

Appendix 6-C

Hydraulic Report Format and Supporting Documents

Revised September 2026

If you require assistance accessing this information or require it in an alternative format, contact the Michigan Department of Transportation's (MDOT) Americans with disabilities Act (ADA) coordinator at Michigan.gov/MDOT-ADA.

HYDRAULIC REPORT FORMAT

Use the following format to prepare a hydraulic report. Deliver the report in a PDF format, with the contents in the following order:

- A. Tabulation of the following items:
 - a. Stream name
 - b. Township
 - c. County
 - d. Sections, Town, and Range
 - e. National Functional Class (NFC)
 - f. Drainage area
 - g. Discharge rates for the 10% Annual Exceedance Probability (AEP) (10-year), 2% AEP (50-year), 1% AEP (100-year), and 0.2% AEP (500-year) flood events
 - h. Scope of study delineating the reach of channel covered and the method used to establish the starting water surface elevation.
 - i. Description of and basis for coefficients and variables used.
 - j. Comments pertaining to the study, including the impacts of the proposed work on the watercourse.

- B. Summary table (refer to example table), including the following items for existing and proposed conditions at each cross-section within the study for the 1% AEP (100-year) flood event:
 - a. Velocity in the channel
 - b. Top width
 - c. Energy grade
 - d. Change in energy grade
 - e. Computed water surface elevation
 - f. Change in water surface elevation

NOTE: A hydraulic summary table is required on the plans in the format shown in Section 4.05.10, MDOT Road Design Manual, or Section 8.05F, General Plan of Structure Sheet, MDOT Bridge Design Manual.

- C. Photographs taken upstream and downstream of the crossing labeled with their location in reference to the trunkline. Include photos of any other structures within the study limits.

- D. Site sheet showing the study limits with the baseline and cross-section locations plotted.

- E. Plotted profile of the channel bottom and the existing and proposed 1% AEP (100-year) water surface and energy grade lines. Include the existing and proposed structures, as well as all other structures within the study limits. Include the top of road and under-clearance elevations for all structures.

- F. Copies of the General Plan of Site and General Plan of Structure Sheets for the existing (if available) and proposed structures.
- G. One copy of the model input and output files.
- H. Refer to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Hydraulic Report Guidelines to determine if a Damage Assessment Certification may be required.

EXAMPLE SUMMARY TABLE

**1% AEP (100-year) Flood Frequency:
Existing (EX) Versus Proposed (PR) Condition**

Elevations are in NAVD 1988

Section No.	EX Velocity (fps)	PR Velocity (fps)	EX Top Width (ft)	PR Top Width (ft)	EX Energy Grade (ft)	PR Energy Grade (ft)	Change in Energy Grade (ft)	EX WSEL (ft)	PR WSEL (ft)	Change in WSEL (ft)
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

THE NINE TENETS IN PREPARING A HYDRAULIC REPORT

- A. Cross-section stationing starts downstream and increase moving upstream.
- B. References to left and right are made as if facing downstream.
- C. Identify downstream controls and ensure they are reflected in the boundary conditions.
- D. In instances where the hydraulic or energy grade line increases upstream of the proposed structure, ensure the model extends far enough upstream to completely capture the extent of this increase.
- E. Show water surface elevation and date on each section.
- F. Include pictures of the channel and overbanks at each cross-section to support the selection of roughness coefficients.
- G. Look for and document high water marks and other evidence of past flooding to support model results.
- H. Compare proposed results to existing conditions.
- I. The report is prepared and sealed by a registered Professional Engineer licensed in Michigan.

DAMAGE ASSESSMENT CERTIFICATION

RE: Road Name
Stream Name
Town, Range, Section
Township
County

I, ***Certifying Engineer's Name and PE #***, do hereby certify that I have inspected the upstream adjoining properties and find that the reduction in hydraulic capacity and resulting _____-foot increase to upstream flood stages or diversion of flow will not cause a harmful interference to flood flows or damage to adjacent structures, crop lands, or potential building sites. I further certify that the existing crossing has not caused environmental and/or property damage in the past, nor are there any indications that the existing crossing is hydraulically inadequate.

_____, PE

EXAMPLE HYDRAULIC REPORT

PREPARED BY: _____

Name
Title

REVIEWED BY: _____

Name
Title

APPROVED BY: _____

Name, PE
Title

SUMMARY

This hydraulic analysis was conducted to examine the backwater effect of the bridge/culvert structure which carries M-() over () in () County. The structure is scheduled to be replaced. The analysis found an improvement with the proposed conditions as compared with the existing conditions for the 1% AEP (100-year) flood event.

PROJECT DATA

STRUCTURE NUMBER:

CONTROL SECTION:

JOB NUMBER:

STREAM:

TOWNSHIP:

COUNTY:

SECTION:

TOWN: Town xx North/South

RANGE: Range xx East/West

NATIONAL FUNC CLASS:

DRAINAGE AREA: Square Miles

DISCHARGE: 10% AEP (10-YEAR): () cfs

2% AEP (50-YEAR): () cfs

1% AEP (100-YEAR): () cfs

0.2% AEP (500-YEAR): () cfs

METHOD OF ANALYSIS

The existing and proposed water surface profiles were computed using the United States Army Corps of Engineers' HEC-RAS Computer Program, Version ().

SCOPE OF STUDY

The first cross-section of the HEC-RAS analysis is approximately () feet downstream from the existing structure, and the study extends to () feet upstream of the structure.

The existing structure has a ()-foot span and ()-foot length. <<DESCRIBE ENTRANCE CONFIGURATIONS FOR CULVERTS, PIER WIDTHS, AND SHAPES FOR BRIDGES, MINIMUM CROWN, OR UNDERCLEARANCE FOR BOTH>>

The proposed structure will have a ()-foot span and a ()-foot length. <<DESCRIBE ENTRANCE CONFIGURATIONS FOR CULVERTS, PIER WIDTHS, AND SHAPES FOR BRIDGES, ROAD GRADE INCREASES, MINIMUM CROWN, OR UNDERCLEARANCE FOR BOTH >>

GEOMETRY OF THE MODEL

(Describe who did the survey, when it was done, and the type of survey.)

A field survey was conducted by CONSULTANT/Michigan Department of Transportation in (month) of (year). Survey data was recorded using a data collector. This data was converted to a HEC-RAS .csv (comma separated value) input file using a conversion program developed by the MDOT Design Support Unit.

A baseline was established on the left channel bank and referenced to the road centerline. All cross-sections were taken from the baseline. Elevations are given in North American Vertical Datum of 1988 (NAVD88).

The proposed structure and road information were entered based on proposed plans.

MANNING'S ROUGHNESS COEFFICIENT

(Describe how you determined coefficient and references used.)

Manning's roughness coefficients for the channel and floodplain were selected on the basis of field inspection notes, photographs, and prior established values for similar floodplain conditions. These values were obtained from Table 5-6 in Chow's Open-Channel Hydraulics (1959)/OTHER REFERENCE(s).

(Describe what you used in the model, note significant changes in the coefficient.)

The channel itself consists primarily of silty sand, with medium to heavy brush overhanging into the channel. For the channel, a Manning's coefficient of () was employed in the model.

The left and right overbanks primarily consist of heavy brush and trees. For the left and right overbanks, a Manning's coefficient of () was employed in the model.

EXPANSION AND CONTRACTION COEFFICIENTS

The range for the expansion and contraction coefficient values used in the model is listed in the table.

CROSS-SECTION	CONTRACTION	EXPANSION
Gradual Transition	0.1	0.3
Bridge Sections	0.3	0.5

STARTING WATER SURFACE ELEVATION

(Describe how you determined WSEL; e.g., slope area method, critical depth, conveyance, stage discharge, high water marks.)

The starting water surface elevations were calculated using the normal depth boundary conditions downstream of the tributary. A normal slope was computed by calculating the average slope of the left and right water surface elevations, provided by the hydraulic survey. The normal slope used in the model was () feet/feet.

FINDINGS

The analysis performed indicates an improved condition with the proposed conditions for the 1% AEP (100-year) flood event. The attached summary table describes this improvement.

APPENDICES

- Summary Table
- Location Map and Map of Cross-Section Locations
- Stream Profiles
- EGLE Discharge Estimates
- Photographs
- Computer Input and Output (Folder)

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