HYDRAULIC REPORTS

Overview

For waterway crossing projects, close communication needs to be maintained between Structure Design and Structure Hydraulics throughout the project. There are three types of Hydraulic Reports:

1. Preliminary Hydraulic Report (PHR) – Provided during the K phase (WBS 150.15.30) or 0 Phase (WBS 160.10.85). These are unchecked reports.
2. Draft Final Hydraulic Report (dFHR) – Provided during the 0 phase (WBS 160.10.85). These are checked reports.
3. Final Hydraulic Report (FHR) – Provided with all other signed contract documents. All Final Hydraulic Reports are signed and sealed.

The following describes the information provided by Structure Design and Structure Hydraulics during the planning and design phases. It should be noted that the following is a guide and should not preclude any additional communication necessary on a specific project to maintain the scope, cost, and schedule.

The structure design engineer shall provide as much of the following information as is available when requesting a hydraulic report:

Pertinent Information included with Request Form (check all that apply):

☐ Copy of APS	☐ Bridge Site Data Submittal	☐ Draft General Plan(s)
☐ Project Survey Datum	☐ Geotechnical Information	☐ Copy of PHR
☐ Project Scoping Report	☐ Draft EIR	☐ Biological Study
☐ Local Hydraulic Study	☐ Consultant Hydraulic Report	☐ Computer Media
☐ Draft Foundation Plan	☐ Other _____	

Preliminary Hydraulic Report (PHR)

The Hydraulics Engineer shall review all information in the request and evaluate the following:

1. Maintenance Record Evaluation
    a. Discussion with Project Manager/ District
    b. District Hydraulics may provide historical problems, local maintenance issues, requirements for test borings, pile driving, etc, and bank protection issues.
    c. Peer Review consideration

2. Mitigation Measure Recommendations
3. Feasibility Evaluation
    a. Potential Environmental / Agency Considerations (CVFPB, USACE, etc.)
    b. Discharge
    c. Water Surface Elevation
    d. Debris Potential
    e. Scour Potential

The preliminary evaluation does not necessarily have to be a thorough hydraulic study, but must be detailed enough for the structure designer to identify the proper structure type(s).

The Preliminary Hydraulics Report (PHR) should include comments regarding:

- Hydraulic problems or issues (drift, degradation, aggradation, migration, etc.)
- Pier/foundation type recommendation
- Suggested minimum soffit elevation based on applicable vertical freeboard
- High water elevation
- Allowable freeboard
- Flow rates (50, 100-year, and record) and in some cases 200-year
- WSEL (50, 100-year, and record) and in some cases 200-year
- Minimum main span length
- Preliminary total scour depth
- Current scour rating (NBIS Item 113 code and definition)
- Hydraulic skew

Draft Final Hydraulic Report (dFHR)

Upon receiving a work request, Structure Hydraulics shall contact either Preliminary Investigations (PI) or District Surveys to schedule channel surveys upstream and downstream of the bridge site if necessary. Communication at this juncture is imperative because it impacts Structure Hydraulics as well as Preliminary Investigations or District Survey schedules. Only after receipt of the survey information can an in-depth hydraulic analysis be undertaken.

The Hydraulics Engineer shall review all information in the request and perform the following:

1. Obtain survey data.
    a. Due to the increased requirements of the permitting agencies, computer models are required deliverables.
    b. Contact Preliminary Investigations, who will determine the need for ground crew surveys (DES or District), LiDAR, photographic, bathymetric, or other survey methods.
2. Evaluate hydrology.
    a. Discharge - Arrive at an official discharge using methods based on site-specific criteria. The Hydraulic Engineer must take into consideration the following entities and/or features for determination of a design flow:
        i. Army Corps/FEMA
        ii. Central Valley Flood Protection Board (CVFPB)
        iii. Other flood/water agencies
        iv. Diversions
            1. Dams (DWR, BLM, etc.)
            2. Canals (irrigation districts)
            3. Split flows
            4. Other pertinent features
        v. Confluences
        vi. Gage data
        vii. Computer models (WMS, etc.)
    b. Evaluate debris potential
    c. Study historic records
        i. Gage data
        ii. Flood history
        iii. Scour history
        iv. Maintenance issues

v. Interview/eyewitness/news reports
vi. As-Builts
vii. District Hydraulics

d. Consider climate change impacts
   i. Discharge
      1. Rainfall intensities
      2. Frequency of occurrence
   ii. Sea level rise scenario
   iii. Vegetation

e. Environmental considerations
   i. Floodplain requirements
   ii. Fish passage
   iii. Wildlife passage
   iv. Habitat restoration

f. Other entities
   i. Levee districts
   ii. PG&E/utilities
   iii. Dual usage – waterway conveyance and access or recreational pathways

3. Evaluate hydraulic conditions to determine flow regime effects of objectionable backwater conditions and velocity changes caused by floodplain encroachments. A hydraulic evaluation will assess adequate waterway area and potential scour. The Hydraulic Engineer must provide discussion and recommendations of the following topics that are pertinent to a Structure Design Engineer in a hydraulic report:

   a. Water surface elevations
      i. i. Freeboard requirements - existing, future, and interim
         1. Army Corps/FEMA
         2. Central Valley Flood Protection Board (CVFPB)
         3. Local flood/water agencies
         4. US Coast Guard

ii. Potential floodplain impacts
iii. Tide / tailwater
iv. Waiver process if freeboard is inadequate

b. Specify datum used
c. Determine hydraulic skew
d. Water velocities
e. Scour recommendations
    i. Local Pier
        1. Shape
        2. Orientation / skew
        3. Size
        4. Depth
        5. Elevation
        6. Scour countermeasures, if applicable
    ii. Abutment
        1. Shape
        2. Orientation / skew
        3. Size
        4. Depth
        5. Elevation
        6. Scour countermeasures, if applicable
    iii. Contraction
    iv. Degradation/aggradation
    v. Stream meander
    vi. Pressure
f. Span configuration
g. Scour mitigation
    i. Design scour countermeasures
    ii. Design river training features

h. Computer model (HEC-RAS, FESMS, SRH2D, or other)
    i. Obtain adequate survey information from others
        1. LiDAR
        2. Photogrametry
        3. Ground surveys
        4. Site investigations
i. Existing, future, and interim conditions (construction falsework and access trestles)
j. Superstructure recommendations
    i. Overtopping designs
    ii. Submerged superstructure
k. Utilities encroachment

The draft Final Hydraulic Report is to be prepared in accordance with Section 2.3 "Location Features" and Section 2.6 “Hydrology and Hydraulics” of the *AASHTO LRFD Bridge Design Specifications and current California Amendments (AASHTO LRFD-BDS-CA)* and the *Caltrans Highway Design Manual (HDM)* Chapters 800-890 “Highway Drainage Design”. The LRFD-BDS-CA and HDM comply with Federal Law in the Code of Federal Regulations, Title 23, Part 650 (23 CFR 650) “Bridges – Structures & Hydraulics, Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains.”

A dFHR must include, but not limited to, the following:

- The State-assigned Bridge Name(s), Bridge Number(s), location(s) and other pertinent information for the applicable structures.
- A brief history and description of the hydrology.
- Comments on constraints or requirements which influence the selection of available alternatives.
- A Hydrologic Summary table, which specifies data on the basin area, frequency, discharge, and associated water surface elevations at the bridge for the Design Flood, Base Flood, and Overtopping Flood/Flood of Record.
- A potential Scour Summary table, which specifies data used by design to determine the appropriate foundation type. The inclusion of this information is intended to assist future Maintenance Inspections and Evaluations to help track the health of the structure.

- Final recommendations on hydrologic, hydraulic and scour issues (recommendations for span length, pier type, pier location, bridge skew, minimum soffit elevation, etc).

Final Hydraulic Report (FHR)

Upon receiving the Bridge Site Submittal documents from the District, Structure Design is to submit a request for a Final Hydraulic Report (FHR) to the Structure Hydraulics Engineer. This report is requested and prepared during the PS&E stage of the project.

The Project Engineer from Structure Design shall invite the Structure Hydraulic Engineer to the Type Selection meeting to respond to hydraulic questions that may arise.

The FHR shall include recommendations based on final Type Selection and final foundation recommendations.

Except for adjacent left and right bridge structures, a separate FHR shall be prepared for each structure and shall contain the State of California registration seal, license number, expiration date and signature of the Engineer responsible for its preparation.

Upon completion of the FHR, the Project Engineer shall provide a copy of the report to the Resident Engineer Pending File for use in the construction phase of the project..

Request for Hydraulic and Hydrologic Information *(internal use only)*

A work request form must be completed for every bridge over a waterway.

For the most current 'Structure Hydraulics Work Request Form', visit the Structure Hydraulics link on the SP&I intranet site-

http://des.onramp.dot.ca.gov/office-design-and-technical-services. Requests for hydraulic information for all waterway crossings should be sent to:

DES.Structure.Hydraulics.Hydrology@dot.ca.gov