



# **Riverine PFHA Pilot Study**

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# Motivation

## **Support the application of the PFHA research results for risk-informed decision-making for riverine flood hazards**

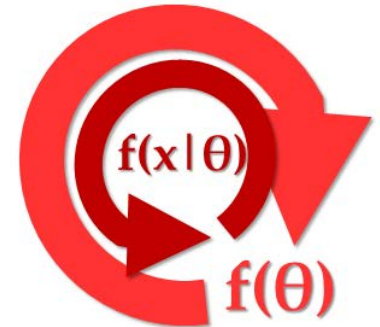
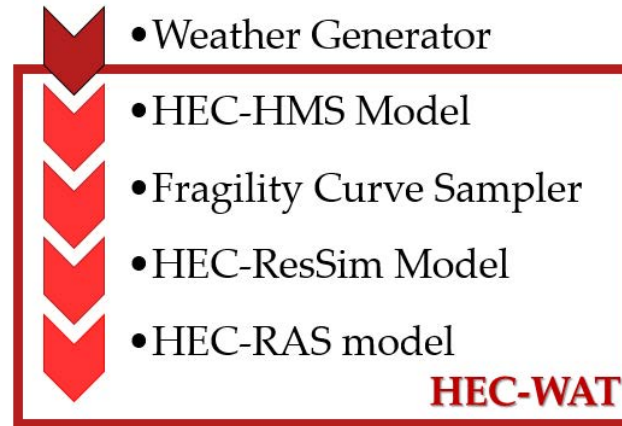
- demonstrate the development of a set of site-specific probabilistic flood hazard curves using available tools
- characterizes the uncertainty associated with these hazards to increase realism
- Inform development of PFHA guidance for riverine and dam failure scenarios



# Objectives

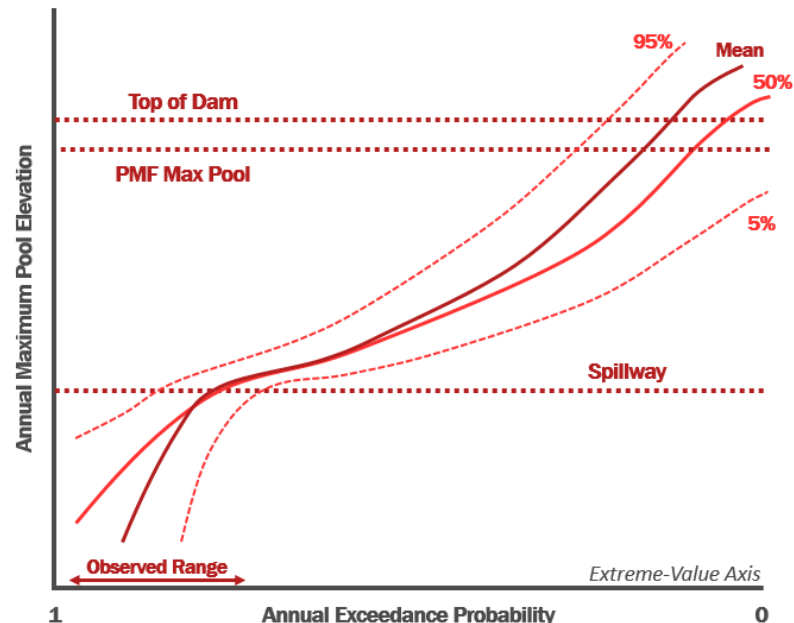
## Aleatory Variability

- Precipitation
  - Timing
  - Areal extent
  - Amount
  - Timing
- Watershed
  - Initial conditions



## Epistemic Uncertainty

- Watershed
  - Infiltration
  - Hydrograph sub-model
  - roughness
- Treatment of dams



## Tasks

- Task 1 - Site Selection
- Task 2 - Peer Review Plan
  - build independent team of qualified experts
  - determine level of participatory peer review
  - documentation
- Task 3 - Data Preparation
- Task 4 - Probabilistic Modeling
  - Selecting Probabilistic Modeling Approach and Options
  - Simulation and Model Refinement
  - Uncertainty Quantification (UQ) and Sensitivity Analysis (SA)
- Task 5 - Knowledge Transfer
  - Presentations and seminars
  - Technical letter reports, final technical report

# Task 1: Watershed Selection

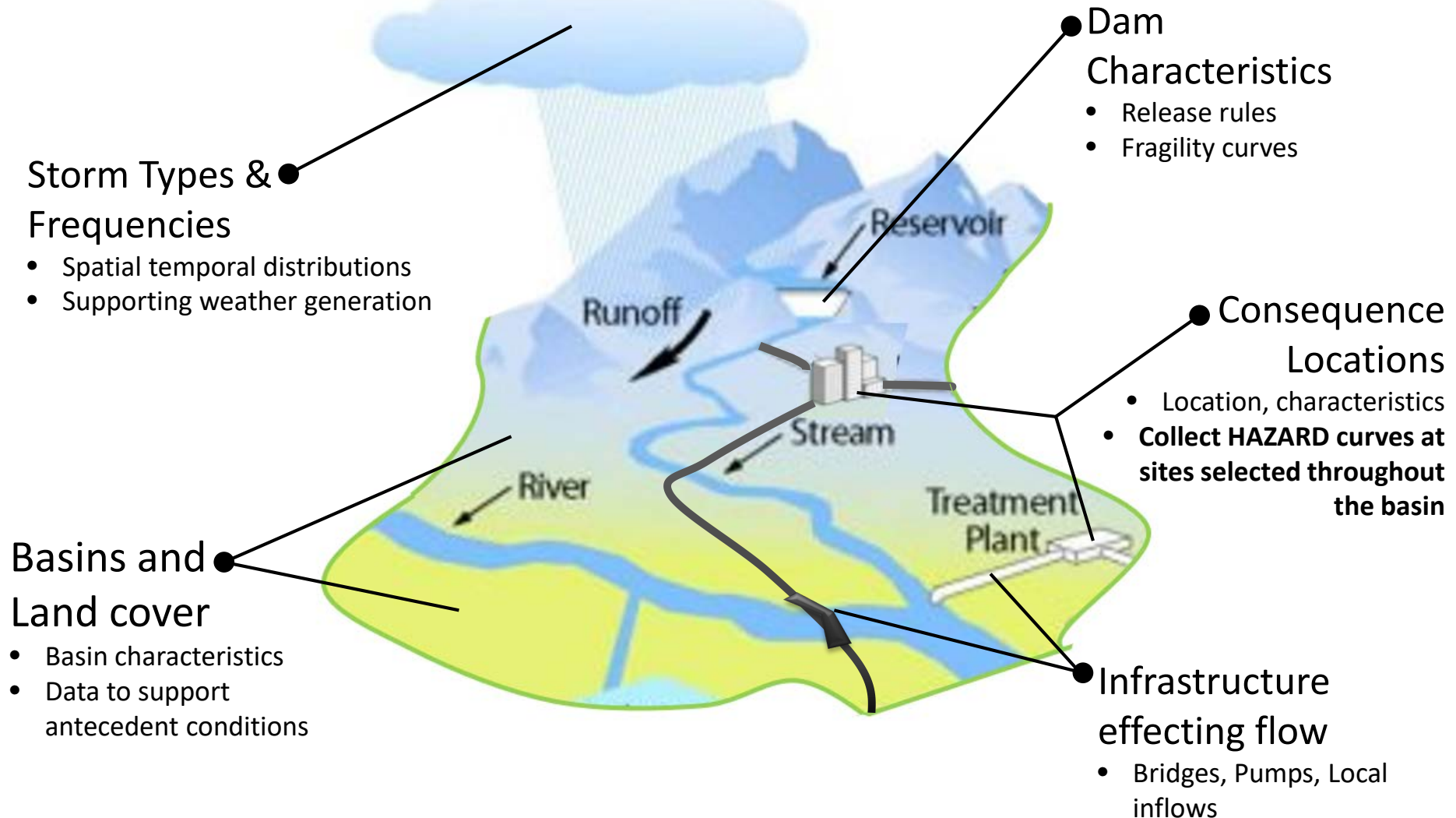
## Target Flood Watershed Characteristics

- Representative complexity of existing NPP basins
- Basin size, contributing area
- Storms impact different parts of the basin
- Different Storm Types, Snowmelt
- Dam failures, sequential, distance from site

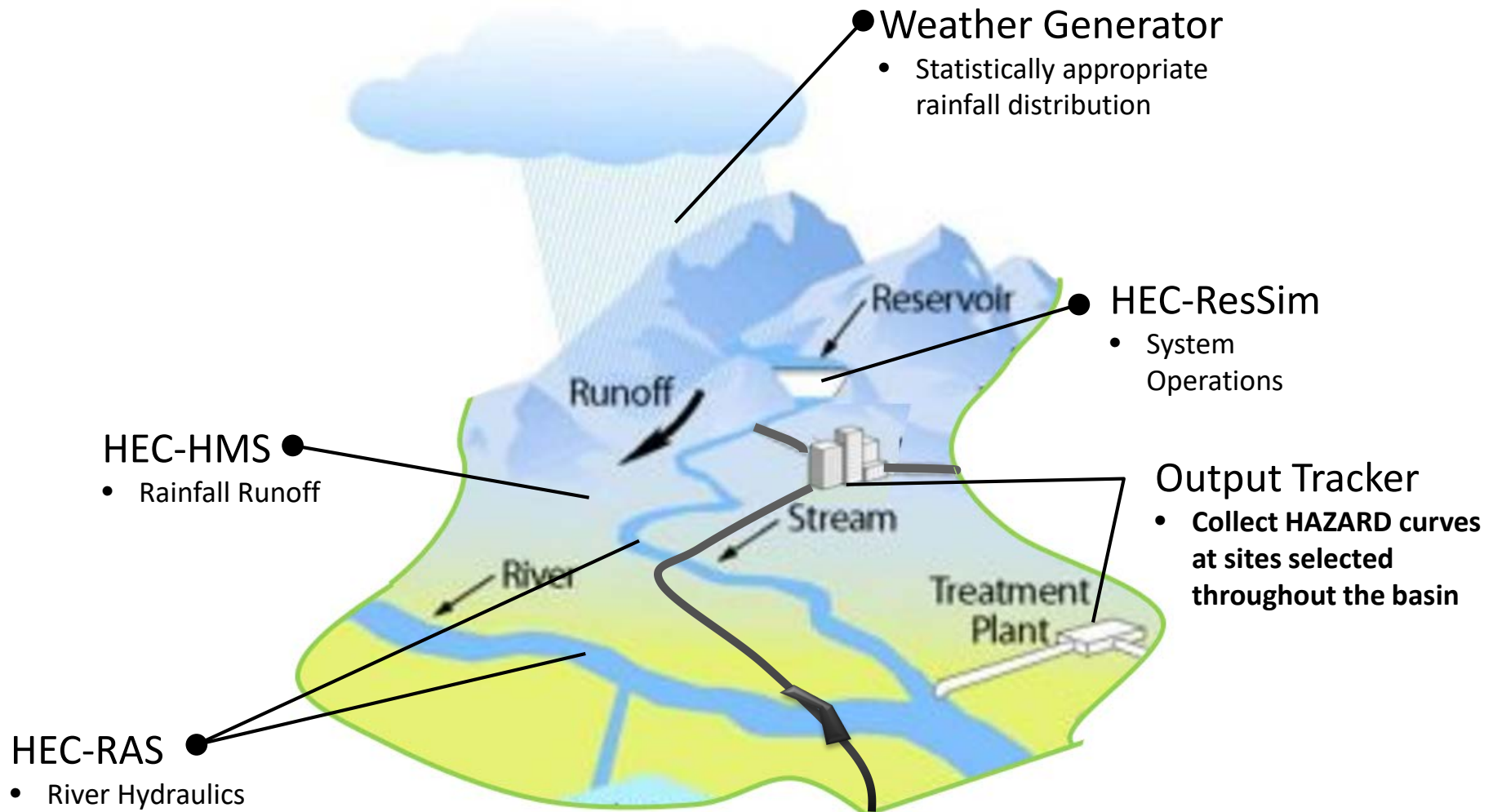
*Table 1. Best Watershed Candidates*

River or Watershed	State	Drainage Area (sq mi)	Snow?	Existing Models				Level of Effort Required to Develop/Adapt Models
				HMS	ResSim	RAS	WAT	
Trinity River	TX	6,000	N	Y	Y	Y	Y	high/med
Connecticut	VT	7,500	Y	Y	Y	Y	Y	high
Middle Fork Willamette	OR	1,400	Y	Y	Y	Y	Y	med/low
South Platte River	CO	4,000	Y	Y	Y	Y	N	high

## Task 3: Data Gathering & Preparation



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## Task 4: Probabilistic Modeling

### Selecting Probabilistic Modeling Approach and Options

#### Aleatory Variability

- Site- and phenomena-specific aleatory models
  - precipitation
  - antecedent conditions

#### Significant Epistemic Uncertainties (Engineering models)

- Watershed Realizations Model features
- Parameter sampling strategies

#### Uncertainty Quantification (UQ) and Sensitivity Analysis (SA)

### Sampling Variability and Uncertainty Nested Monte Carlo Simulation

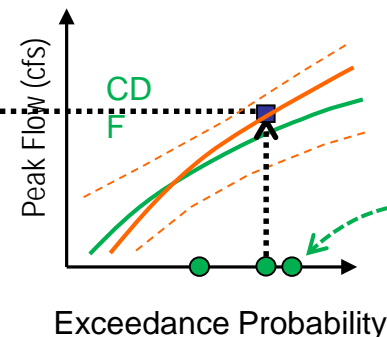
Reservoir Analysis  
Channel Hydraulics  
Spreading Model

*sample uncertain  
model parameters  
sample variabilities*

stage

Inundation Mapping  
Damage to  
Structures

output



*sample new  
frequency curve  
(uncertainty)  
and then sample  
events (variability)*

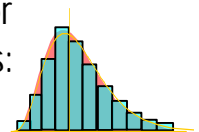
Random choice of  
probability ~  $U_i[0,1]$   
to "generate" event

...still end with  
a sample of  
outputs  
**One  
Realization**

For each realization,  
get an output estimate

$$EV = 1/n \sum (\text{Output}(i))$$

After repeating for  
many realizations:



Distribution of Output

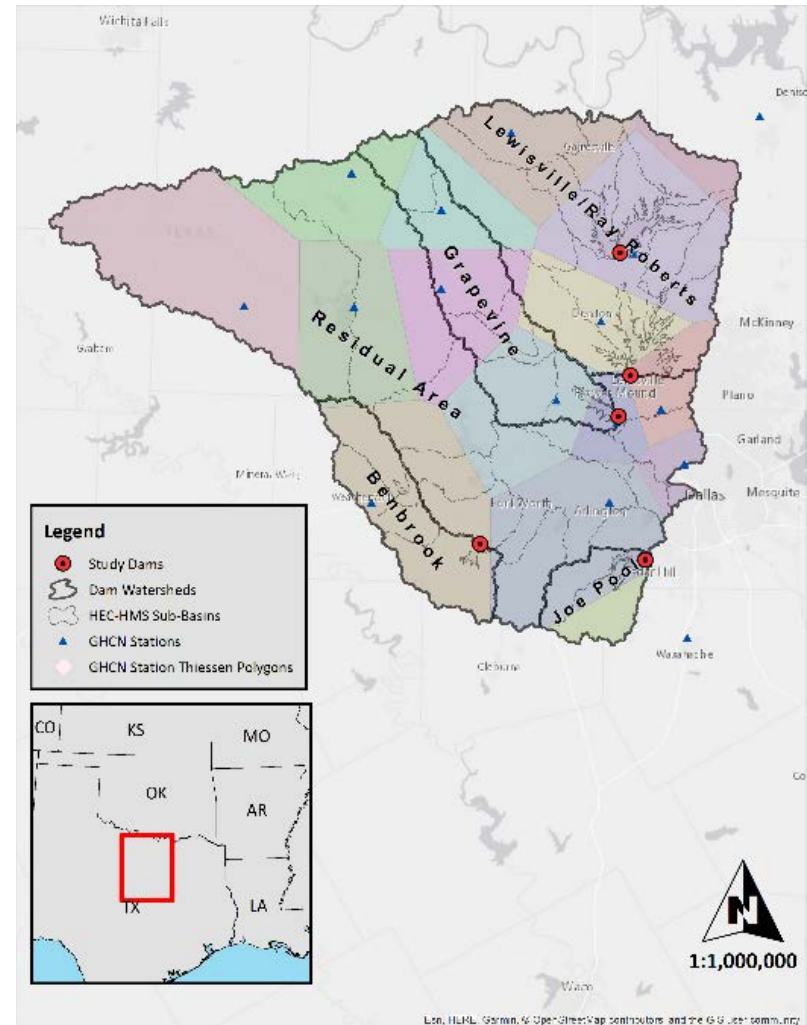


# Status: Task 1 - Watershed Selection

## **Selection complete**

### **Draft Letter Report Submitted**

- **Trinity River Watershed, TX**
- Drainage Area: 6,000 sq mi.
- Watershed characteristics
  - five major dams
  - urban centers
  - differing land use
  - Differing elevations
  - Three major headwater branches
- **Precipitation:** Existing quasi-continuous stochastic weather generator to provide storm forcing
- **Existing Engineering Models:** HMS, ResSim, WAT, 2D-RAS could be incorporated



- Task 1 - Site Selection
  - *Technical Letter Report submitted*
    - *Under revision by HEC*
- Task 2 - Peer Review Plan
  - *In Progress*
- Task 3 - Data Preparation
  - *In Progress*
- Task 4 - Probabilistic Modeling
  - Selecting Probabilistic Modeling Approach and Options
    - *In Progress*
  - Simulation and Model Refinement
    - including Uncertainty Quantification (UQ) and Sensitivity Analysis (SA)
- Task 5 - Knowledge Transfer
  - Presentations and seminars
  - Technical letter reports, final technical report