2D Hydraulic Flood Model Development

Scope of services and deliverables · Jacob Beatty, P.E.

I develop two-dimensional hydraulic flood models that simulate how stormwater moves across the landscape and through the drainage network during a storm. Unlike traditional one-dimensional studies, a 2D model computes depth, water-surface elevation and velocity across every cell of the study area, so it captures overland flow, split flow, ponding and street-level flooding that 1D methods miss. The result is a defensible picture of real flood risk, including flooding outside mapped regulatory floodplains.

What the model includes

Terrain surface

Built from the best available LiDAR-derived elevation data, processed for hydraulic use and quality-checked for voids and artifacts.

Computational mesh and breaklines

A 2D mesh generated across the study area and refined with breaklines along the features that control where water goes: stream channels, ridgelines, and roads or embankments. Breakline development is one of the primary drivers of model accuracy.

Terrain modifications and hydraulic structures

LiDAR does not see below the water surface or through culverts, so channel geometry is cut in, ditches and conveyance paths are enforced, and hydraulic structures (culverts, bridges, weirs) are input so flow routes correctly at crossings. The number of structures modeled is a direct driver of both effort and accuracy.

Infiltration and rainfall losses

Soil properties (SSURGO / Green-Ampt or curve-number methods) mapped across the watershed so the model accounts for how much rainfall soaks in versus runs off.

Surface roughness

Land cover translated into Manning's roughness values so flow resistance reflects actual conditions: pavement, turf, forest and channels.

Hydrology

Design storms (NOAA Atlas 14) and/or peak flows (regional regression or gage analysis) developed and converted into the inflows that drive the model. Rain-on-grid forcing is used where appropriate.

Calibration, at higher levels of detail

Where gage records or observed high-water marks exist, the model is calibrated by adjusting roughness and infiltration and comparing against Bulletin 17C flood-frequency estimates, to confirm it reproduces real events.

Level of detail

Model accuracy is a consequence of effort, and the effort concentrates in breakline development, terrain modifications and structure input.

- **Low detail, screening-grade.** Coarse breaklines, no structures. Fast, for identifying where risk exists and what is worth studying properly.
- **Medium detail.** Refined breaklines and major structures. The standard for most planning and design questions.
- **High detail.** Dense breaklines, all structures, and calibration to observed data. For regulatory submittals and funding applications.

Typical deliverables

- Calibrated or validated 2D HEC-RAS model files
- Flood depth, water-surface elevation and velocity grids
- Floodplain and inundation mapping for the modeled events
- Summary report of methods, inputs, assumptions and results
- Optional: an interactive web flood viewer

Assumptions and exclusions

Fees assume the watershed size, level of detail, number of hydraulic structures, and number of design or calibration events defined at contracting. Added structures, higher detail, additional events, field survey, or regulatory submittal support beyond the agreed scope are handled by amendment.

> **On screening-grade models.** A screening model is built from the best available public data. Making it a city's own means adding what only that city has: field survey, its storm-sewer network, and high-water marks from the storms residents still talk about, then calibrating against what actually happened on the ground. Screening results are for ranking and scoping, never for a determination at a single address, and they do not replace a FEMA flood insurance study.

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