Modeling Approaches:
Watershed Modeling & the Amite River Basin model case study

Sam Crampton (Dewberry)
Ehab Meselhe (Tulane University)

November 15, 2018
Building Community Based Water Planning, Monitoring, Management and Forecasting Systems

Ehab Meselhe, PhD PE, Tulane University

November 15 - 9:00 am – 10:30 am
COMMUNITY-BASED WATERSHED MANAGEMENT APPROACH

• Integration of Social and Technical components
• Approach is not about software/hardware. It is about the community, process, and policies
• Risk reduction strategies must draw from and based on:
  • Community needs
  • Available (and sustainable) resources/capacities
  • Federal regulations and policies
• Training and education is often a forgotten component
COMMUNITY-BASED WATERSHED MANAGEMENT APPROACH

• Technical Components:
  • Goals and objectives
  • Design of modeling approach
  • Design of data/monitoring programs
  • Develop/apply suite of modeling tools (inland watersheds, urban, coastal, ocean)
  • Quality control, long-term maintenance, and access
  • Update/enforce ordinates to strike a balance between managing/regulating developments (economy) AND public safety and quality of life
COMMUNITY-BASED WATERSHED MANAGEMENT APPROACH

• Additional Considerations
  • Consider the frequent nuisance flooding and the extreme weather events
  • Plan for population shifts and growth and accommodate economic development activities
  • Take advantage of substantial increase in information availability and significant computing resources
How is flood stage estimated in coastal areas?

How is flood stage estimated in Inland watersheds?
Flooding from Harvey-like events may not be prevented...but ... We indeed could do A LOT better to prepare and respond ....
One Size Does Not Fit All

Inland Processes

Transition Processes

Gulf Processes
One Size Does Not Fit All
One Size Does Not Fit All
Key Components of an Effective System

• Engagement/communication is just as important as technology
• Key challenge is the buy-in from all levels: community, local, parish, state, and federal
• Focus on the development of a system
  • Sustainable over time – upkeep is just as important as the upfront cost
  • Upgradable – technology evolves; and rapidly!
• Incorporate and fully engage local expertise and balance with fresh ideas
• Decentralize, but maintain consistency
THANK YOU

watershed@la.gov
AMITE RIVER NUMERICAL MODEL

DATASET WORKSHOP

SAM CRAMPTON, JERRI DANIELS - DEWBERRY

NOVEMBER 15, 9:00 am – 10:30 am
What is the Amite River Flood Model?

**Hydrology**
How much stormwater runoff?

**Hydraulics**
How high will it get?

**Consequences**
Economic & Life Safety Consequences

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**The Hydrologic Cycle**
- Precipitation
- Condensation
- Evaporation
- Snowmelt and Runoff
- Infiltration
- Evapotranspiration
- Plant Uptake
- The River

**Hydrologic Model**

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**Consequences Images**
- Flooded streets
- Flooded buildings
- Flooded cars
- Flooded area with a sign that says: "When Flooded, Turn Around Don't Drown!"

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**Additional Information**


What is the Amite River Flood Model?
What is the Amite River Flood Model?

- Nearly 1,200 miles of rivers, creeks, canals and bayous
  - Wide variety of conditions
    - Hydrologic conditions are similar to many areas of the state
- Includes hydrology, hydraulics and consequence assessments
- Tool to support engineers, scientists, planners, regulators
Project Goals

• Provide stakeholders with the tools to defensibly and cost-effectively:
  • Quantify potential impacts of flood control projects, developments and plans
  • Quantify socio-economic impacts of flood projects
  • Ensure that any future analysis considers system-wide impacts
Data Collection and Collaboration

- Extensive data research and coordination
  - Existing and proposed survey data
  - Existing and proposed models
  - Stream gaging
  - High water marks
    - 374/451 HWMs assessed as good
  - LiDAR collection
  - GIS data including tax parcels and information
Model Selection Considerations

- **Technical Solution**
  - Suitable for the unique geography and needs of LA

- **Cost and Maintenance**
  - Affordable solution
  - Continued software development/enhancement

- **Community of Users**
  - Making a solution that is accessible to the Louisiana community of users
What Models Are Being Used?

- HEC-SSP
  - Statistical analysis
- HEC-HMS
  - Hydrologic modeling
- HEC-RAS
  - Hydraulic modeling
- HEC-FIA
  - Consequence assessment
- HEC-WAT
  - Model integration and risk assessment
How will stakeholders use the model?

1. Obtain existing (baseline conditions) model from Center for River Studies
2. Incorporate project conditions or land use plans into model
3. Revise project design or plan to mitigate impacts
4. Assess impacts of proposed project/land use plan
5. Revised model returned to the Center for River Studies
Benefits to Louisiana Stakeholders

• Tool to assess flood control projects assessing impacts on a watershed scale with insight into economic and life safety implications

• Models that are usable by the local Louisiana engineering community; building capabilities and supporting the local economy

• Costs are only incurred to refine and update project conditions by eliminating the cost of existing conditions modeling
  • Value of the existing conditions model is estimated at over $4 million including leveraged data from other agencies
  • Ensures stakeholders use a consistent quality model baseline
Project Schedule

**Data Collection**
- Existing data collection completed July 2017
- Survey Collection completed August 2018
- USACE survey received early 2018
- LiDAR data completed August 2018

**Modeling**
- Floodplain modeling in progress: Completion December 2018
- Economic/life loss modeling in progress: February 2019

**Deployment**
- Deploy to LSU Center for River Studies February 2019
- Updated stakeholder meetings
Testing of the Model

• Validation
  • Re-creating historical floods (including 2016) to ensure model accuracy

• Testing
  • Proof-of-concept by assessing the impacts of:
    • Dredging the lower Amite River
    • Construction of the Darlington Reservoir
    • Future land use plan

• Other potential applications:
  • New and modified levee systems
  • Channelization, dredging
  • Regional detention
Modeling Challenges

• Current limitations in HMS
  • Limited rain-on-grid support for RAS

• Current limitations in RAS
  • Limited rain-on-grid functionality – Enhancements coming
  • Bridges in 2D area – Enhancements coming
  • Stability of 1D/2D coupling – Possible future enhancements
  • Communications with HEC on limitations

• Challenges
  • Run times are large ~10 hours
  • Possible but not straightforward to check portions of models in and out
Assessing the Consequences
HEC-FIA: Flood Impact Assessment
Grids Only Analysis
Structure Inventory Attributes
Structure Occupancy Types
Structure Occupancy Types
Impact Areas Defined
Results 2016 (First Draft)

## Urban Damage Summary by Impact Areas

<table>
<thead>
<tr>
<th>Impact Areas</th>
<th>Struct Damage ($1000)</th>
<th>Content Damage ($1000)</th>
<th>Car Damage ($1000)</th>
<th>Other Damage ($1000)</th>
<th>Total ($1000)</th>
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### Detailed Life Loss Report

**for alternative August2016_Event**  
**for event August2016_Event**  
**for time window August2016_Event**

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<th>Category</th>
<th>Num People Under 65 (2 PM)</th>
<th>Percentage Under 65 (2 PM)</th>
<th>Num People Over 65 (2 PM)</th>
<th>Percentage Over 65 (2 PM)</th>
<th>Num People Under 65 (2 AM)</th>
<th>Percentage Under 65 (2 AM)</th>
<th>Num People Over 65 (2 AM)</th>
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<td>120120</td>
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<td>11383</td>
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<tr>
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<td>13</td>
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<td>1665</td>
<td>13</td>
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<tr>
<td>Warned/Mobilized</td>
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<td>13</td>
<td>12252</td>
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<tr>
<td>Total Life Loss</td>
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<tr>
<td>In Buildings</td>
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<td>23</td>
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</table>
### Results BLE Data

**Urban Damage Summary**

<table>
<thead>
<tr>
<th>Impact Areas</th>
<th>Stud Damage ($1000)</th>
<th>Content Damage ($1000)</th>
<th>Car Damage ($1000)</th>
<th>Other Damage ($1000)</th>
<th>Total ($1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascension</td>
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<td>East Feliciana</td>
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</table>

**Working Together for Sustainability and Resilience**

*Louisiana Watershed Initiative*
THANK YOU

watershed@la.gov