Andrea Carson
Collaboration and Public Participation Center of Expertise
14 November 2018
By the end of this presentation, you will know the following:
- What is the MHT?
- Why is USACE using the MHT?
- How is USACE using the MHT?

How could your organization use the MHT?
Overview: Multi-Hazard Tournament

What is a Multi-Hazard Tournament (MHT)?

- A condensed, accelerated version of Shared Vision Planning that couples serious gaming with collaborative decision-making for planning for multiple hazards (e.g. flood, drought, water quality, sea level rise, etc.)
- Involves participants from wide variety of fields
- Assists regulators, planning authorities, and communities with developing effective hazard plans using stakeholder input

What objectives can the MHT achieve?

- Identifying (and educating participants on) the costs and tradeoffs among various strategies for solving problems – and the values that inform those tradeoffs.
- Identifying (and educating participants on) strengths and weaknesses in various strategies to reduce risk.
- Creating new collaborations to address common problems
- Improving communication among stakeholders
Why is USACE hosting MHTs?

1. USACE cannot do it alone
   – We need to work with knowledgeable partners
2. Regional focus on actual problems
3. Shared Vision Planning and Stakeholder Engagement opportunities
4. Test and Utilized Developed Tools
5. Exploration for Future Investments & Operations

AND...there are many other potential applications.
Shared Vision Planning...

...Integrates tried-and-true:
– Collaboration
– Systems Modeling, &
– Planning

into a practical forum for water resource management decisions;

ALWAYS ask:
“How is the model going to be used?“
“Who is going to use the model”? 

SVP means involving stakeholders in the technical analysis – in the data & technical relationships
Shared Visioning Planning: Multi-Hazard Tournaments

**Traditional SVP**
- Coarse level, trade-off analysis
- Iterative nature
- Collaborate with Stakeholders

**New MHT Concept**
- Serious Gaming; Competitive Element
- Adult Learning, Experiential
- Team-based Approach
- Utilize model as decision support tool
- Allows for failure in order to learn what works best and why

Overview: Multi-Hazard Tournament
Building the Multi-Hazard Tournament: An IWRM planning process

- Stakeholder engagement using 6-step planning process
  - Problems
  - Opportunities
  - Existing Conditions
  - Formulate Alternatives
  - Evaluate Alternatives
  - and Visualize/Select Alternatives

- Allows stakeholders to embrace their competitive and creative nature to recommend plans allowing for failure in order to learn what works best and why.
Overview: Translating Information into the Game

Data Inputs
- Climate (Precipitation)
- Physical
  - Elevation
  - Land Cover
- Human Geography
  - Property Values
  - Demographics
- Geopolitical
  - Parks and Recreation
  - Infrastructure

Action
- Watershed Master Plans
  - Problem Areas Identified
  - Adaptations Options
  - Costs

Simulation
- Hydrology
- Hydraulics
- Water Quality

Analysis
- Floodplain Areas
- Infiltration
- Habitat Changes
  - Riparian Forest
  - Wetlands
- Water Quality Loading
  - TSS
  - *E. coli*
- Recreation
- Property
  - Damage
  - Value

Game
- Decisions
  - Damage Center
  - Adaptation Options

Metrics
- Flood Impacts
- Water Quality
- Water Resources
- Riparian Corridors
- Recreation
Overview: Multi-Hazard Tournament

- Facilitator
- Teams
- Referees
- Tournament creators and implementers
- The “Fans” (Observers)
Fig. 2. The IDT Process. The IDT is an iterative process that uses a game format to arrive at an informed decision on next steps for proactive drought management and research.
There are 3 foundational pieces that are required to carry out every tournament:

1) Problems or risks to be addressed (aka “hazards”)
2) Adaptation Options (Management Measures) to be explored, and
3) Impacts that can be measured

Conditions in which MHT can be applied:

1. The system is vulnerable to a set of hazards,
2. Actions exist that can reduce the impact of such hazards,
3. The system contains competing interests,
4. The system is constrained which means there is no single or set of actions that can be applied to reduce the risk in the system without some tradeoffs across competing interests, and
5. The competing interests are willing to explore possible mutually beneficial solutions.
Limited Resources can achieve:
• Sensitization
• Systems Thinking
• Relationship-Building
• Identification of Problems and/or Priorities
• Qualitative understanding of risks, impacts, tradeoffs, and mitigation options
• Paper-based interface

Medium Resources can achieve:
• Objectives of Limited Resources, and
• Quantified risks, impacts, and risk mitigation options, costs, constraints, tradeoffs and feedbacks (w/only partially quantified synergies)
• Excel-based interface (w/ basic geographic info)

Ample Resources can achieve:
• Objectives of Limited & Medium Resources, and
• Highly quantified risks, impacts, and risk mitigation options, costs, constraints, tradeoffs and feedbacks.
• Planning & Decision-Making level of analysis
• Web-based interface (w/ more geographic info)
Costa Rica Drought Tournament

- Emphasized community priorities under different resource availability levels, did not evaluate alternatives.

- Participants were members of the farming community and from small scale producers to International, Govt., NGO, and private sector institutions

- Concept of ‘building’
San Antonio Multi-Hazard Tournament
Turn 1 - Water Deficit (dry)

Adaptation Options

Select from list

Unit Cost

Investment Level

Option Quantity

Cost for Option

Submit!

Example of budget allocated and how much money has been spent

Each slider represents how much money is being spent on a particular adaptation option

These 4 boxes show the different “metrics” or impacts your adaptation option choices have on the basin. 30% of your teams’ score is based on how your teams’ choices affect these metrics.

Your team will choose a combination of adaptation options to address the hazard in the scenario

Your team can choose to create an ‘innovation’ that is not on the pre-defined list of adaptation options. You will work with referees to decide on its impact on the metrics

This bar represents what could be expected for the scenario without any investments in adaptation options

This bar describes the change in the risk WITH an investment in adaptation options. This bar will move based off adaptation option selection.
<table>
<thead>
<tr>
<th>Adaptation Options</th>
<th>(What are these?)</th>
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<tbody>
<tr>
<td>Stream Restoration and NCD for Urban</td>
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<td>Low Water Crossings, Channelization,</td>
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<td>Widening, and Hardening</td>
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<td>Zoning</td>
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<td>Buy Outs</td>
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<td>Protection of Property</td>
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<td><strong>Water Quality</strong></td>
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<td>E.c (126 MPN/dL)</td>
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<td>TN (5 mg/L)</td>
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<td>Aquatic Communities</td>
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<td>Capacity</td>
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<td><strong>Quality of Life</strong></td>
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San Antonio Multi-Hazard Tournament (x2: Bexar County & Southern Counties)
Overview: Navigating the Master Plans

Description of Damage Center and potential adaptation Options

- **Description of Damage Center**
  - In an area experiencing rapid growth, there is anticipated to be significant increases in flooding. There are relatively few structures currently endangered by the current floodplain, however additional development will increase peak flows and result in higher base elevations.

- **Description of Traditional Infrastructure**
  - Regional detention facility that will provide 1,178 sc. ft of storage.

- **Traditional Infrastructure Cost**
  - $30,000,000

**Source of Information**

**Plan Benefits**

- **Description**
  - DC1
  - All DCs

- **Recreation**
  - $0
  - $131,911

- **WQ - TSS Removed**
  - 4,339 lbs
  - 9,242 lbs

- **WQ - E - coll Removed**
  - 116T MNP
  - 304T MNP

- **GW Recharge**
  - 59,527 m$^3$
  - 9,328 m$^3$

- **Habitat - Forest**
  - $91,000
  - $150,400

- **Habitat - Wetland**
  - $76,000
  - $152,700

**Flood Damages**

- **2 year flood**
  - $479,400
  - $1,117

- **10 year flood**
  - $479,800
  - $1,117

- **100 year flood**
  - $584,400
  - $16,217

**Vulnerable Population (cost)**

- **2 year flood**
  - $51,800
  - $174,200

- **10 year flood**
  - $51,800
  - $167,600

- **100 year flood**
  - $62,800
  - $1,210

**Round 1 Summary**

<table>
<thead>
<tr>
<th>DC Name</th>
<th>Trad</th>
<th>Infil</th>
<th>Freeboard</th>
<th>Buyout</th>
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Case Study: Lower Virginia Peninsula Coastal Resilience Tournament

Lower Virginia Peninsula Coastal Resilience Tournament

Legend

NACCS Vulnerability Value
High
Low

Vulnerability is a composite of population density and infrastructure index, social vulnerability, and environmental and cultural resources index.
Outcomes

• Supports a more systematic understanding of the constraints, potential solutions, and priorities of decision-makers within a watershed.

• Plans and decision points are brought to life

• Raise awareness of flood, drought and water quality threats and adaptation options; best approaches are identified

• Relationship-building and fostering partnerships with the Corps
Discussion –
How could your organization use the MHT?
Questions?
Questions to start planning an MHT?

Logistics
• What would you like to achieve through your tournament? (Relationship-building/Educating/Planning/Decision-making)
• How much time and money do you have to spend?
• Who are you trying to reach?

Content
• What are the problems (aka hazards) you’re having in the Basin?
• What solutions would you like to analyze to mitigate these hazards?
• What scenarios would you like to test your problems against (climate, budget, etc.)?
• Where do you want the MHT to focus on? Whole basin, specific locations?
The tournament consisted of three rounds (Figure 4), each of which began with a scenario consisting of climate and water supply information, drought impact information, and climate outlooks (Table 1).

- **Round 1**
  - Year 1 of a multi-year drought. Water supply was 75% of values during the 2012 drought.

- **Round 2**
  - Year 3 of a multi-year drought. Water supply was 55% of values during the 2012 drought.

- **Round 3**
  - Year 5 of a multi-year drought. Water supply was 35% of values during the 2012 drought.

*Figure 4: North Platte Natural Resources District drought tournament round description.*
Cedar Rapids Regional Multi-Hazard Tournament
San Antonio Multi-Hazard Tournament (x2: Bexar County & Southern Counties)
Overview: Navigating the Master Plans

Adaptation Options

DC1 Information

Description of Damage Center
In an area experiencing rapid growth, there is an anticipated significant increase in flooding. There are relatively few structures currently endangered by the current floodplain; however, additional development will increase peak flows and result in higher base elevations.

Description of Traditional Infrastructure
Regional detention facility that will provide 1,178 sf of storage.

Traditional Infrastructure Cost
$30,000,000

Source of Information

Plan Benefits

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<td>Recreation</td>
<td>$0</td>
<td>$131.9K</td>
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<td>WQ - TSS Removed</td>
<td>4,335 lbs</td>
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<td>1167 MPN</td>
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Flood Damages

- 2 year flood: $479.4K, $1.1M
- 10 year flood: $470.8K, $1.1M
- 100 year flood: $584.4K, $16.2M

- Vulnerable Population (cost): 2 year flood: $51.5K, $174.3K
  - 10 year flood: $51.6K, $167.6K
  - 100 year flood: $52.6K, $132.7K

Round 1 Summary

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Overview: Navigating the Master Plans

Master Plan Elements

Description of Damage Center and potential adaptation Options

DC1 Information

Description of Damage Center
In an area experiencing rapid growth, there is anticipated to be significant increases in flooding. There are relatively few structures currently endangered by the current floodplain, however additional development will increase peak flows and result in higher base elevations.

Description of Traditional Infrastructure
Regional detention facility that will provide 1,178 scf of storage.

Traditional Infrastructure Cost
$30,000,000

Source of Information
Overview: Navigating the Master Plans

Model and Simulation Output

Changes in Floodplain

View Different Events
Impact of Adaptation Option Selected with the metrics modeled and analyzed
Overview: Navigating the Master Plans

Budget Tally

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| Description of Traditional Infrastructure |
| Regional detention facility that will provide 1,176 ac-ft of storage. |

| Traditional Infrastructure Cost |
| $30,000,000 |

| Source of Information |
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Overview: Navigating the Master Plans

DC1 Information

Description of Damage Center
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Description of Traditional Infrastructure
Regional detention facility that will provide 1,178 ac-ft of storage.

Traditional Infrastructure Cost
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Source of Information
JBSA-Kelly Field Annex

Plan Benefits

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Flood Damages

- 2 year flood: $475.4K, $1.1M
- 10 year flood: $479.8K, $1.1M
- 100 year flood: $584.4K, $16.2M

Vulnerable Population (cost)

- 2 year flood: $151.6K, $174.3K
- 10 year flood: $151.6K, $187.6K
- 100 year flood: $52.8K, $1.2M

Round 1 Summary

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Would you make different decisions after being involved in the tournament?

- Yes: 19
- No: 4

Likelihood to use information learned from the tournament

- Very unlikely: 2
- Unlikely: 4
- Likely: 10
- Very likely: 9

Understanding of differences between upstream and downstream users' priorities?

- Yes: 24
- No: 3

Have you increased your knowledge of risk to various hazards and their impacts?

- Yes: 25
- No: 2
Why SVP for a Watershed Study?

- Non-traditional objectives – frequently poorly formed.
- High degree of collaboration across multiple agencies, each with technical expertise and own missions.
- Need for consideration of inter-relationships through systems modeling.
Top 4 Uses of the Multi-Hazard Tournament:

• Identifying the costs and tradeoffs among various strategies for solving problems

• Identifying strengths and weaknesses in various strategies to reduce risk.

• Creating new collaborations to address common problems

• Improving communication among stakeholders
Gamification for Flood Risk Awareness: this is SERIOUS!

Hunter Merritt, Water Resources Planner
U.S. Army Corps of Engineers, Sacramento District

WEBINAR: Urban Waters Learning Forum
Wednesday, November 14, 2018
Before we get started... do you want to play a game?

Download here (Mac, Linux, PC): www.nevadafloods.org

Watch the tutorial video https://youtu.be/GgoYBNhNHzY
Systems are complex.
San Francisco Bay Model, Sausalito, CA

A brief history of the U.S. Army Corps of Engineers...

- Founded 2 days after the Continental Army (1775)
- Polish and French influence (Corps = “Body”)
- Cartographers, Engineers - Civil & Military
- Primary Missions: Navigation, Flood Control, Risk Reduction
- Since National Environmental Policy Act (1969) – Ecosystem Restoration, Regulatory Missions (Nation’s “Environmental Engineers”)

RECENT HISTORY:

Disaster Response, Infrastructure Assessment, “Mega-Projects”, Watershed Studies, Technical Assistance, And...Non-Structural Flood Risk Reduction (what’s that?)
Teachers Promote Flood Risk Critical Thinking Through Serious Gaming While Meeting Science Standards by Hunter Merritt, USACE Sacramento District

The initial goal of the project was to increase awareness among children and young adults, enabling them to prepare for and take action in case of a flood emergency.

The U.S. Army Corps of Engineers (USACE) Sacramento District has been working with the educational community to reduce flood risk in a novel way by bringing science teachers into the conversation on water management and developing games that help them teach complex subjects and promote critical thinking among their students. Essentially, the approach is to help teachers “play” with flood risk as the topic. The concept is not new, and it is used widely in adult learning, but the name might be counterintuitive: Serious Gaming.

The district’s efforts at promoting flood risk through connections in the field of education started in 2014 by way of a Silver Jackets Interagency Nonstructural Flood Risk Management project called the California Educator Project. The initial goal of the project was to increase awareness among children and young adults, enabling them to prepare for and take action in case of a flood emergency. For the younger children, this resulted in a coloring book that has been widely distributed and even translated into Spanish. However, for the older students, a more nuanced approach was necessary.

What kind of thinking does it take to manage a dam? U.S. Army Corps of Engineers Planner Patricia Fontanet speaks to Advanced Placement (AP) Physics students from Folkston High School in Folkston, California, on the genesis of the Flood Fighter: Nevada game and on her work as a planner in the Corps. The free, educational video game provides a unique and engaging platform for teachers and presenters to introduce complex subjects and system-based solutions for water resource challenges.

The team quickly focused on teachers’ needs and asked what USACE could do to help these teachers educate the next generation of scientific thinkers. Phil Romig, a science curriculum specialist in Sacramento County, offered that computer modeling was likely to be a...
2015 CA Educator: Simulated Water Management Model

http://www.spk.usace.army.mil/Missions/Flood-Risk-Awareness/Education-Resources/
Who remembers this?
WE are the Gamers!

Gamification:

“...the application of game-design elements and game principles in non-game contexts.”

...it is not the same as

Game theory

“...the study of mathematical models of strategic interaction between rational decision-makers.”

(or is it?)
Gamification of Flood Risk?
What could be Next?

UI & Graphical Improvements: Improvement of Flood Fighter user interface as well as graphical enhancements.

Mobile Game: Development of Flood Fighter on iOS and Android smartphones. Once developed, the mobile app would be available for download on iOS and Android stores.

Virtual Reality: Development of Flood Fighter for Virtual Reality simulation on the Oculus Rift platform.

Additional Scenarios (including multi-player): Development of new levels/scenarios for single or multi-player.
Were you able to download it?
Let’s play!

Download here (Mac, Linux, PC): www.nevadafloods.org

Watch the tutorial video https://youtu.be/GgoYBNhNZY
Thank you!

hunter.merritt@usace.army.mil // 916-557-5119