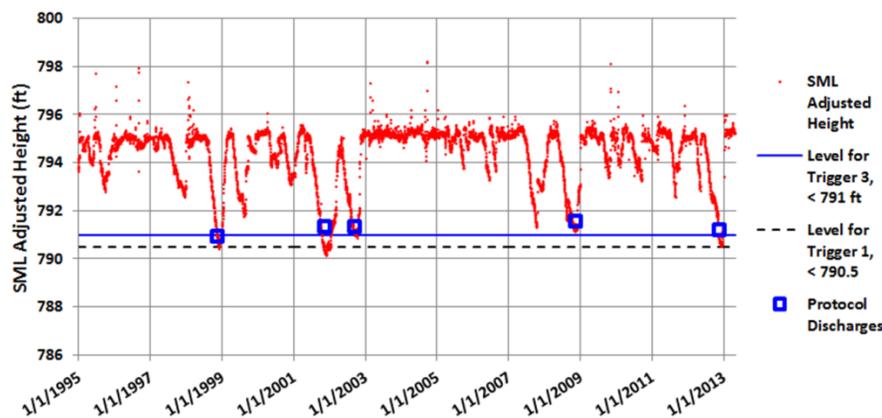


**Executive Summary**  
**Study of Water Level and Release Issues at Smith Mountain and Leesville Lakes**  
Smith Mountain Lake Association Board  
Water Management Committee\*  
February 15, 2015

The Smith Mountain Lake Association (SMLA) formed the Water Management Committee two years ago to study and prepare comments on the performance of the project in maintaining lake levels and in providing flows necessary to protect instream beneficial uses. The Committee adopted a scientific approach with a study focus on keeping lake levels above trigger points, thereby avoiding having to reduce downstream flows below the “no trigger” protocol levels as much as possible. The results of this study are documented in an annotated set of briefing slides that are included as an attachment. The key points of this study are summarized in this Executive Summary.

Figure 1 shows the Smith Mountain Lake (SML) adjusted lake level from 1995 to 2013. The Committee’s primary interest was in the very low lake level events where the lake fell close to or below 791 ft. The figure shows these low lake level events primarily occur in the second half of the year, after June. The 2012 event was of particular interest since the current predictive model used by AEP did not predict any trigger events until the lake finally fell below 791 ft. in late November.

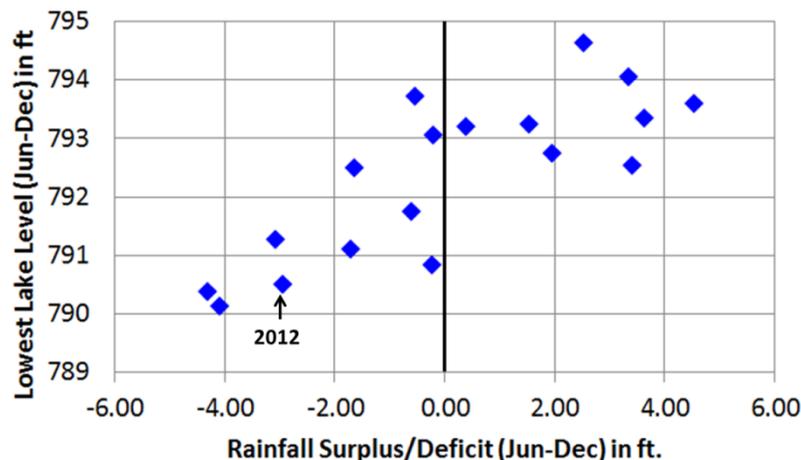


**Figure 1: Effect of Protocol discharges**

The blue squares in Figure 1 show the lake levels that would result if trigger points can be accurately predicted and the appropriate protocol discharges in the current AEP Water Management Plan are followed. In all these instances the lake level is kept above 791 ft. except in 1998 where it falls below by only about 1 inch. Based on this analysis, the Committee felt that current protocols are adequate to maintain lake levels and protect downstream flows provided accurate lake level predictions can be made sufficiently far in advance and the discharge protocols are followed.

Over the past two years, the Committee has examined the factors that might control lake level and analyzed the performance of different simulation methods. Based on the results of this analysis, the Committee now believes:

1. Heavy localized rain storms can cause significant changes in lake level, sometimes in excess of 2 ft. within a day or two, which cannot be predicted by the current model. However, since the current predictive model is always re-initialized to the new lake level after such events, these localized storms will not affect long-range predictive accuracy.
2. Most of the other factors examined by the Committee do not appear at this time to cause lake level fluctuations more than a few inches and are not considered responsible for the very low lake events seen in Figure 1.
3. The very low lake level events seen in Figure 1 do appear to be a combination of prolonged rainfall deficits after June coupled with low winter groundwater recharge in the January-April time period. Figure 2 shows the lowest lake level reached in the second half of the year plotted against the rainfall surplus or deficit in the June to December time period, converted to feet of lake height. All of the lake levels below 792 ft. are associated with rainfall deficits
4. Prolonged rainfall deficits appear to be the primary cause for low lake events with reduced groundwater flows in the June-July time period from low winter recharge acting as a contributing factor. This result suggests there is a possibility to better predict the likelihood of such low lake events based on good groundwater models and NOAA drought predictions.



Note: Surplus/deficits are converted to Feet of Lake Level

**Figure 2: Lowest Lake Level vs Rainfall Surplus/Deficit**

5. Based on the past history shown in Figure 1, low lake levels that can cause trigger points typically occur every 4 to 7 years, although the new discharge protocols may change this behavior.

Based on the Committee's analysis, the following recommendations and requests are proposed with the organization considered most appropriate to handle them shown in parentheses:

1. Use actual Leesville discharges since 2010 to improve predictive accuracy in the June-December timeframe (Hydrologics)
2. Maintain closer adherence to following the minimum Leesville discharges specified in the Water Management Plan (AEP) (*particularly in years predicted to be low lake event years*)
3. Request adding a probability value for the lake falling below 791 ft. in the Trigger 3 definition (Bedford Regional Water Authority)
4. Request that DEQ renew the AEP permit for the next 5 years and review our recommendations and issues (DEQ)
5. Continue to assess predictive model performance and address issues during the next 5 years (SMLA)

The Committee also identified a number of issues that it feels need to be examined over the next five years. These issues are described in more detailed in the attached final report and include:

1. Use NOAA Climate Prediction Center drought predictions to identify low rainfall years
2. Examine more "realistic" groundwater models
3. Examine the interaction of rainfall and groundwater deficits
  - a. *Moderate rainfall and groundwater deficits are additive*
  - b. *Large rainfall deficits dominate*
4. Examine the effect of inflow/discharge correlations
5. Consider alternate methods for generating synthetic streamflows
6. Reevaluate the 40 cfs addition to the Roanoke gage
7. Consider using the Niagara rather than the Roanoke gage for drainage area scaling
8. Reconsider the "groundwater loss" term
9. Examine evaporation loss variability

The Water Management Committee would be very willing to work with any of the appropriate agencies to address these recommendations and study these issues over the next five years. In closing, the Committee wishes to especially recognize and thank AEP and Hydrologics for making their data, procedures and modeling techniques available to us for this study and answering our many questions and Dr. Eric Anderson for his contributions to the Committee's analysis.

- \* Water Management Committee Members: Russ Johnson (chairman), Bill Piatt (vice-chairman), Jim Colby, Bill Brush, Rob Whitener, Chuck Sinex and John Lindsey