

COORDINATION EFFORTS WITH EMERGENCY MANAGEMENT COMMUNITY PAY OFF DURING THE

COLORADO 2013 FLOODS

THE COLORADO DAM SAFETY BRANCH

INTRODUCTION

In 2012, the Colorado Dam Safety Branch began coordination activities with the Colorado Division of Homeland Security and Emergency Management (CDHSEM) in the context of reducing the potential consequences of dam failure flooding. Through 10 months of meetings, presentations, and discussions, members of the Colorado State Dam Safety and State Emergency Management communities became familiar with each other's capabilities, tools, and practices. The flooding event in Colorado's Front Range in the fall of 2013 provided an opportunity to test those relationship building efforts. The floods overwhelmed a significant number of small low hazard dams and tested the capabilities and performance of high and significant hazard dams. Activities that the Colorado Dam Safety Branch initiated with the emergency management community prior to the flooding event facilitated a faster and more coordinated response to dam-related emergencies during the floods. The lessons learned during this event highlight the need for state dam safety officials to focus attention on such coordination efforts in anticipation of future events.

THE COLORADO DAM SAFETY BRANCH

The Colorado Dam Safety Branch of the State Engineer's Office (DSB) is made up of twelve engineers stationed throughout the state. For purposes of water management and administration the State Engineer's Office divides the state into the seven major river basins. Figure 1 shows the seven water divisions and state dam safety engineer (DSE) office locations, strategically placed near the dams to which DSEs are assigned.

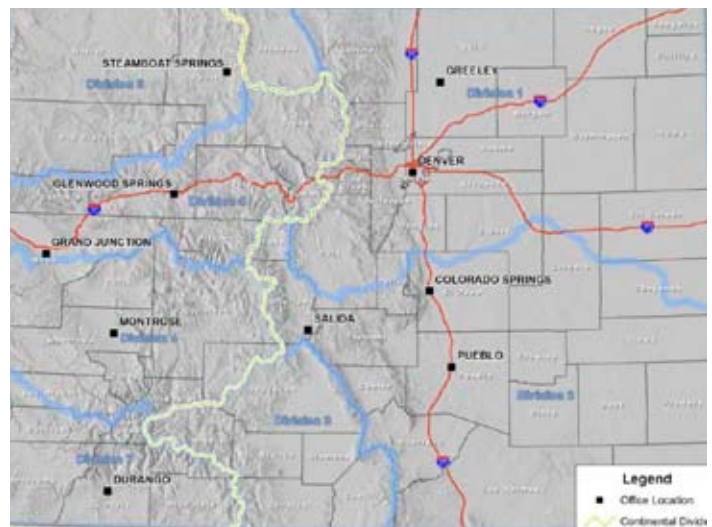


FIGURE 1. DAM SAFETY ENGINEER LOCATIONS WITHIN COLORADO WATER DIVISIONS (BY RIVER BASIN) AND COUNTIES.

THE COLORADO DIVISION OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT

The CCDHSEM also has statewide responsibilities and a similar system of decentralized field staff stationed across the state. The CDHSEM field region boundaries are shown in Figure 2. CDHSEM Regional Field Managers are assigned to each field region and administer all-hazard preparedness responses in their regions.



FIGURE 2. COLORADO DIVISION OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT REGIONS

DAM SAFETY AND EMERGENCY MANAGEMENT COORDINATION ACTIVITIES

Personnel changes within the Branch in the fall of 2011 resulted in Emergency Action Planning (EAP) activities receiving a fresh look and renewed focus. In addition to performing their core dam safety inspection duties, engineers from within the Branch were asked to increase their EAP-related activities. Included in that request was a requirement that all DSEs complete online training in the National Incident Management System (NIMS).

NIMS Training

NIMS is a national level emergency management tool that creates a common platform for communication between entities involved in an emergency situation of any type. It was felt that if members of the DSB had a basic understanding of the system used by emergency responders, they would be able to integrate more effectively into that system in an emergency.

The primary system adopted by the Emergency Management in the United States is the Incident Command Structure. The National Incident Management System (NIMS) is the training used to acquire various levels of knowledge of the Incident Command Structure for use in an all-hazards response. Online NIMS training is provided by the Federal Emergency Management Agency (FEMA) Emergency Management Institute. According to FEMA:

“NIMS provides a systematic, proactive approach to guide departments and agencies at all levels of government, nongovernmental organizations, and the private sector to work seamlessly to prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity, in order to reduce the loss of life and property and harm to the environment.”

The NIMS training consists of the following general categories:

- Preparedness
- Communications and Information Management
- Resource Management
- Command and Management
- Ongoing Management and Maintenance

The web-based NIMS introductory training is not exhaustive, but it provided the DSEs with the ability to ‘speak the same language’ as emergency responders.

Coordination Meetings

Starting in December 2012, Branch Chief Bill McCormick and DSE John Hunyadi engaged members of the Planning, Operations, and Mitigation sections of the CDHSEM to develop relationships and better understand each other’s duties and areas of common interest. CDHSEM is responsible for an “all-hazards” approach to emergency management throughout the state. These coordination meetings were used to highlight the hazards presented by dam failures and put both agencies in a position to work together more effectively in the event of a dam safety emergency. The goal of these engagement activities was to improve the response and reduce potential consequences in the case of a dam safety emergency.

From December 2012 to August 2013, five bi-monthly meetings were held. Typical meeting agenda items included: CDHSEM organization and typical functions; DSB organization, functions, and capabilities; typical preparedness functions of both agencies; plans for additional preparedness activities (i.e. EAP updating and inundation mapping activities); and opportunities for additional consequence-based risk reduction activities. These meetings enabled each of the organizations to learn of each other’s personalities, capabilities, and resources. Through these meetings the need for a dam safety “mission capability set” was established, as was the opportunity for DSB personnel to gain access to the CDHSEM online emergency communication system, WebEOC.

Figure 3 shows a portion of the information contained in this mission capability set. This process was intended to be used by the CDHSEM in the event of a dam safety emergency, in which they would get a request from a partner agency for expertise with dams.

The understanding of possible joint activities of the two agencies was further expanded during the Colorado wildfire season in the summer of 2013. Although wildfires are not typically thought of as a failure mode for dams, the DSB used this opportunity to share information from their dam safety database with emergency responders during several of these events that summer, to raise their situational awareness, and to enable additional interaction. Figure 4 shows a typical map generated and shared with the CDHSEM response team.

In addition to the meetings, mission statement development and wildfire interactions, members of the CDHSEM staff also taught DSB staff McCormick and Hunyadi about the WebEOC emergency communication and alert system and network used in Colorado. WebEOC is discussed in more detail below.

WebEOC

The WebEOC system is an incident management, communication, and alerting system software package that provides a platform for communication and coordination among multiple entities during all-hazard emergencies. Incident management software from a variety of vendors is available and widely used throughout the country. In Colorado, WebEOC (from Intermedix, Inc.) is used by CDHSEM, which then encourages local emergency managers at county and municipal levels to also utilize the system as well.

ESF / AGENCY	MISSION PACKAGE NAME / IDENTIFIER	
ESF-11 DNR	ESF-NG-0004a-DAM ENGINEERING ASSESSMENT TEAM	
TASK & PURPOSE		MISSION FUNCTION
<ul style="list-style-type: none"> The Dam Engineering Assessment Team rapidly deploys to areas regionally affected by storms or unusually high stream/reservoir levels to: <ol style="list-style-type: none"> Provide technical assistance in mitigation against potential Dam failure. Provide technical assistance in damage assessment and infrastructure rehabilitation. 		<ul style="list-style-type: none"> Dam Engineering Assessment Stream flow monitoring technical assistance Damage assessment Dam mitigation assessment
SUPPORTING ESF'S / AGENCIES		MISSION CAPABILITY LIMITATIONS
<ul style="list-style-type: none"> ESF-11 Department of Natural Resources / Division of Water Resources. ESF-12 Energy – Hydro Electric Dams ESF-3 Public Works 		<ul style="list-style-type: none"> Limited to travel and assessment of 200 miles in an 18 hr. period Additional affected areas require additional field personnel.
RECOMMENDED PERSONNEL		RECOMMENDED EQUIPMENT
<ul style="list-style-type: none"> 1 x CO DWR Dam Safety Engineer 1 x CO DWR Water Commissioner/Hydrographer 		<ul style="list-style-type: none"> 1 x 4-wheel drive pickup 1 x Weather Radio 1 x Cell phone 1 x 800 Mhz Radio 1 x digital camera
SUPPORT REQUIREMENTS		WORKS WITH OTHER CAPABILITIES
<ul style="list-style-type: none"> Billeting and meal support Fuel Support Internet Services IT Support General Office Supplies 		<ul style="list-style-type: none"> IMT's EOC's Local & State Damage Assessment Teams
N-HOUR SEQUENCE		SPECIAL INSTRUCTIONS
<ul style="list-style-type: none"> N+1 Hour. 		<ul style="list-style-type: none"> Must coordinate with dam owners, on-site municipal personnel, or utility official. Limited to working public right-of-way Must be self-supporting for up to first 72hrs
COST PER 12 Hr. Operational Period		
PERSONNEL	EQUIPMENT	TOTAL COST ESTIMATE
\$720.00	\$200.00	\$920.00

FIGURE 3. EMERGENCY SUPPORT FUNCTION (ESF) - 11 DAM SAFETY MISSION CAPABILITY SET DESCRIPTION.

WebEOC provides a link to communication, situational awareness reports, and resource requests from any WebEOC user. The user groups or “boards” are assigned by State EM field regions shown in Figure 2. At the time of the September 2013 flooding, DSB participation in WebEOC was in the exploratory stages, with only McCormick and Hunyadi trained, connected, and receiving alerts. Although neither was expert in this system at that point, the alerts and situation awareness reports were invaluable to knowing what information was being reported about dams. The DSB was able to communicate with EM partners who did know the system fully, to enable WebEOC tasks of situational awareness reporting and requesting resources for dam safety incidents.

THE RAINFALL EVENT

Starting on September 9, 2013, a slow-moving cold front stalled over Colorado and, clashing with warm humid monsoonal air from the south, resulted in heavy rain and catastrophic flooding along Colorado’s Front Range. Boulder County and other locations along the Front Range reported up to 9 inches of rain in 24 hours and up to 17 inches of rain over the duration of the storm, which ended on September 16th.

As is shown in Figure 5, the National Weather Service’s Hydrometeorological Design Studies Center stated that the return interval for the entire rainfall event was 1000 years in places, and that return intervals between 100 and 750 years occurred throughout the region.

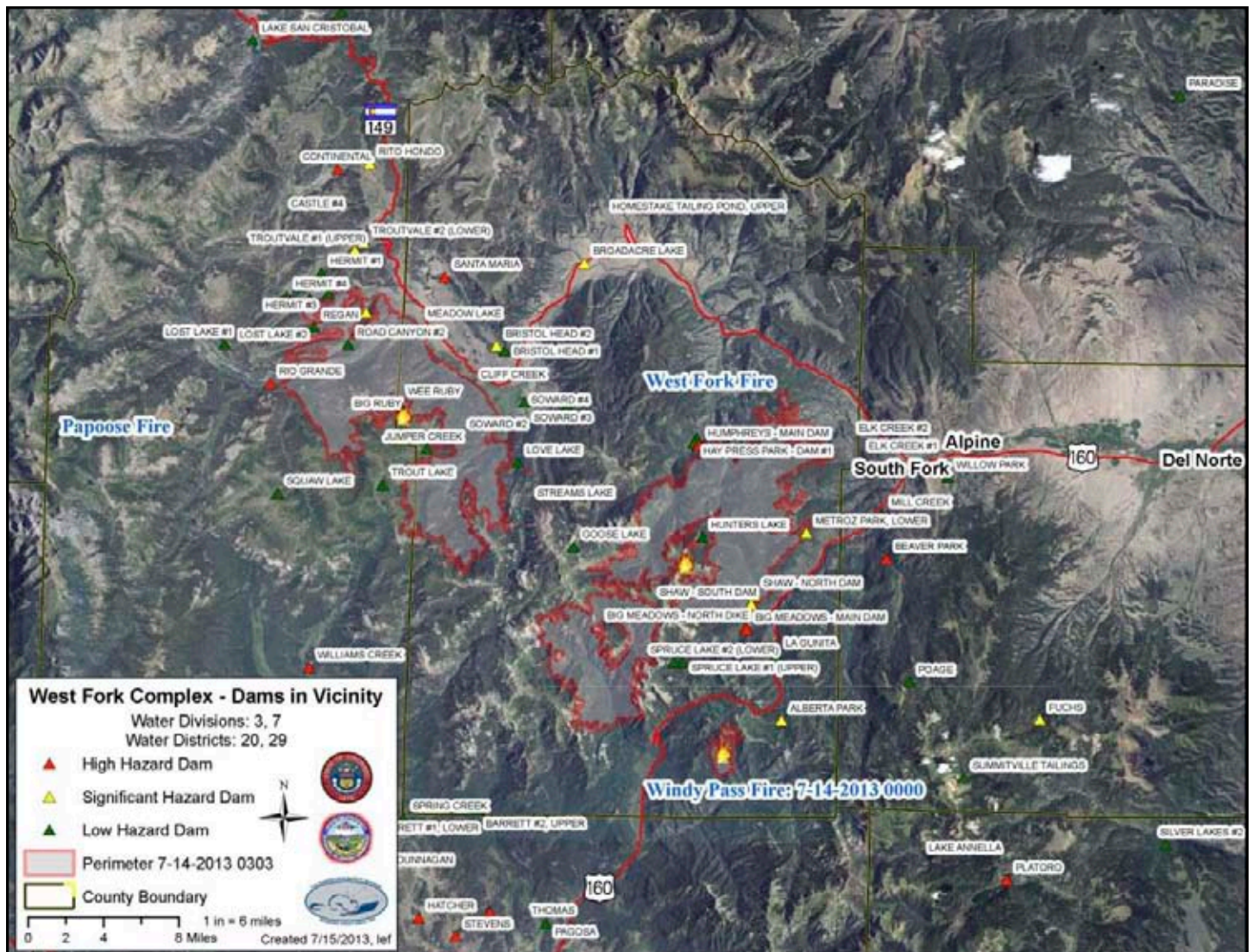


FIGURE 4. MAP OF DAMS RELATIVE TO WILDFIRES PROVIDED TO CDHSEM FOR SITUATIONAL AWARENESS DURING FIRE RESPONSE.

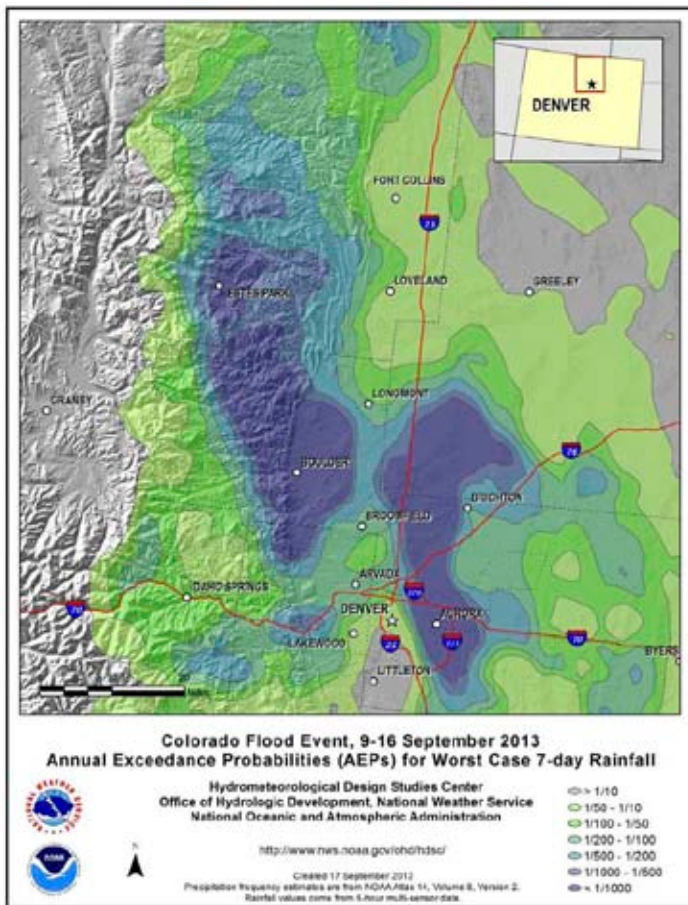


FIGURE 5 – NOAA ATLAS #14 ANNUAL EXCEEDENCE PROBABILITY ANALYSIS OF SEPTEMBER 2013 COLORADO STORM.

The emergency management community in Colorado was responding to innumerable incidents related to the storm, including evacuating stranded people, dealing with road closures, searching for missing people, and among all of this, trying to interpret reports of dams failing and potentially increasing the already severe flooding.

EVENT RESPONSE

As discussed previously, McCormick and Hunyadi were the only two connected to the CDHSEM WebEOC communication system at the beginning of the event. Although they had begun the process of establishing these relationships, there were many locations where the DSB’s integration into the emergency management community was not fully formed at the time of the flood event. During the event, many people within the EM Community looked to the Colorado Dam Safety Branch for information related to dam safety; however it was a surprise to the DSB to find that some went directly to the U.S. Army Corps of Engineers or the U.S. Bureau of Reclamation for technical expertise on non-federal dams, apparently unaware that a dam safety program exists at the state level.

This discovery was made by Hunyadi when a “resource request” was made by the Jefferson County emergency manager in WebEOC for U.S. Army Corps of Engineers dam subject matter experts. Being plugged into WebEOC John responded directly to the resource request, describing the role/capabilities of the Colorado Dam Safety Branch, and received the response, “Well, that’s exactly what I needed; I didn’t know you guys existed!”

The DSB became more integrated with the EM community throughout the flood event. The coordination was helpful for both the DSB and the emergency managers and responders, aiding with response to dam safety incidents, and providing the EM community with information through the Emergency Operation Center (EOC).

EOC participation

As people became aware of the DSB’s existence, more county EMs began to request the physical presence of a dedicated dam safety resource at the county level physical EOC. The DSE’s presence at the EOCs allowed the DSB to communicate directly with emergency managers at both the county and state levels, providing a technical resource for interpreting general and specific dam safety risks and impacts, ongoing situational awareness, and knowledge of dam structures and operations for verification of information being disseminated to the EOCs, media, and general public.

The EOCs were extremely busy and hectic environments, and knowing how to communicate within them was essential. In one case, a DSE was at one of the county EOCs for a few hours, unbeknownst to the people there who were looking for her. Figure 6 shows the typical scene at the EOCs.

The DSB integration into this community was not flawless, but proved to be critical to their ability to function as a valuable part of the response team. The lessons learned by the DSEs during this sudden immersion into a real-life, large-scale emergency response situation hugely advanced recent efforts to communicate with emergency managers and learn how the Dam Safety Branch could/should fit into this important system.



FIGURE 6 - TYPICAL EMERGENCY OPERATIONS CENTER (EOC) SCENE.

Engaging with the emergency management community prior to the event had, to some of the DSEs, seemed like an additional burden to the already heavy workload, but these coordination efforts proved to be critical, as they raised awareness of the dam safety community and resources, and enabled DSB staff to effectively plug into the well-oiled Incident Command Structure machine, providing real value to the emergency response effort. After the event, it was reported that, prior to the DSE presence in the EOCs, the level of stress increased noticeably when dam incidents were reported. With the aid of DSE's presence and technical knowledge, emergency managers reported a greatly reduced level of tension as additional dam incidents were reported.

While managing incidents, the DSB shared rotations to keep the Boulder County, Larimer County, and State EOCs staffed. The typical schedule was to check-in in the morning and evening and stay for as long as necessary to update situational awareness of and mitigate the consequences of ongoing incidents. The DSB developed a Situational Awareness form to use in WebEOC communication and to communicate with the EOC Incident Commander. An example of this form is shown in Figure 7. The information provided in the form included:

- Name of the dam/incident
- WebEOC reference number

- Dam name
- County
- Hazard classification
- Incident description
- Actions taken
- Current status

The DSE assigned to the particular EOC reported the status of known dam safety incidents each morning to the County EM, State EM or the Incident Commander at the EOC; the form was then posted on WebEOC so that emergency management personnel were aware of any potential dam safety hazards in their area. Google Earth was also used to show the locations of any dams of interest and provide a visual of potentially impacted areas downstream.

In addition to regular situational awareness reporting at the EOCs, the branch had also begun a more regimented scheduling of activities and personnel for manning EOCs, following up on incidents, checking on dams of concern, preparing for forensic investigation activities, and performing dam inspections in areas accessible only by helicopter.

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Colorado Division of Water Resources
Office of the State Engineer
Dam Safety Branch

1313 Sherman Street
Denver, Colorado 80202

COLORADO DAM SAFETY BRANCH
EMERGENCY BRANCH SINCE 1988

DAM SAFETY SITUATIONAL AWARENESS REPORT

EOC LOCATION:	
TO: Larimer County ICP	EMERGENCY OPERATIONS CONTACT: Riley Frazer
FROM: Dana Miller	
CONTACT NUMBER: 970-217-6983	
REPORT DATE: 9/21/2013	
REPORT TIME: 10:00 a.m.	

Incident #1:
WebEOC Reference # (if applicable):
Dam Name: Aspen Spa Dam
County: Larimer
Hazard Classification: Low
Description of Incident: Embankment is approximately 12-15' in height and is believed to impound 20 Acre-feet. A landslide has plugged the emergency spillway and the reservoir level is 1-ft below the dam crest.
Threats to the dam include possibility of additional rainfall/runoff that would overflow and overtop the dam due to the spillway being plugged. If this dam fails, it puts Highway 7 at risk.
A tracked excavator has been requested to unplug the spillway to allow storm inflow to be passed.
Current Status: Requested equipment is on site and DWR dam safety engineer is also on site directing the work to clear the spillway. Situation will be stabilized today.

Incident #3:
WebEOC Reference:
Dam Name: Salvation Army, High Peak Camp
County: Larimer
Hazard Classification: Low
Description of Incident: DWR engineer visited the dam on 9/20 and one dam was identified on the camp property that suffered significant overtopping and is unstable. Dam is approx. 10-ft tall and holds less than 10 acre-ft of water.
If additional rainfall comes dam would fail. Potential threat of failure is damage to Hwy 7.
Current Status: DWR Dam Safety Engineer is on-site and is coordinating a contractor to breach the dam and remove the potential threat. This will be done on this

INCIDENTS RESOLVED/REMOVED FROM THE DAILY UPDATE	
Dam	Status
Carnage Hills	• Dam confirmed to have failed

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FIGURE 7 - EXAMPLE OF SITUATIONAL AWARENESS REPORT (SAR) FORM DEVELOPED TO UPDATE EOCs ON DAM SITUATIONAL AWARENESS.

Incident Response

A primary component of the ability of the DSB to respond to incidents was their integration in the EM community. Being directly plugged into the emergency management community gave the DSB access to all state and federal resources being applied to the emergency. Through the EOCs and WebEOC, the DSB was able to directly request resources such as air transport to inaccessible sites for inspection and heavy equipment to clear spillways, lower reservoir levels, and perform controlled breaches of unsafe structures. As the DSB became aware of incidents through WebEOC posts (an example of which is shown in Figure 8), calls from the owner, or other channels, they were able to respond quickly, as outlined in the following examples.

Record #: 1667	Currie Lake Dam. Address is 96 Eiger Road, Livermore, CO 80536.
Event Type: WEBOC Flooding	
Position: ESF #11	Currie Lake Dam is a low hazard dam, approximately 20-ft tall and stores about 50-acre feet.
Name: john.hunyadi	
Phone: 7192580859	Spillway is currently flowing and the spillway is eroding with a 4-ft headcut migrating towards the reservoir. Headcut is currently within 30-ft of reservoir. Spillway breach would flow into small dam downstream.
Date: 09/14/2013 16:37:07	
Attachments:	
Map: Map	
Address/Location: 96 Eiger Road, Livermore, CO	Glacier View Meadows Volunteer Fire Dept. Monitoring ESF #11 - john.hunyadi at 16:37:07 on 9/14/2013
Priority 3 - Medium	Regional Notification Not Submitted
Statewide Significant Events Posted	Update Record

This information is not for public disclosure and is intended for authorized WebEOC users only.

FIGURE 8 - EXAMPLE WEBOC POST.

Button Rock Dam

One incident that was addressed as a result of communication with the emergency management community was the situation at Button Rock Dam. The pilot of a National Guard helicopter rescue mission noted significant flow over the emergency spillway, and nearby residents were hearing reports of the dam failing. No reliable information was available to assess the performance and condition of the emergency spillway, as road access was not possible and the dam's caretaker was evacuated from the site in the midst of the storm.

The Boulder County EOC coordinated with the National Guard on requisitioning a helicopter to transport area Dam Safety Engineer John Batka to reach the site and assess the condition of the dam. He determined that, while flows had eroded the spillway down to bedrock, the dam was performing as designed and not in danger of failing (Figure 9).



FIGURE 9 - PHOTO OF BUTTON ROCK DAM SPILLWAY FLOW AS SEEN FROM THE AIR ON TUESDAY SEPTEMBER 16, 2013.

Aspen Lodge

The night of September 12-13, Aspen Lodge Resort was hit with a debris flow from the west side of the Twin Sisters Peaks. The slide caused extensive damage to resort facilities and clogged the Aspen Lodge Dam spillway with mud and debris (including a 10-ft propane tank). The dam overtopped during the night and into the following day. The owner succeeded in cutting a small notch through the spillway debris, enough to arrest the overtopping. While completing a reconnaissance of the area a week later, Pueblo DSE Mark Perry found that the spillway was still clogged and the reservoir level was about 4 inches below the dam crest.

The floods had washed out two U.S. Highways into Estes Park, and the sole remaining access into the town was CO Highway 7. Aspen Lodge Dam, with a clogged spillway and dangerously high water level, sat about 400-ft upstream of a 3.5 foot-diameter culvert beneath this state highway.

To address the situation, the Larimer County Sheriff submitted a resource request into the WebEOC, but no resources were available. FEMA then picked up the request and ordered resources; however none would be available for quite some time. DSE Mark Perry was informed that the Larimer County EM was placing the highest priority on ensuring that this dam did not fail and cut off all access to Estes Park; however, the county was not able to provide any



FIGURE 10 - PHOTO OF FIRE TRUCK UTILIZED AS A LAST RESORT TO BEGIN TO LOWER THE RESERVOIR AT ASPEN LODGE DAM.



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resources. The pump on a local volunteer fire truck was used to lower the reservoir, but the fire truck was available for only a limited period of time. Consequently, Perry secured a handshake deal with a local contractor to meet the next morning to breach the dam.

Although the EM community and the EOCs were not able to directly provide resources, the DSB's communication with them facilitated resource requests to a broader audience, and made the EM community aware of the threat.

Flatirons Vista

Flatirons Vista Dam was overtopped at some point during the storm, although it was not discovered until after the storm was over. The Boulder County EOC became aware of the dam which had overtopped through the DSB's situational awareness report, and the potentially dangerous situation was aided through a resource request.

Flatirons Vista Dam is located on and owned by City of Boulder Open Space and was one of several "non-roster" dams never reported to the Dam Safety Branch or the Division of Water Resources Water Commissioner. A phone call from the City of Boulder Water Resources Department indicated that the dam had overtopped during the storm but had not failed. The water surface was within about 2 feet of the dam crest and draining through a small spillway. The dam had an outlet, but the gate had reportedly never been operated, and it was unclear if it would work; in addition, the manual operator was inaccessible except by boat.

The dam was located on a normally dry gulch approximately 0.25 miles upstream of Highway 93, which serves as a primary thoroughfare between the cities of Golden and Boulder. It was unclear whether failure of the dam would jeopardize Highway 93. However, as the dam showed signs of overtopping, a downstream slope failure, an inoperable outlet, and possible sinkhole above the outlet conduit, emergency response measures were deemed necessary.

Through the use of two truck-mounted 6-inch pumps, the reservoir was immediately drawn down to a few feet above the outlet and monitored. The pumps were obtained through a resource request made on WebEOC.



FIGURE 11 - PHOTO OF A SLOPE FAILURE CAUSED BY EMBANKMENT SATURATION DUE TO OVERTOPPING OF THE FLATIRONS VISTA DAM. THE WEAKENED DAM WAS EVENTUALLY BREACHED.

LESSONS LEARNED

Following the event, an after-action review or 'hot wash' session for just the Dam Safety Branch was facilitated by members the CDHSEM. The intent of this exercise was to capture lessons learned, processes or procedures that were missing, and ways in which the Branch might be better prepared for the next dam safety incident that will surely come. Take-aways from this experience and some suggested best practices for state agencies to integrate with the EM community and the lessons learned during the flooding are discussed below:

- Reach out to the state EM counterparts and set up meetings, regional exercises and workshops to provide a platform to discuss the integration of dam safety into the EM community. Some of the areas these forums should focus on include:
 - Fostering relationships between state dam safety engineers, emergency managers (local and state), and dam owner which facilitate communications during an incident.
 - Providing education to the EM community regarding dam safety vocabulary. There was a widespread misunderstanding of dam terminology during the emergency which led to confusion. Up-front training would have mitigated these misunderstandings and communications barriers.
 - Promoting internal awareness of resources available through the emergency management network and the process for garnering these (e.g. resources request process for access to heavy equipment, communication radios, transportation, etc.)
- Require NIMS training for all DSB engineers. This training gave us an understanding of our role during an incident and improved our interactions at the state EOCs.
- Develop and maintain staff knowledge of the WebEOC (or other state emergency communication system) by taking training and signing up for WebEOC alerts through state emergency management counterparts. Having a platform to communicate dam emergencies and to request resources was helpful during the event.
- Develop other ways to interface more with emergency managers, such as inviting them on inspections of high hazard dams as a way to further facilitate communication.
- Always have on hand current 24-hour contact information for emergency managers and dam owners. Having information on hand to contact owners provided a way to receive immediate situation updates to provide to the EM community on dam incidents.

CONTINUED COORDINATION ACTIVITIES

In the year following the September 2013 flooding, the DSB coordination efforts with CDHSEM activities have continued. We have focused on those items brought forward in the course of the response and the after-action reviews conducted and lessons learned as described above. All members of the DSB are now on the WebEOC system through a board created exclusively for the Dam Safety Branch.

During the year, modifications were made to the software to add “event types” which correspond to the three levels of EAP activation. An example of WebEOC posts for a Level 1 EAP activation, update, and termination at a significant hazard dam is shown in Figure 12.

By the time this article is published, members of the Dam Safety Branch will have conducted four Regional Dam Safety Exercises in three of the seven Water Divisions within the state. The Regional EAP Exercise format was developed to raise awareness of dams over

broad areas, affecting multiple jurisdictions within defined basin boundaries. Multiple counties and municipalities are invited and participate in introductions of roles and responsibilities, followed by a Dam Safety 101 training session and an overview of the dams within the selected region. A tabletop exercise is conducted on a single dam within the region for the purpose of engaging as many participants as possible in the scenario. The exercise culminates in a hot wash of the day’s activity. In the past eight months these exercises have engaged over two dozen dam owners, over 20 municipalities, five state agencies, four federal agencies and several private entities (e.g. Red Cross), all in the interest of timely response to dam safety emergencies. These efforts have focused on the lessons learned from the September 2013 flood response regarding education and awareness of dams, the Colorado Dam Safety program, and roles and responsibilities for an effective emergency response.

The screenshot displays the 'NC Regional Events' interface with three records listed. Each record includes fields for Record #, Event Type, Position, Name, Phone, Date, Attachments, and Map. The main content area provides detailed descriptions of the incidents and EAP activations, along with their status and notification levels.

Record #	Event Type	Description	Priority	Regional Notification	Statewide Significant Events
8	WEBEOC Dam - Situational Awareness (EAP Level C,1)	Termination of Level 1,C EAP at Ivanhoe Dam, Pitkin, County No Action Required, For Information Only Ivanhoe Reservoir has been drawn down to take the load off the dam. Mearsures are in place to keep water at or below this level until necessary repairs can be made. This EAP activation is therefore terminated as of this date. Dam Safety Engineer - bill.McCormick at 08:26:48 on 7/8/2014	5 - Information Only	Posted	Not Submitted
7	WEBEOC Dam - Situational Awareness (EAP Level C,1)	Situational Awareness Update - No Action Required The site visit today identified the cause of settlement to be a failed outlet pipe, downstream of the gate valve. With the gate closed and an internal geomembrane liner protecting the upstream face of the embankment, the dam is considered safe. Positive efforts are being made to draw the reservoir level down and the on-site caretakers have been instructed on the required monitoring to ensure that is done safely. We anticipate 5-7 days to get water fully off the embankment. We will terminate this Level 1 EAP when the reservoir has been drawn down. Additional updates will be provided if needed. Dam Safety Engineer - bill.McCormick at 18:53:46 on 7/2/2014	5 - Information Only	Posted	Not Submitted
6	WEBEOC Dam - Situational Awareness (EAP Level C,1)	Ivanhoe dam is a Significant hazard dam located on headwaters of Ivanhoe Creek in Pitkin County, upstream of Ruedi Reservoir. See attached Google Earth image. The dam is 16 feet tall and stores water to a depth of 10 feet, retaining 750 acre-ft of water. The dam was recently upgraded from Low to Significant hazard due to develop at Chapman Campground (10.5 miles downstream) and recent residential development near the Fryngpan River in the Thomasville area, upsteam of Ruedi Reservoir. Full time caretakers at the dam have notified the Dam Safety Branch regarding unusual settlement on the embankment when the outlet works in is operation. The outlet works has been closed, flows have stopped, and settlement has ceased. The ditches that feed the reservoir have been turned out, and the reservoir level is being lowered at a rate of about 0.75 ft per day through the Ivanhoe tunnel to the east. The dam is considered stable and improving based on the lowering of the reserovir level and stoppage of the outlet works flows. This notice is for information and situational awareness only. On-site caretakers have been instructed to monitor for any changing conditions overnight. Dam owner, Dam Safety Branch and USFS representatives will be on site tomorrow morning (11:00 am) to further assess the situation. Additional information will be provided following those assessments. Dam Safety Engineer - bill.McCormick at 17:08:31 on 7/1/2014	5 - Information Only	Posted	Not Submitted

FIGURE 12 – RECORD OF DAM INCIDENT AND EAP LEVEL 1 ACTIVATION THROUGH THE WEBEOC SYSTEM JULY 2014 (READ FROM BOTTOM TO TOP).

CLOSURE

The 2013 flooding event was the seventh large flood to occur in Colorado since 1902, suggesting a frequency of about once every 16 years. This suggests that every dam safety engineer planning on a career of 20 years or more can reasonably expect to be involved in such an event and, therefore, should make preparations for it. We at the Colorado DSB were not as prepared as we could have been at the onset of this event. Through application of various lessons learned before and during the event, we succeeded in mitigating flood damages. Like the dams exposed to previously unseen loadings, members of the DSB were tested and stressed. We wonder, could we have reduced that stress, and maybe accomplished more, had we been more diligent with our planning and preparations? We are hopeful other state dam safety programs will take the lessons and information from our shortcomings and our successes and do their best to protect the safety of their citizens during future flood events.

THE COLORADO DAM SAFETY BRANCH

The Colorado Dam Safety Branch (DSB) consists of 12 licensed professional engineers stationed throughout Colorado. Members of the DSB hold BS, MS, and PhD degrees in civil engineering, geology, and geological engineering with specialties in hydrology, hydraulics and geotechnical engineering. All engineers came to the DSB with at least nine years of professional experience gained from the water resources engineering and consulting communities. At the time of the September 2013 flooding members of the DSB had experience regulating Colorado's 1850 non-federal, jurisdictional dams for periods ranging from 2 months to 16 years, with an average of 5 years of dam regulation experience. The DSB is fortunate to have strong statutory authority and responsibility for maintaining safe dams to store water for beneficial uses with the minimum risk to the downstream public in Colorado.





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Pressure Cells	Floor & Roadway Drains
Foundation Drains	Form & Face Drains
Piezometers	Weep Holes



ASDSO's mission is to improve the condition and safety of dams through education, support for state dam safety programs, and fostering a unified dam safety community.

Join us on our mission.

Who is ASDSO?

ASDSO is the leading national non-profit association dedicated to dam and levee safety. ASDSO was created in 1983 in response to an urgent need for establishing and strengthening state dam safety programs and improving interstate communication about dam safety. Becoming a part of the ASDSO community is a way to join with others to work toward advancing technology, standards, and research for a future where all dams are safe.

Membership starts as low as \$55!

New members join now and receive a Complimentary On-Demand Webinar of your choice!

What Does ASDSO do to support me, my program and/or my company?

ASDSO works side-by-side with its members to build a unified community of dam and levee safety experts, recognized as leaders in their field, through the creation of industry standards and best practices; advocacy of legislative policy matters that impact the dam and levee safety community; development of training programs to help members build upon their knowledge of core foundational topic areas, latest technology and practical trends; education of the general public on issues of concern for dam and levee safety professionals; and support for future growth in the profession.

Learn more about ASDSO and the benefits of being a member - [DamSafety.org/JoinASDSO](https://www.damsafety.org/JoinASDSO).



Association of State Dam Safety Officials