

**Appendix 12D-1 Guidelines for the Determination, Documentation,
and Processing of Hydraulically Equivalent
Replacement Structures (HERS)**

12D-1.1 Background

This is to update the guidelines presented in memoranda from Mr. C.F. Boles, III on November 9, 1987 and November 18, 1987 for Hydraulically Equivalent Replacement Structures (HERS) and includes the supplemental scour evaluation recommendations presented in an e-memo by Mr. D.M. LeGrande on August 15, 2000. The purpose of Mr. Boles' original memoranda was to establish guidelines for the determination, documentation, and processing of proposed HERS facilities.

12D-1.2 Definition

A HERS determination is only applicable to the replacement of a culvert or bridge, either the complete structure or portions thereof, with a hydraulically identical culvert or bridge. It is not intended to be applied to the replacement of a bridge with a culvert or the replacement of a culvert with a bridge. The waterway opening of the proposed structure must provide the same height and width as the existing facility. An exception would be instances where existing bridge piers were being removed and not replaced. The proposed roadway grades on the approaches and parapet walls on the proposed bridge superstructure must be such that the same flood overtopping characteristics prevail as would be experienced by the existing facility. It should be noted that a larger proposed facility, though it may be more hydraulically efficient than the existing facility, would not necessarily qualify for a HERS determination as the scour characteristics and potential would normally be different from that of the existing facility. If it can be determined, via a field review by the structural engineer, the geotechnical engineer, and the river mechanics engineer, that a suitable foundation is present (i.e. rock of good quality is at or near the surface), a formal H&HA would not be needed. Whatever the decision, we need to be ever mindful of the potential consequences of not performing a formal H&HA, be they litigation or failure of the structure or both.

12D-1.3 Authorization

A HERS determination can only be made by one of the Department's River Mechanics Engineers or, if a River Mechanics Engineer is unavailable, by one of the Department's Hydraulic Engineers (including the District Drainage Engineers), provided such Hydraulic Engineer has been properly trained and is experienced in river mechanics engineering and bridge hydraulics. If neither a River Mechanics Engineer or Hydraulic Engineer having the necessary training and/or experience is available, the determination as to whether or not a proposed structure qualifies for a HERS determination shall be as directed by the Department's State Hydraulics Engineer.

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12D-1.4 Required Hydraulic Studies

When the proposed bridge is determined to be the hydraulic equivalent of the existing facility and it has also been determined that scour won't be a problem (refer to "Scour Evaluation Guidelines" shown below), no formal H&HA will be required. However, in the event a previous H&HA has been prepared either for or by the Department or by virtue of a FEMA flood insurance study, this information should be used to complete all required documentation and, in the event a scour evaluation must be performed, as a source of information necessary to perform such evaluation. Regardless of whether or not the proposed structure has been determined to qualify for a HERS classification, if it is found that a formal scour analysis is needed, such H&HA as is necessary to perform the scour analysis shall be conducted. In the event a FEMA hydraulic model is not available or cannot be used, it shall be necessary to conduct a complete H&HA to determine those factors necessary to conduct the scour analysis.

12D-1.5 Scour Assessment and/or Analysis

If the proposed facility has been determined to qualify for a HERS classification and no hydraulic data is available from any source, an assessment of the scour potential may be made using the following guidelines:

- (1) A careful review of the bridge inspection reports for the existing bridge
- (2) Checking for the availability of scour data for the existing bridge that may have been obtained during the FHWA mandated bridge scour evaluation program
- (3) Checking (or having the bridge designer check) the "Item 113" code in the Bridge Inventory under the HTRIS system
- (4) An on-site inspection, if possible accompanied by a Bridge Engineer and a Geotechnical Engineer

If there is any evidence whatsoever, that the existing bridge is experiencing scour problems, the designer should assume that a proposed HERS replacement will experience those same problems. In such cases a detailed hydraulic analysis shall be performed to determine such information as will be necessary to perform a detailed scour analysis. If time constraints, no FEMA or other previous hydraulic study is available, lack of or limited survey, etc. or other restrictions prevail, the analysis can be abbreviated but must still be performed. The engineer's findings regarding scour potential could be sufficient justification for the consideration of an entirely different replacement bridge layout.

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12D-1.6 Documentation

If no hydraulic data was available and/or none was performed, and scour was determined not to be a consideration, only the following documentation need be prepared:

- (1) The “Hydrologic Data Sheet” (extracted from the LD-293 document) prepared in accordance with the attached example – it should be sent to the bridge designer and the road designer if an associated roadway project is involved
- (2) LD-293B – to serve as a cover letter to convey the “Hydrologic Data Sheet” to the road designer (if applicable), to serve as a cover letter to convey the LD-293C document to the District Environmental Manager, and notify the Public Involvement Section of no hydraulic impacts
- (3) LD-293C – to be completed with such information as is available and sent to the District Environmental Manager

If hydraulic data was available or if a scour analysis had to be performed (if it was determined that scour potential was significant) then all the usual documentation shall be prepared and distributed.

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**EXAMPLE HYDROLOGIC DATA SHEET
FOR USE ON HERS FACILITIES**

HYDROLOGIC DATA SHEET

The information presented hereon is to be transcribed to the Hydrologic Data Sheet contained in the plan assembly.

DESCRIPTION

Sheet No. 4 Station 31+90
Stream Name Accotink Creek
Drainage Area 17 sq. mi
Structure Size 45' single span bridge

BASE FLOOD

Discharge 11,600¹ cfs
Stage Elevation 265.6¹ ft.

DESIGN FLOOD

Discharge no H&HA performed² cfs
Estimated Exceedence Probability no H&HA performed² %
Stage Elevation no H&HA performed² ft.

OVERTOPPING FLOOD

Stage Elevation 261.8 ft.
Estimated Exceedence Probability no H&HA performed² %

HISTORICAL DATA

Date Feb. 1979
Stage Elevation 258.6 ft.
Estimated Exceedence Probability no H&HA performed² %

REMARKS

¹ Discharges and elevations are taken from U.S.G.S. open file report 76-442 dated 1977.

² This structure and its approaches are the hydraulic equivalent of the existing facility and no formal H&HA was prepared.

No significant hydraulic impact is anticipated as a result of this project.