DAM MODELING COMMUNICATION FACT SHEET

Phase II: Post-Modeling Communication Best Practices

PURPOSE

This fact sheet presents a framework for an engineer/modeler to effectively communicate the results of hydrologic, hydraulic, seepage, and stability models to both a dam owner and regulatory agency. While computer models can be useful tools in evaluating the performance of dams and appurtenant structures, watersheds, and a dam's downstream consequences, there are a variety of approaches and methodologies for conducting and documenting these modeling efforts. Therefore, it is important to owners, consultants, and regulators that clear communication is integrated in the process. The purpose of this fact sheet is to guide communication of the approach and results of a modeling effort. Such post-modeling communication may include a report submittal, a metadata document, digital file delivery, or a meeting with the regulator and owner.

The following sections outline best practices for post-analysis model communication and digital file delivery.

REPORTING GUIDANCE

Reports that present the results of a modeling effort, the following should be included:

- A description of the **project features and operations,** with special attention to those that are important to the development of the model such as key elevations, construction methodology, materials, reservoir operations, historical incidents, floods, and/or seismic events, etc.
- A definition of the **model's purpose and objective**. E.g., was the model prepared for the purposes of designing a new dam, modifying an existing structure, informing a risk analysis, or evaluating the existing conditions of a project?
- A summary of the **assumptions and methods** used to complete the modeling effort. Key assumptions may include software selection, methodology, boundary conditions, and model scenarios. Examples of key assumptions and important considerations for specific model types including seepage analysis, slope stability analysis, hydrologic analysis, hydraulic analysis, and consequence estimation are included in the pre-communication fact sheet attachments. Even if a model work plan was not prepared or submitted, these items should be discussed in the final report. State the software selection and describe the limitations of the program as they apply to this project.
- A summary of the data and references to the sources used as the **basis of the analysis**. Note the guidance documents (e.g., State published guidance, USBR Design Standards, FERC Engineering Guidelines for Evaluation of Hydropower Projects, USACE Engineering Manuals, etc.)
- Results of **sensitivity analyses, model validation and/or calibration**, if completed and/or justification for why these runs were not performed.
- A summary of the **analysis scenarios** modeled. E.g., Flood Frequency/Reservoir Level, Seismic, Static, Transient, Sunny-day, etc.
- A clear presentation of the **model input parameters** and the basis for their selection. Note the sources of information. If a parametric sensitivity analysis was completed, describe the findings.

- Describe the **uncertainties or limitations** of the model (e.g., hydrologic model only valid for storms up to the 1% annual exceedance probability [AEP] event).

- A clear presentation of the **model results and findings** consistent with the analysis scenarios described and focused on addressing the purpose or goal of the modeling project and a comparison to the performance criteria.

- If necessary, **recommended additional work** to resolve data gaps or complete more advanced modeling not included in the scope of work.

MODEL FILE PREPARATION CHECKLIST

Below are suggested best practices for preparing digital model files to be delivered to the owner and/or regulator. It should be noted that some modeling projects have some degree of confidentiality. The confidential nature of a project should be considered before sending files to third parties. If required by the owner or consultant, a digital file release form may need to be signed by the pertinent parties before digital files are transferred.

- **File Naming Conventions**:
  - Use a consistent, clear naming structure (e.g., [ProjectName]_[ModelType]_[ModelVersion]_[Date]).
  - Avoid special characters and spaces—stick to underscores and/or CamelCase.
  - If applicable, consider including the word "CONFIDENTIAL" in the directory name.
- **File Organization**:
  - Structure files logically (e.g., folders for inputs, outputs, scripts, and reports).
  - Compress large files or datasets into archives for easier transfer.
  - Consider including the model software version in the name of the model's parent directory.
  - Add a README file summarizing the purpose of the files and their organization.
    - Define in plain terms each model scenario and what file names they relate to.
    - If not denoted elsewhere, include the software version in the README file.
- **Data Preparation**:
  - Ensure all input data are accurate, up-to-date, and consistent with documented data in other deliverables.
  - Confirm geometry transformations were performed appropriately and provide the coordinate system used, if applicable.
  - Only provide model scenarios used to calibrate or compute final results, as documented in other model deliverables (e.g., design drawings, reports, memorandums, etc.).
  - If a description input is available within the modeling software, include a current description of the model, its purpose, limitations, etc.
  - Perform quality checks on the model results before sending them to the owner and/or regulator.
- **Regulatory Compliance**:
  - Review guidelines from the governing authority to ensure models and data meet their specifications.
  - Include required forms, metadata (see Attachments A through D), or supplementary information.
- **Backups and Redundancy**:
  - Create backups of the modeling files and store them securely.
  - Share files via a reliable platform with proper permissions (e.g., SharePoint, cloud storage).

OPTIONAL METADATA TEMPLATES

In addition to thorough reporting as described above, regulators, owners, and modelers may require or electively use the attached metadata templates for seepage analysis, slope stability analysis, hydrologic analysis, and hydraulic analysis. The purpose of the metadata templates are to provide a tool for recording basic elements associated with modeling that may not otherwise be included in the reporting. Metadata may be included in the report as an Appendix and/or kept in the project file with the models for future reference.

ATTACHMENTS

Application-Specific Modeling Plan Templates

Attachment A – Slope Stability Modeling Template

Attachment B – Seepage Modeling Template

Attachment C – Hydrologic Modeling Template

Attachment D – Hydraulic Modeling Template

ATTACHMENT A – DAM SLOPE STABILITY MODELING

SLOPE STABILITY ANALYSIS METADATA TABLES

In the tables below, the modeler will need to identify which scenario their descriptions apply to in the second column or copy the Input tables to better describe each scenario. For example, it may be likely that different scenarios use different loading conditions, or material parameters; these should be described and assigned to a scenario.

General Information:

Category	Description
Project Name:	
Model Purpose:	
Confidential Nature of Project:	
Date of last edits:	
Engineering Firm(s):	
Modeler/Originator:	
Contact(s) for digital file sharing: (i.e., owner, regulator, engineering firm)	
Software Name and Version:	
Analysis Method (e.g., Morganstern and Price, Spencer, Janbu, etc.)	
Limitations:	

Analysis Scenario Information:
Copy table as needed for multiple scenarios.

Category	Description
Analysis Scenario ID:	
Phreatic Surface (e.g., forebay and tailrace levels, other differentiators)	
Slip Surface (e.g., describe the defined entry and exit ranges)	
Minimum Slip Surface settings (e.g., Minimum slip surface depth of 5 feet)	
Seismic or other Surcharge Loading	
Factor of Safety or other performance result compared to criteria	

Materials Information:
Copy table as needed for each material.

Category	Description
Material ID	
Material Model	
Key Strength Parameters	
Applicable Analysis Scenarios	

ATTACHMENT B – DAM SEEPAGE MODELING

SEEPAGE MODELING METADATA TABLES

In the tables below, the modeler will need to identify which scenario their descriptions apply to in the second column or copy the Input tables to better describe each scenario. For example, it may be likely that different scenarios use different loading conditions, or material parameters; these should be described and assigned to a scenario.

General Information:

Category	Description
Project Name:	
Model Purpose:	
Confidential Nature of Model:	
Date of last edits:	
Engineering Firm(s):	
Modeler/Originator:	
Contact(s) for digital file sharing: (i.e., owner, regulator, engineering firm)	
Software Name and Version:	
Analysis Method (e.g., steady-state, transient)	
Limitations:	

Analysis Scenario Information:
Copy table as needed for multiple scenarios.

Category	Description
Analysis Scenario ID:	
Boundary Conditions (e.g., forebay and tailrace levels, other differentiators)	
Mesh size and type	
Convergence Settings	

Materials Information:
Copy table as needed for each material.

Category	Description
Material ID	
Material Model (e.g., Saturated or Unsaturated)	
Key Seepage Parameters (e.g., permeability and anisotropy for Saturated, additionally provide water content/suction/ conductivity functions for Unsaturated)	
Applicable Analysis Scenarios	

ATTACHMENT C – HYDROLOGIC MODELING METADATA

HYDROLOGIC MODELING METADATA TABLES

In the tables below, the modeler will need to identify which scenario their descriptions apply to in the second column or copy the Basin and Reservoir data tables to better describe each scenario. For example, different scenarios may use different initial conditions and rainfall data; these should be described and assigned to a scenario in the Description Column of the appropriate table.

General Information:

Category	Description
Project Name:	
Model Purpose:	
Confidential Nature of Project	
Date of last edits:	
Engineering Firm(s):	
Modeler/Originator:	
Contact(s) for digital file sharing: (i.e., owner, regulator, engineering firm)	
Software Name and Version:	
General Model Assumptions: (i.e., timestep, gridded vs basin-average precipitation, etc.)	
Limitations:	
Modeled Scenarios: (provide the Simulation Run name(s) and associated Basins, Meteorology/rainfall, etc.)	

Basin Input Information:
Copy table as needed for multiple basins.

Category	Description
Basin Description: (e.g., size, number of subbasins, location)	
Delineation Terrain Source:	
Rainfall Loss Methodology:	
Unit Hydrograph/Rainfall Transport Methodology:	
Other applicable input data: (e.g., gage data, snow, canopy interception, baseflow, etc.)	

Reservoir Data Input Information:
Copy table as needed for multiple reservoirs

Category	Description
Reservoir Name:	
Stage-Storage/Area Data Source(s):	
Stage-Discharge method/Data Source(s): (Include assumptions for all structures, i.e., weir coefficients, cross-section source, rating curve source, outlet curve, etc.	
Initial reservoir elevations/outflows:	
Other applicable input data:	

Reach Routing Input Information:

Category	Description
Name, Location, Length of Reaches:	
Routing Method:	
Routing Parameters: (e.g., slope, roughness, shape, etc.)	
Other applicable input data:	

Rainfall Input Information:

Category	Description
Rainfall Events Modeled:	
Rainfall Depth Sources:	
Rainfall Temporal Distributions:	
Other applicable input data: (e.g., gage data basin-specific applications, gridded application assumptions, etc.)	

ATTACHMENT D – HYDRAULIC AND DAM BREACH METADATA

HYDRAULIC MODELING METADATA TABLES

In the tables below, the modeler will need to identify which scenario their descriptions apply to in the second column or copy applicable Flow Data and Geometry Input tables to better describe each scenario. For example, different scenarios may use different initial and boundary conditions; these should be described and assigned to a scenario in the Description Column of the Flow Data table.

General Information:

Category	Description
Project Name:	
Confidential Nature of Project:	
Model Purpose:	
Date of last edits:	
Engineering Firm(s):	
Modeler/Originator:	
Contact(s) for digital file sharing (i.e., owner, regulator, engineering firm)	
Software Name and Version:	
General Model Assumptions: (i.e., 1D vs. 2D, steady vs. unsteady, etc.)	
Limitations:	
Modeled Scenarios (provide the Plan name(s) and associated geometry/flow files):	

Flow Data Input Information:
Copy table as needed for multiple flow scenarios

Category	Description
Flow Data Source(s): (e.g., stream gage, runoff model, USGS StreamStats, etc.)	
Boundary Conditions (BCs): (e.g., location, type, steady vs. unsteady flow, flow rates, water surface elevations (WSELs), internal BCs etc.)	
Initial Conditions (ICs): (e.g., initial elevations or flows, restart filenames, etc.)	
Other applicable input data: (e.g., meteorological data, observed data, etc.)	

Geometry Editor Input Information:
Copy table as needed for multiple geometries.

Category	Description
Terrain Source(s): (e.g., USGS, State GIS database, horizontal and vertical datums, data resolution):	
Terrain Modification(s): (description of any modifications to the existing surface and/or proposed design alternatives)	
1D cross-section spacing or 2D mesh cell sizes:	
Source(s) of energy loss coefficients and surface roughness values: (e.g., Landcover dataset, field observations, etc.)	
Source(s) of reservoir/dam characteristics: (e.g., key elevations, stage-storage, stage-discharge curves)	

Category	Description
Inline structure/bridge characteristics: (e.g., sources of key elevations/geometry, stage-discharge curves, solver type etc.)	
Other applicable input data:	

Flow Analysis Input Information:
Copy table as needed for multiple flow analyses scenarios

Category	Description
Solver used: (e.g., diffusion wave, SWE-ELM, subcritical, mixed)	
Computation Settings: (e.g., timesteps, output intervals)	
Other applicable input data:	

DAM BREACH METADATA TABLE

Modeler needs to note breach geometry and/or methodology for each scenario modeled.

Breach Geometry Input Information:

Category	**Description**
Breach Scenarios: (e.g., IDF, sunny-day, top of dam, etc.)	
Method(s) used: (e.g., FERC, USACE, Froehlich 1995 or 2008, MacDonald 1984, etc.)	
Assumed failure mode: (i.e., overtopping or internal erosion)	
Breach Invert:	
Bottom Width:	
Side Slopes:	
Formation Time:	
Other applicable input data:	