Appendix A – Forms

- **Data Collection and Field Review (pages 9.A-1 to 9.A-11)**
- **Hydraulic Data (pages 9.A-13 to 9.A-16)**

DATA COLLECTION AND FIELD REVIEW

I. GENERAL PROJECT DATA

Bridge No.: _____
Town: _____ County: _____
Feature carried: _____ Feature crossed: _____
Quadrangle: _____ DEP watershed basin no.: _____

Functional class:

☐ urban principal arterial-interstate	☐ rural principal arterial-interstate
☐ urban principal arterial-other expwy.	☐ rural principal arterial-other expwy.
☐ urban principal arterial-other	☐ rural principal arterial-other
☐ urban minor arterial	☐ rural minor arterial
☐ urban collector	☐ rural major collector
☐ urban local	☐ rural minor collector
	☐ rural local

Year built: _____ Year of reconstruction: _____
Overall NBIS structure rating: _____ NBIS Item 113: _____
USGS total scour index: _____ Sufficiency rating: _____

Plans available? ☐ yes ☐ no

II. SUPERSTRUCTURE INFORMATION

Bridge width: _____ m (ft) Bridge length: _____ m (ft)
Number of spans: _____ Bridge skew: _____ (degrees)

Bearing connection type: ☐ positive connection ☐ no positive connection

III. HYDROLOGIC AND HYDRAULIC INFORMATION

Watershed area: _____ km^2 (sq. mi.)

Is it tidally influenced? ☐ yes ☐ no

What information is available?

☐ floodway analysis report	☐ hydraulic report	☐ scour report
☐ FEMA F.I.S.	☐ SCEL analysis	☐ comparative report
	☐ Other: _____	

	Source	2 Yr. Event	10 Yr. Event	50 Yr. Event	100 Yr. Event	500 Yr. Event
Flow rates m^3/s (cfs)						
Precipitation mm (in)						
Tidal elevations m (ft)						

Elevations m (ft.)							
At Structure			Water Surface at Approach Cross Section				
Streambed	Low Chord	Roadway	2 Yr. Event	10 Yr. Event	50 Yr. Event	100 Yr. Event	500 Yr. Event

Pressure flow at design storm? ☐ yes ☐ underclearance ____ m (ft.)

Comments: _____

_____

_____

_____

IV. SITE DATA

A. Existing structure(s) – Provide sketch of culvert/structure with dimensions and brief description.

Comments: Include structure or culvert type and condition. Note particularly any scour adjacent to abutments or at culvert outlet and the presence of debris or sediment. Also note the location of any utilities in the area of the crossing.

B. High water marks – Describe the nature and location of any apparent high water marks and relate to a date of occurrence, if possible.

C. Maximum allowable headwater – Describe the nature of the apparent controlling feature and note its location.

D. Fish passage requirements – Comment on the apparent need for fish passage or impediments to same; such as dams or restrictive crossings in the area.

V. PERIPHERAL SITE DATA

A. Hydraulic control – Note location and description.

B. Upstream and downstream structures – Provide sketches and brief descriptions of existing bridges/culverts. Include dimensions.

Comments: _____

C. Watershed area – Check watershed boundaries for accuracy. Note current land uses within watershed.

D. Flow control structures within watershed – Note the location and type of all significant flow control structures (dams, etc.) within the watershed. Provide sketches with dimensions as required.

E. Site photographs – Attach to report. Include an index and sketch of photograph locations.

VI. STREAM CHANNEL AND RELATED ASPECTS

A. Stream characterization

Twenty Groupings of Stream Characteristics (check box)

	Identifier	Drainage Area	Streambed Slope	Streambed Soils	Land Use
☐	A	Large	Low	SD	S/F
☐	B	Large	Low	SD	Urban
☐	C	Large	Moderate	SD	Forested
☐	D	Medium	Moderate	SD	Urban
☐	E	Medium	Moderate	SD	S/F
☐	F	Medium	Moderate	CLAY	S/F
☐	G	Medium	Moderate	TILL	S/F
☐	H	Medium	Moderate	SD	Forested
☐	I	Medium	Moderate	TILL	Forested
☐	J	Small	Low	SD	Urban
☐	K	Small	Moderate	TILL	Urban
☐	L	Small	Low	SD	S/F
☐	M	Small	Moderate	SD	S/F
☐	N	Small	Moderate	SD	Forested
☐	O	Small	Low	CLAY	S/F
☐	P	Small	Steep	TILL	S/F
☐	Q	Small	Moderate	TILL	S/F
☐	R	Small	Low	TILL	S/F
☐	S	Small	Moderate	TILL	Forested
☐	T	Small	Steep	TILL	Forested

Drainage area
- Small ≤ 64.75km^2 (25 mi^2)
- Medium > 64.75km^2 (25 mi^2) and ≤ 259 km^2 (100 mi^2)
- Large > 259 km^2 (100 mi^2)

Streambed slope
- Low ≤ 4.76 m/km (25 ft/mi)
- Moderate > 4.76 m/km (25 ft/mi) and ≤ 19.05 m/km (100 ft.mi)
- Steep > 19.05 m/km (100 ft/mi)

Streambed soils: SD = Stratified Drift

Land Use: S/F = Suburban or Farming

B. Channel stability

Previous NBIS Item 61 rating: _____

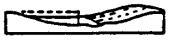
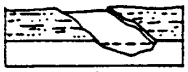
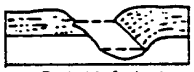
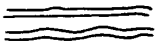
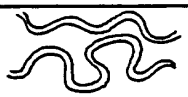
Lateral stability: ☐ stable ☐ unstable

Bank erosion:
☐ none ☐ light fluvial erosion ☐ heavy fluvial erosion ☐ mass wasting

Streambed: ☐ stable ☐ aggradating ☐ degrading

Armoring potential: ☐ none ☐ low ☐ moderate ☐ high

Geomorphic factors that affect stream stability (circle factors that apply)

STREAM SIZE	Small (< 30 m wide)		Medium (30–150 m)		Wide (> 150 m)
FLOW HABIT	Ephemeral	(Intermittent)	Perennial but flashy		Perennial
BED MATERIAL	Silt-clay	Silt	Sand	Gravel	Cobble or boulder
VALLEY SETTING	 No valley; alluvial fan		 Low relief valley (< 30 m deep)	 Moderate relief (30-300 m)	 High relief (> 300 m)
FLOOD PLAINS	 Little or none (<2X channel width)		 Narrow (2-10 channel width)	 Wide (>10X channel width)	
NATURAL LEVEES	 Little or None		 Mainly on Concave	 Well Developed on Both Banks	
APPARENT INCISION	 Not Incised		 Probably Incised		
CHANNEL BOUNDARIES	 Alluvial		 Semi-alluvial	 Non-alluvial	
TREE COVER ON BANKS	<50 percent of bankline		50-90 percent		>90 percent
SINUOSITY	 Straight Sinuosity 1-1.05)	 Sinuous (1.06-1.25)	 Meandering (1.25-2.0)	 Highly meandering (>2)	
BRAIDED STREAMS	 Not braided (<5 percent)		 Locally braided (5-35 percent)	 Generally braided (>35 percent)	
ANABRANCHED STREAMS	 Not anabranched (<5 percent)		 Locally anabranched (5-35 percent)	 Generally anabranched (>35 percent)	
VARIABILITY OF WIDTH AND DEVELOPMENT OF BARS	 Equiwidth		 Wider at bends	 Random variation	
	 Narrow point bars		 Wide point bars	 Irregular point and lateral bars	

Source: Adapted From Brice and Blodgett, 1978

(See also FHWA HEC-20, "Stream Stability at Highway Structures" for discussion of the above factors)

Secondary bed material: ☐ sand ☐ gravel ☐ boulders ☐ manmade ☐ silt/clay ☐ cobble ☐ bedrock

Bank protection

Type ☐ none ☐ modified ☐ intermediate ☐ standard ☐ concrete ☐ slope paving ☐ absent ☐ other

Condition ☐ n/a ☐ good ☐ weathered ☐ slumped ☐ poor ☐ missing ☐ fair

Comment on the need (if any) for training walls, cutoff walls or special slope or channel protection.

_____

_____

_____

C. Channel and overbank roughness coefficients

Basic channel description: ☐ channel in earth ☐ channel cut into rock ☐ channel fine gravel ☐ channel coarse gravel

Surface irregularity of channel:

☐ smooth – best obtainable section for materials involved
☐ minor – slightly eroded or scoured side slopes
☐ moderate – moderately sloughed or eroded side slopes.
☐ severe – badly sloughed banks of natural channels or badly eroded sides of man-made channels - jagged and irregular sides or bottom sections of channels in rock.

Variations in shape and size of cross sections

☐ changes in size or shape occurring gradually
☐ large and small sections alternating occasionally or shape changes causing occasional shifting of main flow from side to side.
☐ large and small sections alternating frequently or shape changes causing frequent shifting of main flow from side to side.

Channel obstructions – (Judge the relative effect of obstructions – consider the degree to which the obstructions reduce the average cross sectional area, character of obstructions, and location and spacing of obstructions).

NOTE: Smooth or rounded objects create less turbulence than sharp, angular objects.

The effect of obstructions is:

☐ negligible
☐ minor
☐ appreciable
☐ severe

Degree of vegetation - (Note amount and character of foliage).

The effect of vegetative growth upon flow conditions is:

☐ LOW - Dense growths of flexible turf grasses where average depth of flow is 2 to 3 times the height of vegetation. Supple seedling tree switches where the average depth of flow is 3 to 4 times the height of the vegetation.

☐ MEDIUM - Turf grasses where the average depth of flow is 1 to 2 times the height of vegetation. Stemmy grasses, weeds or tree seedlings, (moderate cover), average depth of flow 2 to 3 times the height of vegetation. Bushy growths, (moderately dense), along channel side slopes with no significant vegetation along channel bottom.

☐ HIGH - Turf grasses where average height is about equal to the average depth of flow. Willow of Cottonwood trees 8 to 10 years old with some weeds or brush. Bushy growths about 1 year old with some weeks. No significant vegetation along channel bottom.

☐ VERY HIGH - Turf grasses where the average depth of flow is less than one half the height of vegetation. Bushy growths about 1 year old intergrown with weeds. Dense growth of cattails along channel bottom. Trees intergrown with weeds and brush (thick growth).

Additional comments:

_____
_____
_____
_____
_____

VII. HYDRAULIC VULNERABILITY

Previous Item 71 rating: _____

Is there confluence present? ☐ yes ☐ no

Angle of attack (flood flow): ☐ yes ☐ no

Bends in channel: ☐ upstream of bridge ☐ downstream of bridge ☐ straight channel reach ☐ at bridge

Velocity order of magnitude: ____ m/s (ft/s)

Trapping potential: ☐ low ☐ medium ☐ high

Debris potential: ☐ low ☐ moderate ☐ high

Overtopping relief: ☐ none ☐ left approach ☐ right approach ☐ on bridge ☐ relief bridge ☐ cannot be determined

Primary bed material: ☐ sand ☐ gravel ☐ boulders ☐ manmade
☐ silt/clay ☐ cobble ☐ bedrock

Comments: _____

VIII. VISUAL SCOUR EVIDENCE

USGS observed scour index: _____

History of scour problem: ☐ yes ☐ no

Comments: _____

Note: Comment should address any evidence of scour at ALL substructure units.

CONTRACTION SCOUR SUSCEPTIBILITY

Channel width upstream: _____ m (ft.)
Channel width under bridge: _____ m (ft.)
Channel width ratio (channel width upstream / channel width under the bridge: _____

Overbank flow: ☐ yes ☐ no

Percent of flow in main channel of the approach section:
☐ >90% ☐ 75%-90% ☐ 50%-75% ☐ 25%-50% ☐ <25%

Average bed material size (D_{50}):
@ approach section _____ mm (in) ☐ sample taken for sieve analysis
@ bridge _____ mm (in) ☐ sample taken for sieve analysis

Contraction scour susceptibility rating: ☐ low ☐ medium ☐ high

Comments: _____

ABUTMENT SUSCEPTIBILITY

Which abutment is worst?: ☐ left ☐ right

Observed scour depth: _____ m (ft.) Remaining embedment in river bed: _____ m (ft)

Abutment shape: ☐ vertical ☐ vertical with wingwalls ☐ spillthrough

Abutment location: ☐ in channel ☐ at bank ☐ set back

Abutment foundation: ☐ unknown ☐ spread footing ☐ pile bent ☐ friction piles ☐ EB piles ☐ set in rock

Pile type: ☐ metal ☐ concrete ☐ timber ☐ N/A

Pile length: _____ m (feet)

Abutment material: ☐ timber ☐ concrete ☐ metal ☐ stone

Angle of inclination: _____ (degrees)

Primary bed material: ☐ sand ☐ gravel ☐ boulders ☐ manmade ☐ silt/clay ☐ cobble ☐ bedrock

Are borings available? ☐ yes ☐ no

Abutment protection

Type:	☐ modified	☐ intermediate	☐ standard	☐ slope paving
	☐ concrete	☐ other	☐ absent	☐ none
Permanent or Temporary:		☐ n/a	☐ permanent	☐ temporary
Condition:	☐ good	☐ weathered	☐ slumped	☐ missing
	☐ fair	☐ poor	☐ N/A	

Abutment exposure due to scour:

☐ none ☐ no exposure ☐ footing exposed ☐ piles exposed
☐ undermining ☐ settlement ☐ failed

Abutment susceptibility rating ☐ low ☐ medium ☐ high

Comments: _____

_____

_____

_____

PIER SUSCEPTIBILITY

Worst pier number: _____
Observed scour depth: _____ m (ft.) Remaining embedment in river bed: _____ m (ft)

Angle of attack flood flow: _____ (degrees)

Pier foundation: ☐ unknown ☐ spread footing ☐ pile bent
☐ EB piles ☐ set in rock ☐ friction piles ☐ N/A

Pile type: ☐ metal ☐ concrete ☐ timber ☐ N/A

Pile length: _____

Pier material:
☐ concrete ☐ stone ☐ wood ☐ metal ☐ N/A

Pier shape: ☐ solid pier with square nose ☐ solid pier with round nose
☐ solid pier with sharp nose ☐ column with square nose ☐ column with round nose
☐ column with sharp nose ☐ cylinders/group of cylinders

Pier width: _____ Pier dimensions: _____

Cap/Footing dimensions: _____

Pier exposure due to scour: ☐ none ☐ no exposure ☐ footing exposed
☐ piles exposed ☐ undermining ☐ settlement
☐ failed

Pier protection

Type:	☐ modified	☐ intermediate	☐ standard	☐ slope paving
	☐ concrete	☐ other	☐ absent	☐ none
Permanent or Temporary:		☐ n/a	☐ permanent	☐ temporary
Condition:	☐ good	☐ weathered	☐ slumped	☐ missing
	☐ fair	☐ poor	☐ N/A	

Primary bed material: ☐ sand ☐ gravel ☐ boulders ☐ manmade
☐ silt/clay ☐ cobble ☐ bedrock

Are borings available? ☐ yes ☐ no

Pier susceptibility rating ☐ low ☐ medium ☐ high

Comments: _____

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HYDRAULIC DATA

1) Location

   a) Town(s): State Project No.(s):

   b) Highway: Station(s):

   c) Location Relative to Highway Landmark:

   d) Stream:

   e) Location Relative to Stream Landmark:

2) Design Flood

   a) Hydrologic Procedure Used for Design:

   b) Hydrologic Procedure Used by FEMA:

   c) Drainage Area:

   d) ConnDOT Drainage Manual Structure Classification:

   e) Design Storm Frequency:

   f) Required Underclearance at Design Discharge:

   g) Design Discharge:

      i. D.O.T. Design:

      ii. FEMA:

      iii. SCEL:

3) Hydraulic Analysis Procedure

   a) Model Used and Version No.:

   b) Flow Regime:

   c) Boundary Conditions (starting water surface at the ends of the river system – i.e. known water surface, normal depth, critical depth, rating curve, etc.):

i. Downstream:

ii. Upstream:

d) Other Method(s):

4) Hydraulic Control (i.e. culvert/bridge, dam (weir), channel construction, tide, known water surface elevation, etc.)

a) Type of Control:

b) Location Relative to Proposed Construction:

5) Coefficients of Roughness

a) Downstream: Channel _____ Overbank _____

b) At Crossing: Channel _____ Enclosed Conduit _____

c) Upstream: Channel _____ Overbank _____

6) Existing Structures

Upstream:

a) Type:

b) Gross Waterway Opening:

At Site:

a) Type:

b) Gross Waterway Opening:

c) Effective Waterway Opening:

d) Overall Width of Waterway Opening:

e) Effective Depth of Waterway Opening:

f) Minimum Low Chord Elevation:

g) Minimum Roadway Elevation:

h) Computed Water Surface Elevation at Approach Section Upstream of Structure at Design Discharge:

i) Underclearance at Design Discharge:

j) Mean Velocity of Channel:

Downstream:

a) Type:

b) Gross Waterway Opening:

7) Proposed Structure

a) Type:

b) Gross Waterway Opening:

c) Effective Waterway Opening:

d) Overall Width of Waterway Opening:

e) Effective Depth of Waterway Opening:

f) Minimum Low Chord Elevation:

g) Minimum Roadway Elevation:

h) Computed Water Surface Elevation at Approach Section Upstream of Structure at Design Discharge:

i) Maximum Regulatory Elevation:

j) Other Controlling Water Surface Elevation (If Below Maximum Regulatory Elev.):

k) Difference in Water Surface Elevation (Approach Section) Proposed vs. Existing and Proposed vs. Regulatory @ Design Discharge:

l) Underclearance at Design Discharge with Respect to Structure Low Chord:

m) Mean Velocity Through Structure:

8) Remarks

a) Navigational Requirements:

b) Tidal Conditions:

c) Record Floods:

d) Average Daily Flow:
$Q_{AD}(cms) = [A\,(km^2)]^{0.98} * 0.0208$ ($Q_{AD}(cfs) = [A\,(sm)]^{0.98} * 1.87$)

e) Average Spring Flow:
$Q_{AS}(cms) = [A\,(km^2)]^{0.988} * 0.04$ ($Q_{AS}(cfs) = [A\,(sm)]^{0.988} * 3.62$)

f) Flood Hazard Zone:

g) Vertical Datum: