~~Using HEC-RAS to Project Effects of Increased Flooding with the Placement of Large Woody Debris~~

Jeff Burkey – King County DNRP

Project Team: Dan Eastman, Doug Chin, John Bethel, Meredith Radella

(May 2008)

~~Increasing Roughness Suggests Flows may seek alternative paths?~~

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(May 2008)

~~Effects to stream flooding with the introduction of solid phase matter in large quantities of $C_xH_xO_x$?~~

Jeff Burkey – King County DNRP

Project Team: Dan Eastman, Doug Chin, John Bethel, Meredith Radella

(May 2008)

A Method Used to Evaluate Potential Effects on Flooding with the Placement of Large Woody Material

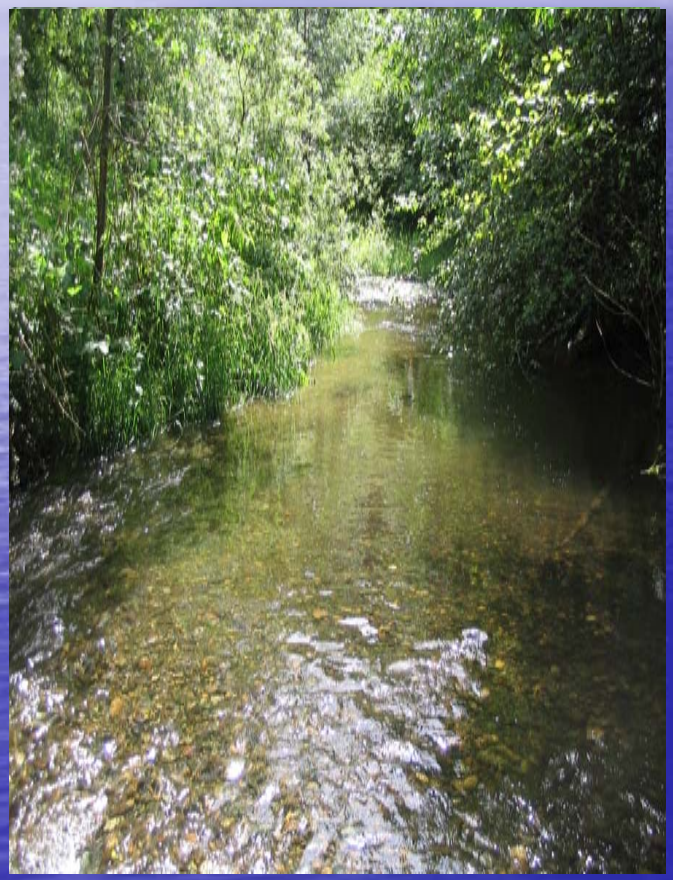
Jeff Burkey – King County DNRP

Project Team: Dan Eastman, Doug Chin, John Bethel, Meredith Radella, Jeff Burkey

(May 2008)

Tributaries in basin with project

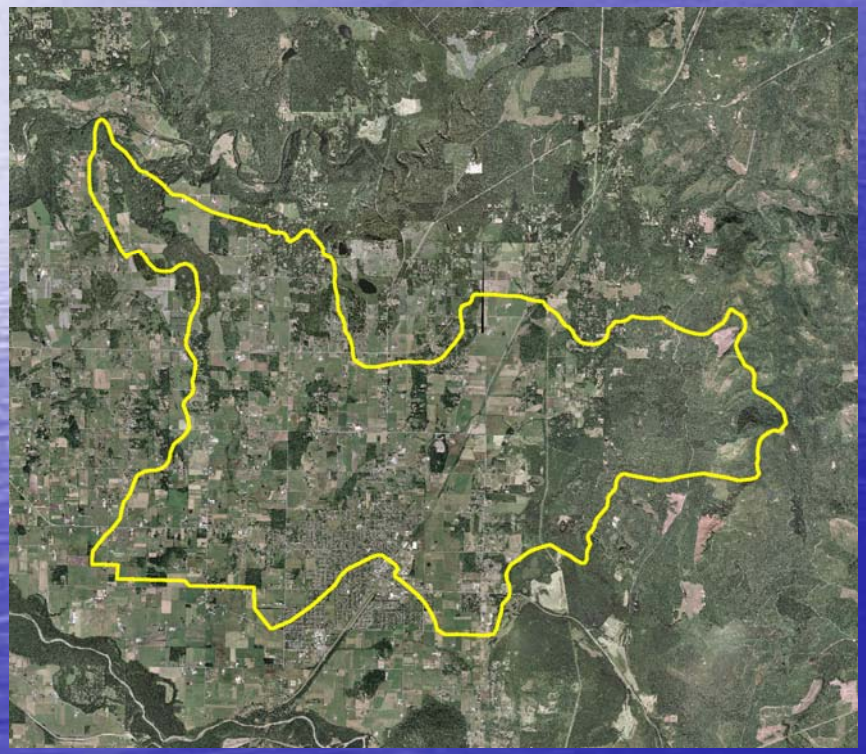
Add complexity and you might get this



Examples of complexity

Site Location

Site Conditions



- 26 Square Miles
- Land Use –
  - Agricultural
  - Residential
  - Forest Management
  - Commercial

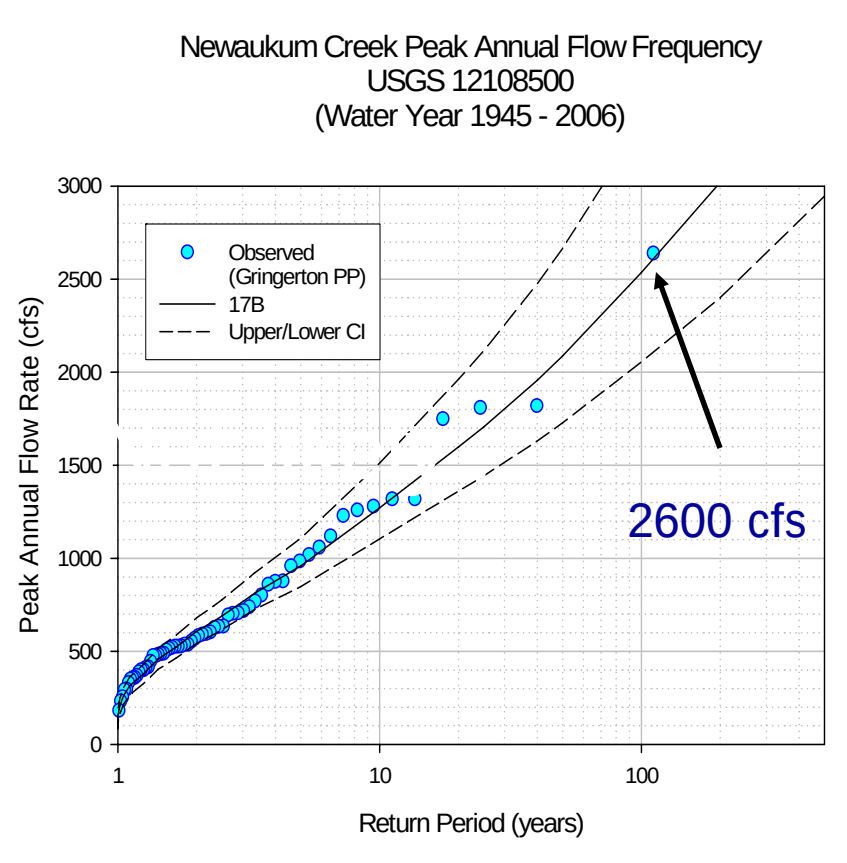
Relevant Site Conditions

- Subbasin Flow Rates
- River Stage Conditions
- Topography
- Expected flow paths

Translate to Model Setup

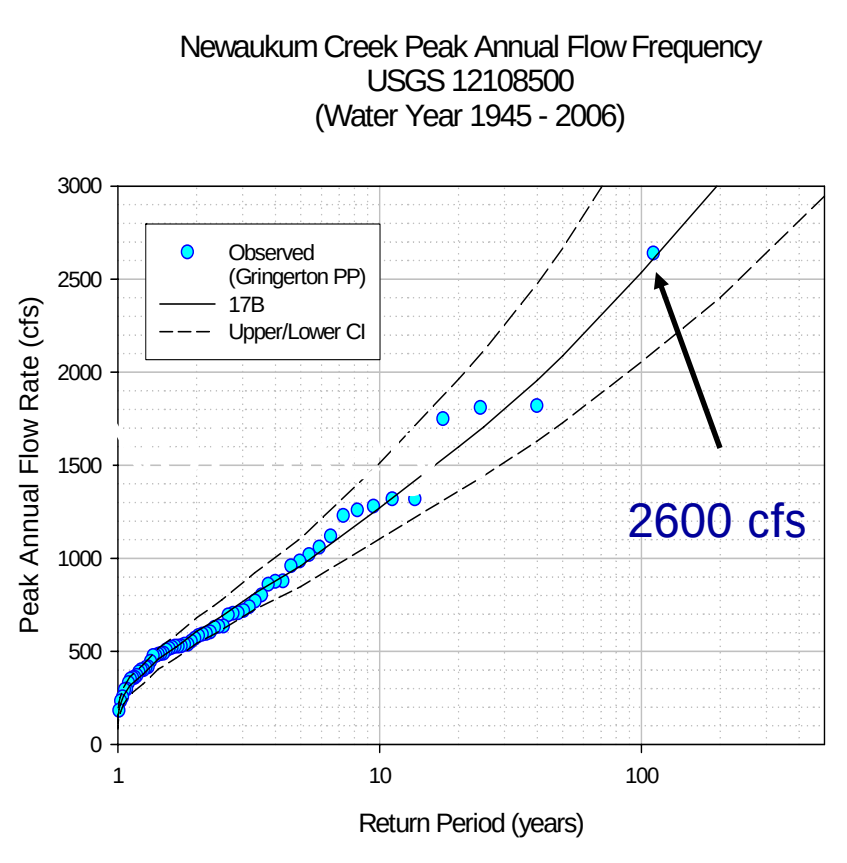
- Boundary Conditions
- Landscape roughness
- Channel Geometry
- Overland Geometry

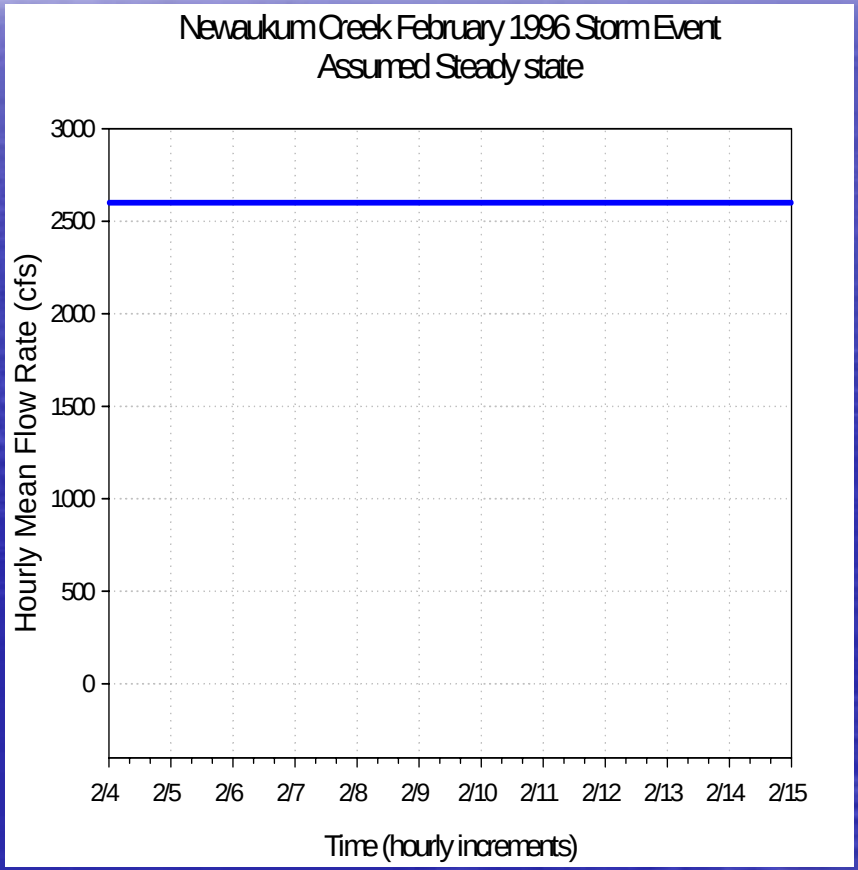
Upstream Boundary Conditions



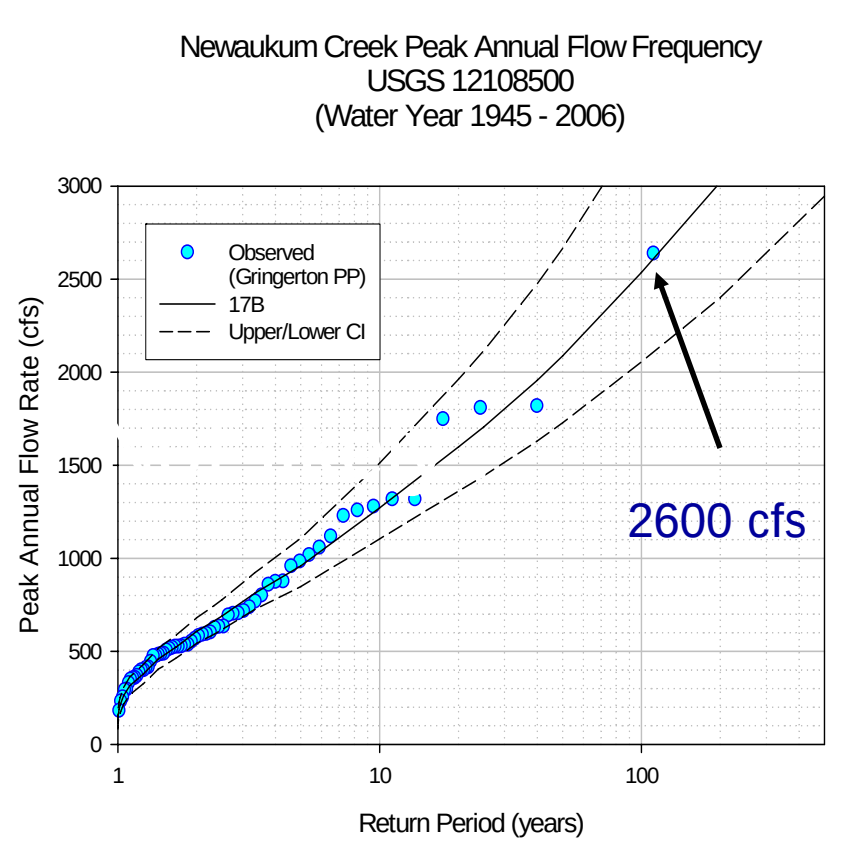
Does this flow create a steady-state condition?

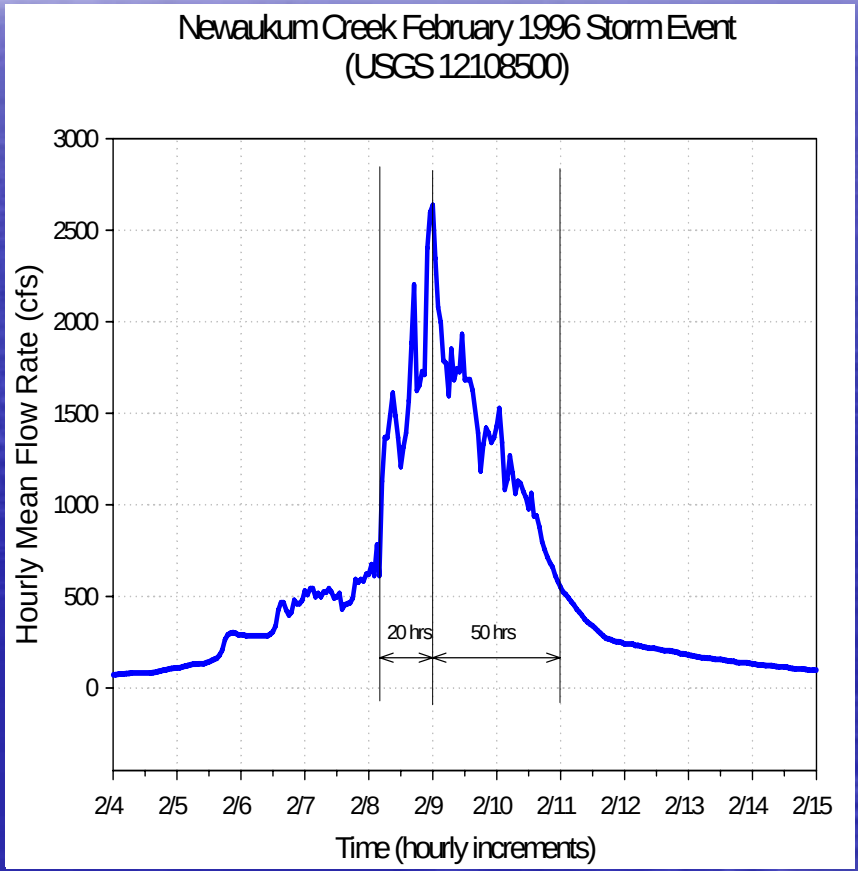
Upstream Boundary Conditions





Upstream Boundary Conditions

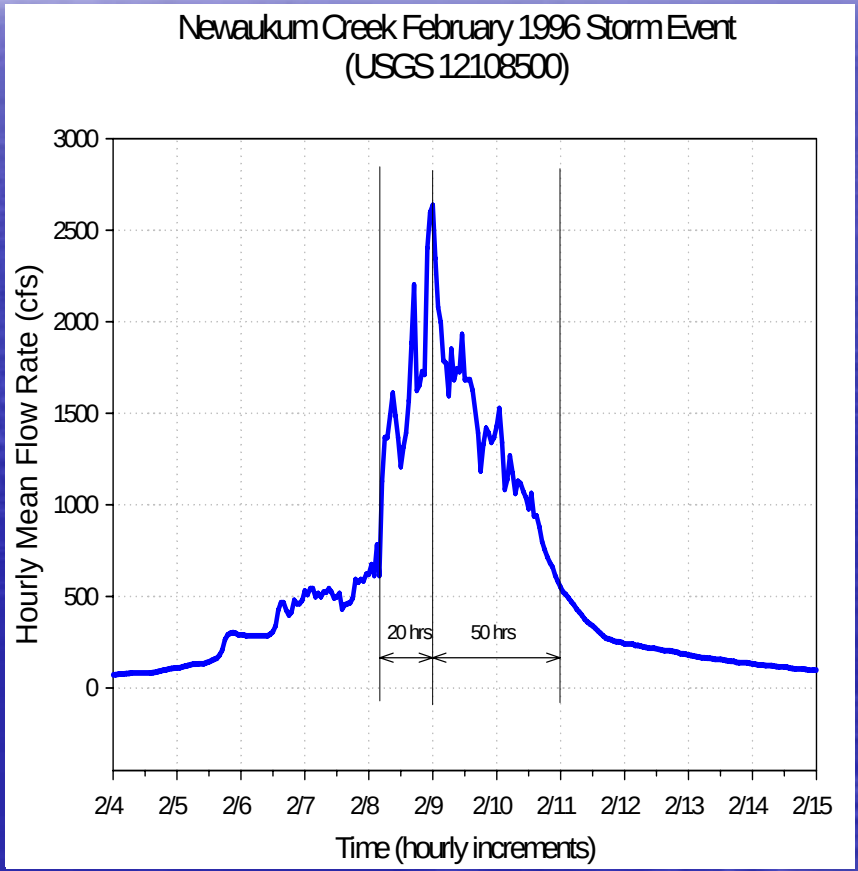




Upstream Boundary Conditions

Not likely...

2600 cfs



Downstream Boundary Conditions

Estimates of Over Bank Roughness

USGS n = 0.10

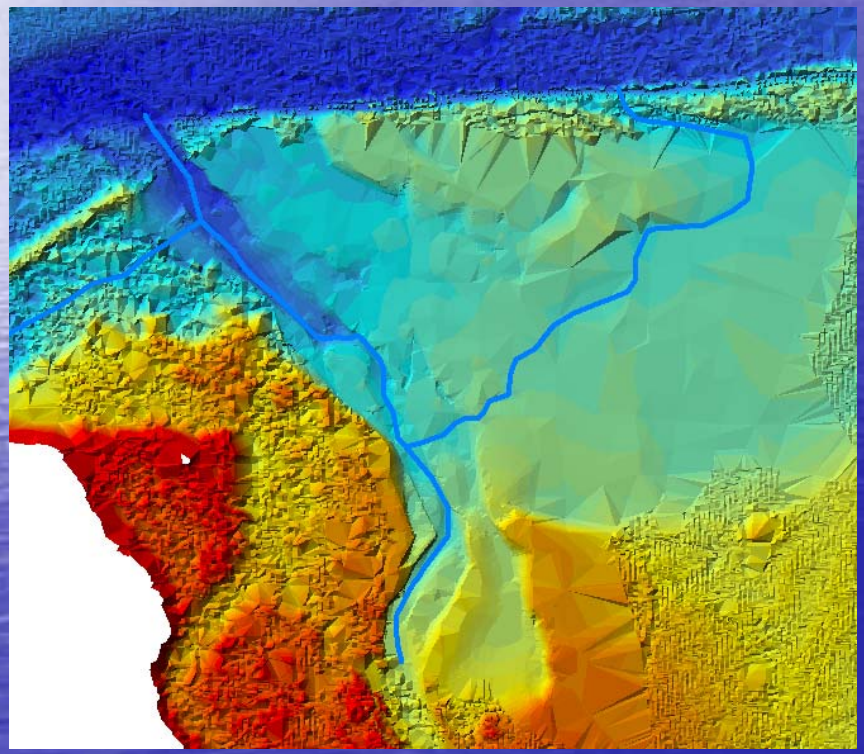
Computed roughness coefficient: Manning's n=0.10
Date of flood: February 21, 1974
Date of photograph: February 13, 1979
Depth of flow on flood plain: 2.6 ft

Description of flood plain: The vegetation of the flood plain is primarily trees, including oak, gum, and pine. The base is firm soil and has slight surface irregularities. Obstructions are negligible (a few downed trees and limbs). Ground cover and vines are negligible. Veg_d=0.0067, and C_*=12.0. The selected values are n_b=0.025, n_1=0.005, n_3=0.005, and n_0=0.035.

Newaukum Over bank area

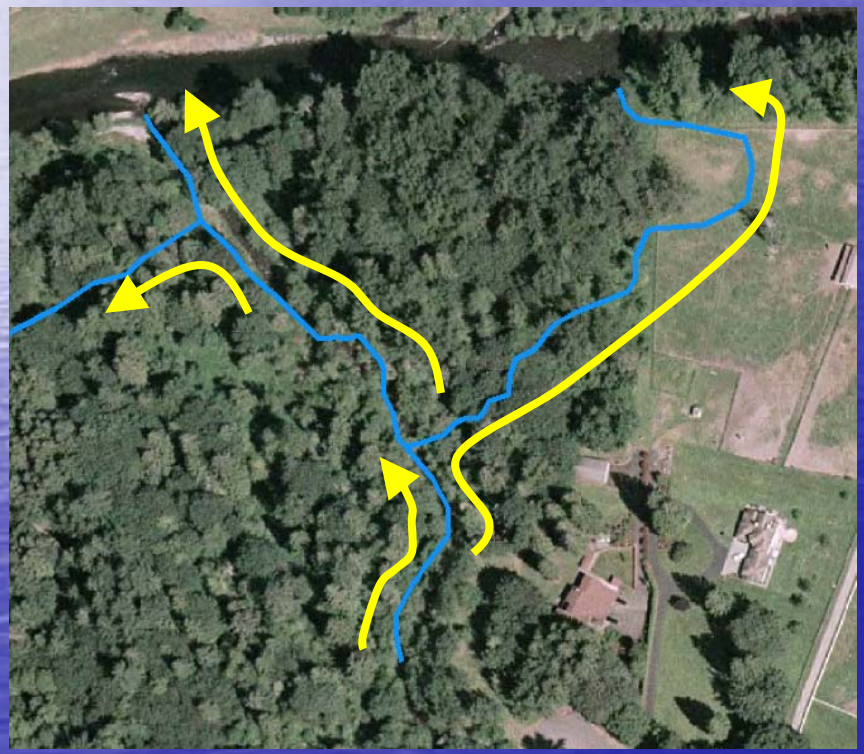
(n = 0.10)

Model Geometry



- Existing LiDAR
- Conducted Survey
- Composite (LiDAR + Survey) TIN

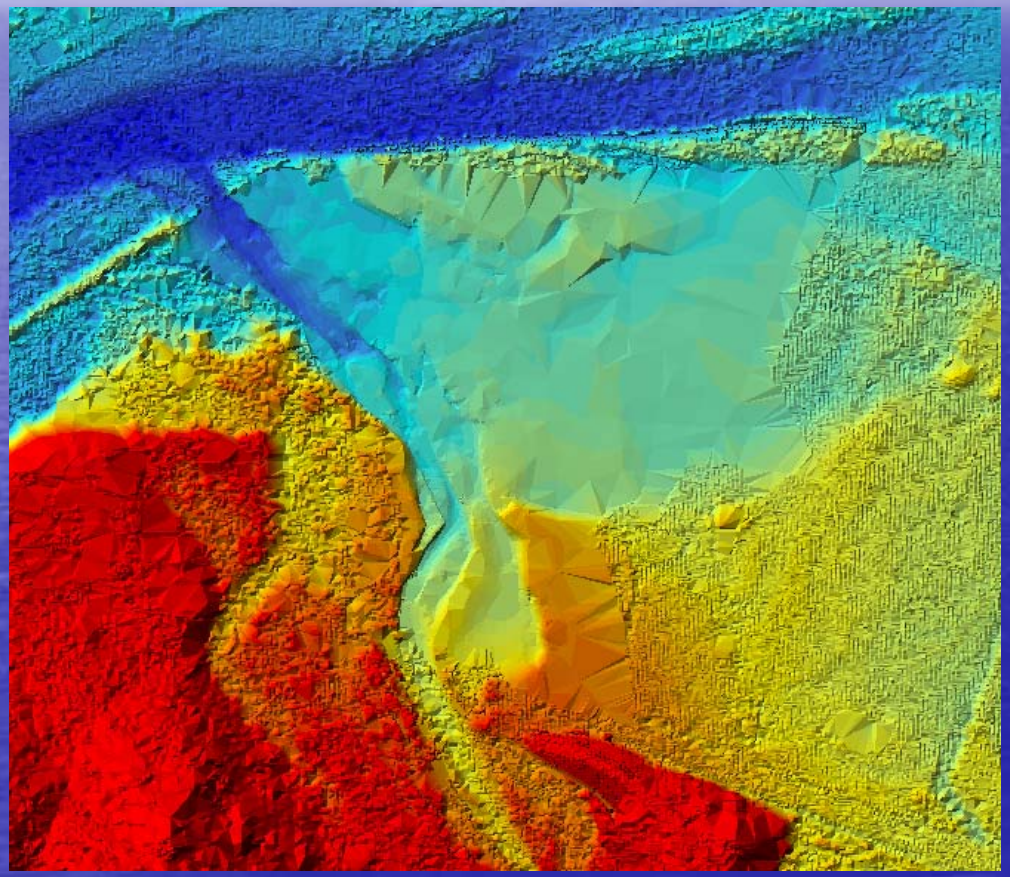
Expected Flow Paths



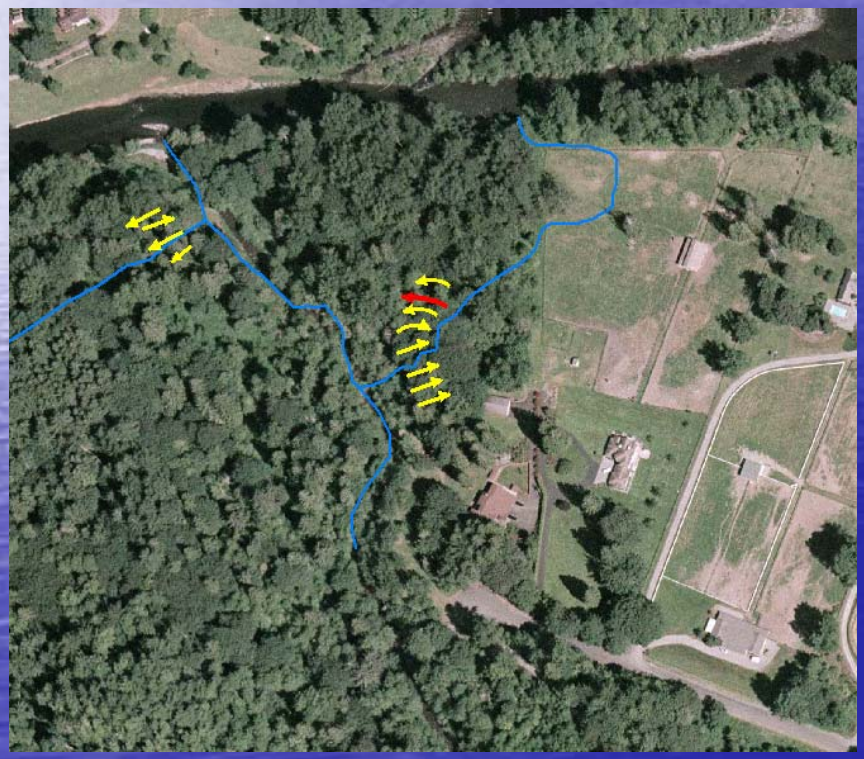
- Main Channel
- Over bank paths

However...

LiDAR shows a Historical Delta

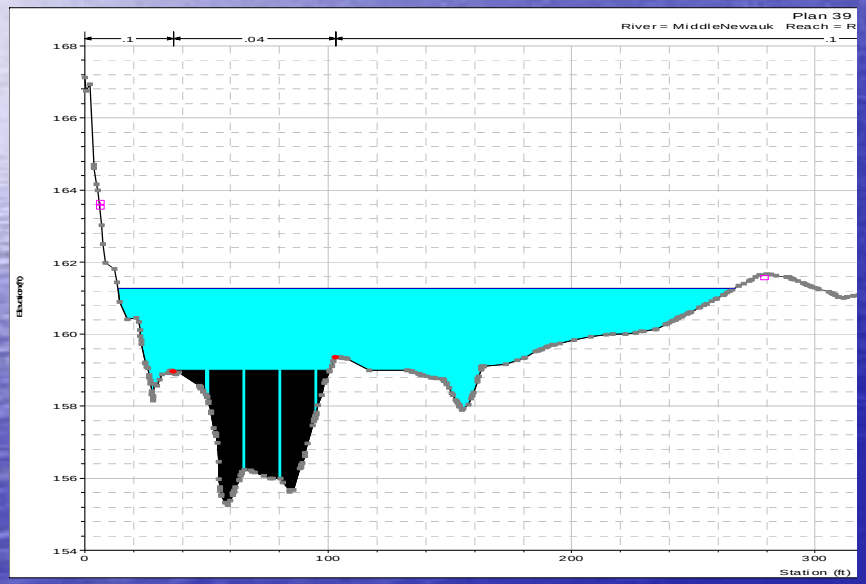


Existing Conditions Model Design



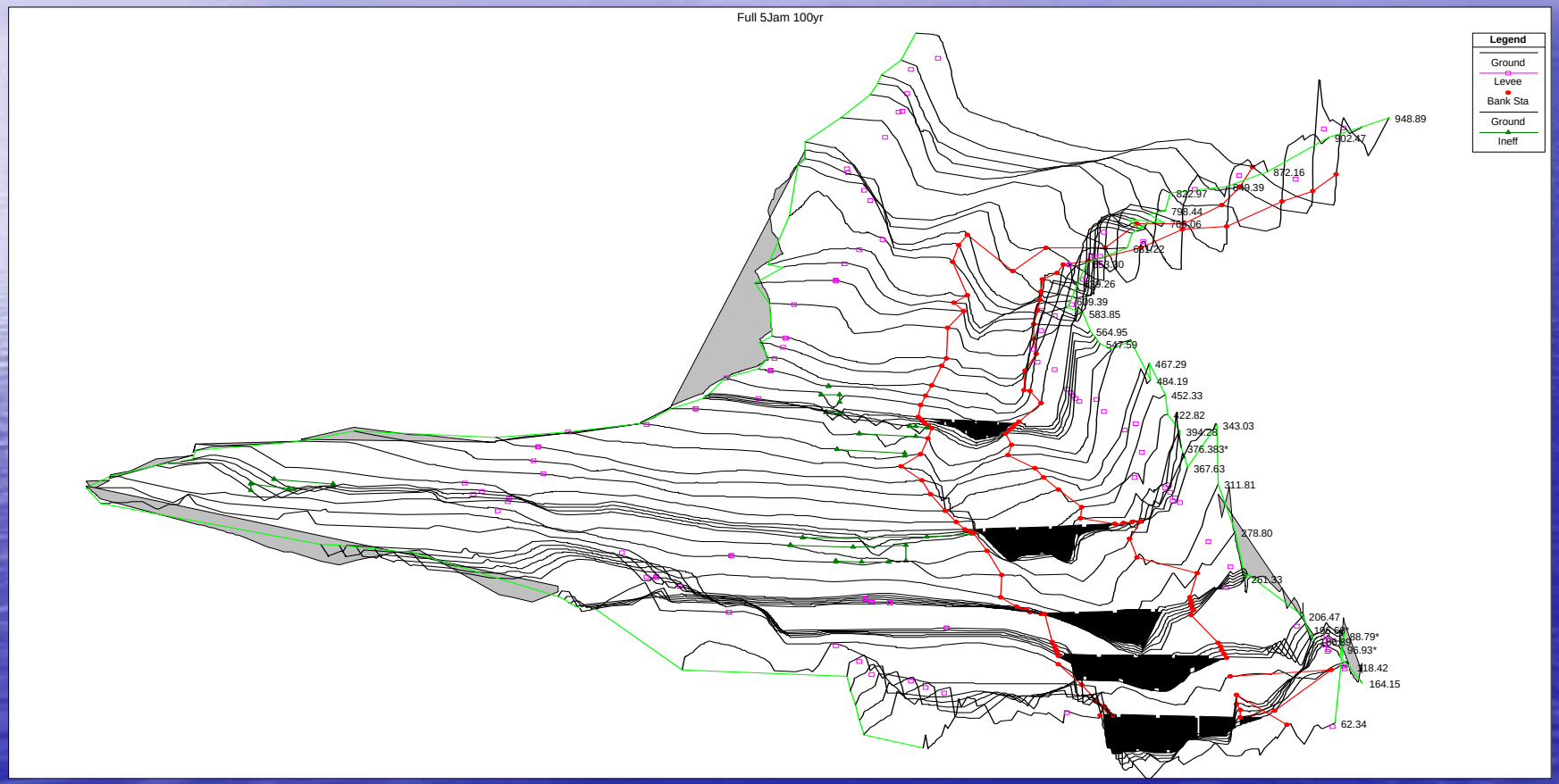
- Cross-section alignment
- Divide not absolute
- Flows Exchange between reaches at higher flood flow rates
- Low point in divide shown with red arrow

Numerical Representation of Placed Large Woody Material



- Concept Abstracted from Tim Abby
- Multiple vertical obstructions allows flow around, and over
- Modified to assume 10-percent porosity
- Paired Cross-sections with obstructions.

An example of Placements of Large Woody Material

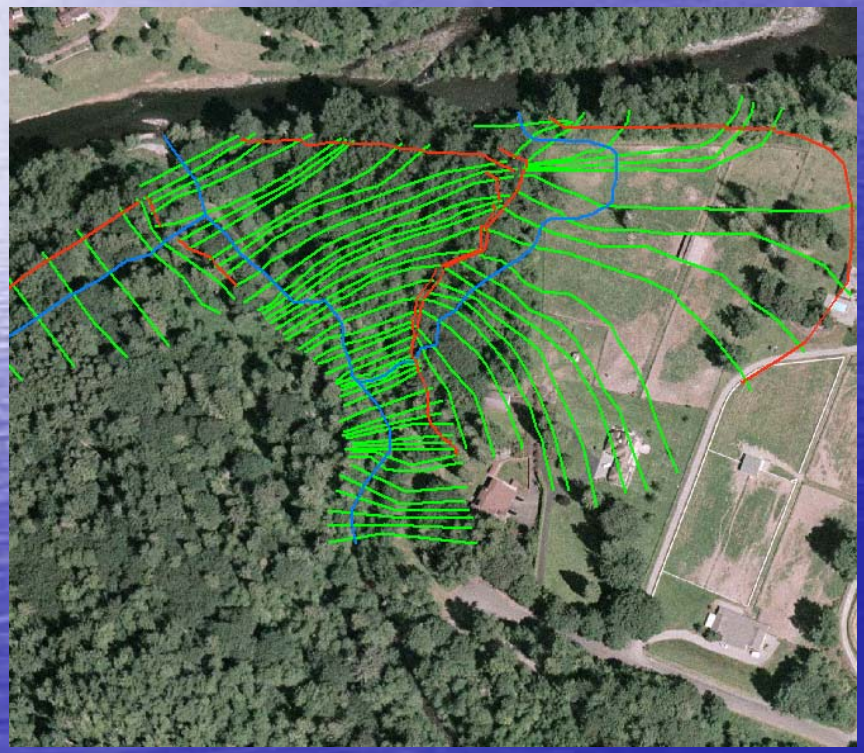


Design of models are dependant on the questions asked

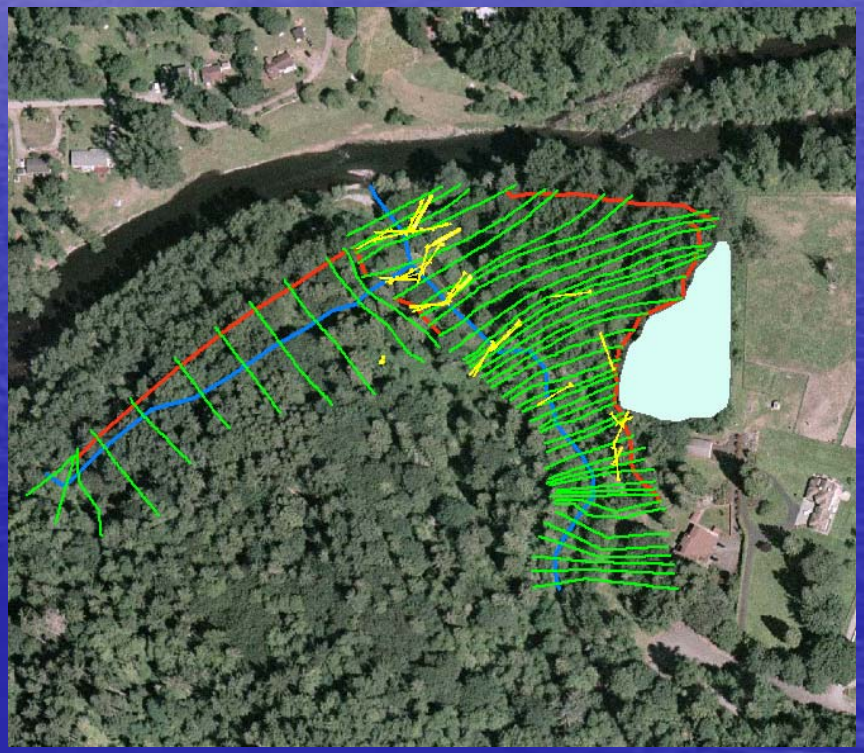
- Is there an increase in over bank flooding in the pasture area as a result of the proposed LWM?
- With the landscape berm in place, what is the expected 100-year water surface elevation of the impoundment area?
- At what frequency is the over bank flooding expected to occur in the proposed impoundment area?
- What are the projected benefits gained from this project design with respect to flooding extents?

Design Methods for Simulating Flow Exchanges

Existing Conditions



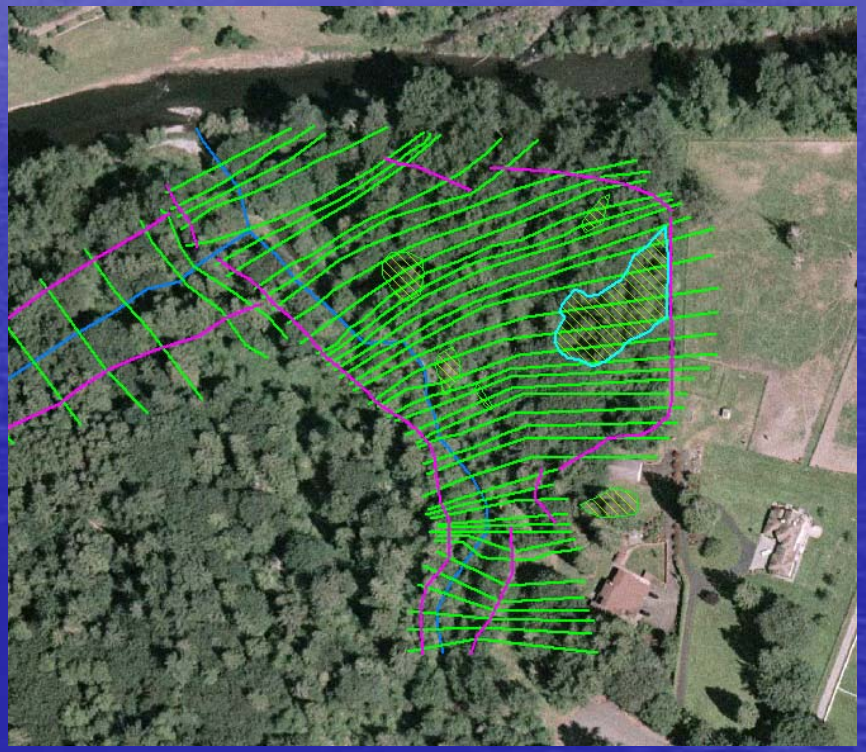
Landscape Berm: Full Containment



Design Methods for Simulating Flow Exchanges

Landscape Berm:
Short Loop Reach

Landscape Berm:
Extend Cross-sections



Projection of Flooding

Results attempt to answer the flowing questions:

- Where will flooding occur?
- At what flow rates will flooding occur?
- How deep will flooding be?

Thank you!

Photos shown were taken by
Project team members