A vision for a more resilient Iowa

The Iowa Watershed Approach

Larry Weber
Director, IIHR—Hydroscience & Engineering
Larry-weber@uiowa.edu
Iowa Watersheds Project

- August 2010, HUD announces $312M for Disaster Recovery Enhancement Fund (DREF) to 13 states in response to flood mitigation efforts
- Iowa received the largest grant of $84.1M of CDBG funds
- $10M allocated to watershed demonstration projects directed toward flood damage reduction and educational programming
- $8.8M used for watershed demonstration projects overseen by the Iowa Flood Center
- $800K was used to establish the first WMAs in Iowa
A vision for a more resilient Iowa

The Iowa Watershed Approach

Iowa Watersheds Project Goals

Specific Project Goals:

- Maximize soil water holding capacity from heavy precipitation
- Minimize severe scour erosion and sand deposition during floods
- Manage water runoff in uplands under saturated soil moisture conditions
- Reduce and mitigate structural and nonstructural flood damages
Phase I: Hydrologic Assessment & Modeling

- Understand flood hydrology in the watershed
- Estimate watershed response to different rainfall events
- Quantify the impact of small-scale flood mitigation practices
- Identify areas in subwatersheds for project construction

A vision for a more resilient Iowa
The Iowa Watershed Approach

Available at iowafloodcenter.org
A vision for a more resilient Iowa

The Iowa Watershed Approach

Soap Creek Watershed

1986 – Formation of Soap Creek Watershed Board – 28E
1988 – Study identifies 154 project locations to reduce flooding
2012 – 132 watershed projects complete
Phase II: Project Construction & Implementation

- Consult with WMA on location/type of projects
  - 75% cost share assistance available to landowner; 25% local (landowner) contribution
- Engage volunteer landowners to construct projects in identified sub-watersheds
- Monitor impacts of constructed projects and evaluate feasibility at a larger scale
A vision for a more resilient Iowa
The Iowa Watershed Approach

Beaver Creek: 6 wetlands
Otter Creek: 5 on-road structures, 19 farm ponds, 5 WASCObS
Soap/Chequest Creek: 22 farm ponds, 106 WASCObS
A vision for a more resilient Iowa

The Iowa Watershed Approach

Engagement of the WMAs, watershed partners, and private landowners was vital to the IWP’s success!
A vision for a more resilient Iowa

The Iowa Watershed Approach

National Disaster Resilience Competition

- **Funder:** US Dept. of Housing and Urban Development, in collaboration with the Rockefeller Foundation
- **Funding level:** $1B; CDBG; Superstorm Sandy
- **Applicant:** State of Iowa, Iowa Economic Development Authority (IEDA)
- **Iowa Watershed Approach program developed by IFC in consultation with many, many partners**
A vision for a more resilient Iowa

The Iowa Watershed Approach
NDRC Qualifications

- Presidential Declared Major Disaster in 2011, 2012, or 2013
- Benefit to low to moderate income (LMI) areas
- Environmental and/or infrastructure most impacted and distressed and unmet recovery needs areas (MID-URN) present
A vision for a more resilient Iowa

The Iowa Watershed Approach

Iowa Watershed Approach: $96,887,177
IWA Goals

- Reduce flood risk
- Improve water quality
- Increase resilience
- Engage stakeholders through collaboration and outreach/education
- Improve quality of life and health, especially for vulnerable populations
- Develop a program that is replicable throughout the Midwest and the United States
IWA Project Description

- **Built of the framework of the IWP**
- Establish a WMA
- Develop a hydrologic assessment and watershed plan
- Deploy monitoring equipment
- Work with *project coordinators* and volunteer landowners to implement projects that reduce the magnitude of downstream flooding and improve water quality
- Assess project benefits based on monitoring data and modeling
Data Collection & Monitoring
A vision for a more resilient Iowa
The Iowa Watershed Approach

http://ifis.iowafloodcenter.org/ifis/en/app/
A vision for a more resilient Iowa

The Iowa Watershed Approach

http://iwqis.iowawis.org/app/
A vision for a more resilient Iowa

The Iowa Watershed Approach

Project Construction & Implementation

- Engage volunteer landowners to construct projects in subwatersheds
- Practices may include:
  - Floodplain restoration or easements, farm ponds, terraces, buffer strips, bioreactors, wetlands, saturated buffers, storm water detention basins, sediment detention basins
- 75% cost share assistance available to landowners; 25% local (landowner) contribution
- Practices will follow NRCS guidelines and specifications
- Monitor impact of constructed projects and evaluate feasibility at a larger scale

Engagement of WMA, Alliance, and private landowners will be vital to project success
A vision for a more resilient Iowa
The Iowa Watershed Approach

Existing BMPs

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready 0</td>
<td>Ready 0</td>
<td>Ready 0</td>
<td>Ready 33</td>
<td>Ready 15</td>
</tr>
<tr>
<td>Processing 0</td>
<td>Processing 0</td>
<td>Processing 3</td>
<td>Processing 5</td>
<td>Processing 8</td>
</tr>
<tr>
<td>Completed 0</td>
<td>Completed 0</td>
<td>Completed 20</td>
<td>Completed 0</td>
<td>Completed 6</td>
</tr>
<tr>
<td>Metadata 0</td>
<td>Metadata 0</td>
<td>Metadata 0</td>
<td>Metadata 0</td>
<td>Metadata 0</td>
</tr>
</tbody>
</table>

Overall Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>48</td>
</tr>
<tr>
<td>Processing</td>
<td>8</td>
</tr>
<tr>
<td>Completed</td>
<td>474</td>
</tr>
<tr>
<td>Metadata</td>
<td>73</td>
</tr>
</tbody>
</table>

Digitized at Iowa State University GIS Facility, in cooperation with IA DNR GIS personnel

IHR
Iowa Flood Center
Agricultural Conservation Planning Framework: Staff Creek Watershed

Conservation Practices:
- Drainage Water Management
- Grassed Waterways
- Buffer Strips
- Water and Sediment Control Basins (WASCOBs)
- Nutrient Removal Wetlands
- Saturated Buffers

Further Information: http://northcentralwater.org/acpf/
Grassed Waterways
A vision for a more resilient Iowa
The Iowa Watershed Approach

Nutrient Removal Wetlands
A vision for a more resilient Iowa

The Iowa Watershed Approach

IIHR Water Quality Sensor Setup

Turbidity
Water Temp, pH, SC, DO
Nitrogen (NO$_x$)

Flow
Inlet
Outlet

Slough Creek
CREP Wetland

0 0.5 1 mi

0 1,000 2,000 ft

IIHR Water Quality Sensor Setup

Turbidity
Water Temp, pH, SC, DO
Nitrogen (NO$_x$)
A vision for a more resilient Iowa
The Iowa Watershed Approach

**MIKE SHE**
30 m cells (18K nodes)
Calculations performed on each 0.25 acre grid cell
Spatially distributed land use, soils, and radar rainfall

**MIKE 11**
5 branches
6.5 steam miles
Cross section spaced ~100 m and ~50 m through wetland
A vision for a more resilient Iowa

The Iowa Watershed Approach

Rainfall Intensity (mm/h):
- 1.6”
- 2.7”

Discharge (m³/s):
- 9% peak reduction
- 13% peak reduction

Meas: Water Depth in
Sim: Qin
Sim: Qout
A vision for a more resilient Iowa
The Iowa Watershed Approach

2015 Measured Wetland Performance

Rainfall Intensity (mm/h)

<table>
<thead>
<tr>
<th>Date</th>
<th>Rainfall (&quot;')</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1-15</td>
<td>3.6</td>
<td>-12%</td>
</tr>
<tr>
<td>5-1-15</td>
<td>3.6</td>
<td>-23%</td>
</tr>
<tr>
<td>5-31-15</td>
<td>5.3</td>
<td>+1%</td>
</tr>
<tr>
<td>6-30-15</td>
<td>5.1</td>
<td>+14%</td>
</tr>
<tr>
<td>7-30-15</td>
<td>3.8</td>
<td>-19%</td>
</tr>
<tr>
<td>8-29-15</td>
<td>3.7</td>
<td>+1%</td>
</tr>
<tr>
<td>9-28-15</td>
<td>1.3</td>
<td>-44%</td>
</tr>
<tr>
<td>10-28-15</td>
<td>3.3</td>
<td>+77%</td>
</tr>
</tbody>
</table>

NOx In
NOx Out
Water Depth: In

NOx-N (mg/l) vs. Water Depth (ft)
A vision for a more resilient Iowa

The Iowa Watershed Approach

2016 Measured Wetland Performance

Reduced wetland performance (N-removal)
**A vision for a more resilient Iowa**

**The Iowa Watershed Approach**

<table>
<thead>
<tr>
<th>Description</th>
<th>IIHR Approach</th>
<th>EPA STEPL Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Physically-based, spatially distributed hydrologic and water quality modeling along with field data</td>
<td>Excel spreadsheet model</td>
</tr>
<tr>
<td>Spatial scale</td>
<td>~1 acre to watershed scale</td>
<td>Watershed</td>
</tr>
<tr>
<td>Time scale</td>
<td>Single events to continuous multi-year simulations</td>
<td>Annual</td>
</tr>
<tr>
<td>Estimating baseline load</td>
<td>Determined by watershed-specific hydrology and agricultural management conditions</td>
<td>Predefined areal loading rates assigned to a particular land cover and soil type based on EPA region</td>
</tr>
<tr>
<td>Estimating BMP performance</td>
<td>Represent the practice in the watershed model and determine practice performance under variable hydrologic conditions</td>
<td>Average annual removal efficiency (%) assigned to each BMP based on EPA region; <strong>does not take into account varying hydrologic conditions</strong></td>
</tr>
</tbody>
</table>

**Graph:**
- **Slough Creek Wetland**
- **STEPL**

- **Load Reduction (%)**:
  - 2014: 39"
  - 2015: 36"
  - 2016: 46"
  - 3 yr avg: 30%
IWA Program Timeline

A vision for a more resilient Iowa
The Iowa Watershed Approach

Iowa Watershed Approach (IWA) Program Timeline:

- **Year 1 (2016)**: WMA Formation, Sensor Deployment
- **Year 2 (2017)**: Hydrologic Assessment, Baseline Data Collection and Analysis
- **Year 3 (2018)**: Watershed Plan, Detailed Model Development and Scenario Analysis
- **Year 4 (2019)**: Select Implementation Sites, Project Design, Evaluation of Projects
- **Year 5 (2020)**: Project Construction/Implementation
- **Year 6 (2021)**: Overview of Watersheds Requiring WMA Formation:
  - North Raccoon
  - E. Nishnabotna
  - W. Nishnabotna
A Vision for Iowa's Future

The Iowa Watershed Approach: Reducing Flooding and Advancing Water Quality

HUD Disaster Resilience Grant to Iowa: $96.9 million
The Iowa Watershed Approach (IWA) is a vision for Iowa’s future that voluntarily engages stakeholders throughout the watershed to achieve common goals, while moving toward a more resilient state.

Nine Participating Watersheds:
- Clear Creek Watershed
- Dubuque/Bee Branch Watershed
- East Nishnabotna Watershed
- English River Watershed
- Middle Cedar Watershed
- North Raccoon Watershed
- Upper Iowa Watershed
- Upper Wapsipinnicon Watershed
- West Nishnabotna Watershed

http://www.iihr.uiowa.edu/iwa/
A vision for a more resilient Iowa

The Iowa Watershed Approach

Iowa Flood Center
The University of Iowa
100 C. Maxwell Stanley Hydraulics Laboratory
Iowa City, IA 52242

319-384-1729
www.iowafloodcenter.org

Twitter / Facebook