EXAMPLE OF A MONTE CARLO SIMULATION

TO DETERMINE FLOOD RISK

This simulation is a tool used by the Corps of Engineers to answer the question "What is the likelihood of a levee failure?"

TO SET UP THE SIMULATION …

Identify a point along the river that is representative of the levee system's ability to contain the floodflows (for example, a weak spot in the levee).

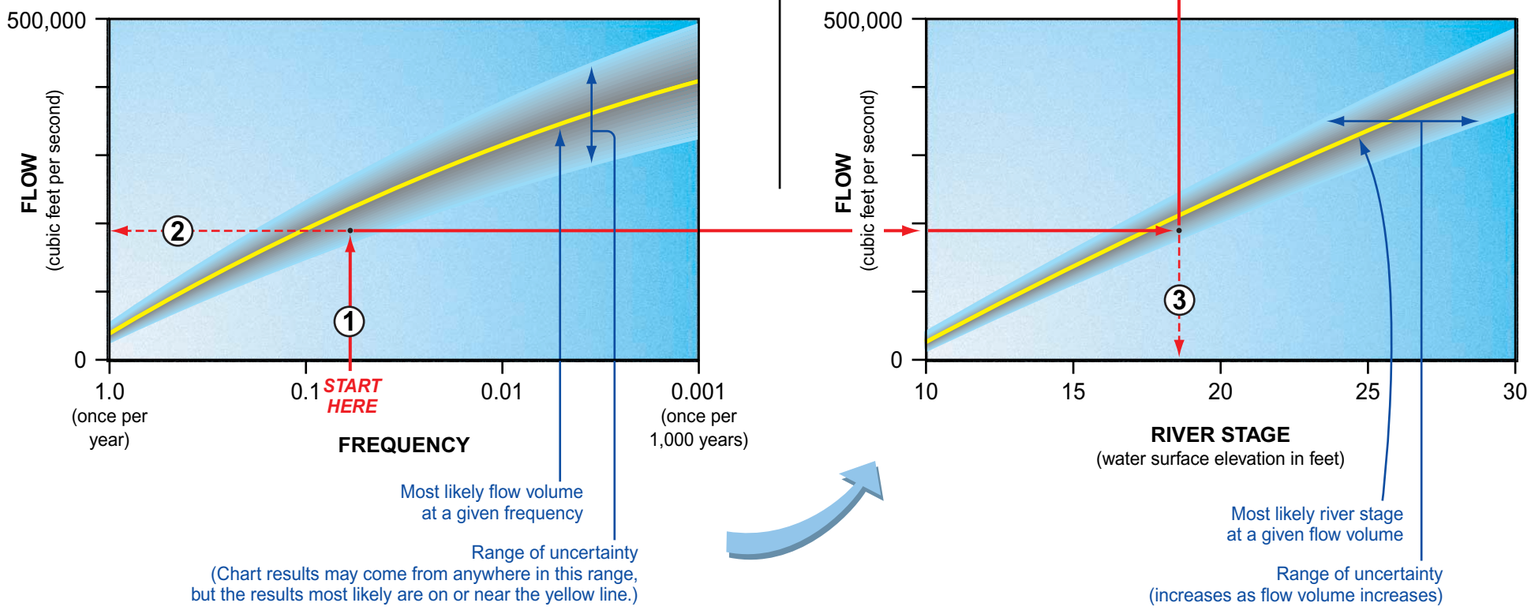
Run the simulation using representative hydrology, hydraulics, and geotechnical levee data.

STEP ①: GENERATE A FREQUENCY OF OCCURRENCE

Frequencies are randomly generated but naturally distributed (more occurrences on the left side of the chart). In 1,000 simulations, approximately 10 floods will exceed a 1% (100-year) event.

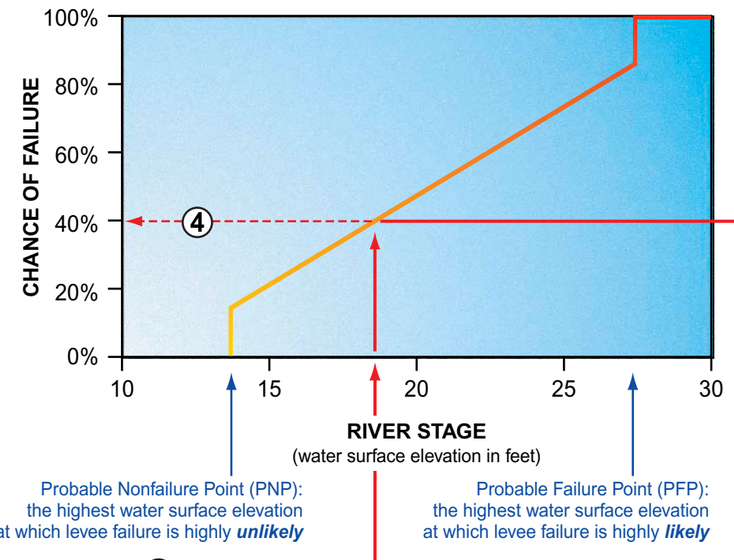
STEP ②: DETERMINE FLOW

The chart below is based on historic and calculated hydrology data.



STEP ④: DETERMINE THE PERCENT CHANCE OF LEVEE FAILURE BASED ON STAGE

The chart below is based on geotechnical levee data.

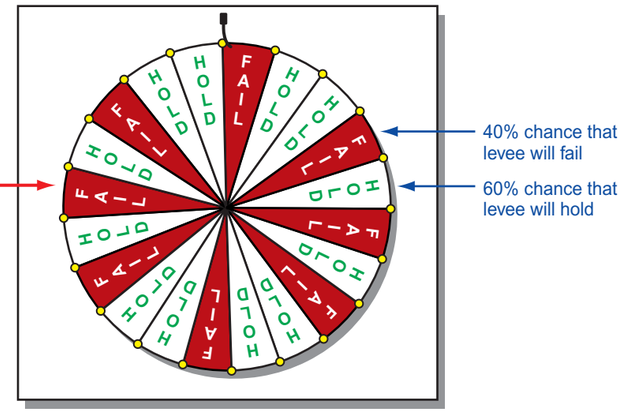


STEP ③: DETERMINE RIVER STAGE (ELEVATION) BASED ON FLOW

The chart below is based on hydraulics data.

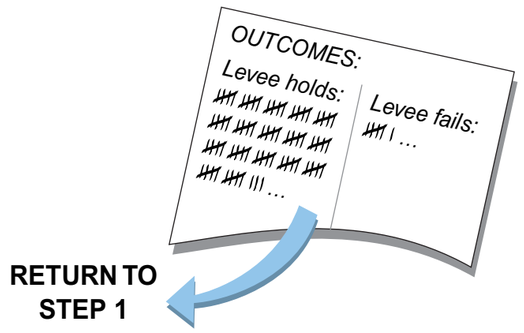
STEP ⑤: FAIL OR DON'T FAIL THE LEVEE BASED ON PERCENT CHANCE

Set up a "Wheel of Fortune" for levee failure or nonfailure based on result of Step 4.



Spin the wheel – the levee will either hold or fail.

STEP ⑥: RECORD OUTCOME AND REPEAT SIMULATIONS



Stop the simulations after (for example) 1,000 runs. Then divide the number of simulations by the number of levee failures:

$$\frac{\textit{1,000 simulations}}{\textit{55 levee failures}} = \textit{1 chance in 18 per year of a levee failure resulting in a flood}$$

American River Watershed, California
Long-Term Study
Final Supplemental Plan Formulation Report/EIS/EIR
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