STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

November 8, 2011

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

ATTN: Ms. Lori Beckwith
NCDOT Coordinator

Subject: **Addendum to the Application for Section 404 Regional General Permit 198200031 and Section 401 Water Quality Certification** for the proposed replacement of Bridge No. 148 over Lamance Creek on SR 1326 in Transylvania County, Federal Aid Project No. BRZ-1326(3); Division 14; TIP No. B-4989.

Dear Madam:
This addendum provides supplemental information to the Section 404 Application submitted July 13, 2011. The following Bridge to Culvert Avoidance & Minimization and Hydraulic Design Criteria has been submitted by the NCDOT Hydraulics Unit.

Bridge to Culvert Avoidance and Minimization for B-4989 Transylvania County

Proposed Structure Summary
Drainage Area-*430 acres*
DWQ Stream Classification- *C;Tr*
Culvert Size and Type-*12' x 6' Reinforced Concrete Box Culvert*
Culvert Length-53'
Minimization Efforts-*The proposed culvert will be buried 1 ft. with alternating 8 ft. wide by 0.5 ft. high low flow sills for fish passage. The culvert maintains the existing stream slope, low flow channel dimensions, low flow velocities and provides a smooth transition from upstream to downstream with no sharp bends at the inlet or outlet.*

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LOCATION:
1020 BIRCH RIDGE DRIVE
RALEIGH NC 27610-4328

Stream Slope
Existing average stream slope = *0.4%*
Proposed culvert slope =*0.38%,*

Fish and/or Aquatic life Passage
Existing low flow channel dimensions in the stream- *The existing low flow channel width up and downstream of the culvert is approximately 8 ft. with an average depth of 0.5 ft.*
Proposed low flow dimensions through the culvert- *culvert will have alternating low flow sills to facilitate fish passage. The low flow sills will provide an 8 ft. wide by 0.5 ft. deep low flow channel in the culvert.*

Existing low flow velocities in the stream- *existing low flow velocity = 1.4 ft/sec*
Proposed low flow velocities through the culvert- *proposed low flow velocity through culvert = 1.5 ft/sec*

Alternating low flow sills and/or baffles- *culvert will have alternating low flow sills to facilitate fish passage since the proposed total culvert width is larger than the existing low flow channel width.*

Culvert Burial
Existing streambed material- *cobbles, gravel and sand*
Proposed culvert burial-*1 foot*
Proposed sills and or baffles- *Alternating low flow sills will be used. The low flow sills will be spaced approximately 26 ft apart and will provide an 8 ft.wide by 0.5 ft deep low flow channel in the culvert. Culvert slope of 0.38% does not necessitate the use of baffles to hold bed material but they are being used to provide low flow channel through culvert.*

Culvert/Stream Alignment
Stream patterns upstream and downstream of the culvert that could affect fish passage and bank stability- *The stream channel is relatively straight through the reach of the stream where the culvert will be placed with a very slight bend at downstream culvert outlet. The stream slope is also constant through the reach of the stream up and downstream of where the culvert will be placed.*
Bed forms impacted by culvert (riffles, pools glides etc.)- *There is a glide located just upstream of the bridge that transitions through the bridge to a riffle section downstream of the bridge. The culvert will be placed in this glide riffle section.*
Establishment of a low flow floodplain bench- *low flow floodplain bench not required since culvert width fits within the stream channel up and downstream.*
Culvert alignment with stream- *culvert provides a smooth transition from the upstream to downstream with no sharp bends at entrance and outlet.*
Stream realignment necessary- *no*
Sharp bends at entrance and outlet-*no*
Bank stabilization- *Class I rip rap on banks only for 20 ft downstream*

Outlet Velocities
Natural stream channel 2yr velocity-*3.8 ft/sec*
Proposed Culvert 2yr outlet velocity-*2.4 ft/sec*
Natural stream channel 10yr velocity-*4.4 ft/sec*
Proposed Culvert 10yr outlet velocity-*4.3 ft/sec*

Roadway Geometric Considerations
Evaluate/describe roadway geometric constraints-*N/A*

Hydraulic Design Criteria
The design criteria for this road would be 25 year (secondary road). The pre and post construction outlet velocities for the 25yr storm are as follows:

Natural stream channel 25yr velocity=4.6ft/sec
Proposed culvert 25yr outlet velocity=5.3ft/sec

We provided the 2yr velocity for comparison since it is close to what would be considered the bankfull flow. The 10yr velocity was also provided because this discharge is used to evaluate the need for outlet channel protection and or energy dissipation.

Analysis Process
The overall hydrologic analysis for a project begins with review and extrapolation of pertinent information from data sources identified during the pre-design study. Final determination of sources of **watershed areas** and base mapping for drainage area delineation are also made at this time. Primary resources for this information are:

- U.S.G.S. and T.V.A. quadrangle mapping
- U.S.G.S. open file report 83-211 *"Drainage Areas of Selected Sites on Streams in North Carolina"*
- Photogrammetric contour mapping
- Aerial photography
- Special studies (Corps, TVA, FEMA)
- Field reconnaissance (This is required for most non-riverine drainage areas in the coastal plain as well as any small watersheds in other areas.)

The selection of a "**design discharge**" for a drainage feature is a risk based assessment process involving the evaluation of a range of flood magnitudes for such factors as potential damages, costs, traffic service, environmental impact, and flood plain management criteria, to determine an appropriate and acceptable structure for each site. One specific criterion on which the design is evaluated and generally referred to as the "design discharge" is the flood level and frequency which results in inundation of the travelway. Table 4-3 relates desirable minimum levels of protection from travelway inundation to roadway classification. Variation from these minimum design levels must be justified through the assessment process and appropriately documented. When roadway overtopping is not involved, the "design discharge" will be the level of flood used for establishing freeboard and/or backwater limitations.

TABLE 4-3	
ROADWAY CLASSIFICATION	**FREQUENCY**
Interstate (I)	50 year
Primary (US & NC)	50 year
Secondary (Major, City thoroughfare)	50 year
Secondary	25 year

The hydrologic analysis process for a specific drainage feature is accomplished as an integral part of the hydraulic sizing and performance analysis. Specific discharge criteria and

computational needs are addressed in further sections of this guideline for each particular drainage feature. Documentation of the hydrologic data is included with the hydraulic design.

A copy of this permit application addendum will be posted on the NCDOT website at: http://www.ncdot.org/doh/preconstruct/pe/neu/permit.html. If you have any questions or need additional information, please e-mail Jeff Hemphill at jhemphill@ncdot.gov.

Sincerely,

E. L. Lusk

for Gregory J. Thorpe, Ph.D.
Branch Manager
Project Development & Environmental Analysis Unit

Cc: David Chang
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