State of Missouri
2012 Governor's Award for Quality and Productivity
Executive Summary

Team Name: Emergency Action Planning for High Hazard Potential Dams in Missouri

Nominator: Ryan P. Mueller, Director of Water Resources, Missouri Department of Natural Resources

Nominating Department: Missouri Department of Natural Resources

Category: Technology in Government

Executive Summary: Dams and reservoirs play an important part in enhancing the quality of life in Missouri and often serve multiple functions for communities such as flood protection, water supply, irrigation, erosion control, and recreation. For these reasons, many of the reservoirs in Missouri are located in or adjacent to populated areas where they can provide citizens with a number of the benefits mentioned above. The Missouri Department of Natural Resources recognizes these needs and is committed to helping ensure the integrity of these structures and the safety of nearby residents. For this reason the Department's Water Resources Center is leading an effort to develop Emergency Action Plans, or EAPs, for all regulated high hazard potential (HHP) dams in Missouri by 2014. To date over 200 EAPs have been completed.

Approximately 470 of the 681 regulated dams in Missouri are classified as high hazard potential (HHP) dams. HHP dams receive this designation due to the potential for significant loss of life and/or property and infrastructure damage if the dam were to fail and release a floodwave downstream.

An EAP is a written plan that provides guidance for evaluation of potential dam safety emergencies, emergency response activities and potential evacuation of downstream dwellings and facilities. EAPs contain critical information such as emergency call lists and notification procedures, lists of downstream residents, structures and infrastructure, a flood inundation map, and a list of available resources to draw upon during an emergency.

A critical component of an EAP is a flood inundation map that depicts the downstream area of flooding, arrival time of the floodwave, and the locations of dwellings and other critical infrastructure that would be impacted if a dam were to fail. Project team engineers develop inundation maps using Light Detecting and Ranging (LiDAR) data that represents the best available topographic elevation data (i.e. a highly accurate map of the landscape). LiDAR data is a cost effective alternative to surveyed cross sections and allows for additional flexibility during the modeling process. LiDAR data is managed with Geographic Information System software (ArcView) where stream cross sections are constructed at key locations such as bridges, culverts, and at numerous locations along the stream profile. The ArcView layers are then moved into HEC-RAS (software) where hydraulic analyses are performed. HEC-RAS results are then transferred back into ArcView where the maximum water surface elevation (the zone inundated by the floodwave) is mapped on both a topographic map and an aerial photograph.

EAPs are presented to dam owners and county emergency management officials during regional workshops. Dam owners verify the accuracy of the information in the plan and complete the EAP in cooperation with the county Emergency Management Director. This project exemplifies a successful working partnership that has raised the awareness of dam safety issues while enhancing emergency preparedness and response capabilities.

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NOMINATION FORM

I. GENERAL INFORMATION

Department: Missouri Department of Natural Resources

1. **Project or team name.** Emergency Action Planning for High Hazard Potential Dams in Missouri

2. **List the name of all team members, job titles, state agency department, and/or community organization.**

   Allen, Brian – Acting Director of Environmental Services Program, Missouri DNR
   Baumer, Clifford – Engineer, Natural Resources Conservation Service
   Blevins, Cara – AOSA, Missouri DNR
   Cheavens, Steve – SEMA Area H Statewide Coordinator
   Clay, Bob – Chief Engineer Dam Safety Program, Missouri DNR
   Daniels, Michael – Emergency Management Director, Warren County Missouri
   Ellis, Rod – Surface Water Section Chief, Missouri DNR
   Lloyd, Glenn – Engineer Dam Safety, Missouri DNR
   Mueller, Ryan – Director of Water Resources, Missouri DNR
   Simon, Paul – Engineer Dam Safety, Missouri DNR
   Stack, Ryan – Engineer Dam Safety, Missouri DNR
   Toler, Terry – SEMA Area G Statewide Coordinator
   Vitello, Diane – Engineer Surface Water Section, Missouri DNR
   Vitello, Matt – Engineer Interstate Waters Section, Missouri DNR
   Weller, Michael – Engineer Surface Water Section, Missouri DNR
   Wilson, Tammy – Management Analysis Specialist, Missouri DNR

3. **Describe the project:** Approximately 470 of the 681 regulated dams in Missouri are classified as high hazard potential (HHP) dams. HHP dams receive this designation due to the potential for significant loss of life and/or property and infrastructure damage if the dam were to fail and release a floodwave downstream. The goal of this project is to develop Emergency Action Plans (EAPs) for all regulated HHP dams in Missouri by 2014. An EAP is a written plan that provides guidance for evaluation of potential dam safety emergencies, emergency response activities and potential evacuation of downstream dwellings and facilities. EAPs contain critical information such as emergency call lists and notification procedures, lists of downstream residents, structures and infrastructure, a flood inundation map, and a list of available resources to draw upon in an emergency. This project represents a working partnership between the Department, dam owners and county emergency response officials to complete EAPs for HHP dams while raising awareness of dam safety issues and emergency preparedness. To date, over 200 EAPs have been completed.

4. **Nomination category.**
   (*Check only one)*

   ☐ INNOVATION
   ☐ CUSTOMER SERVICE
   ☐ EFFICIENCY / PROCESS IMPROVEMENT
   X TECHNOLOGY IN GOVERNMENT

5. **Describe why you selected this nomination category.** A critical component of an EAP is an inundation map that depicts the downstream area of flooding, arrival time of the floodwave, and the locations of dwellings and other critical infrastructure that would be impacted if a dam were to fail. Project team engineers develop inundation maps using Light Detecting and Ranging (LiDAR) data that represents the best available topographic elevation data (i.e. a highly accurate map of the landscape). LiDAR data is managed with Geographic Information System software (ArcView) where stream cross sections are constructed at key locations such as bridges, culverts, and at numerous locations along the stream profile. The ArcView layers are then moved into HEC-RAS (software) where hydraulic analyses are performed. HEC-RAS results are then transferred back into ArcView where the maximum water surface elevation (the zone inundated by the

floodwave) is mapped on both a topographic map and an aerial photograph. This methodology was developed by project team engineers and has been presented to external agencies such as the United States Geological Survey and Association of State Dam Safety Officials for technical review.

II. BACKGROUND

1. **When did the team begin its work?** Project planning, methodology development, data acquisition and stakeholder engagement began in September 2008.

2. **When did the team implement this project?** Project implementation began in September 2009. This included finalization of the standard Emergency Action Plan template for Missouri, modeling of dam breach scenarios, developing flood inundation maps, and initiating regional workshops to share information with dam owners and county Emergency Management Directors.

3. **How long has the project been implemented?**

☐ 0 - 3 Months	☐ 4 – 6 Months	☐ 7 - 9 Months
☐ 10 – 12 Months	X 12 or more	☐ Completed

III. RESULTS/ACCOMPLISHMENT

1. **What did the team accomplish?**

This project has heightened the emergency preparedness and response capabilities of dam owners and county Emergency Management Directors regarding dam safety issues. Prior to this initiative, only 34 EAPs had been completed for regulated HHP dams (out of 470 HHP dams statewide). Today there are over 200 completed EAPs and progress is ongoing to complete an EAP for every regulated HHP dam in the state. In addition, this process has raised the awareness among the county Emergency Management Directors, dam owners and others in the emergency response community regarding dam safety issues.

2. **Which of the following describes the benefits of the accomplishment?** (Check all that apply and provide an explanation)

X cost reduction	X time savings	☐ increased effectiveness
☐ improved process	X other: Enhanced public safety and emergency preparedness	

Explanation: Cost is reduced, time is saved and product accuracy is gained by using high resolution LiDAR data instead of field surveys. Literally millions of LiDAR data points are collected by an aerial survey (airplane and data collection equipment) over project areas. This amount of data would be impractical and unaffordable to collect using traditional survey methods. Field verification of LiDAR data ensures accuracy and thus the quality of resulting inundation maps.

3. **Explain how the accomplishments of the team are beyond regular duties and responsibilities** (*150 words or less*).

EAPs are required to be completed by dam owners and submitted to the Department's Dam and Reservoir Safety Program. However, given the low rate of EAP completion at the start of this project (only 34 EAPs completed out of 470 HHP dams), the Department decided to utilize staff expertise and technical capabilities to assist dam owners with completion of their EAPs and to raise awareness with county and local emergency management personnel. This was accomplished through development of a standard EAP template, summarization of design and construction information for each regulated HHP dam, modeling of dam breach scenarios and development of flood inundation maps, and by providing information and education to dam owners and county emergency response officials during regional workshops hosted by Department staff.

IV. MEASUREMENT/EVALUATION

1. **Describe how the success of the project was measured and what outcomes were achieved.** (description should not exceed *300-500 words)*

The success of this project is measured directly through the completion of EAPs for HHP dams in Missouri. Prior to initiation of this project, less that 10 percent of regulated HHP dams in Missouri had a completed EAP (34 out of 470). Not only has this project lead to the development of over 200 completed EAPs for HHP dams, it has also raised awareness of dam safety issues with the county Emergency Management Directors and other emergency response personnel throughout the state. A completed EAP represents a working partnership between the dam owner (regulated entity), Department of Natural Resources, and various emergency response personnel. While the Department completes the portions of the EAP beyond the means of the dam owner to provide (i.e. inundation map) the dam owner must finish the EAP in cooperation with the emergency response personnel. This makes the dam owner responsible for and familiar with the plan, while establishing the relationship with the emergency management personnel at the outset. The concrete result is a collection of valuable information that will be used to prevent loss of life and/or significant property damage during a dam safety emergency. The goal of this project is to develop an EAP for all regulated HHP dams in Missouri by 2014.

2. **Are the benefits derived from this project:** (Check only one.)

X Recurring ☐ One-time

3. **If recurring, how will the benefits be sustained?** (Explain in 150 words or less)

Information contained within EAPs provides guidance for dam safety evaluations, notification, emergency response and evacuation any time a dam safety emergency were to occur. Information in EAPs is updated periodically to reflect current conditions (e.g. downstream residents, list of critical infrastructure, flood inundation area, etc.). In addition, engineers within the Department's Dam and Reservoir Safety Program will periodically review the EAPs when the HHP dam is due for safety inspection and/or permit renewal consideration.

V. RECOGNITION/AWARDS

1. **Has this project ever been nominated for the Governor's Award for Quality and Productivity? If yes, when?** No

2. **If yes, for which category was it nominated?** NA

3. **Has this project received any other awards or recognition in the past? If yes, describe.** NA

VI. NOMINATOR'S INFORMATION

NOMINATING DEPARTMENT

Name	Signature	Telephone Number	E-Mail Address
Ryan P. Mueller		(573) 751-1134	Ryan.mueller@dnr.mo.gov

VII. DEPARTMENT COORDINATOR INFORMATION

DEPARTMENT

Name	Signature	Telephone Number	E-Mail Address
Jennifer Terry	Jennifer Terry	751-6788	Jennifer.Terry@dnr.mo.gov

VIII. DEPARTMENT DIRECTOR APPROVAL

DEPARTMENT DIRECTOR'S NAME	DEPARTMENT DIRECTOR'S SIGNATURE*
Sara Parker Pauley	Sara Parker Pauley