When 1D Modeling Isn’t Enough
Modeling the Walker River in Yerington, NV

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What can we learn from the Walker River?

- Every project has its own story and characteristics that will influence how it should be studied and how best to communicate the results for optimal adoption/acceptance

- Lessons learned from the 1D and 2D modeling

- Specific modeling approaches for 2D modeling

- How will Yerington use this data moving forward? *A look through the Risk MAP lens*
- Yerington is farming and mining community
- Relies on irrigation from the Walker River
- At the same time the terminus of the Walker River (Walker Lake) is drying up
- History of flooding
- History of sedimentation
- Repeatedly successful grant applications for mitigation projects (dredging)
- Historically not mapped! Rather, newly mapped due to levee de-accreditation
1D Model – Initial Approach

- Reduced discharges
- New survey (along stream corridor) and topography (covering greater Yerington)
- De-accredited levee and other earthen berms
- Probable split flows
1D Model – Initial Approach

- **HEC-RAS Steady State Model**
  - Two Primary Reaches
    - Walker River
    - Walker River Split (through City of Yerington)
  - Lateral Weirs
    - Split flow loss from Walker River
    - Return flow (recharge) to Walker River
  - Five Model Scenarios
    - Accounting for one levee, two earthen berms, and floodway
1D Model – Study Reaches

- **Walker River** (12.6 miles)
  - 5 Bridges
  - 2 Inline Weirs
  - 2 Earthen Berms (LB)
  - 1 Levee (RB)

- **Walker River Split** (5.5 miles)
  - No Structures Modeled

- **Walker River Overflow** (0.5 miles)
  - Connection to Split (Floodway)
1D Model – Model Scenarios

- Model Scenarios
  - With “Levees”
  - Without Upstream Earthen Berm
  - Without Downstream Earthen Berm
  - Without De-accredited Levee
  - Floodway

- Total Model Runs
  - 18
  - Includes Optimization
1D Model – Split Flow

- **Walker River 100-Year**
  - 6,000 cfs

- **Split Flow Loss**
  - 4,860 cfs
    - Maximum Over Study Reach – W/O Levee Scenario
    - 2,460 cfs
      - Upstream of Levee

- **Walker River Recharge**
  - 640 cfs
1D Model – Floodway Analysis

- Walker River cannot convey the 100-year flow without exceeding the allowable 1-foot surcharge, resulting in a split floodway
- Conveyance channels to the dominant split flow path had to be identified
1D Model – Mapping Results
Results Compared Against 1997 Flood

- More accurately reflects the risk than the effective maps, but...
- Does not capture the flow downstream of Bridge Street that occurred in the 1997 flood
Communicating the Results

- Flood Risk Review meeting
- Technical data presented
- Review and comment deadline was established
Subsequent Yerington/FEMA Interaction

- City requested additional time for review
  - Request granted

- City requested that the Walker River floodplain be mapped using a 2D model
  - Request granted

- Additional “check-in” calls by both sides have occurred subsequently, including recent communication from the City stating that a local engineering firm will be doing some mitigation work they’d like incorporated into the model
2D Model Approach

- FLO-2D selected
- HEC-RAS/FLO-2D hybrid
- HEC-RAS determined inflow
- Hydraulic structures
- 40-foot grid cell
- No channels (canals)
- Detailed Manning’s
- Width Reduction Factors (WRF)
Inflow/Outflow

- Steady state
- 48-Hour simulation
- RAS/FLO-2D balance
Hydraulic Structure Survey (Leveraged)

- 17 culverts
- Rating tables
- HY-8 v7.3
“High” Resolution

- 40-foot grid cells
- 11.4-mi² model domain
- 196,500 grid cells
- 48-hour simulation
- 55-hour run time
- Land use type & roughness
- Aerial imagery
- CVFED guidance
- Higher roughness in lieu of WRF in “small” structure urban areas
Manning’s Roughness - Interpolated

- Shapefile
- Interpolated
- Large commercial buildings
- Walls: WRF 1.0
- Doors & low level glass: WRF = 0.0
2D Model - Results

- Higher resolution of floodplain in overflow areas
- Flow downstream of Bridge Street
- Better correlation with 1997 flood
Current Day Status

- Modeling completed and additional products are being finalized
- A meeting is tentatively planned for June/July
- Some additional products are planned to be completed after the meeting
- Heading into the next meeting in a Risk MAP state of mind
A Look Forward Through the Risk MAP Lens

- Build messaging around technical analysis
  - Requires proper framing of issues
  - Needs to be compelling
  - Stress the benefits of the ancillary products yet to come
    - Depth grids
    - Scenarios

*Let the Process Build the Partnership*

*Leverage the Partnership into Mitigation*
Communicating the Results

The analysis incorporates Yerington’s field conditions

Resulting in accurate modeling of flooding in Yerington
Communicating the Results

Correlation with 1997 flood

Flooding in downtown Yerington at the RC Market along Bridge Street, January 4, 1997.

Flooding in downtown Yerington, looking south at the intersection of West and Bridge Streets, January 4, 1997.

100-YR Flow Depth (ft)
- 0.010 - 0.489
- 0.500 - 0.989
- 1.000 - 2.999
- 3.000 - 5.380
- 5.381 - 13.380

[Map showing flood depth in feet]
Communicating the Results

Structure Damages: 10-Year Storm
Communicating the Results

Structure Damages: 50-Year Storm
Communicating the Results

Structure Damages: 100-Year Storm

- Total Loss: $12,473
- Total Loss: $4,996
- Total Loss: $7,988
- Total Loss: $0.00
Closing Out the Project

- Gain insight in our next meeting on how best to support Yerington on the remaining products
- Deliver a suite of products to the City to prepare them for the issues they’ll face:
  - Risk communication
  - Mitigating the risk in their community for years to come
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