GUIDELINES FOR CONSTRUCTION OF HIGHWAY IMPROVEMENTS ADJACENT TO OR CROSSING TROUT WATERS IN NORTH CAROLINA

The Division of Highways in western North Carolina has the responsibility for construction and maintenance of state system roads, many of which are adjacent to trout streams and other high quality waters. Highway improvement and maintenance will always be needed and it is incumbent upon the Division of Highways to make every effort to perform this construction and maintenance work without doing harm to the public waters. General Statute 113A-57 describes mandatory standards for land disturbing activities and specifically requires that a buffer zone be either provided or retained along any lake or natural water course to confine visible siltation within the 25 percent of the buffer zone nearest the land disturbing activity. (See Appendix B-8) Waters that have been classified as trout waters by the Environmental Management Commission are required to have an undisturbed buffer zone 25 feet wide or of sufficient width to confine visible siltation within the 25 percent of the buffer zone nearest the land disturbing activity, whichever is greater. The law also provides, however, that the Sedimentation Control Commission may approve plans which include the land disturbing activity along trout waters when the duration of said disturbance would be temporary and the extent of such disturbance would be minimal. Under this provision of the law, the Department of Environment, Health, and Natural Resources (DEHNR) has established procedures for granting of approval of temporary disturbances in the buffer zone. The North Carolina Administrative Code under Section T-15A:04B.0025, buffer zone Requirements, spells out the general rules that the DEHNR has established for the granting of approval to encroach on the trout water buffer zone. (See Appendix C-13)

The purpose of these guidelines is to establish a procedure for districts and divisions to follow in obtaining approval from the Director of the Division of Land Resources of DEHNR for construction within the buffer zone of a trout stream.

In planning construction and maintenance activities adjacent to trout streams, the first consideration should be to avoid any encroachment on the trout stream buffer zone. When construction in the trout stream buffer zone cannot be avoided, approval from the Director of DEHNR Land Resources is required before construction can proceed. The following guidelines should be utilized to request approval from DEHNR.

The Approval Process

I. SUPPORTIVE INFORMATION. The District Engineer will need several tools to begin the process.

A. A set of United States Department of the Interior Quad Maps to be used for locating Division of Environmental Management (DEM) trout streams. These quad sheets will also be necessary for the determination of drainage areas for the computation of fill protection elevations.

B. DEHNR classification schedule to identify trout waters.

C. Maps provided by DEHNR with trout waters marked, along with an alphabetical listing of all streams.

D. Flood stage determination procedures accompaning these guidelines.

II. PROPOSAL PREPARATION. When the project has been identified as encroaching upon the buffer zone of a trout stream, certain information must be provided to DEHNR for consideration of approval to work in the buffer zone.

A. Procedures

1. STEP ONE

A plan view of the project showing erosion control measures and location of the stream relative to the right of way will be prepared. The plan will generally be a straight line diagram type plan; however, additional information will be required in the buffer zone encroachment area of the project. This additional information will include cross sections within the buffer zone showing both before and after conditions for the road construction and the stream. Ordinarily, two or three cross sections will be all that is required within an area with some narrative description of the remainder of the area. It is important that District Engineers communicate with the Land Quality Regional Engineer at this point to determine the amount of cross section information required.

The plan view and cross section should indicate the measures to be taken to prevent erosion of fill slopes and temporary and permanent erosion and sediment control devices required to limit siltation of the trout stream.

A description of the slope protection treatment is required and generally would include a reference to the 1990 Standard Specifications for Roads and Structures, Section 868 and Section 1042. If slope protection is to be constructed from materials obtained from the project, a narrative description of the materials to be used, along with construction method, should be provided.

The District Engineer will make a hydraulic analysis to determine the stream bank protection level required, using the procedure outlined in the Flood Stage Determination procedures on page V-5.

Details showing the construction of culverts should be included on the straight line diagram and cross sections. A narrative description of construction methods for installing culverts should be provided: for pipe culverts 36 inches in diameter and greater, a sequence of operations should be submitted with an emphasis on minimizing stream disturbance. If at all possible, these lines should be installed in the dry.

2. STEP TWO

The Area Roadside Environmental Engineer will be requested to review the proposed work in the trout water buffer zone and a written statement from the Area Roadside Environmental Engineer is required. The Area Roadside Environmental Engineer will respond with an Erosion Control Plan Evaluation Form indicating on the transmittal sheet that he has reviewed the trout water buffer zone submittal and that adequate erosion/sediment control methods are planned for protection of the stream. In either case, the comments of the Area Roadside Environmental Engineer must be submitted along with the package to the Land Quality Regional Engineer.

3. STEP THREE

The District Engineer will solicit and receive comments from the District Wildlife Resources Commission Fisheries Biologist. The letter of request must be specific and request a review for a trout water buffer zone approval by DEHNR. See page V-16 for a sample request letter. The comments received from the District Wildlife Resources Commission Fisheries Biologist must be submitted along with the package to the Land Quality Regional Engineer.

4. STEP FOUR

Every approval request should contain a narrative statement describing the project and discussing alternatives considered for the project to avoid encroaching on the trout water buffer zone. Justification for encroachment on the trout water buffer zone should be provided in this narrative statement.

5. STEP FIVE

The entire package of information is to be forwarded to the appropriate Regional Land Quality Engineer, DEHNR. The Land Quality Section has committed to prompt review of variance requests from the NCDOT.

B. Procedures For High Quality Waters (HQW). Trout water buffer zone encroachments along high quality water (HQW) trout streams will require the same process as outlined in the five steps above. The hydraulic analysis, however, must be done for Q-25 flow and all temporary and permanent erosion/sediment control devices must be designed for a Q-25 flow level. It is recommended that the District Engineer consult with the Hydraulics Unit if it is necessary to encroach on the trout water buffer zone of a high quality water stream. Not all high quality waters are trout streams and no buffer zone approvals are required if a trout stream is not involved.

C. General Considerations. These guidelines have dealt with the problem of construction in trout water buffer zones generally along or parallel to a trout stream. According to G. S. 113A-57(1), the buffer zone requirement does not apply to a land disturbing activity in connection with the construction of facilities to be located on, over or under a lake or natural water course. The Sedimentation Control Commission has previously considered "facilities" to include culverts and bridges. The practical implication is that no approval by Land Quality Section Regional Engineers to work in the buffer zone is necessary for projects as long as the alignment is perpendicular or only slightly skewed to the stream as opposed to paralleling the stream. It is necessary that the Land Quality Section Regional Engineer be notified when crossings of trout waters or high quality waters are planned. This notification shall be in the form of a notation on the erosion control plan submitted to the Regional Engineer. Erosion and sediment control plans prepared by the District Engineer for near perpendicular crossings of trout waters must include measures to minimize the amount of sediment lost downstream during construction and must be completely implemented on the project. This must include, but not necessarily be limited to, sediment basins or pits in the roadside ditches ahead of the stream, sediment fence below the toe of earth fills, earthen berms with slope drains at the top of earth fills, diversions across the roadway prior to final grading and base course, and check dams immediately below the construction site to minimize the movement of sediment farther downstream.

Temporary stream crossings should be avoided whenever possible. Where stream crossings are absolutely necessary, they must conform to the practice referenced in the detail drawing for Temporary Stream Crossings in the Erosion and Sedimentation Control Guidelines for Division Maintenance Operations or their equivalent.

FLOOD STAGE DETERMINATION FOR TROUT STREAM BUFFER ZONE

STEP 1 - Determine location(s) where project construction limits will encroach upon 25' buffer zone.

STEP 2 - Determine drainage area size from USGS quad map (1:24000 maps - 1 sq. inch = 0.1435 sq. miles)

STEP 3 - If drainage area;

a) greater than 0.8 square. miles calculate 10 year discharge
@ $Q(10) = 334 (Area)^{0.665}$
Note: - Area in square miles
- Q(10) in cubic feet/second, cfs

b) less than 0.8 sq. miles contact Hydraulics Unit with specific location for assistance.

STEP 4 - Determine stream slope to be used;

a) field survey slope
b) from quad map contour crossings
c) use flatter of two slopes

STEP 5 - Select a typical stream cross section in area of encroachment for analysis.

STEP 6 - Select initial Q(10) water surface elevation. (Rule of thumb - Use one foot above top of bank for for each 1 sq. mile of drainage area).

STEP 7 - Calculate waterway area beneath initial Q(10) water surface (square feet).

STEP 8 - Measure "wetted perimeter" of channel and floodplain beneath initial Q(10) water surface (linear feet)

STEP 9 - Calculate discharge using Mannings equation and roughness coefficient of n = 0.055.

$Q = 1.49/n\ (A)(R)^{0.667}\ (S_o)^{0.5}$

A = Area, ft^2 (Step 7)

R = Area/Wetted Perimeter, ft^2/ft (Step 7/Step 8)

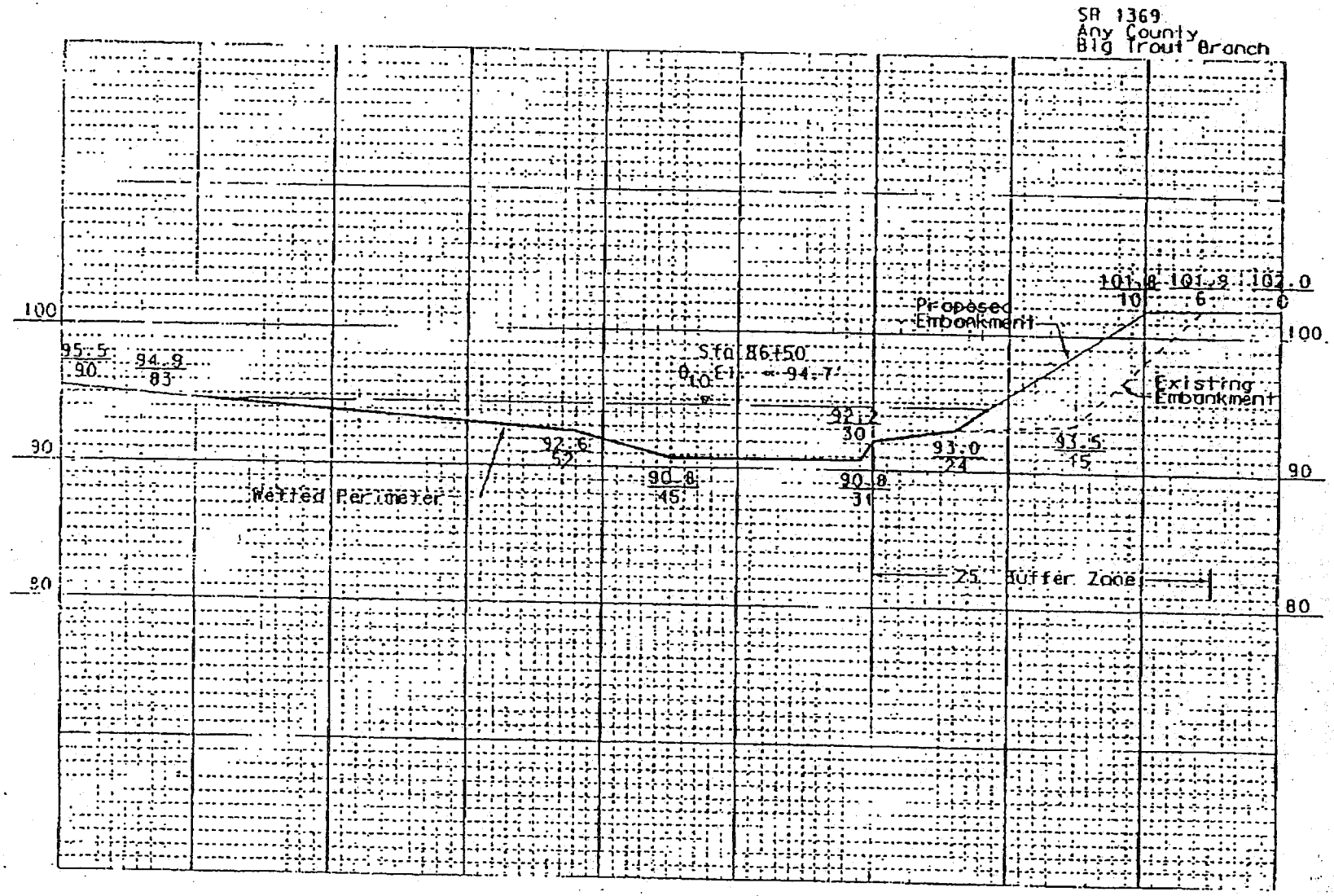
S_o = Slope, (ft/ft) (Step 4)

STEP 10 - If Mannings discharge is;

a) less than Q(10) increase water surface elevation one foot

b) more than Q(10) decrease water surface elevation one foot

then repeat Steps 7, 8, 9, 10 until Mannings discharge is within 5% of Q(10) note: Elevation change alters area and wetted perimeter.


SR 1369
Any County
Big Trout Branch
100
90
80
95.5
90
94.9
83
92.6
90.8
45
92.2
30
90.8
31
93.0
24
93.5
15
101.8
10
101.9
6
102.0
0
Proposed
Embankment
Existing
Embankment
Sta 86+50
θ_{LOC} = 94.7
Wetted Perimeter
25' Buffer Zone

EXAMPLE CALCULATIONS

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BIG TROUT BRANCH
DRH 10-21-92

TROUT STREAM BUFFER ZONE
STATION 86+50
D.A. = 2.7 sq mi (Rural)

STEP 3(a): $Q_{10} = 334(2.7)^{0.665}$

$Q_{10} = 646$ cfs

STEP 4: STREAM SLOPE = 0.01 ft/ft

STEP 5: USE X-SECTION 86+50

STEP 6: TRY WATER DEPTH 5.0' ABOVE BED (SEE SECT. TRIAL I)

STEP 7: WATERWAY AREA = 184 ft²

STEP 8: WETTED PERIMETER = 66 ft

STEP 9: CALCULATE DISCHARGE (Q)

$Q = \frac{1.49}{n}(A)(R)^{0.667}(S_o)^{0.5}$ WHERE $n = 0.055$ $R = \frac{184\ ft^2}{66\ ft} = 2.79$ ft

$Q = \left(\frac{1.49}{0.055}\right)(184\ ft^2)(2.79\ ft)^{0.667}(0.01\ ft/ft)^{0.5}$

$Q = 988$ cfs

STEP 10: $Q > Q_{10}$ ∴ WATER SURFACE IS TOO HIGH, DECREASE WATER DEPTH TO 4.0 ft.

TRIAL II - WATER DEPTH 4.0' ABOVE BED (SEE SECT. TRIAL II)

STEP 7: WATERWAY AREA = 123 ft²

STEP 8: WETTED PERIMETER = 61 ft

STEP 9: CALCULATE Q WITH $n = 0.055$ & $R = 2.02$

$Q = \left(\frac{1.49}{0.055}\right)(123\ ft^2)(2.02)^{0.667}(0.01)^{0.5}$

$Q = 533$ cfs

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BIG TROUT BRANCH
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STEP 10: $Q < Q_{10}$ ∴ WATER SURFACE IS TOO LOW, INCREASE WATER DEPTH TO 4.3'

TRIAL III - WATER DEPTH 4.3' ABOVE BED

STEP 7: WATERWAY AREA = 140 ft^2

STEP 8: WETTED PERIMETER = 62 ft

STEP 9: CALCULATE Q WITH n=0.055 & R=2.27

$$Q = \left(\frac{1.49}{0.055}\right)(140\,ft^2)(2.27)^{0.667}(0.01)^{0.5}$$

$Q = 654$ cfs

STEP 10: $Q \approx Q_{10}$ (WITHIN 5%)

∴ WATER SURFACE Q_{10} IS 4.3' ABOVE BED.

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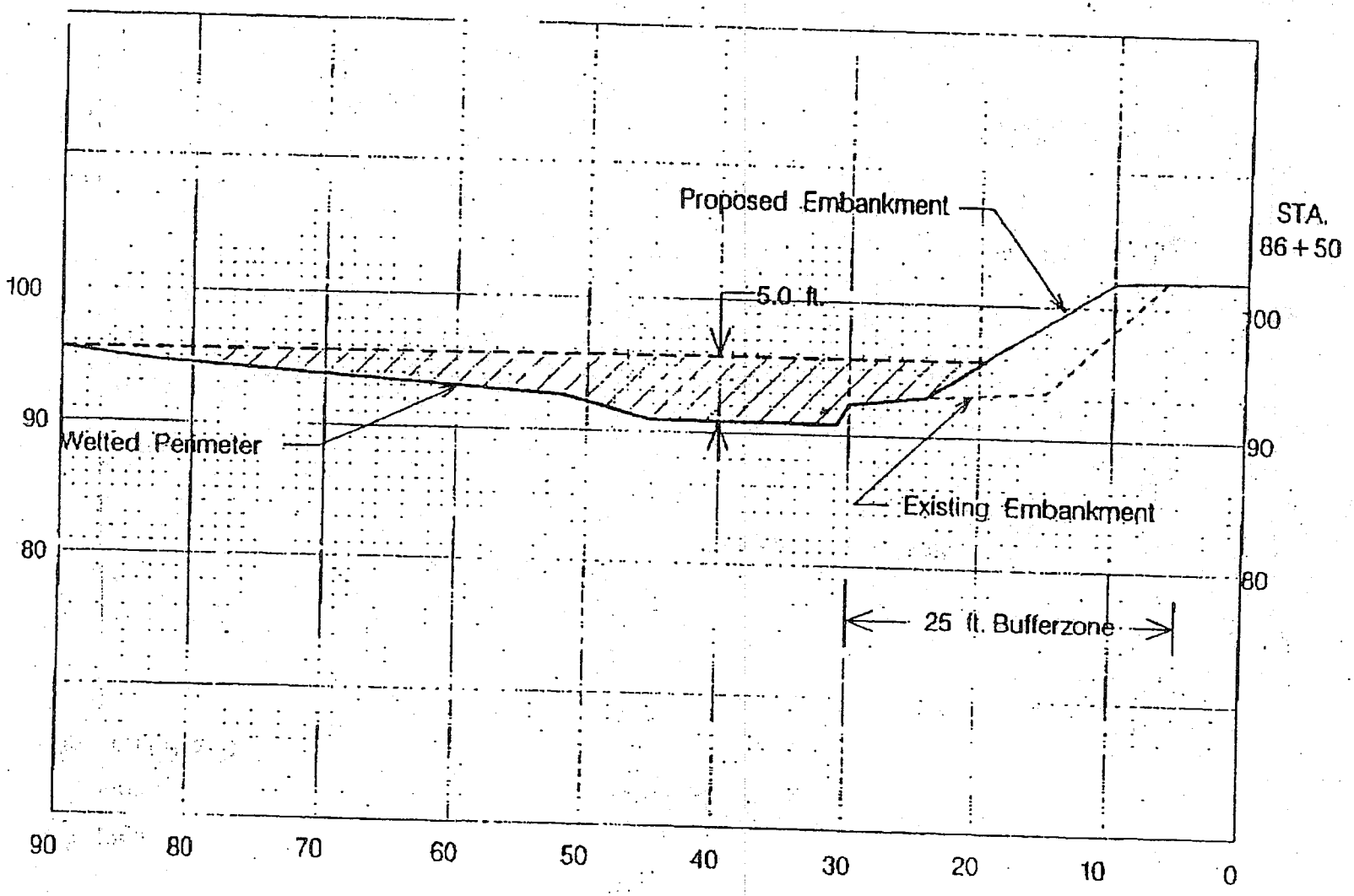
Big Trout Branch

Trial #1



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Big Trout Branch

Trial #2