

***Selection of “Drought of Record” in  
MODFLOW Simulations***

***Edwards Aquifer  
Recovery Implementation Program***

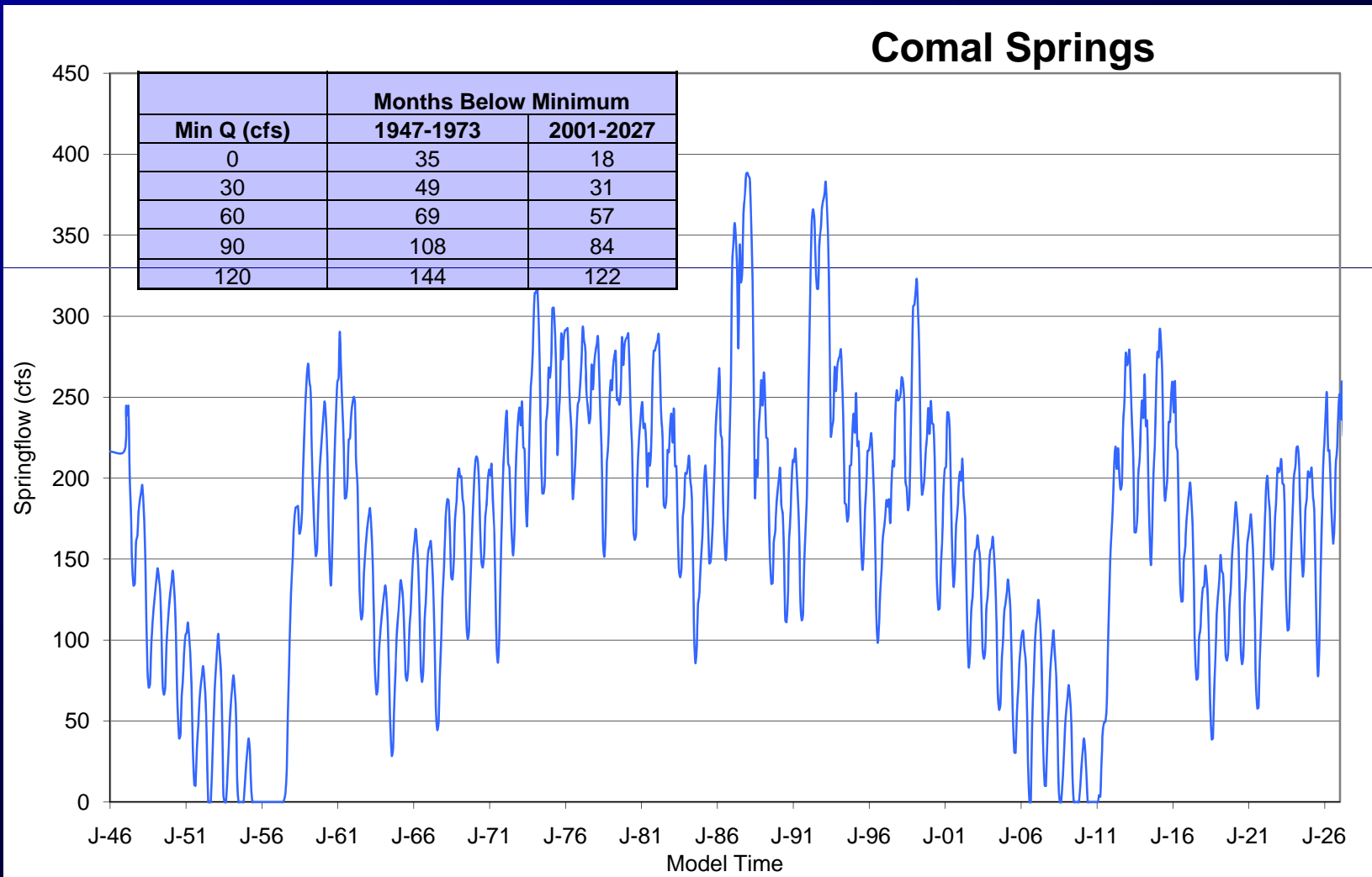
***Steering Committee and Stakeholders***

**Larry Land, P.E.  
June 29-30, 2010**

## ***Topics of Discussion***

- 1) Issue**
- 2) Review and Tests**
- 3) Recommendations**

# ***Issue: Drought of Record Results are Sensitive to Antecedent Conditions***



# ***Review # 1***

## ***Tests by Todd Engineers***

- ❑ **Drought 1:** Natural temporal sequence of the model simulation.
- ❑ **Drought 2:** 1947-'73 period follows the 1974-2000 simulation. It is the one that was described in the June 4 meeting.
- ❑ **Drought 3:** 1947-'73 period follows 1995.
- ❑ **Drought 4:** 1947-'73 period follows 1971. The test was formulated by Todd Engineers following their additional review of the historical recharge pattern.

# Results of Four Tests by Todd Engineers

Evaluation Period		Drought 1	Drought 2	Drought 3	Drought 4
1947-1957		2001-2011	1996-2006	1972-1982	
Springflow	cfs	Months Below Minimum			
Comal	0	35	18	19	34
	30	48	31	35	47
	60	63	52	52	63
	90	88	69	69	87
	120	103	91	91	101
SanMarcos	0	0	0	0	0
	40	12	5	5	10
	80	52	50	51	51
	120	107	107	108	107
	160	122	121	126	122

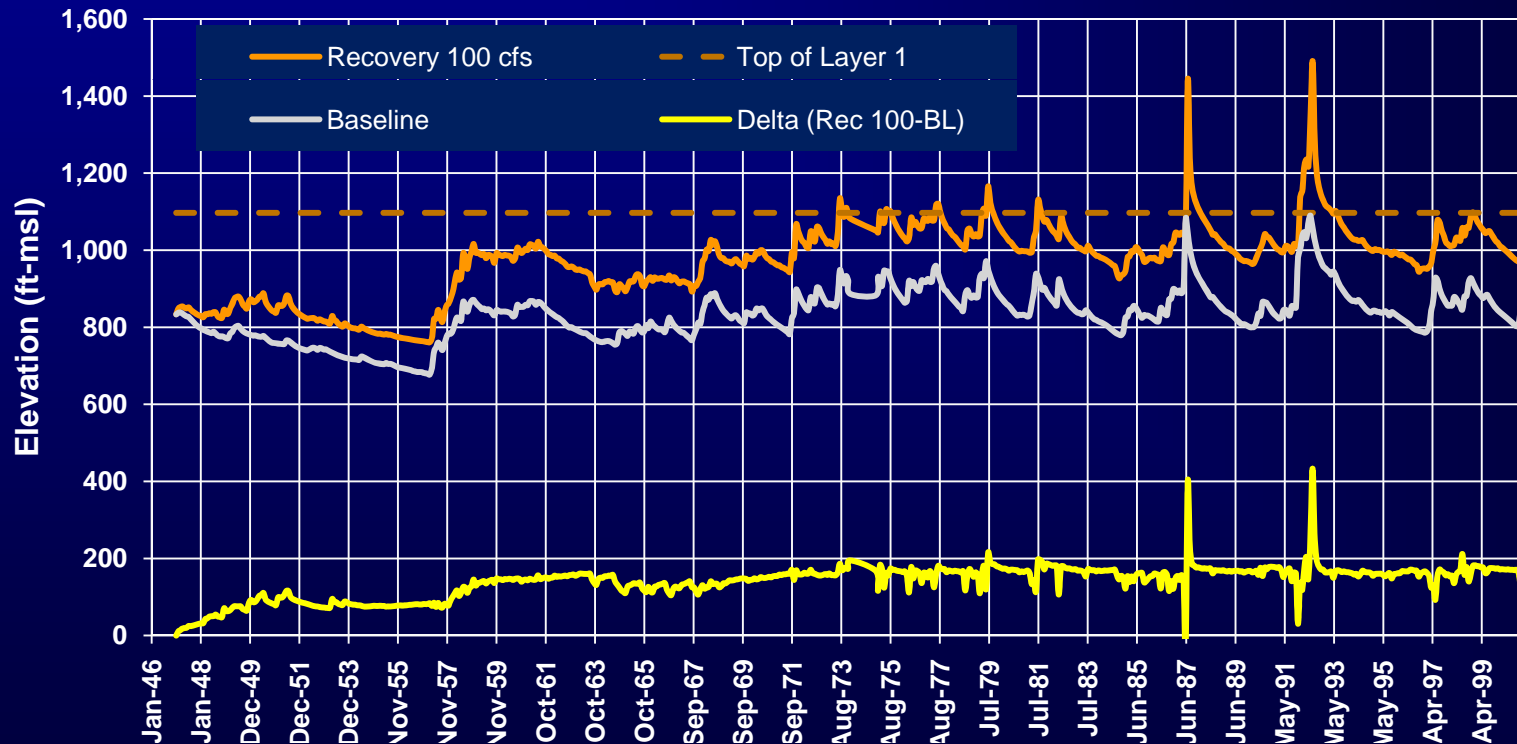
## ***Review # 2***

### ***Modeled Water Levels in R&R Simulation***

- Comparison of Model Results at
  - Hondo Recharge Site
  - Verde Recharge Site
- Use R&R simulations for 100 and 150 cfs Triggers at Comal Springs.
- **Question: Is the Dynamic Storage reasonably full in comparison to similar hydrologic periods?**

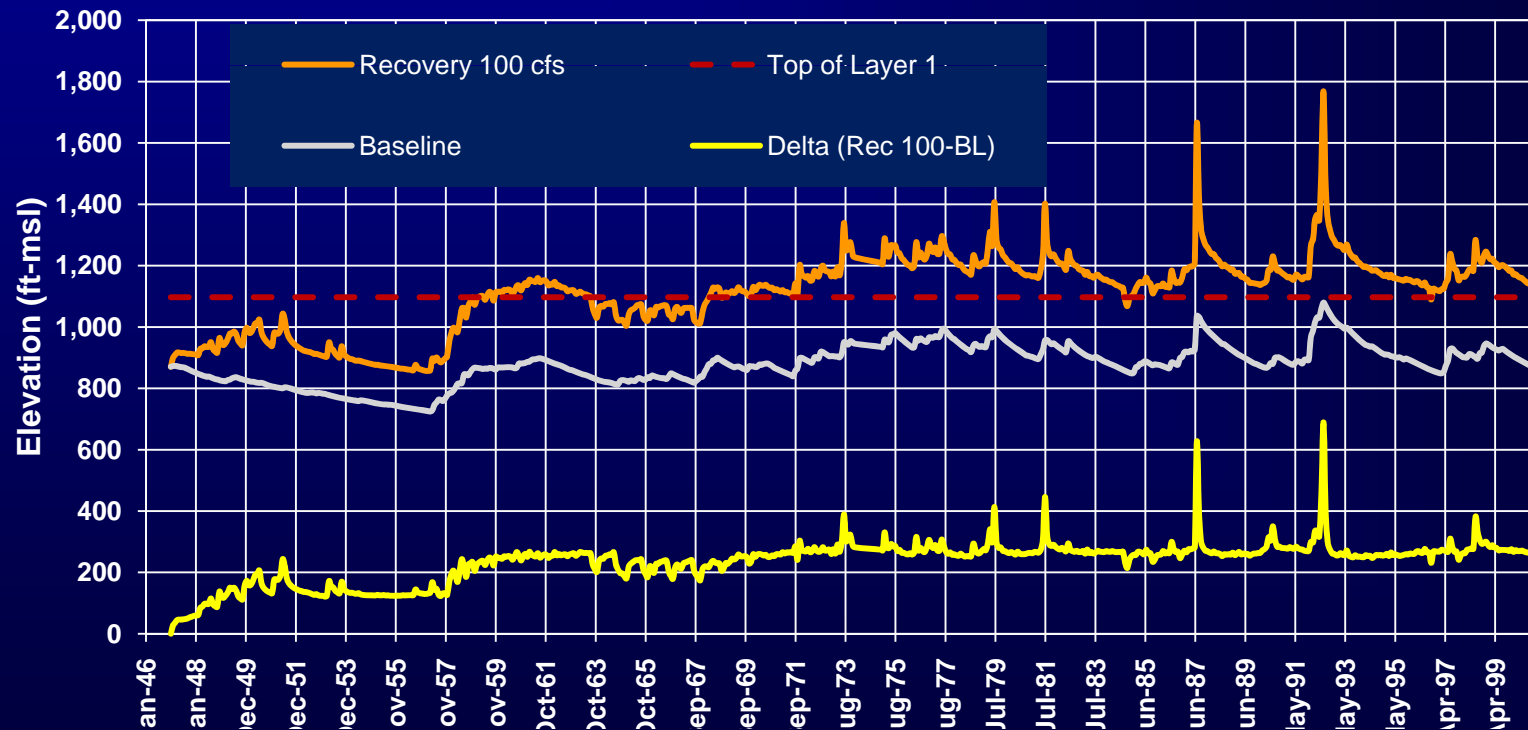
# Model Calculated Water Levels for R&R Simulation (100 cfs Trigger) Hondo Site

R&R Simulations  
Target Model Cell at/near Hondo Recharge Site



# Model Calculated Water Levels for R&R Simulation (100 cfs Trigger) Verde Site

R&R Simulations  
Target Model Cell at/near Verde Recharge Site



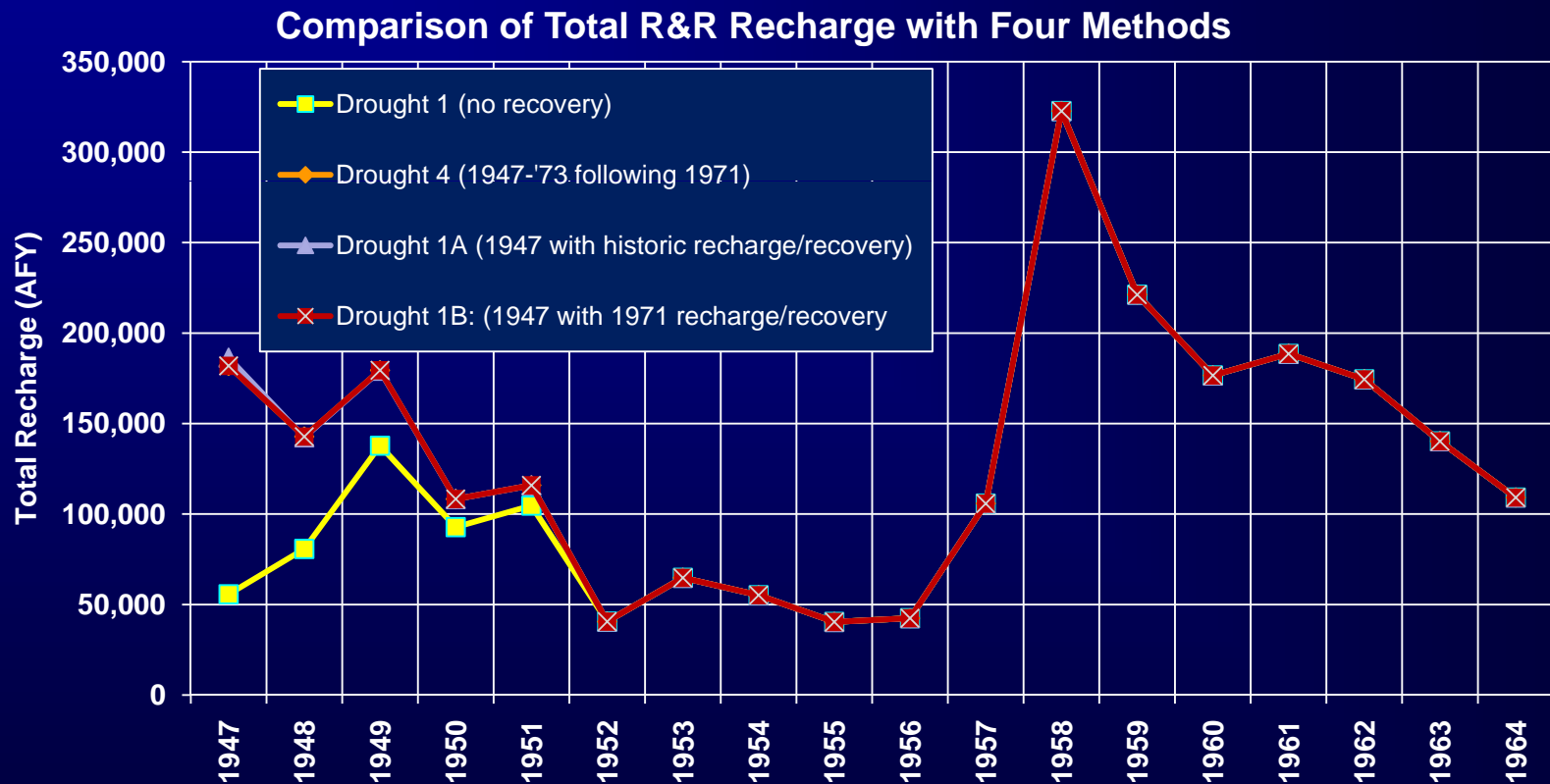


## ***Review # 3***

### ***Comparison of Recharge for Four Approaches for Drought of Record***

- ❑ **Drought 1:** Natural temporal sequence of the model simulation
- ❑ **Drought 4:** 1947-'73 period follows 1971
- ❑ **Drought 1A:**
  - 1947 R&R recharge is calculated with historical data for Type II
  - Unused irrigation permits for 1946 is approximated by the results from 1947
- ❑ **Drought 1B:**
  - 1947 R&R recharge is assumed to be equal to 1971 R&R recharge
  - Unused irrigation permits for 1946 is approximated by the results from 1947

# Comparison of Total R&R Recharge with Four Methods



## ***Recommendation***

- **Todd Engineers:**
  - **Drought 1A**
    - 1946 recharge is calculated with historical data
    - 1946 Unused Irrigation Permits is approximated by 1947
    - Model Simulation is 1947-2000
- **HDR (Larry Land)**
  - **Concurs with Todd Engineers**
- **TWDB (Dr. Robert Mace)**
  - **Concurs with Todd Engineers and HDR**

# ***Questions & Discussion***