaching an adult size of approximately 3.0 to 4.0 inches (7.6 to 10.2 centimeters). This otherwise darkly-colored species is readily identifiable by the presence of a bright orange or yellow blotch on the sides of the head and neck (Martof *et. al.* 1980). The bog turtle has declined drastically within the northern portion of its range due to over-collection and habitat alteration. As a result, the FWS officially proposed in the January 29, 1997 Federal Register (62 FR 4229) to list bog turtle as threatened within the northern portion of its range, and within the southern portion of its range, which includes North Carolina. The bog turtle is now listed as threatened due to similarity of appearance (T S/A) to the northern population. The listing would allow incidental take of bog turtles in the southern population resulting from otherwise lawful activity. The bog turtle is typically found in bogs, marshes, and wet pastures, usually in association with aquatic or semi-aquatic vegetation and small, shallow streams over soft bottoms (Palmer and Braswell 1995). In North Carolina, bog turtles have a discontinuous distribution in the Mountains and western Piedmont.

BIOLOGICAL CONCLUSION: NOT APPLICABLE

NHP records document the nearest occurrence of the bog turtle in Alexander County, approximately 1.4 miles (2.3 kilometers) north of the project area in the Mills River drainage. There is no suitable habitat for this species within the project area. T (S/A) species are not subject to Section 7 consultation and a biological conclusion for this species is not required.

***Alasmidonta raveneliana* (Appalachian elktoe)**
Endangered
Family: Unionidae
Date Listed: November 23, 1994

Appalachian elktoe is a small, subovate- to kidney-shaped freshwater mussel that grows to approximately 3.1 inches (8.0 centimeters) in length, 1.4 inches (3.5 centimeters) in height, and 1.0 inch (2.5 centimeters) in width (Clarke 1981). The shell is thin, but not fragile, and exhibits slight inflation along the posterior ridge near the center of the shell. Beaks project only slightly above the hinge line. Lateral teeth are absent; however, the hinge plate of both valves is thickened. Small, pyramidal, compressed pseudocardinal teeth are present, and an interdental projection is present in the left valve. Juveniles are yellowish brown, but the periostracum (outer shell surface) is thicker and dark brown in adults. Individuals may be variably marked with prominent to obscure greenish rays. The nacre (shell interior) is shiny, blue to bluish white with salmon, pink, or brown coloring in the central portion of the shell and beak cavity.

Appalachian elktoe is endemic to the upper Tennessee River system in the mountains of western North Carolina and eastern Tennessee including the French Broad River Basin. In North Carolina, this species may now be restricted to the Little Tennessee and Nolichucky drainages (LeGrand and Hall 2001). Recent WRC surveys have documented this species in the Little Tennessee River in Macon and Swain Counties, Cane River in Yancey County, Nolichucky and North Toe Rivers in Yancey and Mitchell Counties. A new population has recently been found in the Little River near the Henderson-Transylvania County line (personal communication, Mark Cantrell, FWS, July 11, 2001). The Pigeon River once supported a population of this mussel, but now is reported to be severely polluted and no longer likely to support the species (TSCFTM 1990). Suitable habitat for Appalachian elktoe consists of well-oxygenated riffle areas with sand and gravel substrate among cobbles and boulders. Current is usually moderate to swift and depth is no more than 3.0 feet (0.9 meter) (Parmalee and Bogan 1998).

BIOLOGICAL CONCLUSION: UNRESOLVED

Within the project area, Boylston Creek and Sweetwater Branch are medium-sized creeks with a riffle/pool structure, and moderate flow over a cobble/boulder/sand substrate. Therefore, suitable habitat for Appalachian elktoe does potentially exist within the project area. NHP records do not document the occurrence of Appalachian elktoe within 1.0 mile (1.6 kilometers) of the project area. The nearest known population occurs in the French Broad River approximately 7.5 miles (12.0 kilometers) southwest of the study area. Based on habitat types within the project area, this project could potentially affect Appalachian elktoe, and surveys for this species may be required. BMPs for the protection of surface waters and HQW guidelines (*Design Standards in Sensitive Watersheds*) should be strictly enforced during the life of the project.

***Epioblasma capsaeformis* (Oyster mussel)**
Endangered
Family: Unionidae
Date Listed: January 10, 1997

The oyster mussel is a small, freshwater mussel reaching approximately 2.1 inches (7.0 centimeters) in length. The shell is dull to sub-shiny and yellowish to green with numerous dark green rays. The nacre (inside shell surface) is white to blue in color. Shells of females are slightly inflated and thinner toward the posterior margin. Oyster mussels inhabit small to medium-sized rivers with sand/gravel substrate, in shallow riffles and fast water less than 3.0 feet (0.9 meter) deep (Parmalee and Bogan 1998). This species is sometimes associated with water willow (*Justicia americana*) and is found in gravel pockets between bedrock and swift currents. Four species of fish have been identified as hosts including spotted darter (*Etheostoma maculatum*), redline darter (*E. rufilineatum*), dusky darter (*Percina sciera*), and banded sculpin (*Cottus carollinae*) (FWS 2000).

The oyster mussel is endemic to the Cumberland and Tennessee River drainages in Alabama, Kentucky, Tennessee, Virginia, and North Carolina. Within North Carolina, the species was known to have been abundant in the early 1900s in the upper Tennessee River system of the mountains of western North Carolina and Tennessee. Currently the oyster mussel survives in nine tributaries of the Tennessee and Cumberland River systems in Kentucky, Tennessee, and Virginia. This species is now considered to have been "formerly reported" from the French Broad River (LeGrand and Hall 2001). Much of the historic range of this species has been impounded by projects of the TVA and the COE. Other populations have probably been lost due to pollution and siltation. All known populations are small and vulnerable to disturbance.

BIOLOGICAL CONCLUSION: UNRESOLVED

Within the project area, Boylston Creek is a medium-sized stream with relatively shallow water, a riffle/pool structure and moderate flow over a cobble/boulder/sand substrate. Therefore, suitable habitat for oyster mussel does potentially exist within the project area. Oyster mussels have been documented within the French Broad River basin historically. NHP does not document the occurrence of oyster mussel within 1.0 mile (1.6 kilometers) of the project area. Based on habitat types within the project area, this project could potentially affect oyster mussel, and surveys for this species may be required. BMPs for the protection of surface waters and HQW guidelines (*Design Standards in Sensitive Watersheds*) should be strictly enforced during the life of the project.

***Helonias bullata* (Swamp pink)**
Threatened
Family: Liliaceae
Date Listed: September 9, 1998

Swamp pink is a perennial, hydrophytic herb in the lily family with simple leaves in a basal rosette. Small scale-like leaves or bracts are found on a hollow flowering stem which may be 16.0 inches (40.6 centimeters) tall in flower and 24.0 inches (61.0 centimeters) tall in fruit. The

inflorescence consists of pink to lavender flowers borne on a raceme without bracts. Fruits consist of three-lobed papery capsules. Vegetative portions of the plant may emerge in April and persist through September. Flowering occurs in April and May, with fruits present from May through July (Massey *et al.* 1983).

In North Carolina, swamp pink is found in mountain swamps and bogs. Swamp pink occurs along small watercourses in permanently saturated, acidic, organic soils or black muck which is mostly sphagnous (Porter and Wieboldt 1991). Swamp pink does not tolerate prolonged inundation, but can survive infrequent and brief flooding. In North Carolina, the current distribution is restricted to Henderson, Jackson, and Transylvania Counties (Amoroso 2002).

BIOLOGICAL CONCLUSION: UNRESOLVED

Wetland areas within the project area provide suitable habitat for swamp pink. Swamp pink is not detectable during the dormant winter season when the site visit was undertaken. NHP records do not document swamp pink within 1.0 mile (1.6 kilometers) of the project area. The nearest known population occurs in the French Broad River approximately 3.6 miles (5.8 kilometers) southwest of the study area. Based on the habitat types within the project area, surveys should be completed for the swamp pink during the optimal survey window (April to May).

***Isotria medeoloides* (Small whorled pogonia)**
Threatened
Family: Orchidaceae
Date Listed: September 10, 1982

Small-whorled pogonia is a terrestrial orchid growing to about 10.0 inches (25.4 centimeters) high. Five or six drooping, pale dusty green, widely rounded leaves with pointed tips are arranged in a whorl at the apex of the greenish or purplish, hollow stem. Typically a single, yellowish green, nearly stalkless flower is produced just above the leaves; a second flower rarely may be present. Flowers consist of three petals, which may reach lengths of 0.7 inch (1.7 centimeters), surrounded by three narrow sepals up to 1.0 inch (2.5 centimeters) in length. Flower production occurs from May to July and is followed by the formation of an erect ellipsoidal capsule 0.7 to 1.2 inches (1.7 to 3.0 centimeters) in length (Massey *et al.* 1983). This species may remain dormant for periods up to 10 years between blooming periods (Newcomb 1977).

Populations of small-whorled pogonia are sparse and widely distributed. The species is found in open, dry deciduous or mixed pine-deciduous forest and along stream banks. Examples of suitable habitat conditions (open canopy and shrub layer with a sparse herb layer) where small-whorled pogonia has been found include old fields, pastures, windthrow areas, cutover forests, old orchards, and semi-permanent canopy breaks along roads, streams, lakes, and cliffs (Massey *et al.* 1983). Suitable forest is generally of second- or third-growth. Soils are often sandy or stony, acid, nutrient poor soils overlain by leaf litter. Beyond the common characteristics of soils, sparse ground cover and open canopy with persistent breaks, myriad exceptions and local variations occur (FWS 1992). In the mountains and Piedmont of North

Carolina, this species is usually found in association with white pine (Weakley 1993), or at scattered locations in the mountains, Piedmont, and Sandhills (Amoroso 2002), including wooded slopes and streamsides (Radford *et al.* 1968).

BIOLOGICAL CONCLUSION: UNRESOLVED

The project area contains areas of white pine trees as well as edge communities along roads and streams. NHP records do not document small-whorled pogonia within 1.0 mile (1.6 kilometers) of the project area. The nearest documented population of small-whorled pogonia is located approximately 9.0 miles (14.5 kilometers) southeast of the project area. Based on the habitat types within the project area, surveys should be completed for the small whorled pogonia during the optimal survey window (mid May to early July).

***Sagittaria fasciculata* (Bunched arrowhead)**
Endangered
Family: Alismataceae
Date Listed: July 25, 1979

Bunched arrowhead is a perennial, emergent, aquatic herb growing to 14.0 inches (35.6 centimeters) in height with simple, basal leaves. Two leaf forms are produced: phyllodes (blade-less) early in the season, and progressively longer, broader leaves later in the season (Kral 1983). The phyllodes are linear, distinctively flattened, spongy-tissued, and are up to 4.0 inches (10.2 centimeters) long and 0.8 inch (2.0 centimeters) wide. Later leaves may be spoon-shaped or narrowly oblanceolate and strap-like, growing to lengths of 14.0 inches (35.6 centimeters) and widths of 1.6 inches (4.0 centimeters). Unisexual flowers are borne on an erect, flowering stem in two to four whorls, with each whorl subtended by three bracts fused at the base. Fruits consist of a round aggregate of large, distinctively crested achenes. Flowering has been reported to occur from May to July, with fruits present from May through September. Vegetative portions of the plant may emerge in April and persist through September (Massey *et al.* 1983, Kral 1983).

Bunched arrowhead is found rooted in shallow water in or along shallow, sluggish streams flowing through mountain swamps or bogs (Kral 1983). Typical substrate is reported to be siliceous and micaceous silty muck, often with high sulfide content (Kral 1983). The current distribution is restricted to Buncombe and Henderson Counties in the mountains of North Carolina (Amoroso 2002) and Greenville County in the upper Piedmont of South Carolina.

BIOLOGICAL CONCLUSION: UNRESOLVED

Agricultural drainage ditches within the project area contain slow moving water and emergent vegetation. Therefore, suitable habitat for swamp pink does exist within the proposed project area. Bunched arrowhead is not detectable during the dormant winter season, when the site visit was undertaken. NHP records do not document bunched arrowhead within 1.0 mile (1.6 kilometers) of the project area. The nearest documented population of bunched arrowhead is located approximately 8.5 miles (13.7 kilometers) southeast of the project area. Based on the

habitat types within the project area, surveys should be completed for the bunched arrowhead during the optimal survey window (mid May to July).

***Sarracenia jonesii* (Mountain sweet pitcher plant)**
Endangered
Family: Sarraceniaceae
Date Listed: March 10, 1988

Mountain sweet pitcher plant is an insectivorous, perennial, hydrophytic herb growing to 30.0 inches (76.2 centimeters) in height with hollow, trumpet-shaped leaves. The pitcher chamber is narrow but expands sharply along the upper quarter of the length. An ascending, cordate-shaped hood is held high over the exposed pitcher chamber orifice. Solitary flowers are produced on erect flowering stems. Petals are dark red to maroon on the outside, with the inner surface often yellow-green tinged with red. Flowering has been reported from April to June with fruits formed by August. Vegetative portions of the plant may emerge in April and persist through August (Massey *et al.* 1983). Mountain sweet pitcher plant is treated as a subspecies of the more common sweet pitcher plant (*S. rubra*). Mountain sweet pitcher plant is found in mountain bogs and along streams on granite rock faces. The current distribution is restricted to Buncombe, Henderson, and Transylvania Counties in the mountains of North Carolina (Amoroso 2002) and Greenville and Pickens Counties in western South Carolina.

BIOLOGICAL CONCLUSION: UNRESOLVED

Wetland areas within the project area may provide suitable habitat for mountain sweet pitcher plant. NHP records do not document mountain sweet pitcher plant within 1.0 mile (1.6 kilometers) of the project area. The nearest documented population of mountain sweet pitcher plant is located approximately 3.7 miles (5.9 kilometers) south of the project area. Based on habitat types within the project area, surveys should be completed for the mountain sweet pitcher plant during the optimal survey window (April to October).

***Sisyrinchium dichotomum* (White irisette)**
Endangered
Family: Iridaceae
Date Listed: October 28, 1991

White irisette is a perennial herb in the iris family that grows to 16.0 inches (40.6 centimeters) tall. Stem leaves are at least as wide as the winged stem and may reach 5.5 inches (14.0 centimeters) long and 0.2 inch (0.5 centimeter) wide. Basal leaves reach one-third to one-half the height of the plant and may be up to 7.5 inches (19.0 centimeters) long and 0.14 inch (0.4 centimeter) wide. White irisette differs from other blue-eyed grasses by having three to five nodes with successively shorter internodes between dichotomous branches (FWS 1995). Four to six flowers with white, recurved perianth units are borne per spathe. Flowering occurs from late May through July. White irisette is found in dry to mesic, open oak-hickory forest on mid-elevation mountain slopes at elevations from 1300.0 to 3300.0 feet (396.2 to 1005.9 meters) with aspects ranging primarily from southeast to southwest (FWS 1995). White irisette grows in shallow, circumneutral soils, especially over weathered amphibolite. White irisette is reported to

grow best on regularly disturbed sites, such as power lines, roadsides, and woodland edges, which mimic suppressed natural disturbances and maintain open habitat (FWS 1995). The current distribution is restricted to Forsyth, Henderson, Polk, and Rutherford Counties in North Carolina (Amoroso 2002) and Greenville County in western South Carolina.

BIOLOGICAL CONCLUSION: UNRESOLVED

The study area contains southeastern facing slopes with oak species. Therefore, there may be appropriate habitat for white irisette. NHP records do not document white irisette within 1.0 mile (1.6 kilometers) of the project area. The nearest documented population of white irisette is located approximately 17 miles (27.4 kilometers) east of the project area. Based on the habitat types within the project area, surveys should be completed for the white irisette during the optimal survey window (late May to July).

Federal Species of Concern - The February 24, 2003 FWS list also includes a category of species designated as "Federal species of concern" (FSC) in Henderson County. A species with this designation is one that may or may not be listed in the future (formerly C2 candidate species or species under consideration for listing for which there is insufficient information to support listing). The FSC designation provides no federal protection under the ESA for species listed. NHP files do not document any occurrences of FSC species within 4.0 miles (6.4 kilometers) of the project area. None of the species listed as FSC were observed during the site visit. A list of FSC species occurring in Henderson County is given in Table 4.

Significant Aquatic Endangered Species Habitats proposed by WRC (June 13, 1995 listing) were consulted to determine the presence of Proposed Critical Habitats for aquatic species. The project region contains no Significant Aquatic Endangered Species Habitat. The nearest Significant Aquatic Endangered Species Habitat within the French Broad River Basin occurs approximately 30.0 miles (48.3 kilometers) northeast of the project area.

Table 4. Federal Species of Concern listed for Henderson County (February 24, 2003 FWS list).

Common Name	Scientific Name	Potential Habitat	State Status*
Green salamander	*Aneides aeneus*	No	E
Hellbender	*Cryptobranchus alleganiensis*	No	SC
Eastern small-footed myotis	*Myotis leibii*	Yes	SC
Southern Appalachian woodrat	*Neotoma floridana haematoreia*	Yes	SC
French Broad crayfish**	*Cambarus reburrus*	Yes	W2
Tennessee heelsplitter	*Lasmigona holstonia*	No	E
Diana fritillary butterfly**	*Speyeria diana*	Yes	SR
Schweinitz's sedge	*Carex schweinitzii*	Yes	E
Mountain heartleaf	*Hexastylis contracta*	Yes	E
French Broad heartleaf	*Hexastylis rhombiformis*	Yes	SR-L
Butternut	*Juglans cinerea*	Yes	W5
Rough rush	*Juncus caesariensis*	Yes	E
Gray's lily	*Lilium grayi*	Yes	T-SC
Fraser's loosestrife***	*Lysimachia fraseri*	Yes	E
Large-flowered Barbara's buttons**	*Marshallia grandiflora*	Yes	SR-T
Sweet pinesap**	*Monotropsis odorata*	Yes	SR-T
Bog asphodel**	*Narthecium americanum*	Yes	E
White fringeless orchid	*Plantantherea integrilabia*	Yes	E
Divided-leaf ragwort**	*Packera millefolium*	No	T
Mountain catchfly	*Silene ovata*	Yes	SR-T

* E = Endangered; T = Threatened; SC = Special concern; SR = Significantly Rare (SR-T = rare through out range; SR-L: range limited to North Carolina and adjacent states); C = Candidate; W2 = NC Plant Watch List: rare, but taxonomically questionable; W5 = NC Plant Watch List: rare because of severe decline (Amoroso 2002; LeGrand and Hall 2001).

** Historic occurrence in county - last seen more than 50 years ago

*** Obscure record date and/or location of observation is uncertain

5.0 REFERENCES

Amoroso, J.L. 2002. Natural Heritage Program List of the Rare Plant Species of North Carolina. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health and Natural Resources, Raleigh, NC.

Clarke, A.H. 1991. The Tribe Alasmidontini (Unionidae: Anodontinae), Part I: *Pegias, Alasmidonta, and Arcidens*. Smithsonian Contributions to Zoology, No. 326. 101 pp.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS -79/31. Fish and Wildlife Service, U.S. Department of the Interior, Washington, DC. 103 pp.

Department of the Army (DOA). 1987. Corps of Engineers Wetlands Delineation Manual. Tech. Rpt. Y-87-1. US Army Engineer Waterways Experiment Station, Vicksburg, MS. 100 pp.

Department of Environmental Management (DEM). 1996. A Field Guide to North Carolina Wetlands. North Carolina Department of Environment and Natural Resources, Raleigh. 129 pp.

Division of Water Quality (DWQ). 1998. Classifications and Water Quality Standards Assigned to the Waters of the French Broad River Basin. North Carolina Department of Environment and Natural Resources, Raleigh.

Division of Water Quality (DWQ). 2000A. French Broad Basinwide Water Quality Management Plan. North Carolina Department of Environment and Natural Resources, Raleigh.

Division of Water Quality (DWQ). 2000B. 2000 303(d) List (Final Draft). Website http://h2o.enr.state.nc.us/wqs/. Accessed January 6, 2003.

Fish and Wildlife Service (FWS). 1992. Small Whorled Pogonia (*Isotria medeoloides*) Recovery Plan, First Revision. Newton Corner, MA. 75 pp.

Fish and Wildlife Service (FWS). 1995. White Irisette Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 22 pp.

Fish and Wildlife Service (FWS). 2000. Endangered and Threatened Mussels in North Carolina. Oyster Mussels in North Carolina. http://nc-es.fws.gov/mussel/ oystermuss.html (10-23-00).

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., MacPherson, T.F., Glover, J.B., and Shelburne, V.B., 2002, Ecoregions of North Carolina and South Carolina, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Surgery (map scale 1:1,500,000).

Kartesz, J. 1998. A Synonymized checklist of the Vascular Flora of the United States, Puerto Rico and the Virgin Islands. Biota of north America Program.

Kral, R. 1983. A Report on Some Rare, Threatened, or Endangered Forest-Related Vascular Plants of the South. United States Department of Agriculture, Forest Service, Southern Region, Atlanta, GA. Technical Publication R8-TP 2. 1305 pp.

LeGrand, H. E. and S. P. Hall. 2001. Natural Heritage Program List of the Rare Animal Species of North Carolina. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources, Raleigh.

Martof, B.S., W.M. Palmer, J.R. Bailey, and J.R. Harrison III. 1980. Amphibians and Reptiles of the Carolinas and Virginia. The University of North Carolina Press, Chapel Hill, NC. 264 pp.

Massey, J.R., D.K.S. Otte, T.A. Atkinson, and R.D. Whetstone. 1983. An Atlas and Illustrated Guide to the Threatened and Endangered Plants of the Mountains of North Carolina and Virginia. Southeastern Forest Experiment Station, Asheville, North Carolina. 218 pp.

Menhinick, E.F. 1991. The Freshwater Fishes of North Carolina. North Carolina Wildlife Resources Commission, Raleigh. 227 pp.

Newcomb, L. 1977. Newcomb's Wildflower Guide. Little, Brown, and Company, Boston, MA. 490 pp.

Palmer, W.M. and A.L. Braswell. 1995. Reptiles of North Carolina. The University of North Carolina Press, Chapel Hill, NC. 412 pp.

Parmalee, P.W. and A.E. Bogan. 1998. The Freshwater Mussels of Tennessee. University of Tennessee Press, Knoxville. 328 pp.

Porter, D.M. and T.F. Wieboldt. 1991. Vascular Plants. Pp.51-171 in: K. Terwilliger (ed.), Virginia's Endangered Species: Proceedings of a Symposium. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. 672 pp.

Potter, E.F., J.F. Parnell, and R.P. Teulings. 1980. Birds of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 408 pp.

Radford, A.E., H.E. Ahles, and C.R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. The University of North Carolina Press, Chapel Hill, NC. 1183 pp.

Rohde, F.C., R.G. Arndt, D.G. Lindquist, J.F. Parnell. 1994. Freshwater Fishes of the Carolinas, Virginia, Maryland, and Deleware. The University of North Carolina Press, Chapel Hill, N.C. 222 pp.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Boylston Approximation. Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources. Raleigh. 325 pp.

The Scientific Council on Freshwater and Terrestrial Mollusks (TSCFTM). 1990. A report on the Conservation Status of North Carolina's Freshwater and Terrestrial Molluscan Fauna.

Soil Conservation Service (SCS). 1980. Soil Survey of Henderson County, North Carolina. U.S. Department of Agriculture.

U.S. Department of Agriculture (USDA). 1996. Hydric Soils: Henderson County, North Carolina. United States Department of Agriculture Technical Guide, Section II-A 2.

Weakley, A. S. 1993. Guide to the Flora of the Carolinas and Virginia. Working Draft of November 1993. North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health, and Natural Resources. 575 pp.

Webster, W.D., J.F. Parnell, and W.C. Biggs, Jr. 1985. Mammals of the Carolinas, Virginia, and Maryland. The University of North Carolina Press, Chapel Hill, NC. 255 pp.

Received 6/18/04

The Catena Group

410-B Millstone Drive
Hillsborough, NC 27278
(919) 732-1300

Freshwater Mussel Survey

SR 1329 over Boylston Creek
TIP B-4148
Henderson County
North Carolina

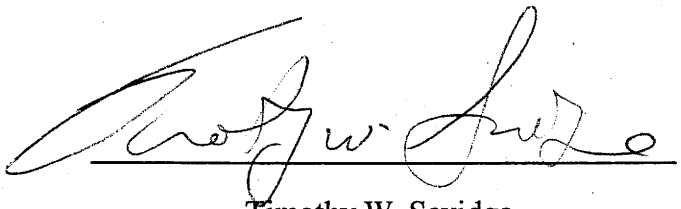
Prepared For:

North Carolina Department of Transportation
PDEA – Office of Natural Environment
1598 Mail Service Center
Raleigh, NC 27699-1598

Prepared By:

The Catena Group
Hillsborough, North Carolina

May 4, 2004



Timothy W. Savidge

INTRODUCTION

The proposed action calls for the replacement of bridge No. 12 over Boylston Creek on SR 1329 in Henderson County, North Carolina, TIP No. B-4148 (Figure 1). Two federally endangered freshwater mussel species: the Appalachian elktoe (Alasmidonta raveneliana) and the oyster mussel (*Epioblasma capsaeformis*) are listed by the US Fish and Wildlife Service as occurring in Henderson County. The oyster mussel is historically known from the mainstem of the French Broad River in Henderson and Buncombe County (Ortman 1918). The Appalachian elktoe was recently reported from the Mills River in Henderson County (T. Savidge, pers. observ. 2003) whose confluence with the French Broad is approximately 1.5 river miles downstream of the confluence of Boylston Creek with the French Broad. In addition to the Appalachian elktoe and oyster mussel, there are several other rare freshwater mussel species known to occur in the French Broad River Basin in Henderson County. These include the Tennessee heelsplitter *(Lasmigona holstonia)*, slippershell mussel *(Alasmidonta viridis)*, and the creeper *(Strophitus undulatus)*. The Tennessee heelsplitter is Federal Species of Concern and is considered Endangered in North Carolina. The slippershell mussel is also considered Endangered in North Carolina, while the creeper is considered Threatened in North Carolina. It is important to note that while the Tennessee heelsplitter has been recorded from the Mills River, this identification is uncertain and awaits taxonomic verification.

WATERS IMPACTED: Boylston Creek

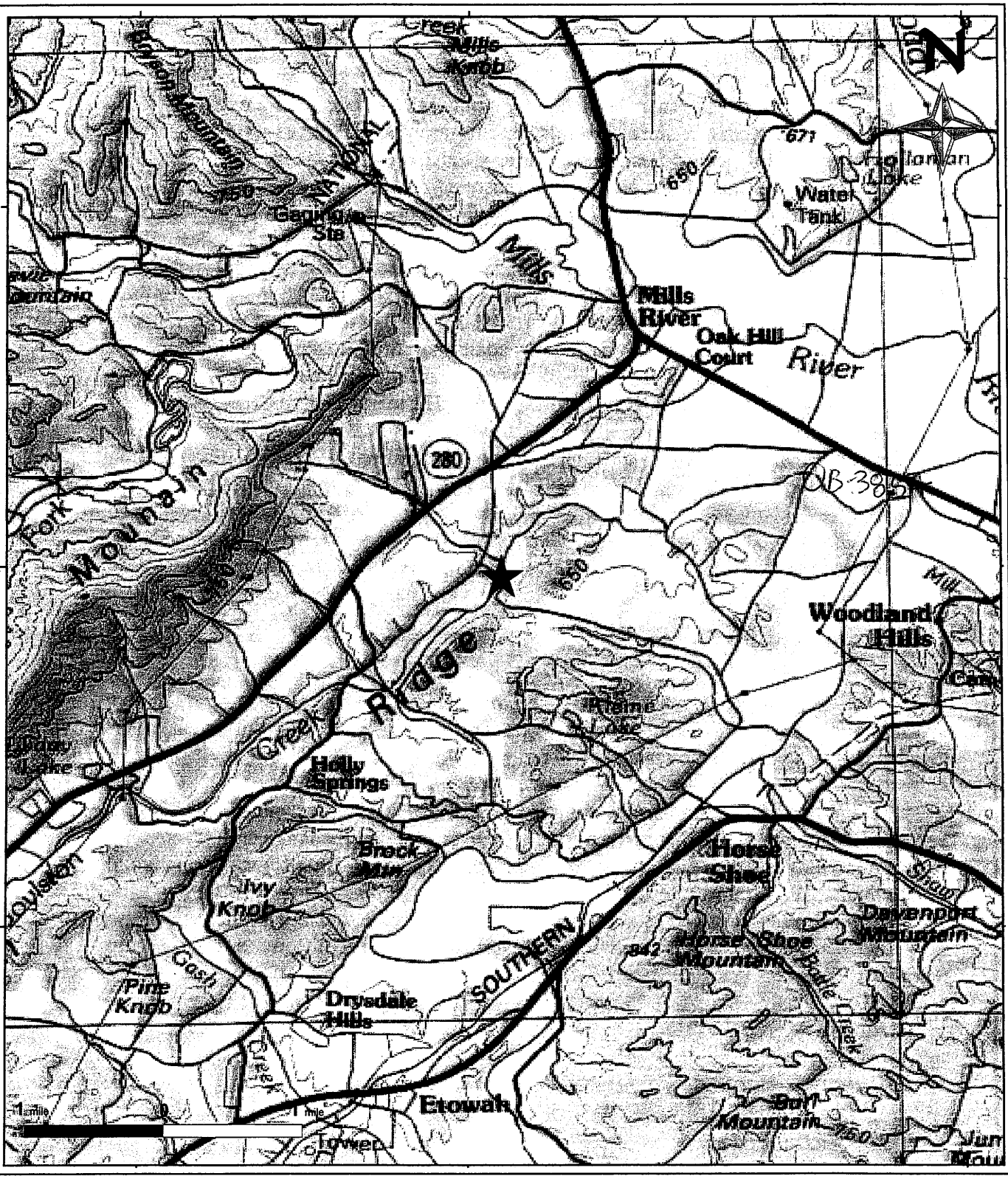
The proposed project will impact Boylston Creek, which arises approximately 7.5 miles southwest of the crossing and generally flows east into the French Broad River approximately 3 miles downstream of the project crossing.

The stream channel in the survey reach is approximately 7 meters (23.0 feet) wide with 1.5 meters (4.9 feet) high streambanks. These clay stream banks are unstable throughout the surveyed reach, as active agricultural fields with little to no riparian buffer border them. The substrate within the downstream reach is predominately unconsolidated sand with occasional gravel in run areas, and heavy silt deposits in pooled areas. The water level was moderately deep with good clarity throughout the survey reach.

SPECIES DESCRIPTIONS

Appalachian elktoe *(Alasmidonta raveneliana) (Lea 1834)*

Status: Endangered
Family: Unionidae
Listed: September-03-1993



The Catena Group	**Project Location (★)** SR 1329 (Holden Road) over Boylston Creek, B-4148 Henderson County, North Carolina	Date: May 2004 Scale: As Shown Job No.: 3012	Figure **1**

Characteristics

Isaac Lea (1834) described the Appalachian elktoe (AE) from the French Broad River system in North Carolina. Its shell is thin but not fragile, oblong and somewhat kidney-shaped, with a sharply rounded anterior margin and a broadly rounded posterior margin. Parmelee and Bogan (1998) site a maximum length of 80 mm. However, recently observed individuals from the Little River (French Broad River Basin) in Transylvania County and West Fork Pigeon River (French Broad River Basin) in Haywood County measured in excess of 100 mm in length (personal observations). The periostracum (outer shell) of the adult Appalachian elktoe is dark brown in color, while juveniles have a yellowish-brown color. Rays may be prominent in some individuals, usually on the posterior slope, and nearly obscure in other specimens. The nacre (inside shell surface) is a shiny bluish white, changing to salmon color in the beak cavity portion of the shell. A detailed description of the shell characteristics is contained in Clarke (1981). Ortmann (1921) provides descriptions of the soft anatomy.

Little is known about the reproductive biology of the Appalachian elktoe; however nearly all freshwater mussel species have similar reproductive strategies, which involves a larval stage (glochidium), which becomes a temporary obligatory parasite on a fish. Many mussel species have specific fish hosts that must be present to complete their life cycle. Based upon laboratory infestation experiments, Watters (1994) identified the banded sculpin (*Cottus carolinae*) as the potential fish host for the AE, however the banded sculpin does not occur in much of the range of the AE (including the Little Tennessee River). Obviously another fish species serves as a host species in these areas. The closely related mottled sculpin (*Cottus bairdi*) is a likely candidate. Pennak (1989) should be consulted for a general overview of freshwater mussel reproductive biology.

Distribution and Habitat Requirements

At the time of listing, two known populations of the Appalachian elktoe existed in North Carolina; the Nolichucky River (including its tributaries of the Cane River and the North Toe River), and the Little Tennessee River and its tributaries. Since listing, the AE has been found in additional areas. These "new" occurrences include extensions of the known ranges in the Nolichucky (South Toe River) and Little Tennessee (Tuckasegee and Cheoah rivers) rivers as well as a rediscovery in the French Broad River Basin (Pigeon and Little rivers). Most of these newly discovered populations are small in size and range and may be represented by very few (<5) individuals observed. The Appalachian elktoe has been observed in gravelly substrates often mixed with cobble and boulders, in cracks of bedrock and in relatively silt-free, coarse sandy substrates (USFWS 1996).

Threats to Species

The decline of the AE throughout its range has been attributed to a variety of factors, including sedimentation, point and non-point source pollution, and habitat modification (impoundments, channelization, etc.).

With the exception of the Little Tennessee River population, all of the other populations are generally small in numbers and restricted to short reaches of isolated streams. The low numbers of individuals and the restricted range of most of the surviving populations make them extremely vulnerable to extirpation from a single catastrophic event or activity. Catastrophic events may consist of natural events such as flooding or drought, as well as human influenced events such as toxic spills associated with highways or railroads. In 1998 a toxic spill resulting from a tanker truck accident carrying Octocure 554 (a chemical liquid used in the rubber making process), killed several miles of mussel populations in the Clinch River near Cedar Bluff, Virginia. The spill killed thousands of fish and mussels, including three federally protected species. The Clinch River contains one of the most diverse mussel faunas in the United States. The reproducing population of the Endangered tan riffleshell (*Epioblasma florentina* stretch of the river affected by the spill was one of the few remaining areas that contained *walkeri*). The toxic spill is believed to have eliminated this population (Richmond Times Dispatch, September 2, 1998). Biologists in Virginia feel that it could take more than 20 years before mussel populations in this area recover, if they recover at all (Bristol Herald Courier, September 4, 1998).

Siltation resulting from improper erosion control of various types of land usage, including agricultural, forestry and development activities has been recognized as a major contributing factor to degradation of mussel populations (USFWS 1996). Siltation has been documented to be extremely detrimental to mussel populations by degrading substrate and water quality, increasing potential exposure to other pollutants and by direct smothering of mussels (Ellis 1936, Marking and Bills 1979). Sediment accumulations of less than 1 inch have been shown to cause high mortality in most mussel species (Ellis 1936). In Massachusetts, a bridge construction project decimated a population of the Endangered dwarf-wedge mussel (*Alasmidonta heterodon*) because of accelerated sedimentation and erosion (Smith 1981). The abrasive action of sediment on mussel shells has been shown to cause erosion of the outer shell, which allows acids to reach and corrode underlying layers (Harman 1974).

The impact of impoundments on freshwater mussels has been well documented (USFWS 1992a, Neves 1993). Construction of dams transforms lotic habitats into lentic habitats, which results in changes with aquatic community composition. These changes associated with inundation adversely affect both adult and juvenile mussels as well as fish community structure, which could eliminate possible fish hosts for glochidia (Fuller 1974). In addition the construction of dams often results in fragmentation of mussel populations, by effectively blocking upstream expansion and recruitment of mussel and fish species. Mussel Shoals on the Tennessee River in northern Alabama, once the richest site for naiads (mussels) in the world, is now at the bottom of Wilson Reservoir and covered with 19 feet of muck (USFWS 1992b).

Sewage treatment effluent has been documented to significantly affect the diversity and abundance of mussel fauna (Goudreau et al. 1988). Goudreau et al. (1988) found that recovery of mussel populations might not occur for up to two miles below

points of chlorinated sewage effluent. Most of the waterbodies where the AE still exists, have relatively few point source discharges within the watershed, and have been rated as having excellent water quality (USFWS 1996).

The introduction of exotic species such as the Asiatic clam (*Corbicula fluminea*) and zebra mussel (*Dreissena polymorpha*) has also been shown to pose significant threats to native freshwater mussels. The Asiatic clam is now established in most of the major river systems in the United States (Fuller and Powell 1973). Concern has been raised over competitive interactions for space, food and oxygen with this species and native mussels, possibly at the juvenile stages (Neves and Widlak 1987, Alderman 1995). Because of its restricted distribution, the AE "may not be able to withstand vigorous competition" (USFWS 1996).

The zebra mussel, native to the drainage basins of the Black, Caspian and Aral Seas, is an exotic freshwater mussel that was introduced into the Great Lakes in the 1980s. Since its introduction, this species has rapidly expanded its range into the surrounding river basins, including those of the South Atlantic slope (O'Neill and MacNeill 1991). This species competes for food resources and space with native mussels, and is expected to contribute to the extinction of at least 20 freshwater mussel species if it becomes established throughout most of the eastern United States (USFWS 1996). The zebra mussel is not currently known from any river supporting AE populations.

Oyster mussel (*Epioblasma capsaeformis*) (Lea 1834)
Status: Endangered
Family: Unionidae
Listed: January 10,1997

Characteristics:

The oyster mussel has a dull to sub-shiny yellowish green shell with numerous narrow dark green rays. The shells of females are obovate, with an inflated and quite thin-shelled marsupial swelling toward the posterior margin, which is usually a darker color than the rest of the shell. Shells of males are elliptical, with the ventral margin slightly curved. The dorsal margin is straight, and the hinge ligament is short. The inside of the shell is whitish to bluish white in color (Johnson 1978, Parmalee and Bogan 1998).

Distribution and Habitat:

This species historically occurred throughout much of the Cumberland region of the Tennessee and Cumberland River drainages in Alabama, Kentucky, Tennessee, and Virginia. This species is not found in small streams. Preferred habitat consists of shallow riffles over course sand/gravel/cobble substrate in medium sized fast-flowing streams and rivers less than three feet deep (Parmalee and Bogan 1998). The recent addition of the oyster mussel to the county species list for counties in North Carolina is based on historic records from the French Broad River in the early 1900s (Ortman 1918).

These historic records had previously been overlooked when compiling the county by county protected species list for North Carolina.

Threats to Species:

Most of the threats associated with the Appalachian elktoe described above apply to the oyster mussel as well. The major identified threats to the oyster mussel are loss of habitat and water pollution. Many of the rivers in the oyster mussel's historic range have been impounded, rendering these areas unsuitable for the species. Freshwater mussels as a group are sensitive to poor water quality; siltation, agricultural runoff, and other non-point sources pose a major threat. Coal mining and increasing development also impact this species by affecting water quality. In addition, most populations are small and isolated, making them more susceptible to predation and local disturbance. Genetic isolation is also a factor that may have a negative impact on the species, as small populations are less able to sustain themselves.

SURVEY EFFORTS

Boylston Creek is a perennial stream that could provide potential habitat for the oyster mussel and Applachian elktoe, and thus surveys for these and other freshwater mussel species were conducted for NCDOT.

Pre- survey Investigation

Prior to conducting in-stream surveys, a review of survey work previously conducted in the Boylston Creek drainage was performed. Sources consulted include the North Carolina Natural Heritage Program (NHP) systematic inventory (database) of rare plant and animal species, and the North Carolina Wildlife Resources Commission. The pre-survey searches revealed no records of any rare mussel species in Boylston Creek.

Mussel Surveys for this Project

Tim Savidge and Tom Dickinson of The Catena Group, Inc., visited Boylston Creek on April 29, 2004. Mussel surveys were conducted from a point approximately 400 meters downstream of the project crossing to a point approximately 100 meters upstream. Boylston Creek was also surveyed at the SR 1314 crossing approximately 2 river miles downstream of the SR 1329 crossing, for TIP project B-3857.

Methodology and Results

Visual (using batiscopes) and tactile methods were used to survey for mussels. Water clarity was good during the site visit. Water level was moderately deep, with approximately 40% of the survey reach averaging less than 2 feet in depth. Timed searches were conducted for a total of 1.5 person/hours. No mussel species were found during the survey effort. The aquatic snail (*Elimia proxima*) is common in the stream.

Discussion

The survey results indicate that freshwater mussels are not present in the surveyed reach of Boylston Creek. It is unlikely that the oyster mussel or the Appalachian elktoe occur in the project area, mostly due to the heavy sediment loading in this stretch of the creek. It can therefore be concluded that project construction has "**No Effect**" for these two species.

REFERENCES

Alderman, J.M. 1995. Monitoring the Swift Creek freshwater mussel community. Unpublished report presented at the UMRCC symposium on the Conservation and Management of Freshwater Mussels II Initiative for the future. UMRCC. Rock Island II.

Augspurger, T. 1992. Environmental contaminant impacts of highway runoff on freshwater mussels, Swift Creek, Nash County, North Carolina. Draft. US Fish and Wildlife Service. Ecological Services, Raleigh Field Office, NC.

Clarke, A. H. 1981. The tribe Alasmidontini (Unionidae: Anodontinae), Part I: Pegias, Alasmidonta, and Arcidens. Smithsonian Contributions to Zoology, (326), 101 pp.

Code of Federal Registar 1997. Final Rule for Determination of Endangered Status for the Cumberland Elktoe, Oyster Mussel, Cumberlandian Combshell, Purple Bean, and Rough Rabbitsfoot. Federal Register: January 10, 1997 (Volume 62, Number 7), Page 1647-1658.

Conrad, T. A. 1837. Monography of the family Unionidae. No. 8:65.

Ellis, M.M. 1936. Erosion silt as a factor in aquatic environments. Ecology. 17:29-42.

Fuller, S.L.H., and C.E. Powell. 1973. Range extensions of *Corbicula manilensis* (Philippi) in the Atlantic drainage of the United States. Natilus. 87(2): 59.

Fuller, S.L.H., 1974. Clams and mussels (Mollusca: Bivalva). Pages 215-273 in: C.W. Hart, Jr. and S.L.H. Fuller (eds.) Pollution ecology of freshwater invertebrates. Academic Press, N. Y.

Goudreau, S.E., R.J. Neves, and R.J. Sheehan. 1988. Effects of sewage treatment effluents on mollusks and fish of the Clinch River in Tazewell County, Virginia. Final Rep., U.S. Fish and Wildl. Serv. 128 pp.

Harman, W.N. 1974. The effects of reservoir construction and channelization on the mollusks of the upper Delaware watershed. Bull. Am. Malac. Union 1973:12-14.

Johnson, R. I. 1978. Systematics and zoogeography of Plagiola (=Dysnomia=Epioblasma), an almost extinct genus of mussels (Bivalvia: Unionides) from middle North America. Bull. Mus. Comp. Zool. 148:239-320.

Lea, I. 1834. Observations on the naiads; and descriptions of new species of that and other families. Trans. Of the American Philosophical Society 5[New Series]: 23-119,pls. 1-19.

Marking, L.L., and T.D. Bills. 1979. Acute effects of silt and sand sedimentation on freshwater mussels. Pp. 204-211 in J.L. Rasmussen, ed. Proc. of the UMRCC symposium on the Upper Mississippi River bivalve mollusks. UMRCC. Rock Island IL. 270 pp.

McMahon, R.F. and A.E. Bogan. 2001. Mollusca: Bivalva. Pp. 331-429. In: J.H. Thorpe and A.P. Covich. Ecology and Classification of North American freshwater invertebrates. 2nd edition. Academic Press.

Neves, R.J. 1993. A state of the Unionids address. Pp. 1-10 in K.S. Cummings, A.C. Buchanan, and L.M. Kooch, eds. Proc. of the UMRCC symposium on the Conservation and Management of Freshwater Mussels. UMRCC. Rock Island IL. 189 pp.

Neves, R.J., and J.C. Widlak. 1987. Habitat ecology of juvenile freshwater mussels (Bivalvia: Unionidae) in a headwater stream in Virginia. Amer. Malacol. Bull. 1(5): 1-7.

O'Neill, C.R., Jr., and D.B. MacNeill. 1991. The zebra mussel (*Dreissena polymorpha*): an unwelcome North American invader. Sea Grant, Coastal Resources Fact Sheet. New York Sea Grant Extension. 12 pp.

Ortmann, A. E. 1921. The anatomy of certain mussels from the Upper Tennessee. The Nautilus 34(3): 81-91.

Ortman, A.E. 1918. The nayades (freshwater mussels) of the Upper Tennessee drainage. With notes on synonymy and distribution. Proceedings of the American Philosophical Society 57:521-626.

Pennak, R.W. 1989. Fresh-water invertebrates of the United States, protozoa to Mollusca Third Edition, John Wiley & Sons, Inc. New York, 628 pp.

Parmalee, P.W. and A.E. Bogan. 1998. The Freshwater Mussels of Tennessee. The University of Tennessee Press, Knoxville. 328pp.

Smith, D. 1981. Selected freshwater invertebrates proposed for special concern status in Massachusetts (Mollusca, Annelida, Arthropoda). MA Dept. of Env. Qual. Engineering, Div. of Water Pollution Control. 26 pp.

U.S. Fish and Wildlife Service. 1992a. Endangered and Threatened species of the southeast United States (The red book). Prepared by Ecological Services, Div. of Endangered Species, Southeast Region. Government Printing Office, Wash. D.C. 1,070 pp.

U.S. Fish and Wildlife Service. 1992b. Special report on the status of freshwater mussels.

U.S. Fish and Wildlife Service. 1996. Recovery Plan for the Appalachian elktoe (*Alasmidonta raveneliana*) Lea. Atlanta GA. 32 pp.

ENVIRONMENTAL SERVICES, INC.
524 S. New Hope Road
Raleigh, NC 27610

MEMORANDUM

TO:	**Chris Underwood**
FROM:	**Gail Tyner**
DATE:	**August 20, 2004**
RE:	**T & E Updates for B-4263, B-3697, B-4145, B-4148, B-3659, and B-3868**

Environmental Services, Inc. (ESI) was asked to perform specific Threatened and Endangered Species Updates for the following bridge projects:

- **B-4263** Rutherford County, Replacement of Bridge No. 41 on SR 1549 over Cathey's Creek
  - Small whorled pogonia, white irisette
- **B-3697** Rutherford County, Replacement of Bridge No. 270 on SR 1155 over Broad River
  - Small whorled pogonia
- **B-4145** Henderson County, Replacement Bridge No. 56 on SR 1006 over Dunn Creek.
  - Swamp pink, bunched arrowhead, mountain sweet pitcher plant, small whorled pogonia, white irisette
- **B-4148** Henderson County, Replacement of Bridge No. 12 on SR 1329 over Boylston Creek
  - Swamp pink, bunched arrowhead, mountain sweet pitcher plant, small whorled pogonia, white irisette
- **B-3659** Haywood County, Replacement of Bridge No. 112 on SR 1147 over Allens Creek
  - Small whorled pogonia
- **B-3868** Macon County, Replacement of Bridge No. 172 on SR 1456 over Little Tennessee River
  - Small whorled pogonia, Virginia spiraea

ESI surveyed each project study area for the specific species requested by NCDOT. No individuals of Threatened and Endangered status were observed during field investigations.

TELEPHONE 919 212-1760

In order to verify vegetative status ESI biologists visited populations of white irisette (off of Sugarloaf Mountain Road in Rutherford and Henderson County) and Virginia spiraea [on the Little Tennessee River Greenway in Franklin, NC (Macon County)] as recommended by Carolyn Wells of the US Fish and Wildlife Service.

Carolyn Wells noted in a telephone conversation with ESI that the small whorled pogonia populations in NC are on the decline and the species appears to be in bad health this year. The one accessible population is on US Forest Service land and they have requested that it not be used as a reference population.

The biologists conducting the surveys, Gail Tyner and Matt Simon, had recently attended a rare plant workshop on May 12-13 2004, sponsored by the US Fish and Wildlife Service, which provided specific training on the identification of swamp pink, bunched arrowhead, dwarf-flowered heartleaf, white irisette, and mountain sweet pitcher plant. Ms. Tyner is a senior scientist with more than 6 years of experience with natural resource investigations including Threatened and Endangered Species surveys. Mr. Simon is a project scientist with more than two years of experience with mountain botany.

The following update reports include a site description, species description, and an updated Biological Conclusion based on the field investigation performed by ESI. If you have any questions or concerns please contact me or Kevin Markham at 212-1760.

TELEPHONE 919 212-1760

Threatened & Endangered Species Update
Small Whorled Pogonia, White Irisette, Swamp Pink,
Bunched Arrowhead, and Mountain Sweet Pitcher Plant
SR 1329 over Boylston Creek
Henderson County
B-4148

The following serves as an update for evaluating potential impacts to small whorled pogonia (*Isotria medeoloides*), white irisette (*Sisyrinchium dichotomum)*, swamp pink (*Helonias bullata*), bunched arrowhead (*Sagittaria fasciculata*), and mountain sweet pitcher plant (*Sarracenia jonesii*) for the proposed bridge replacement on SR 1329 over Boylston Creek in Henderson County (B-4148).

Site Description

The project study area consists of agricultural fields, roadsides, and streambanks. All four quadrants of the project study area are agricultural fields that support corn (*Zea mays)* production. There is an approximately 20-foot riparian buffer adjacent to Bolyston Creek. The riparian buffer is densely vegetated by Chinese privet (*Ligustrum sinense*), smooth sumac (*Rhus glabra)*, greenbrier (*Smilax* spp.), rose (*Rosa multiflora)*, blackberry (*Rubus* sp.), and grape (*Vitis* spp.). The tallest vegetation is only 10 to 15 feet in height and includes black walnut (*Juglans nigra*), black cherry (*Prunus serotina)*, and Chinese privet. The herbaceous layer is dominated by jewelweed (*Impatiens capensis*) and wingstem (*Verbesina alternifolia*). The roadside is frequently maintained and is dominated by clover (*Trifolium* spp.).

Species Descriptions and Biological Conclusions

Small whorled pogonia is a terrestrial orchid growing to about 10 inches high. Five or six drooping, pale dusty green, widely rounded leaves with pointed tips are arranged in a whorl at the apex of the green or purplish, hollow stem. Typically a single, yellowish green, nearly stalkless flower is produced just above the leaves; a second flower rarely may be present. Flowers consist of three petals, which may reach lengths of 0.7 inch, surrounded by 3 narrow sepals up to 1 inch in length. Flower production, which occurs from May to July, is followed by the formation of an erect ellipsoidal capsule 0.7 to 1.2 inches in length (Massey *et al.* 1983). This species has been known to flower infrequently and may remain dormant for extended periods (Porter and Wieboldt 1991).

The small whorled pogonia is widespread, occurring from southern Maine to northern Georgia, but is very local in distribution. In North Carolina, this species is found in scattered locations in the Mountains, Piedmont, and Sandhills (Amoroso 2002). Small whorled pogonia is found in open, dry, deciduous or mixed pine-deciduous forests, or along streambanks. Examples of areas providing suitable conditions (open canopy and shrub layer with a sparse herb layer) where small whorled pogonia has been found include old fields, pastures, windthrow areas, cutover forests,

old orchards, and semi-permanent canopy breaks along roads, streams, lakes, and cliffs (Massey *et al.* 1983). In the southern part of its range small whorled pogonia is typically associated with canopy species such as white pine (*Pinus strobus)*, white oak (*Quercus alba*), red maple (*Acer rubrum)*, rock chestnut oak (*Quercus prinus*), and tulip poplar (*Liriodendron tulipifera*) (USFWS 1992a). Typical ground layer species associated with small whorled pogonia include Virginia creeper (*Parthenocissus quinquefolia*), catbrier (*Smilax glauca*), and Christmas fern (*Polystichum acrostichoides)* (USFWS 1992a).

BIOLOGICAL CONCLUSION: No Effect

No known occurrences of small whorled pogonia have been documented within 1.0 mile of the project study area (NCNHP records review June 2004). Due to the disturbed nature of the agricultural portion of the project study area and the dense nature of the vegetation along the streambanks, potentially suitable habitat does not exist in this portion of the project study area. No impacts to this species are expected as a result of this project due to the absence of suitable habitat within the project study area.

White Irisette is a perennial herb in the iris family that grows up to 16 inches tall. Stem leaves are at least as wide as the winged stem and may reach 5.5 inches long and 0.20 inch wide. Leaf-blades at the base of the plant are a bluish-green and reach one-third to one-half the height of the plant and may be up to 7.5 inches long and 0.14 inch wide. White irisette differs from other blue-eyed grasses by having three to five nodes with successively shorter internodes between dichotomous branches (USFWS 1995a). Four to six tiny flowers with white, recurved perianth units are borne per spathe. Flowering occurs from late May to July. The fruit is a pale to medium brown capsule containing three to six rounded black seeds (Russo 2000).

The white irisette typically occurs on rich, basic soils in dry to mesic woodlands and forests clearings, and near the edges of upland woods where the canopy cover is thin (Weakley 2002, Bunch 2004). It occurs on mid-elevation mountain slopes at elevations from 1300 to 3300 feet with aspects ranging primarily from southeast to southwest (USFWS 1995a). It is also found on dry rocky slopes in near-neutral soil, from weathered mafic rocks (such as Amphibolite), and on chestnut/hickory ridges in the above elevation range (Weakley 2002). It is often found in places where the humus or mineral soil layers have been exposed by downslope runoff, which has removed the litter layer from the soil's surface. Most populations are in artificially disturbed areas, such as power line and road rights-of-way (NatureServe 2004). This species is prevalent in disturbed sites such as roadbeds. The current distribution is restricted to Forsyth, Henderson, Polk, and Rutherford Counties in North Carolina (Amoroso 2002) and Greenville County in western South Carolina.

BIOLOGICAL CONCLUSION: No Effect

No known occurrences of white irisette have been documented within 1.0 mile of the project study area (NCNHP records review June 2004). Due to the disturbed nature of the agricultural portion of the project study area and the dense nature of the vegetation

along the streambanks, potentially suitable habitat does not exist in this portion of the project study area. No impacts to this species are expected as a result of this project due to the absence of suitable habitat within the project study area.

Swamp pink is a perennial herb in the lily family, and a monotypic genus. Forming an evergreen, light green basal rosette, the lance-shaped parallel veined leaves have a pointed tip and are typically 4 to 12 inches long and 0.8-1.6 inches wide. Arising from the rosette is a thick hollow stalk growing 1 to 2 feet high in flower and up to 4 to 5 feet in fruit. The stalk has many small, scale-like leaves 0.2 to 0.8 inch long. Thirty to fifty small pink, fragrant flowers are clustered at the tip of the stem in a 1 to 3 inches long bottlebrush shape (Russo 2000, Weakley 2002, Massey *et al.* 1983). Swamp pink flowers April-May and fruits June to July (Weakley 2002).

Usually growing in colonies, Swamp pink occurs in swamps, bogs, and spring seepage areas as well as along small streams and meadows (Russo 2000). It is often found under dense shrubs in peaty soils (Weakley 2002). Swamp pink relies on a constant water supply and therefore occurs in a variety of wetland habitats but rarely in areas inundated by floodwaters.

BIOLOGICAL CONCLUSION: No Effect

No known occurrences of swamp pink have been documented within 1.0 mile of the project study area (NCNHP records review June 2004). Potentially suitable habitat does not exist in the project study area, as the vegetation along the stream banks is too dense with no openings and suitable soil and hydrology conditions are not present. No impacts to this species are expected as a result of this project due to the absence of suitable habitat within the project study area.

Bunched arrowhead is an herbaceous aquatic plant that grows 6 to 16 inches tall. This is the only *Sagittaria* in the Southern Appalachians without arrow-shaped leaves. The spatulate to lance-shaped emergent leaves are up to 12 inches long and 1 inch wide. A few primary parallel veins converging apically and numerous parallel transverse veins form a subtle netted venation. White 3-petaled flowers are on a long petiole and arranged in 2 to 4 whorls on an erect spike. Typically 3 flowers occur in a whorl and petals are 0.2 to 0.7 inch long. Bunched arrowhead flowers in mid-May through July and fruits mature a few weeks after flowering.

Bunched arrowhead is typically found in swamps and bogs, ditches adjacent to drained bogs and wooded seepage areas (Weakley 2002). Favorable site conditions include saturated to flooded soils, just below the origin of slow, clean, continuous seeps on gently sloping terrain in deciduous woodlands (USFWS 1995b). Soils are often sandy loams covered with 10 to 24 inches of spongy, mucky sphagnum. Habitat is specifically restricted to the narrow band at the bluff-floodplain ecotone that is refreshed by slow continuous seepage of cool clear water (Nature Serve 2004). Bunched arrowhead rarely occurs in stagnant water.

BIOLOGICAL CONCLUSION: No Effect

No known occurrences of bunched arrowhead have been documented within 1.0 mile of the project study area (NCNHP records review June 2004). Potentially suitable habitat does not exist in the project study area, as the vegetation along the streambanks is too dense with no openings and suitable soil and hydrology conditions are not present. No impacts to this species are expected as a result of this project due to the absence of suitable habitat within the project study area.

Mountain sweet pitcher plant is an insectivorous, rhizomatous perennial herb endemic to the Blue Ridge Mountains of northwestern South Carolina and southwestern North Carolina (Massey *et al.* 1983). Tall hollow pitcher-shaped leaves and red-sweet smelling flowers characterize this species. The leaves are trumpet-shaped and tubular averaging 15 to 20 inches long and rarely over 0.4 inch in diameter (Weakley 2002, NatureServe 2004) and display a distinct netted venation that covers both the inside and outside of the narrow tube. The tube expands sharply in the upper quarter to form a hood about 0.8 to 2.1 inches wide. Flowering plants can reach a height of 29 inches (USFWS 1995c) and each flower is supported on a singular stalk that usually exceeds the leaves. Most often there are five distinct petals, 1 to 2 inches long and 1 inch wide. This species flowers from April to June and fruits in August, with vegetative portions present April through August (Massey *et al.* 1983).

Mountain sweet pitcher plant is a very narrow endemic known from only three North Carolina counties and one South Carolina county (Russo 2000, USFWS 1995c). It is most often sited as occurring in seepage-fed mountain bogs and flat to gently sloping valley bottoms that are not subjected to flooding. Preferential soils are high in organic matter, acidic, deep, and composed of poorly drained loam/sand/silt. According to Nature Serve (2004), the pitcher plants grow preferentially in the wettest areas of the bogs. It is also cited as occurring in level depressions associated with floodplains, along streams, waterfall edges, and granite rockfaces along the Blue Ridge Divide (Russo 2000).

BIOLOGICAL CONCLUSION: No Effect

No known occurrences of mountain sweet pitcher plant have been documented within 1.0 mile of the project study area (NCNHP records review June 2004). Potentially suitable habitat does not exist in the project study area, as the vegetation along the streambanks is too dense with no openings and suitable soils and hydrology conditions are not present. No impacts to this species are expected as a result of this project due to the absence of suitable habitat within the project study area.

REFERENCES

Amoroso, J.L. (ed.). 2002. Natural Heritage Program List of the Rare Plant Species of North Carolina. North Carolina Natural Heritage Program, Division of Parks and Recreation; N.C. Department of Environment and Natural Resources; Raleigh. 107 pp.

Bunch (Speaker). 2004. Rare Plant Identification Workshop. South Carolina Department of Natural Resources.

Massey, J.R., D.K.S. Otte, T.A. Atkinson, and R.D. Whetstone. 1983. An Atlas and Illustrated Guide to the Threatened and Endangered Plants of the Mountains of North Carolina and Virginia. Southeastern Forest Experiment Station, Asheville, North Carolina. 218 pp.

NatureServe Explorer. (2004 June). *Sisyrinchium dichotomum; Sagittaria fasciculata; Sarracenia jonesii.* Retrieved July 4, 2004, from <http://www.natureserve.org/explorer/servlet/NatureServe>

Porter, D.M., and T.F. Wieboldt. 1991. Vascular Plants. Pp. 51-171 in: K. Terwilliger (ed.), Virginia's Endangered Species: Proceedings of a Symposium. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. 672 pp.

Russo M. 2000. Threatened and Endangered Species in Forests of North Carolina: A Guide to Assist with Forestry Activities. The Nature Conservancy and International Paper Company, Raleigh, North Carolina. 183pp.

Weakley, A.S. 2002. Flora of the Carolinas and Virginia. Working Draft of March 29, 2002. NatureServe, Durham, North Carolina. 909p.

[USFWS] U.S. Fish and Wildlife Service. 1992a. Small Whorled Pogonia (*Isotria medeoloides*) Recovery Plan, First Revision. Newton Corner, Massachusetts. 75 pp.

[USFWS] U.S. Fish and Wildlife Service. 1992b. Virginia Spiraea (*Spiraea virginiana* Britton) Recovery Plan. Newton Corner, Massachusetts. 47 pp.

[USFWS] U.S. Fish and Wildlife Service. 1995a. White Irisette Recovery Plan. U.S. Fish and Wildlife Service, Atlanta, Georgia. 22 pp.

[USFWS] U.S. Fish and Wildlife Service. 1995b. Bunched Arrowhead, Endangered Species Information. U.S. Fish and Wildlife Service, Asheville Field Office. 2pp.

[USFWS] U.S. Fish and Wildlife Service. 1995c. Mountain Sweet Picture Plant, Endangered Species Information. U.S. Fish and Wildlife Service, Asheville Field Office. 2pp