



## Certain Facts Related to the September 2013 Flooding Little Thompson River Watershed, Colorado



### ***Certain Facts Related to the September 2013 Flooding on the Little Thompson River Watershed***

Presented by: Members of the Colorado Dam Safety Branch  
For: Public Meeting on September 2013 Little Thompson River Flooding  
Date: 3/29/2014  
Location: Lyons, CO

#### **Basin:**

Little Thompson River Drainage above the vicinity of X Bar 7 Ranch.

A stream cross – section was measured at approximate Lat: N40° 17.28'; Long: W105° 16.25'. Section used for computer model calibration. (shown on right)

Approximate Drainage Area - 82.5 square miles.

#### **Subbasins:**

Meadow Lake – 19.75 sq miles (24%)  
Muggins Gulch/Little Thompson – 30.8 sq miles (37%)  
North Fork – 27.9 sq miles (34%)  
Rowell Gulch – 4 sq miles (5%)

#### **Rainfall:**

Gage-Calibrated Radar Rainfall Data obtained for all subbasins. Basin-average rainfall calculated as follows:

Sunset, Willow, Rainbow, Mirror dam basins – 14.4 in.  
Meadow Dam basin – 13.6 in.  
Muggins Gulch/ Little Thompson -12.6 in.  
North Fork – 11.8 in.  
Rowell Gulch – 10.5 in.

#### **Computer Modeling:**

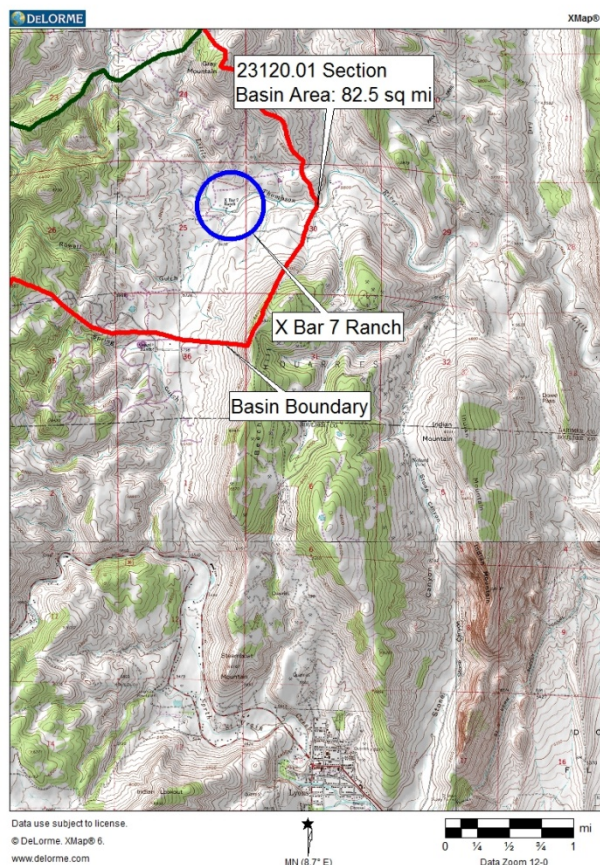
Basin characteristics and rainfall-runoff modeled using the HEC-HMS hydrologic rainfall-runoff computer model.

Runoff modeled in accordance with: *Hydrologic Basin Parameter Estimation Guidelines, 2008* (<http://water.state.co.us/DWRIPub/Documents/HyBasinRsp200805.pdf>.)

Dam breaching modeled in accordance with: *Guidelines for Dam Breach Analysis, 2010* (<http://water.state.co.us/DWRIPub/Documents/GuidelinesForDamBreachAnalysis.pdf>)

Unsteady hydraulic modeling performed using the HEC-RAS model

Computer modeling performed within the current state of the practice. The model is simplified relative to actual real-world processes during flooding. The model does not account for debris accumulation or erosion processes. Models used are considered accurate for calculating rainfall volumes, calculating excess runoff volumes, and determining flows and stages at measured cross-sections and for comparison of rainfall-flood and dam failure-flood responses within the basin.





Certain Facts Related to the September 2013 Flooding  
Little Thompson River Watershed, Colorado



**Dams:**

Dam Name	Reservoir Normal Storage (acre-feet)	Reservoir Flood Storage (acre-feet)	Reservoir Area (acres)	Jurisdictional Height (ft)
Sunset Lake	8.6	19.26	2.5	6
Willow Lake	26.67	59.5	5.5	10
Rainbow Lake	37.3	48.9	6.5	10
Meadow Lake	32.3	90.38	7	10.1
Mirror Lake	18.16	29.91	4	10
<b>Totals</b>	<b>123</b>	<b>248</b>	<b>26</b>	

Meadow Lake classified as a “minor size, low hazard” dam in accordance with dam safety Rules. All other dams were considered “non-jurisdictional” (10 feet or less in height) according to Rules. (see references). All dams were reportedly built in the late 1950’s.

Meadow Lake dam is inspected every 6 years. Last regular inspection – 11/7/2008 recommended outlet works rehab; Outlet works rehab project final construction inspection 11/16/2012, project accepted for full use April 3, 2013. Dam considered in satisfactory condition prior to September.

All other dams within Big Elk Meadows HOA are 10 feet or less in height and considered “Non-jurisdictional” per Rules, no formal inspections required.

**Flooding: Preliminary Results of Analysis**

**Rainfall-Induced:** The total volume of rain that fell on the subbasins and the percentage of the total is as follows:

Subbasin	Rainfall (Ac-ft)	Runoff (Ac-ft)	% of total Runoff	Peak Discharge (cfs)	% of Peak Discharge (cfs)
Meadow	14,110	10,850	26.5%	7884	36%
Muggins/LT	20,650	15,200	37.1%	6560	30%
North Fork	17,520	13,270	32.4%	6552	30%
Rowell	2,230	1,700	4.1%	936	4%
<b>Totals</b>	<b>54,510</b>	<b>41,020</b>	<b>100%</b>	<b>17,700*</b>	<b>100%</b>

Based on the basin response parameters utilized in the model:

Percent of total rainfall to run off – 75.3%

Average percent Infiltration – 24.7%

Peak Discharge at station 23120.01 (just below X Bar 7 Ranch) – 17,700\* cfs

(\*cumulative peak discharge is lower and the sum of the peak discharges due to differences in timing of the basin flows relative to each other)

Peak Stage (water depth) at station 23120.01 (just below X Bar 7 Ranch) = 14 feet



Certain Facts Related to the September 2013 Flooding  
Little Thompson River Watershed, Colorado



**Dam Failure - Induced:** The total volume of water released from reservoir and peak flows into and out of the reservoir as a result of failure during the flooding are as follows:

Dam Name	Reservoir Storage at failure (acre-feet)	Dam Failure Time	Flow Vol. at Time of Failure (acre-ft)	% of Total flow	Inflow to res. at Failure (cfs)	Increase in flow (at dam) from Failure (cfs)
Sunset Lake	19.3	9/12/13 @7:41am	751	2.6	3933	N/A
Willow Lake	59.5	9/12/13 @12:02pm	5324	1.2	4693	1070
Rainbow Lake	48.9	9/12/13 @12:24pm	5848	0.8	4120	1370
Meadow Lake	90.4	9/12/13 @1:40pm	7671	1.2	4030	1848
Mirror Lake	30.0	9/13/13 @2:00am	20586	0.1	1332	799
<b>Totals</b>	<b>248</b>			<b>0.6</b>		

(increase in flow (at dam) due to modeled 1-hour failure time, worst case scenario)

Peak flow and stage (water depth) at Section 23120.01 (downstream of X Bar 7 Ranch) are as follows:

Dam Name	Peak Flow at Time of flood wave (cfs)	Increase in flow due to flood wave (cfs)	Peak Stage at time of flood wave (ft)	Increase in stage due to flood wave (ft)
Sunset Lake	11,100	N/A	5590.7 (11.6)	N/A
Willow Lake	17,700	370 (2%)	5593.1 (14.0)	0.2 (1.4%)
Rainbow Lake	17,700	370	5593.1 (14.0)	0.2
Meadow Lake	17,700	780 (4%)	5593.1 (14.0)	0.4 (2.9%)
Mirror Lake	17,700	N/A	5593.1 (14.0)	N/A

(increase in flow and stage (at section 23120.01) due to modeled 1-hour failure time, worst case scenario)

**Colorado Dam Safety:**

The Dam Safety Branch is managed by the State Engineer in accordance with his general duties as described in Section 37-80-102 C.R.S.. Sections 37-87-101 through 37-87-125 C.R.S. form the regulatory basis for dam and reservoir construction in Colorado.

The Dam Safety Branch is responsible for the safety of all existing dams in the State of Colorado. Dam Safety Engineers regularly inspect jurisdictional dams throughout the state.

State of Colorado Rules and Regulations for Dam Safety and Dam Construction, 2007 edition, establish the procedures and requirements of the State Engineer in the implementation of these statutes. [http://water.state.co.us/DWRIPub/Documents/ds\\_rules07.pdf](http://water.state.co.us/DWRIPub/Documents/ds_rules07.pdf)



Certain Facts Related to the September 2013 Flooding  
Little Thompson River Watershed, Colorado



**State of Colorado Dam Hazard Classifications**

<b>Classification</b>	<b>Definition</b>	<b>Number of Dams</b>
High	Loss of human life is expected to result from failure of the dam.	373
Significant	Significant damage is expected to occur, but no loss of human life expected from the failure of the dam.	333
Low	Loss of human life is not expected and significant damage to structures and public facilities is not expected to result from failure of the dam.	1028
No Public Hazard (NPH)	No loss of human life is expected and damage will occur only to the dam owner's property will result from failure of the dam.	231
TOTAL		1965

Our design review and approval process typically applied to 50-60 dam construction projects per year.

For more information go to our website at:

<http://water.state.co.us/SurfaceWater/DamSafety/Pages/DamSafety.aspx>.

**Big Elk Meadows Dams Reconstruction:**

Currently reconstruction is in the feasibility and preliminary design stage. No official application for the review and approval of plans and specifications has been submitted.

Hydrology studies and hazard classifications determinations have been submitted and are currently under review.

Current plans call for dams to be built back to original sizes, at original locations, for the decreed uses and purposes.

All dams will be designed and constructed using modern engineering and construction standards and methods

Spillways for all the dams are to be designed to safely pass the minimum 100-yr flood, an increase over the minimum Rules for these size and classification dams.

Review and approval of design and construction documents for all five dams, jurisdictional and non-jurisdictional is begin required.