HYDRAULIC Modeling Checklist

State Form 52882 (5-14)
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER

This checklist will assist the staff at the Division of Water in the review of modeling for the definition of the floodway, for evaluation of a Construction in a Floodway permit application, for state concurrence of a Letter of Map Revision or a Flood Insurance Study or any other modeling that is submitted for review. The checklist items are based on the document "General Guidelines for the Hydrologic-Hydraulic Assessment of Floodplains in Indiana." The modeler should be familiar with this document and any discrepancies between the general guidelines and the submitted modeling should be discussed with the Division of Water Engineering Services staff prior to submittal.

This completed checklist must be submitted to the Division of Water along with your models. The Division of Water will not review any modeling submittal that is not accompanied by a completed checklist.

Please keep in mind that these questions were written primarily for the application of HEC-RAS computer models. HEC-RAS is preferred by the Division of Water, however, other modeling programs may be used provided their use has been discussed previously with Division of Water Staff. Should you have any questions, please contact Division of Water staff at (317) 232–4160 or toll free at (877) 928-3755.

1. General Information
   a. Preparer Name: _____
   b. Preparer Firm: _____
   c. Date: (mm/dd/yy) _____

2. Project Location and Background Information
   a. Waterbody Name: _____
      _____
   b. Location Description: _____
      _____
      _____
      _____
   c. Nearest Town/City: _____
   d. County: _____

Waterbody Name: _____
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Date: (mm/dd/yy) _____

e. Modeling Study Reach: Downstream Limit _____ _____ *(unit of distance)*

Upstream Limit _____ _____ *(unit of distance)*

f. Reach Length Equation $L = \frac{150\ HD^{0.8}}{S}$

Comments _____
_____
_____

g. Type of Model

☐ HEC-RAS ☐ HEC-2 ☐ WSPRO ☐ WSP2 ☐ HY-8

Other _____

Program Version: 4.1.0

h. Base Model

☐ FIS ☐ IDNR Model ☐ New _____

i. H&H Model Library Stream Name: _____
_____

j. Models used for Cumulative Impacts:

Previous FARA/Floodway Permits within study reach

	Permit or FARA Number	H&H Model Library Stream Name	Comment
1	ex: FW-25178	Wabash River	08/21/2009
2			
3			
4			
5			

Waterbody Name: _____
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Date: (mm/dd/yy) _____

3. Model Purpose

Please indicate for what purpose the models are submitted for review and approval:

- ☐ Floodway / Base Flood Elevation Determination (FARA)
- ☐ Construction in a Floodway Application
- ☐ Letter of Map Revision (LOMR)
- ☐ Flood Insurance Study modeling
- ☐ Other (*please describe*) _____

4. Discharges

The source of the **1% annual chance** flood discharges used in a hydraulic model need to be fully documented by completing the questions listed below.

It is strongly suggested that a preparer-determined **1% annual chance** discharge be submitted for approval prior to the submittal of hydraulic models. Discharge determinations and hydraulic models are considered to be separate items, each subject to review.

a. What is the source of the discharges used in the submitted model *(Please check one.):*

- ☐ Curve published in "Coordinated Discharges of Selected Streams in Indiana" *(Please attach copy of applicable graph.*)
- ☐ Determination approved by the Department of Natural Resources *(Please attach copy of letter from IDNR.)*
- ☐ Hydrologic analyses submitted with this application
- ☐ Flood Insurance Study
- ☐ Other modeling *(Indicate source.)* _____

b. Table of Discharges used in the model *(Expand table as needed.)*

Location Name	Drainage Area (sq. mi.)	Flow Rate (cfs)	Cross Section range on Stream Reach

c. Are discharges unchanged from base condition model to other model plans (corrected effective, proposed, etc.)?

☐ Yes ☐ No

d. Comments regarding discharge determination:

_____
_____
_____
_____
_____
_____
_____
_____

5. Starting Elevation / Boundary Conditions

Complete the following section fully to document the starting elevations and boundary conditions for starting the model:

a. Boundary condition used to derive starting elevations: *(Please check one.)*

☐ Known water surface *(Indicate source.):* _____
☐ Energy slope estimated from historic flood profile *(Indicate date.):* _____
☐ Energy slope estimated from stream thalweg *(Indicate mapping used.):* _____
☐ Other *(Please Describe.):* _____

b. Datum (*if applicable*)_____

c. Description (*show any calculations*):

_____
_____
_____

6. Manning's Roughness Coefficients ("n" Values)

Complete the following section fully to document the Manning's roughness coefficients:

a. How were the roughness coefficients estimated? *(Check all that apply.)*

☐ Flood Insurance Study
☐ Other modeling
☐ Field inspection
☐ Site photos
☐ Aerial photography or mapping
☐ Calibration
☐ Other *(Describe)* _____

b. What is the range of the roughness coefficients?

Left Overbank	Minimum _____	Maximum _____
Channel	Minimum _____	Maximum _____
Right Overbank	Minimum _____	Maximum _____

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c. Are proposed roughness coefficients different from the base roughness coefficients?

☐ Yes ☐ No

d. Description of "n" values

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

e. Is Check-RAS output submitted with this checklist?

☐ Yes ☐ No

Waterbody Name: _____
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Date: (mm/dd/yy) _____

7. Cross Sections

The following questions have to do with the cross section information that is the basis of the submitted modeling:

a. What is the source of the cross section information *(Check all that apply.):*
- ☐ Flood Insurance Study
- ☐ Field survey *(Date)* (mm/dd/yy) _____
- ☐ Detailed topographic mapping *(Date)* (mm/dd/yy) _____
- ☐ Other modeling *(Indicate source.)* _____
- ☐ Other *(Please specify.)* _____

b. Vertical Datum: NAVD 1988 _____
Conversion factor (*if necessary*): NGVD-0.4=NAVD _____

c. Are cross sections stationed increasing from left to right looking downstream?
☐ Yes ☐ No

d. How are sections labeled *(check one)* (Note: The following list is in order of preference)
- ☐ Consistent with FIS / other studies
- ☐ Miles above mouth
- ☐ Feet above other landmark *(Please specify landmark.)* _____
- ☐ Other *(Please specify.)* _____

e. Are sections oriented perpendicular to flow at all portions of the cross section?
☐ Yes ☐ No

f. Are the full cross section extents shown on submitted mapping?
☐ Yes ☐ No

g. Do the cross sections extend fully across the floodplain *(above expected 1% annual chance flood elevations)*?
☐ Yes ☐ No

h. Do the cross sections represent average conditions in the reach at which they are located?
☐ Yes ☐ No

i. Are areas of blocked or ineffective flow indicated on the submitted cross sections?
☐ Yes ☐ No ☐ N/A

j. Are cross sections located at places where discharge values change along the stream reach?
☐ Yes ☐ No ☐ N/A

k. Are cumulative reach lengths the same in different plans or model runs?
☐ Yes ☐ No

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l. For any "No" answers above, please provide an explanation:

_____
_____
_____
_____
_____
_____

m. Are interpolated sections used anywhere in the model (*If yes, state reasons for using interpolated sections.)*

☐ Yes ☐ No

Reason:

_____
_____
_____
_____

n. Is Check-RAS output submitted with this checklist?

☐ Yes ☐ No

Waterbody Name: _____
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Date: (mm/dd/yy) _____

8. Stream Crossings

The following questions should be answered for each bridge in the model being submitted. Use a separate sheet for **additional stream crossings.**

Name of stream Crossing		
Type of Crossing		
Stream crossing section locations		
Section 1 Cross section number:		
Section 2 Cross section number:		
Section 3 Cross section number:		
Section 4 Cross section number:		
This crossing is in support of a construction in a floodway application	☐	☐
The same number of sections are used in the existing (pre-project) and the proposed (post-project)	☐	☐
Cross sections extend across the entire valley to the 1% annual chance flood elevation	☐	☐
Cross section 1 is located at a 2:1 flow expansion ratio downstream of the bridge face	☐	☐
Cross section 4 is located at a 1:1 flow contraction ratio upstream of the bridge face	☐	☐
Expansion/Contraction coefficients have been adjusted to reflect the effects of the bridge	☐	☐
Ineffective flow limits are set a sections 2 and 3	☐	☐
Selected low flow modeling method		
Selected high flow modeling method		
The approach roadway profile data extend across the full valley cross section	☐	☐
Bridges piers are included at this crossing	☐	☐
HEC-RAS default embankment side slopes were applied at all stream crossings in the model	☐	☐

For all unmarked answers above, please explain.

_____
_____
_____
_____
_____
_____
_____

Is Check-RAS output submitted with this checklist?

☐ Yes ☐ No

Waterbody Name: _____
Preparer: _____
Date: (mm/dd/yy) _____

Stream Crossings **(cont.)**

The following questions should be answered for each bridge in the model being submitted. Use a separate sheet for **additional stream crossings.**

Name of stream Crossing		
Type of Crossing		
Stream crossing section locations		
Section 1 Cross section number:		
Section 2 Cross section number:		
Section 3 Cross section number:		
Section 4 Cross section number:		
This crossing is in support of a construction in a floodway application	☐	☐
The same number of sections are used in the existing (pre-project) and the proposed (post-project)	☐	☐
Cross sections extend across the entire valley to the 1% annual chance flood elevation	☐	☐
Cross section 1 is located at a 2:1 flow expansion ratio downstream of the bridge face	☐	☐
Cross section 4 is located at a 1:1 flow contraction ratio upstream of the bridge face	☐	☐
Expansion/Contraction coefficients have been adjusted to reflect the effects of the bridge	☐	☐
Ineffective flow limits are set a sections 2 and 3	☐	☐
Selected low flow modeling method		
Selected high flow modeling method		
The approach roadway profile data extend across the full valley cross section	☐	☐
Bridges piers are included at this crossing	☐	☐
HEC-RAS default embankment side slopes were applied at all stream crossings in the model	☐	☐

For all unmarked answers above, please explain.

_____
_____
_____
_____
_____
_____
_____

Is Check-RAS output submitted with this checklist?

☐ Yes ☐ No

Waterbody Name: _____
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9. Floodways

Has floodway determination been done in accordance with Section 8.1**4** of the Guidelines?

☐ Yes ☐ No ☐ N/A

10. Model Output

For all model outputs review the "errors and warnings" and address those comments not already addressed.

_____
_____
_____
_____
_____
_____

11. Documentation

Submitted documentation *(Check all that apply.)*:

- ☐ Narrative regarding modeling
- ☐ Project Evaluation Results *(Mandatory – See Figure 3.1)*
- ☐ Application Forms and/or LOMR Application Forms
- ☐ Pictures of stream reach *(w/ orientation map)*
- ☐ FIS map / profile
- ☐ Check-RAS output
- ☐ Cross Section plots
- ☐ HEC-RAS "Standard Table 1"
- ☐ HEC-RAS "Encroachment 1" table *(only for floodways)*
- ☐ Profile plots (only for LOMR and FIS)
- ☐ Floodplain mapping including:
    - ☐ Stream in question
    - ☐ Roads *(With street names)*
    - ☐ Existing features *(Buildings, parking lots, woods, etc.)*

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- ☐ The full extent of each cross section included in the model, with each cross section clearly labeled *(Include the location of initial and end points as used in the model.)*
- ☐ Topographic data *(If available)*
- ☐ Property limits *(Approximate property limits are acceptable only if surcharges are 0.14' or less at all cross sections.)*
- ☐ North arrow
- ☐ Scale *(Numerical and graphical)*
- ☐ Horizontal and vertical control benchmark used *(See Section 5.3 of the Guidelines for benchmark guidance.)*
- ☐ Horizontal and vertical datums
- ☐ Delineated flood fringe and floodway limits

☐ Computer Model Plans submitted *(Check all that apply.)*

HEC-RAS project name_____ .prj

- ☐ Base Condition (FIS, IDNR Regulatory) Plan name: _____
- ☐ Duplicate Effective Plan name: duplicate.p02
- ☐ Corrected Effective Plan name: corrected.p03
- ☐ Existing (Pre-project) Plan name: existing.p04
- ☐ Proposed (Post-project) Plan name: proposed.p05

Waterbody Name: _____
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12. Affirmation

By signing this document you are indicating that the submitted models have been developed and reviewed in accordance with accepted Division of Water guidelines. Should the Division of Water find inconsistencies between your submitted models and the checklist or other deficiencies in the submittal, you will be notified in writing of the deficiencies and given a limited number of days to correct these problems. If you cannot correct the deficiencies in the given time, you must contact the Division to avoid closure of the file or denial of the permit application due to lack of supporting information.

(mm/dd/yy)
Date:

_____
Signature

_____
Name

_____
Firm