STAKEHOLDER ADVISORY FORUM MEETING

AUGUST 21, 2002

PRESENTATION

- REVISIONS TO MODEL (since SAF on Feb. 21, 2002)
  - Hydraulic conductivity
- STEADY-STATE CALIBRATION
  - Calibration results
- TRANSIENT DATA COMPILATION

REVISIONS TO MODEL

(since SAF on Feb. 21, 2002)

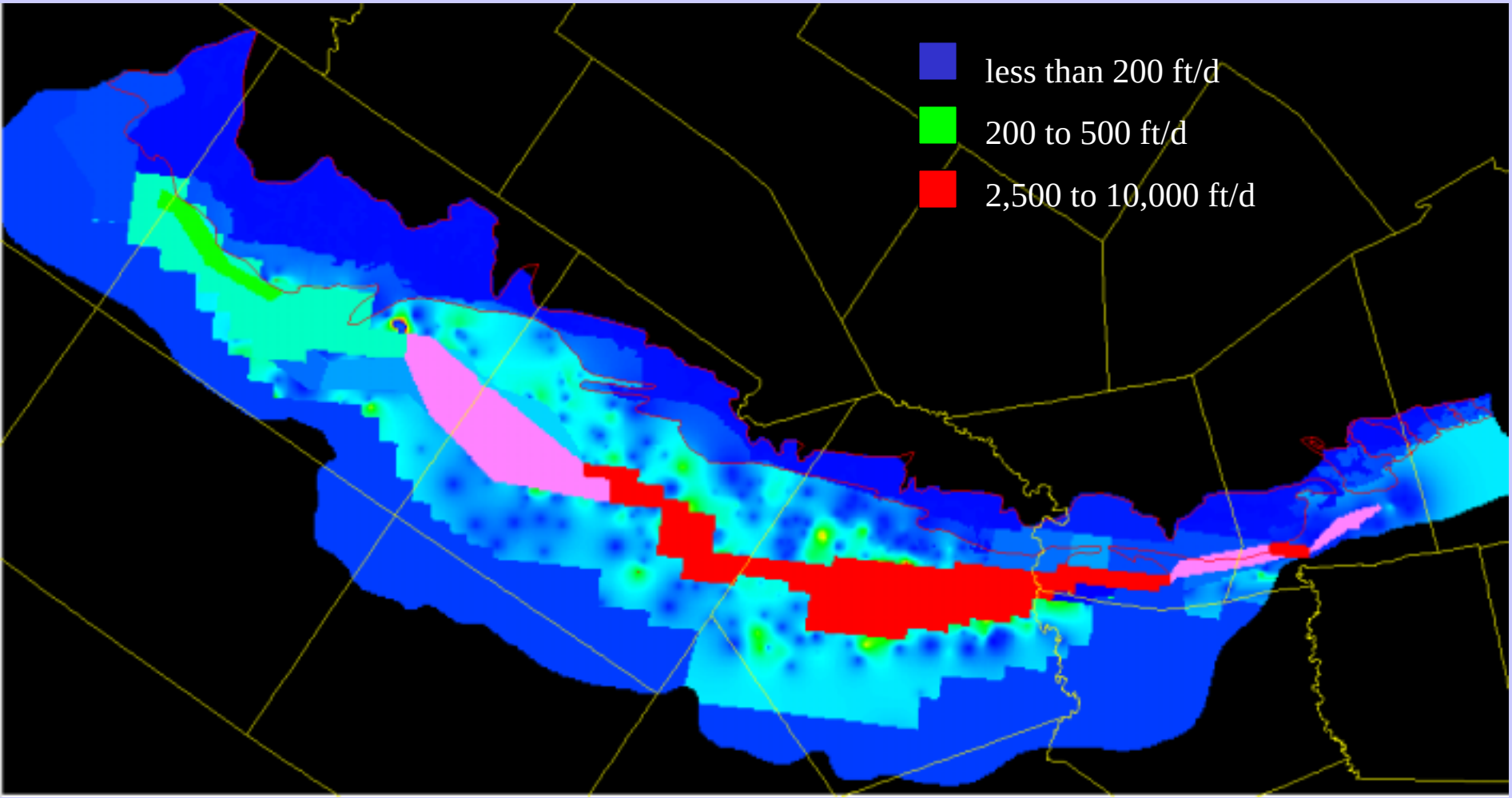
HYDRAULIC CONDUCTIVITY

HYDRAULIC CONDUCTIVITY

Base distribution from SWRI (Version 1)

[Derived from aquifer tests]

(As of 02/21/02 – To be revised)



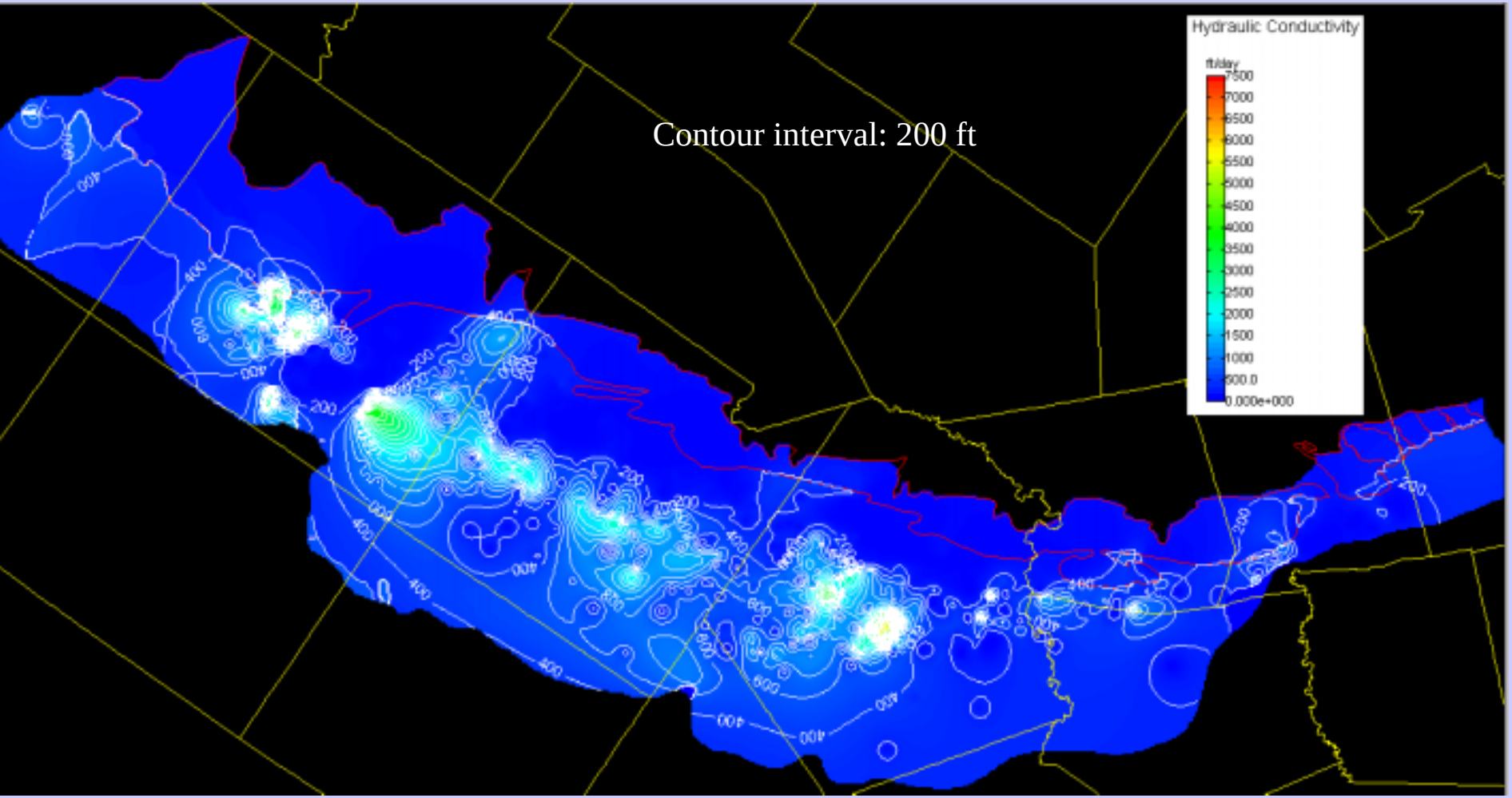
EXPECTED REVISIONS TO HYDRAULIC CONDUCTIVITY

(as of Feb. 21 SAF meeting)

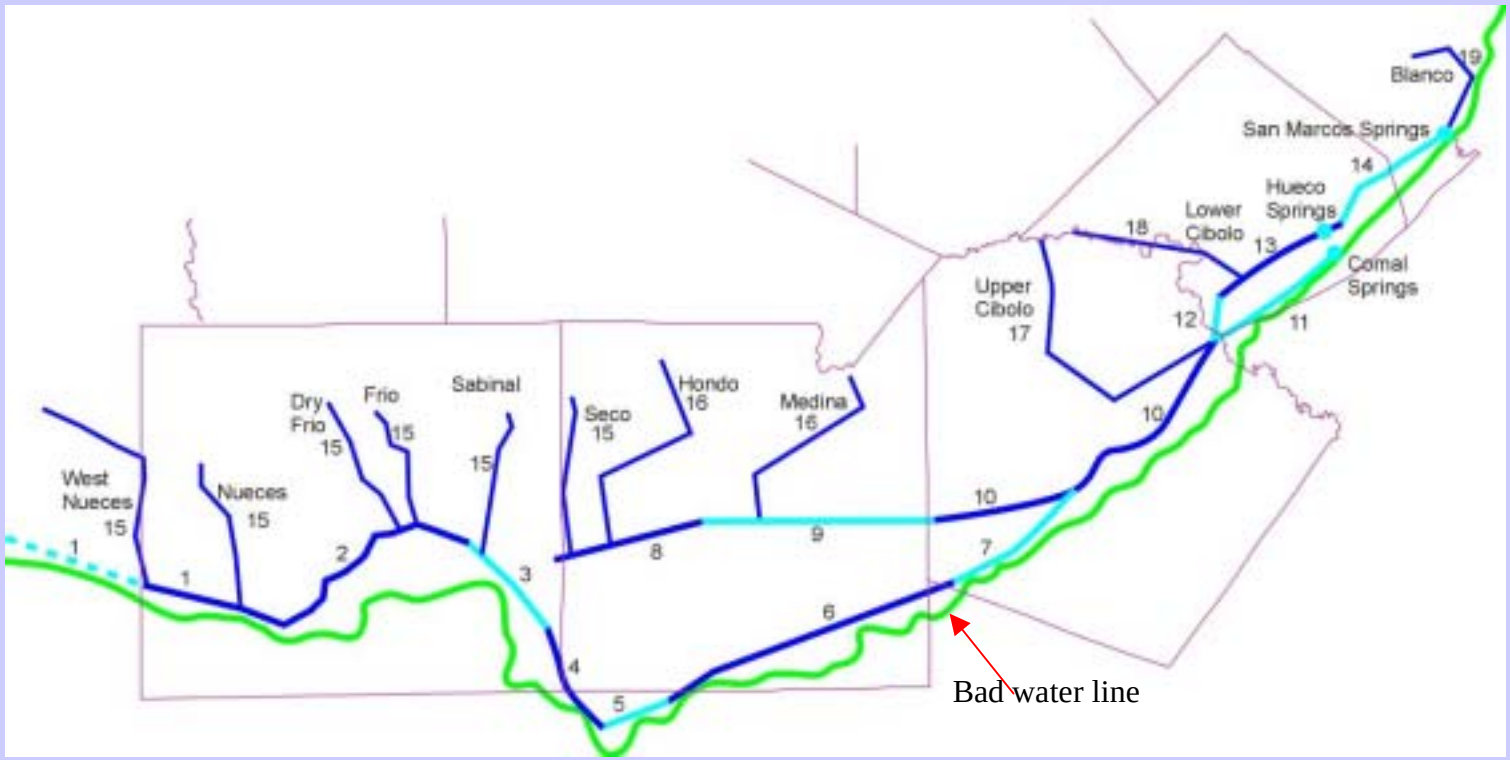
- Revised K distribution from SWRI
  - based on aquifer tests and measured hydraulic heads (SWRI version 2)
  - based on aquifer tests and measured hydraulic heads and springflows (SWRI version 3)
- Mapped narrow high K zones (conduits—Steve Worthington)
  - based on potentiometric surface maps, sinking (losing) streams, geologic structures, and water chemistry
- Measured hydraulic heads and springflows (model calibration)

HYDRAULIC CONDUCTIVITY
SWRI (Version 2)

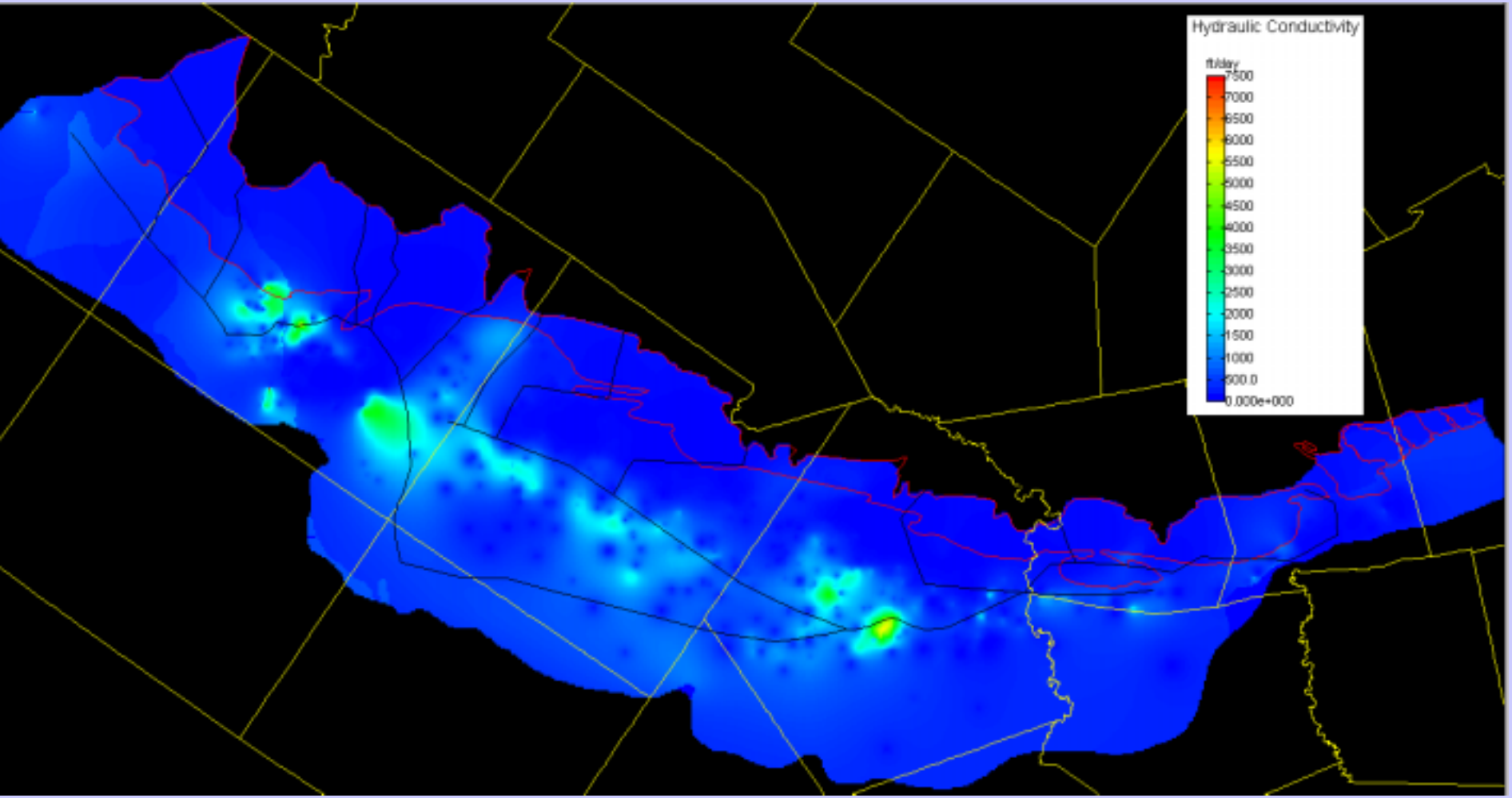
[Derived from aquifer tests and measured hydraulic heads]



CONDUITS (mapped by Steve Worthington)

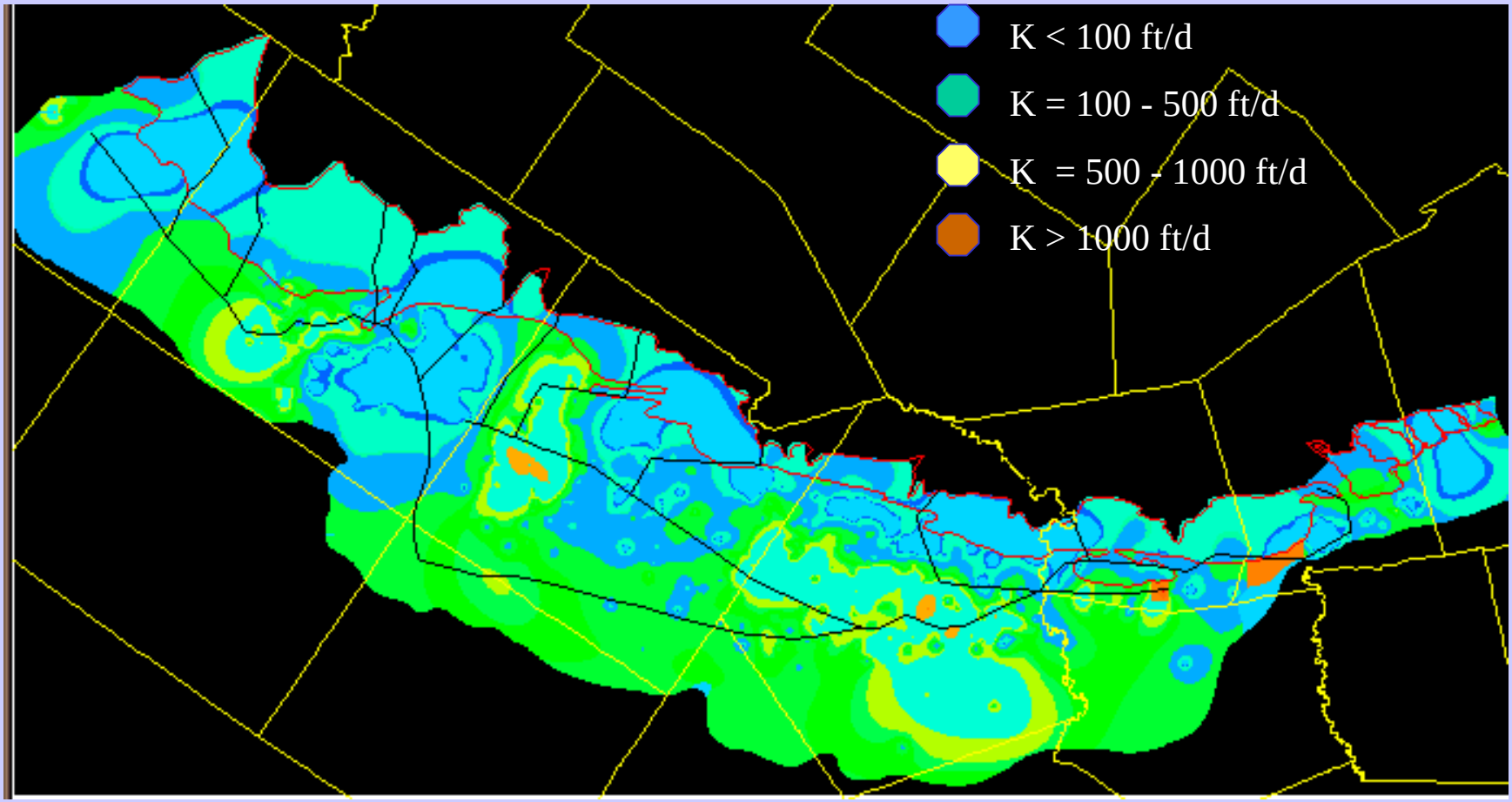


HYDRAULIC CONDUCTIVITY
SWRI (Version 2) + Conduits



HYDRAULIC CONDUCTIVITY
SWRI (Version 3) + Conduits

[Derived from aquifer tests and measured hydraulic heads and springflows]



HYDRAULIC CONDUCTIVITY

- Results of April 19, 2002 meeting:

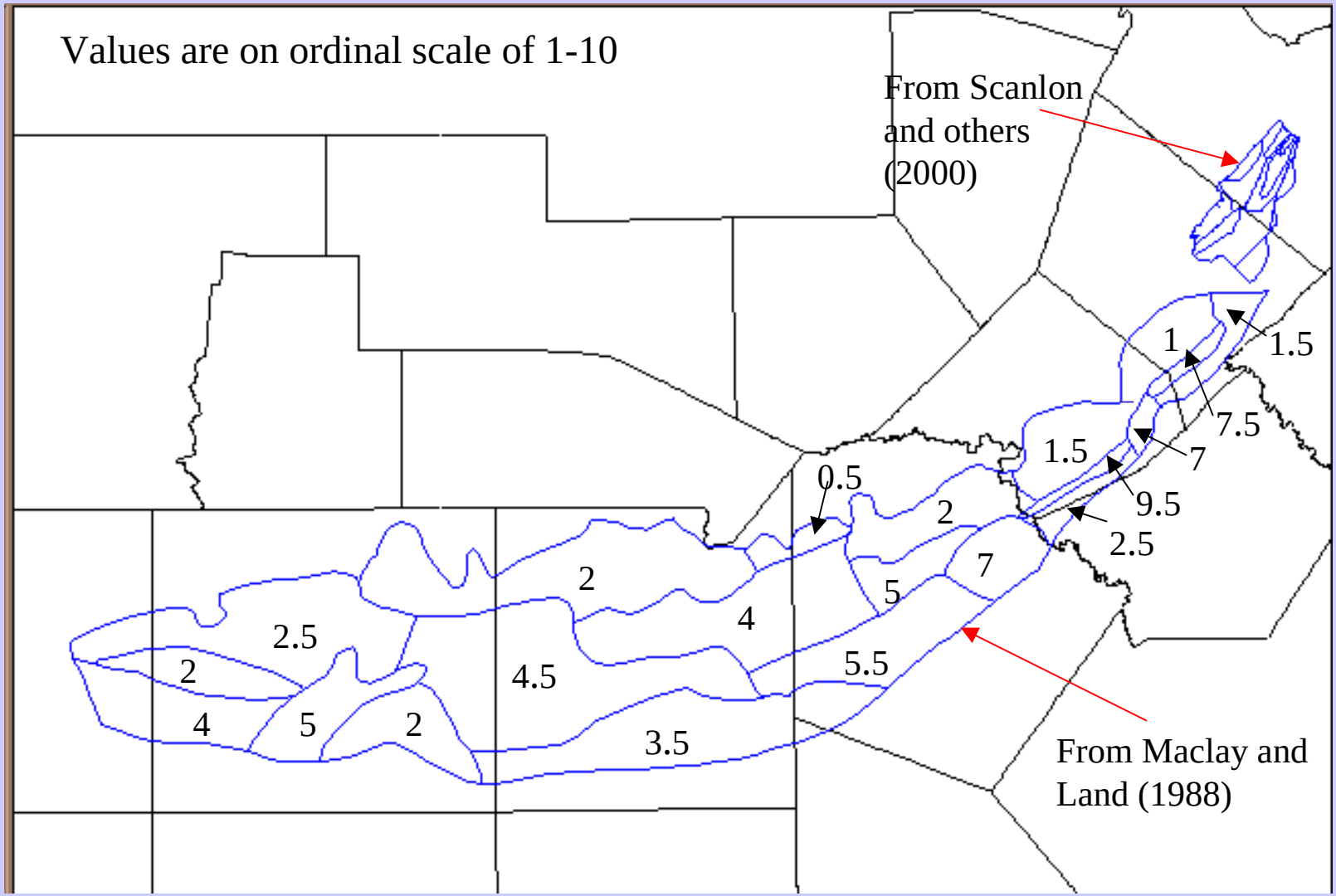
✓ Do not use SWRI hydraulic conductivity (K) distributions as “base”

- deficiencies in aquifer test data
- statistical; not based on hydrogeology

✓ Use transmissivity sub areas as defined by Maclay and Land (1988) (fig. 10) as “base”

✓ Overlay conduits defined by Steve Worthington on “base” K distribution

HYDRAULIC CONDUCTIVITY ZONES

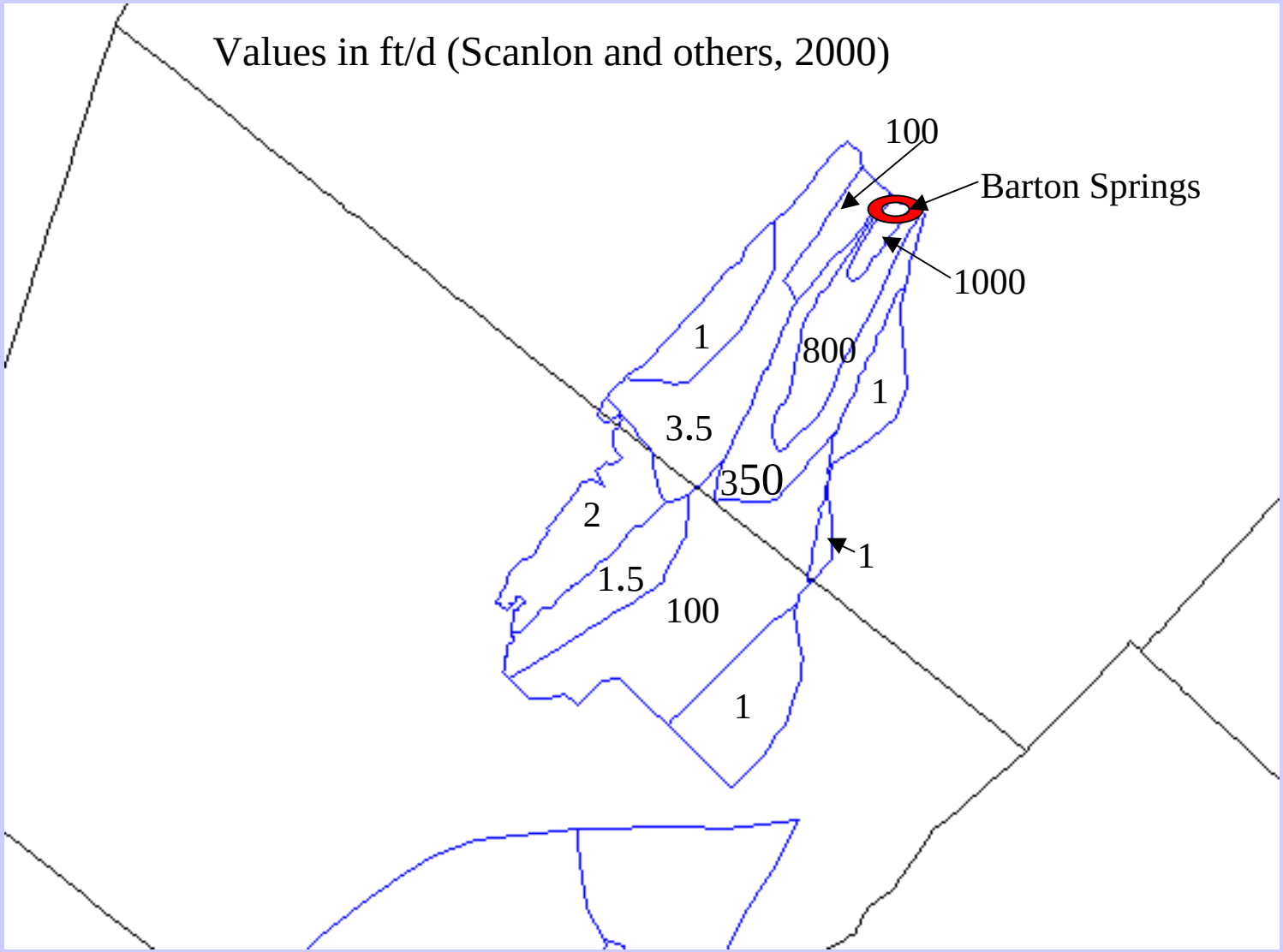


HYDRAULIC CONDUCTIVITY ZONES

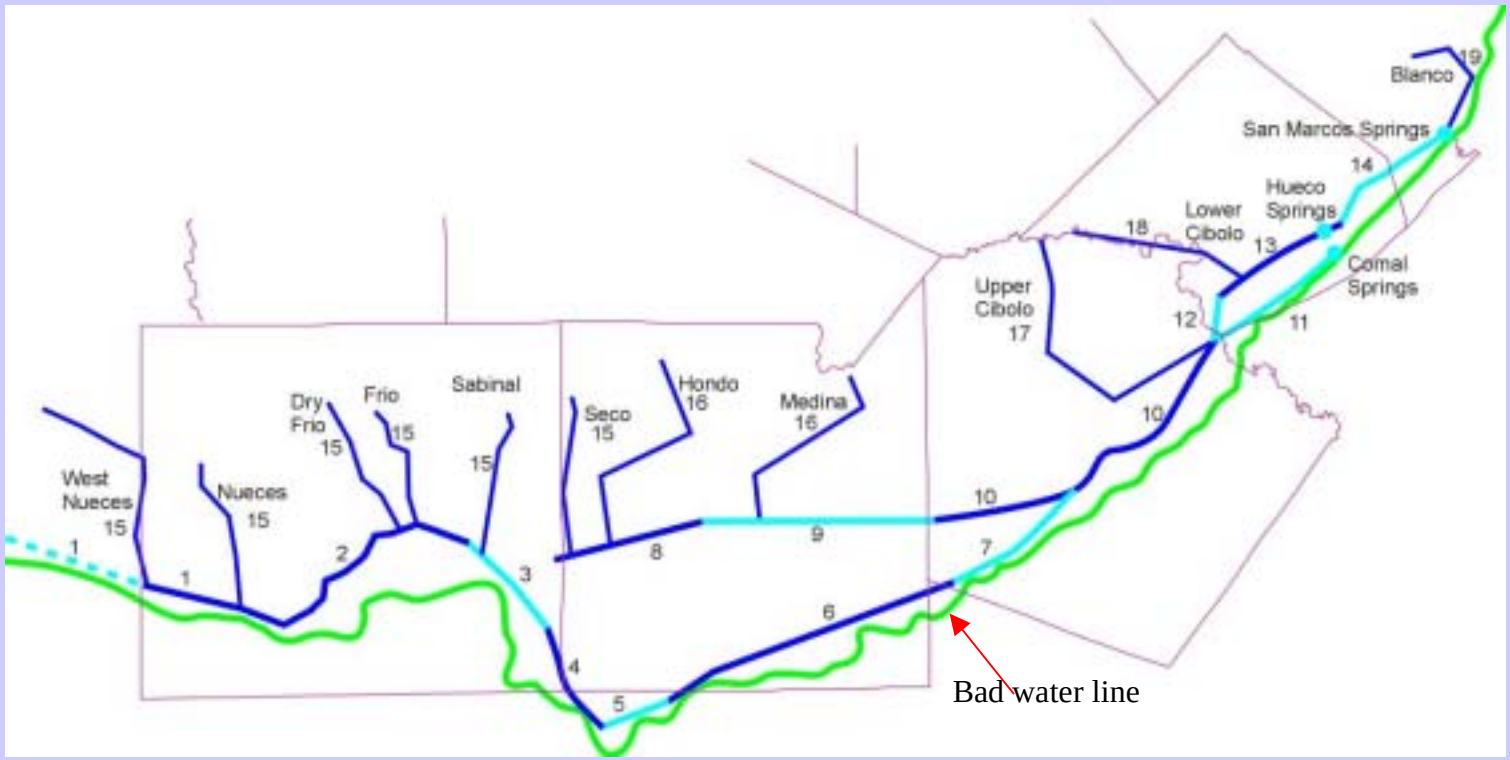
(based on Maclay and Land, 1988)

Subarea	Model zone #	Trans (ordinal range)	Trans (ordinal average)	K Log min 1 ft/d	K Log min 10 ft/d
A	1	1-3	2	6	38
B	2	0-5	2.5	9.5	56
C	3	0-4	2	6	38
D	4	0-1	0.5	1.6	14
E	5	0-4	2	6	38
F	6	0-3	1.5	4	28
G	7	0-2	1	2.4	20
H	8	3-5	4	40	160
I	9	3-7	5	100	310
J	10	1-3	2	6	38
K	11	3-6	4.5	64	220
L	12	3-4	3.5	25	110
M	13	3-5	4	40	160
N	14	4-7	5.5	160	440
O	15	4-6	5	100	310
P	16	6-8	7	600	1250
Q	17	2-3	2.5	9.5	56
R	18	9-10	9.5	6400	7000
S	19	6-8	7	600	1250
T	20	7-8	7.5	1000	1750
U	21	1-2	1.5	4	28

HYDRAULIC CONDUCTIVITY ZONES

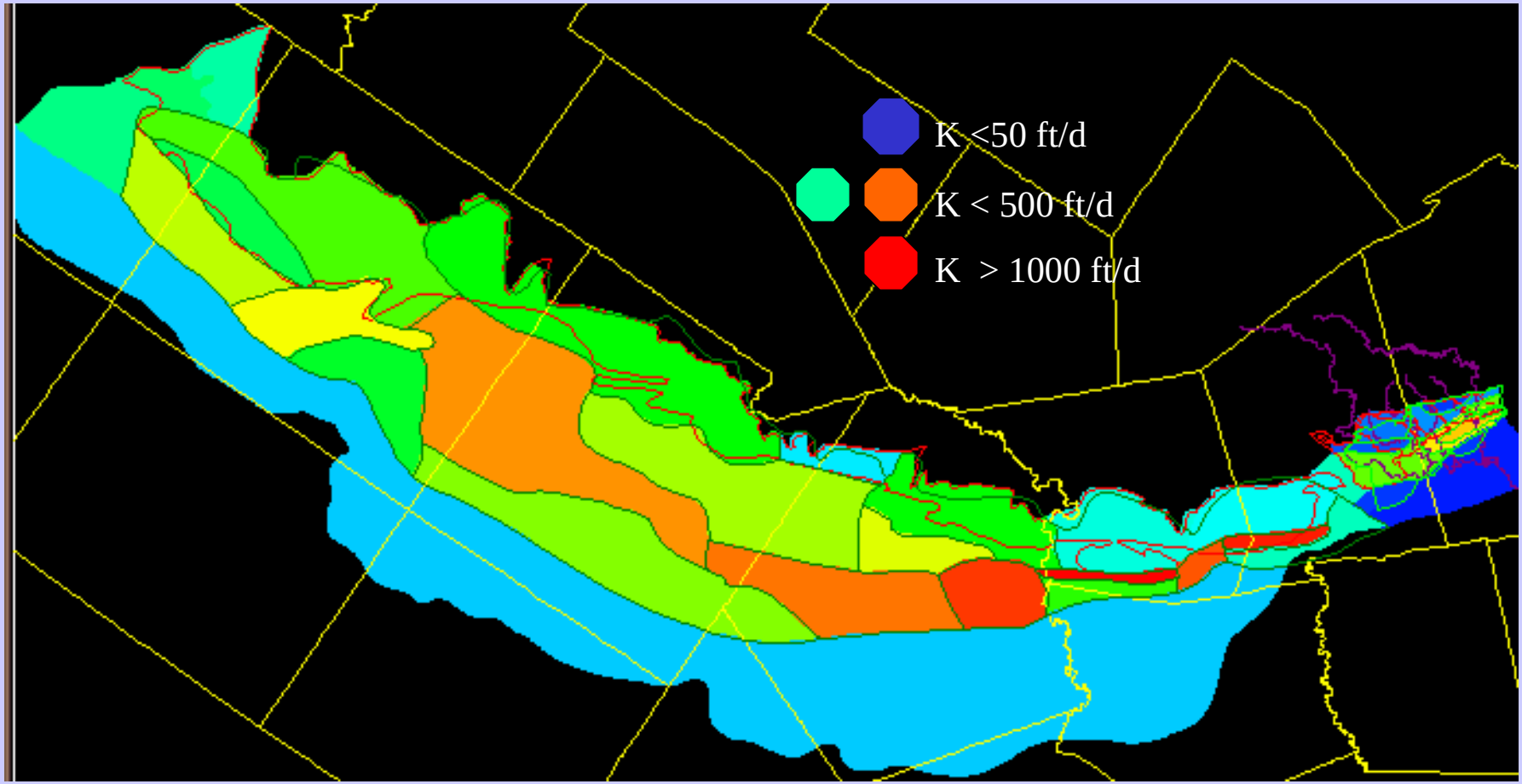


CONDUITS (mapped by Steve Worthington)



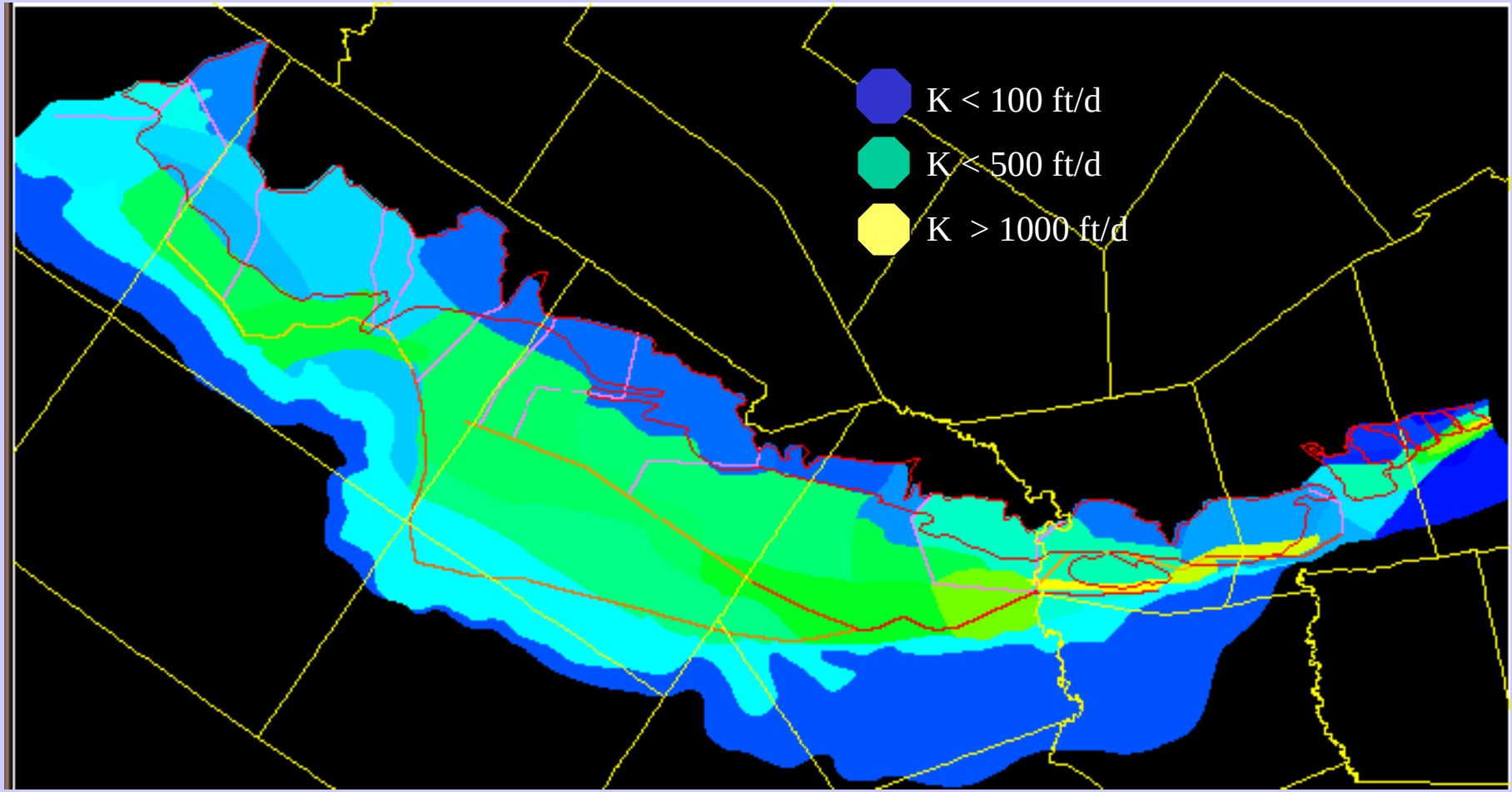
HYDRAULIC CONDUCTIVITY ZONES

(As of 6/14/02 – Subject to revision)



HYDRAULIC CONDUCTIVITY ZONES

(As of 6/14/02 – Subject to revision)



STEADY-STATE CALIBRATION

STEADY-STATE CALIBRATION

- Calibration period: 1939 – 1946
- Pre-1950's drought, minimal irrigation development
- Near-normal precipitation
- San Antonio precipitation:

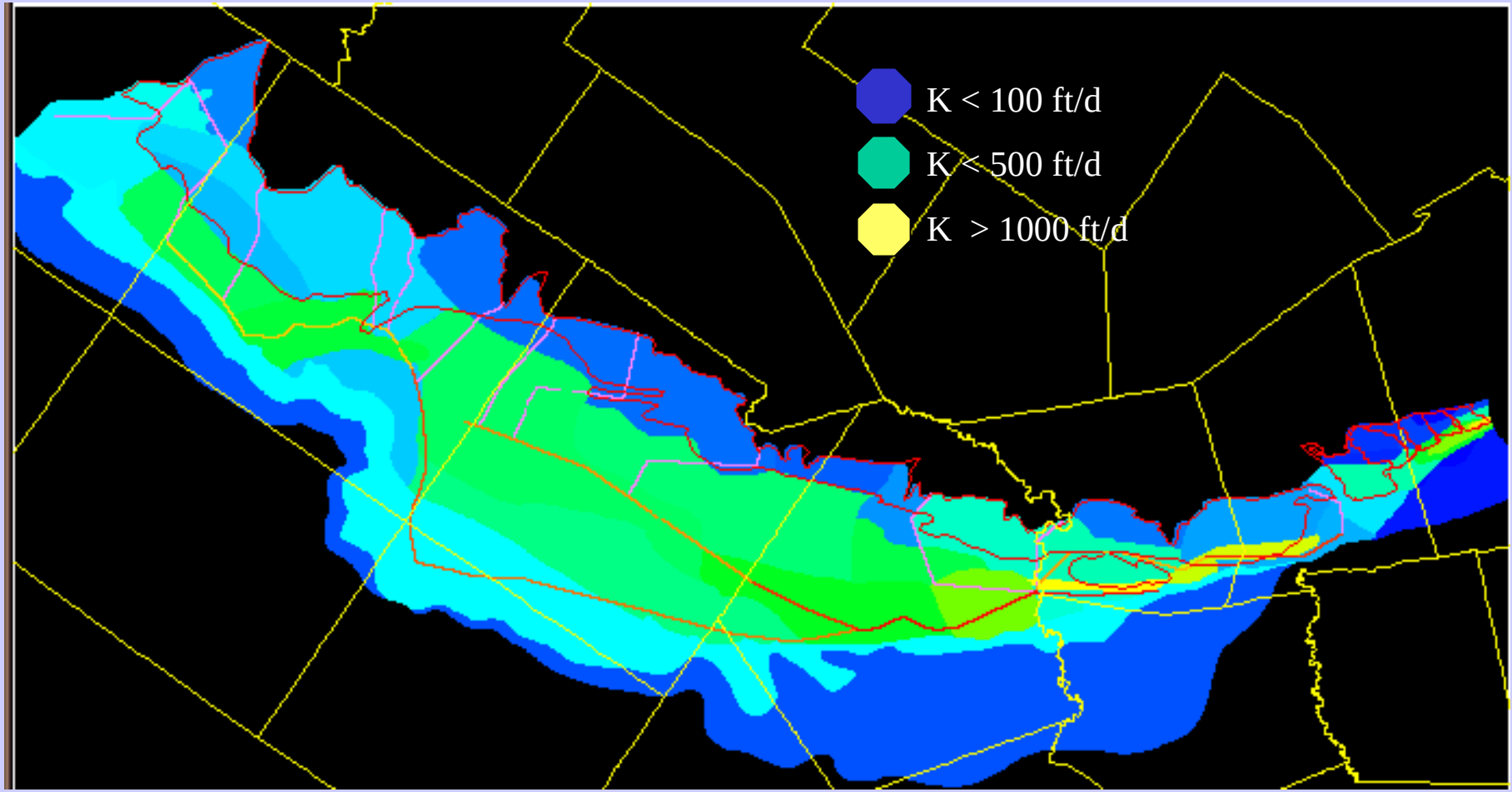
  normal (1961-90) 30.98 in/yr

  average 1939-46 30.47 in/yr

HYDRAULIC CONDUCTIVITY ZONES

[K based on Maclay and Land (1988) + Conduits]

(As of 6/14/02 – Subject to revision)

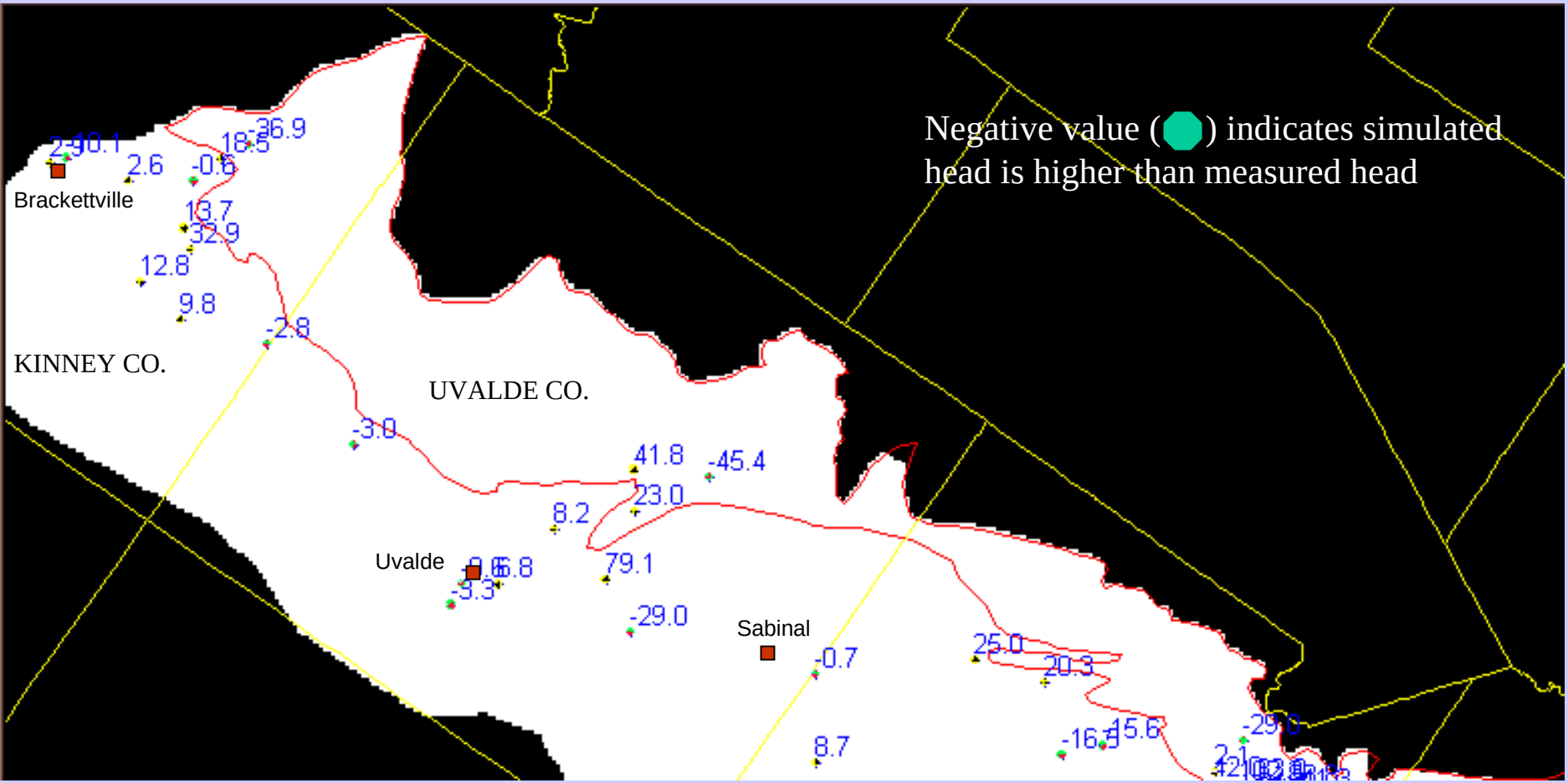


CALIBRATION REVISIONS

- Lowered hydraulic conductivity (K) in recharge zone
- Varied K of conduit segments
- Redistributed recharge
  -- decrease Cibolo Creek, increase Blanco River
- Added barrier fault in Nueces recharge zone
- Varied K in saline water zone and Kinney County

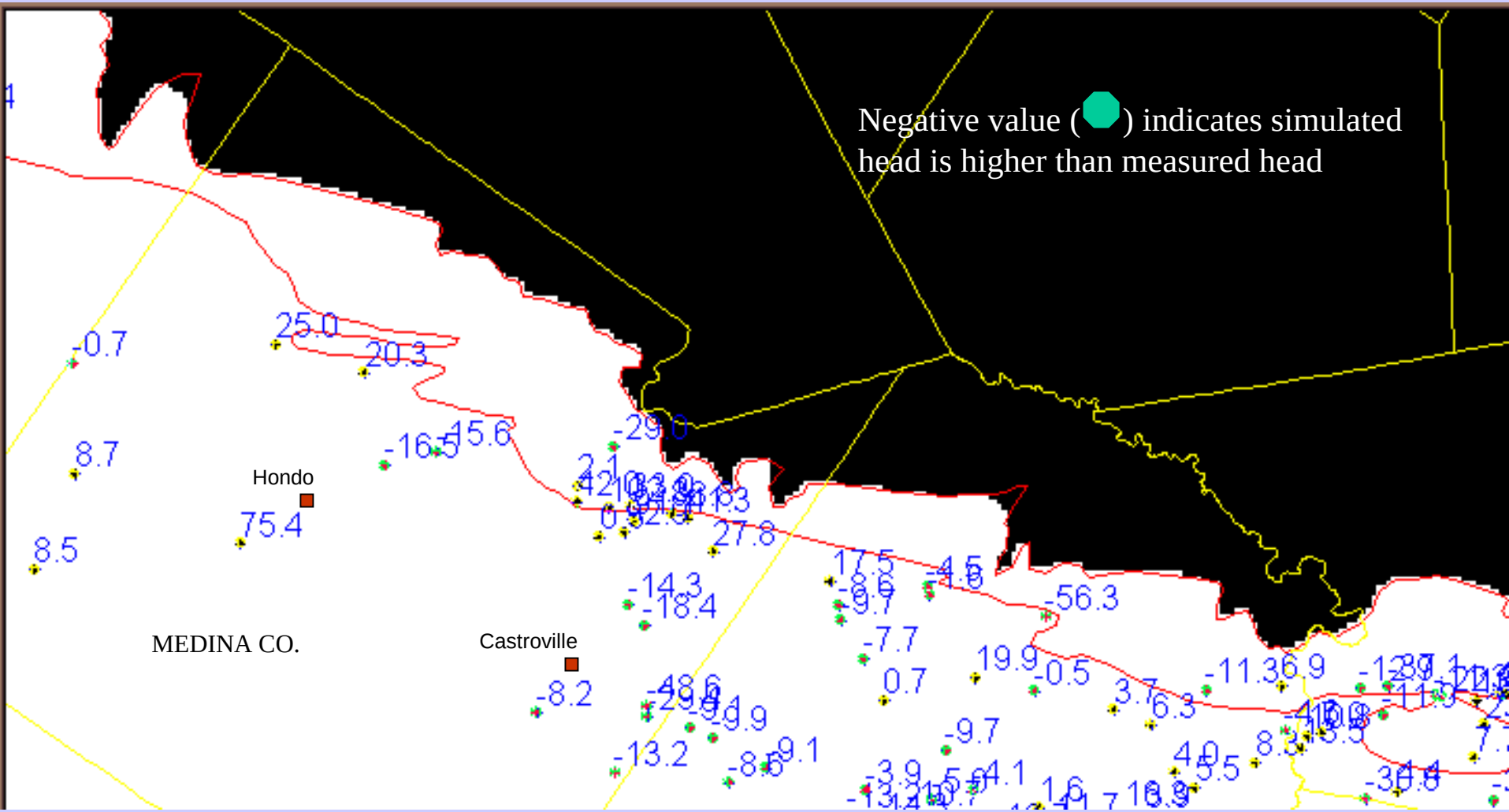
HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)



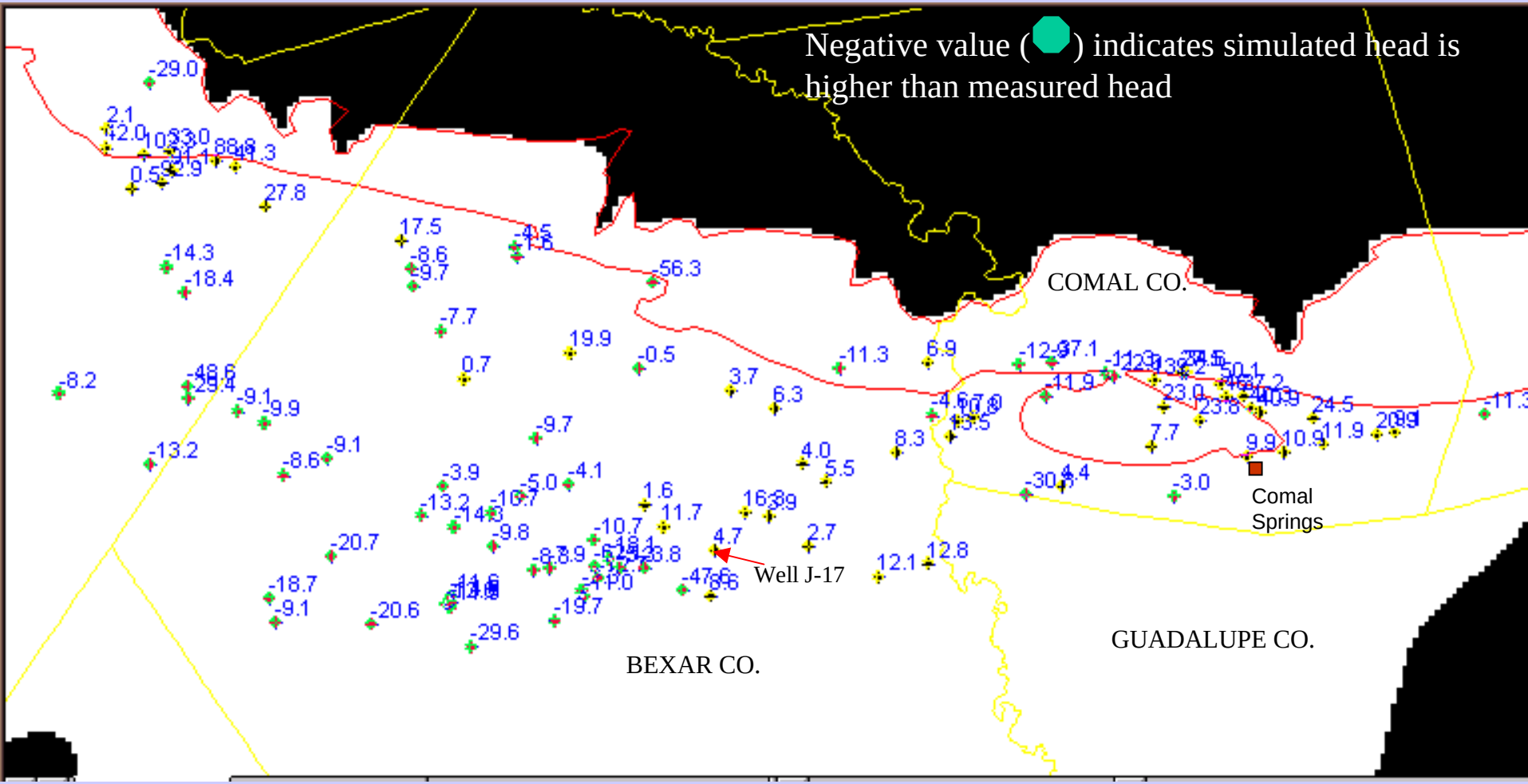
HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)



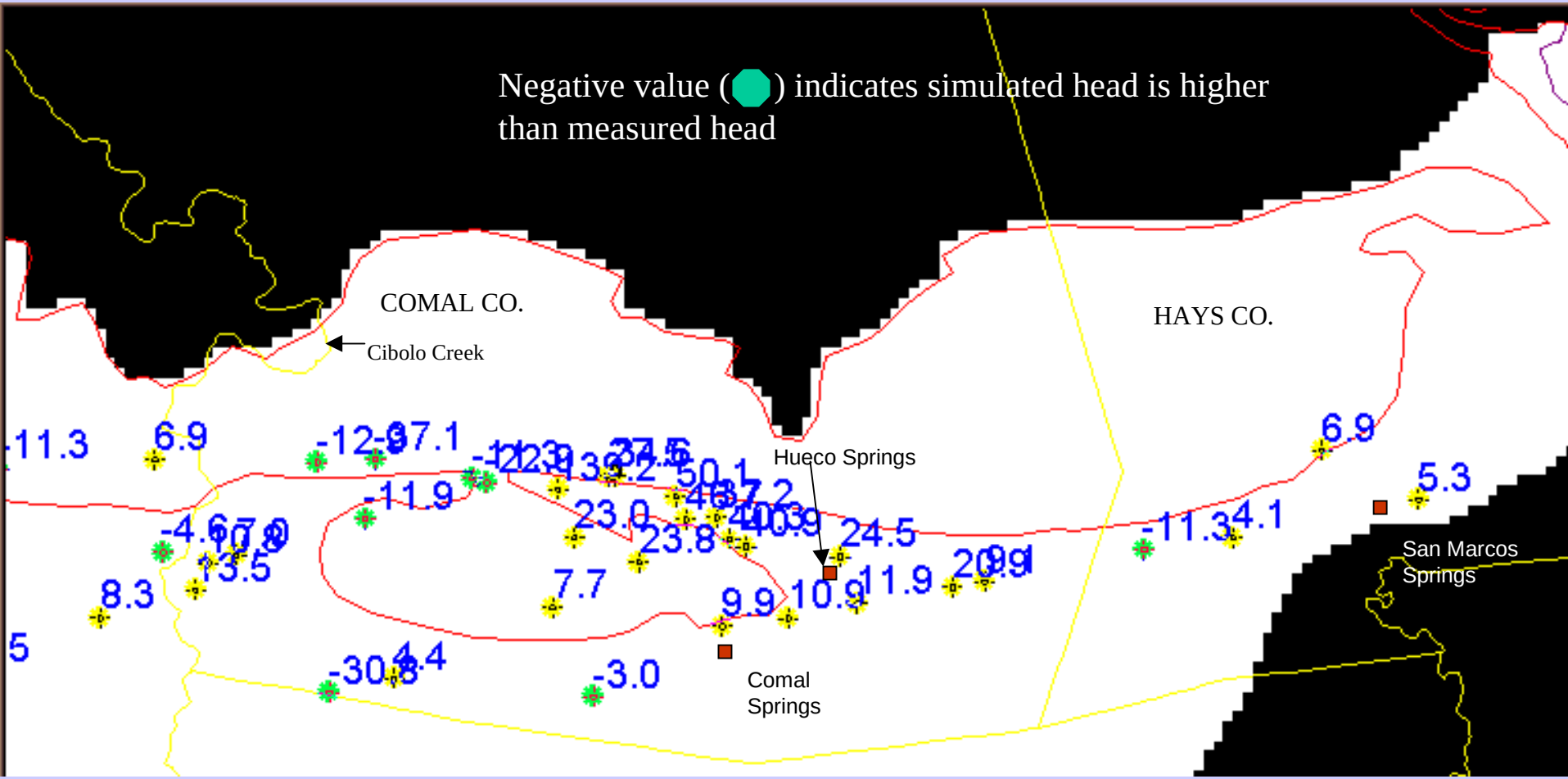
HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)



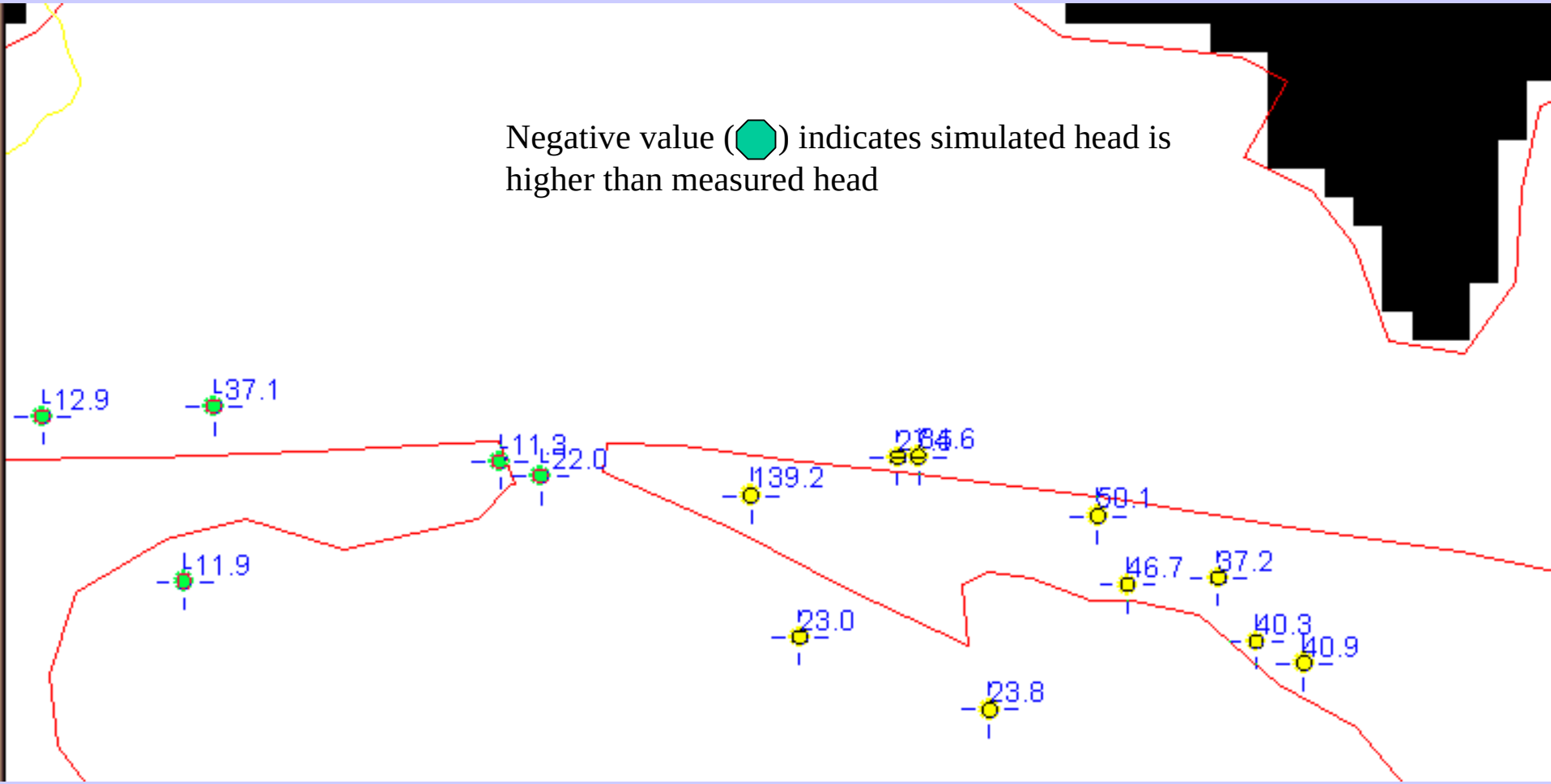
HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)

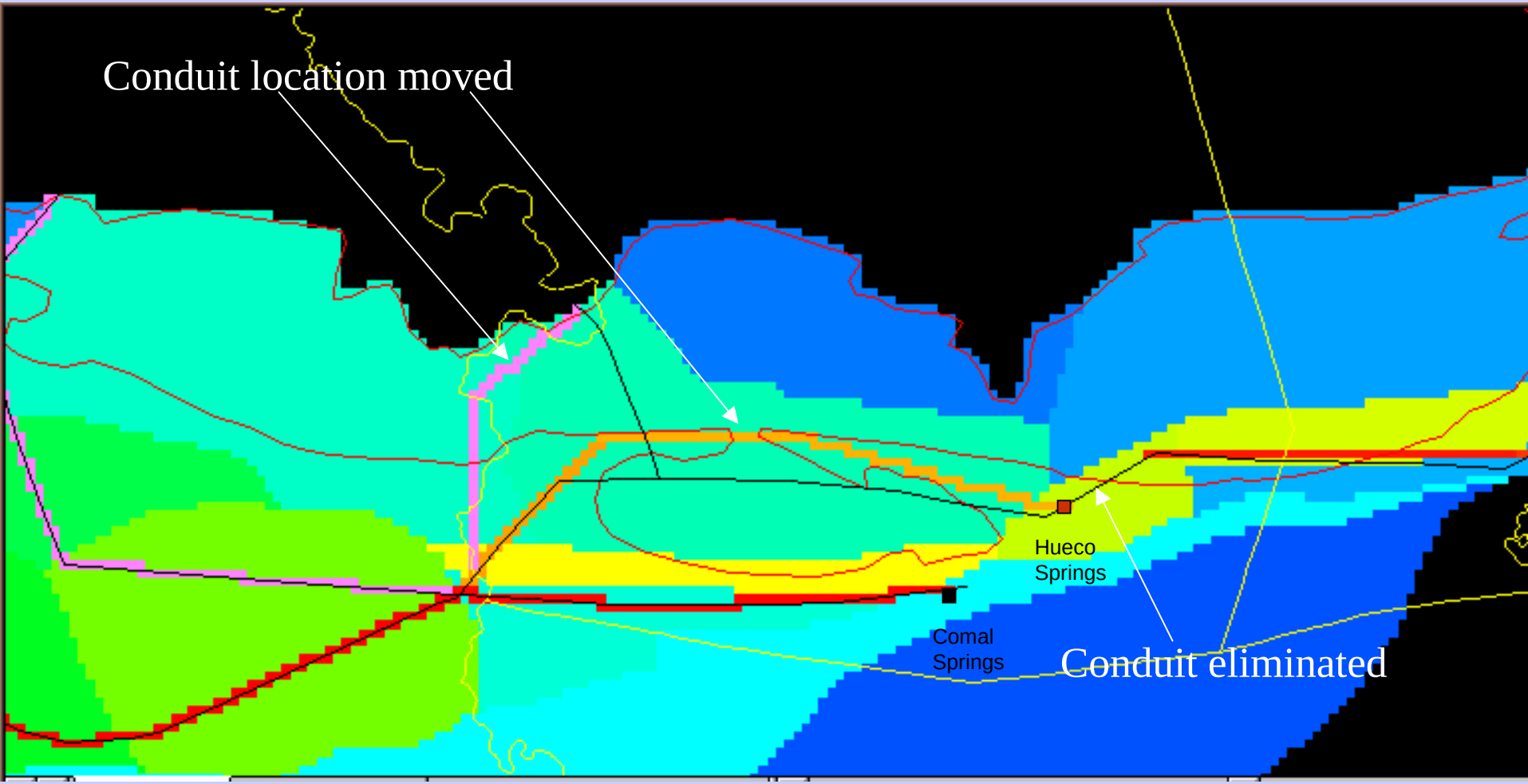


HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)

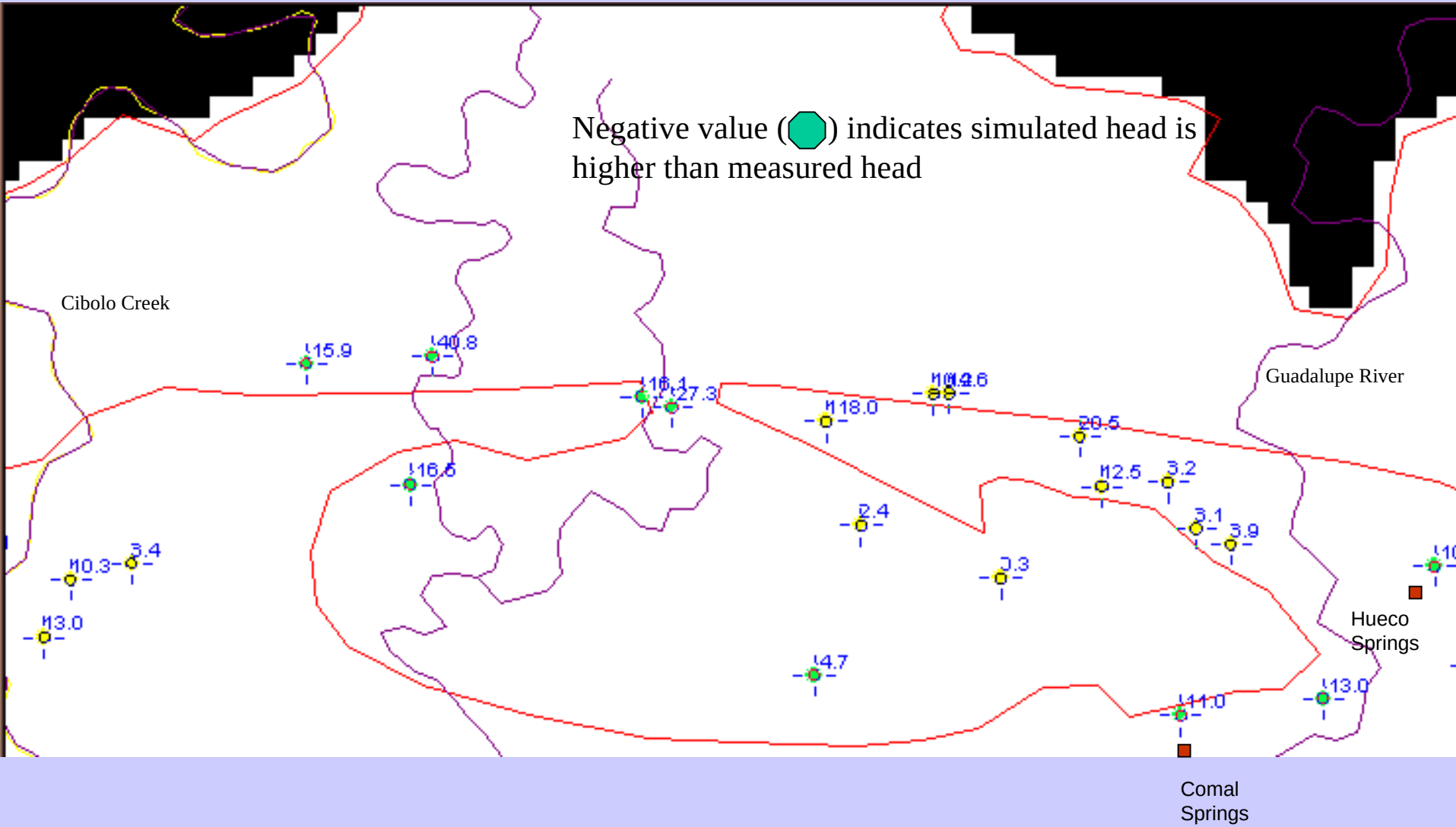


CONDUIT LOCATION REVISIONS



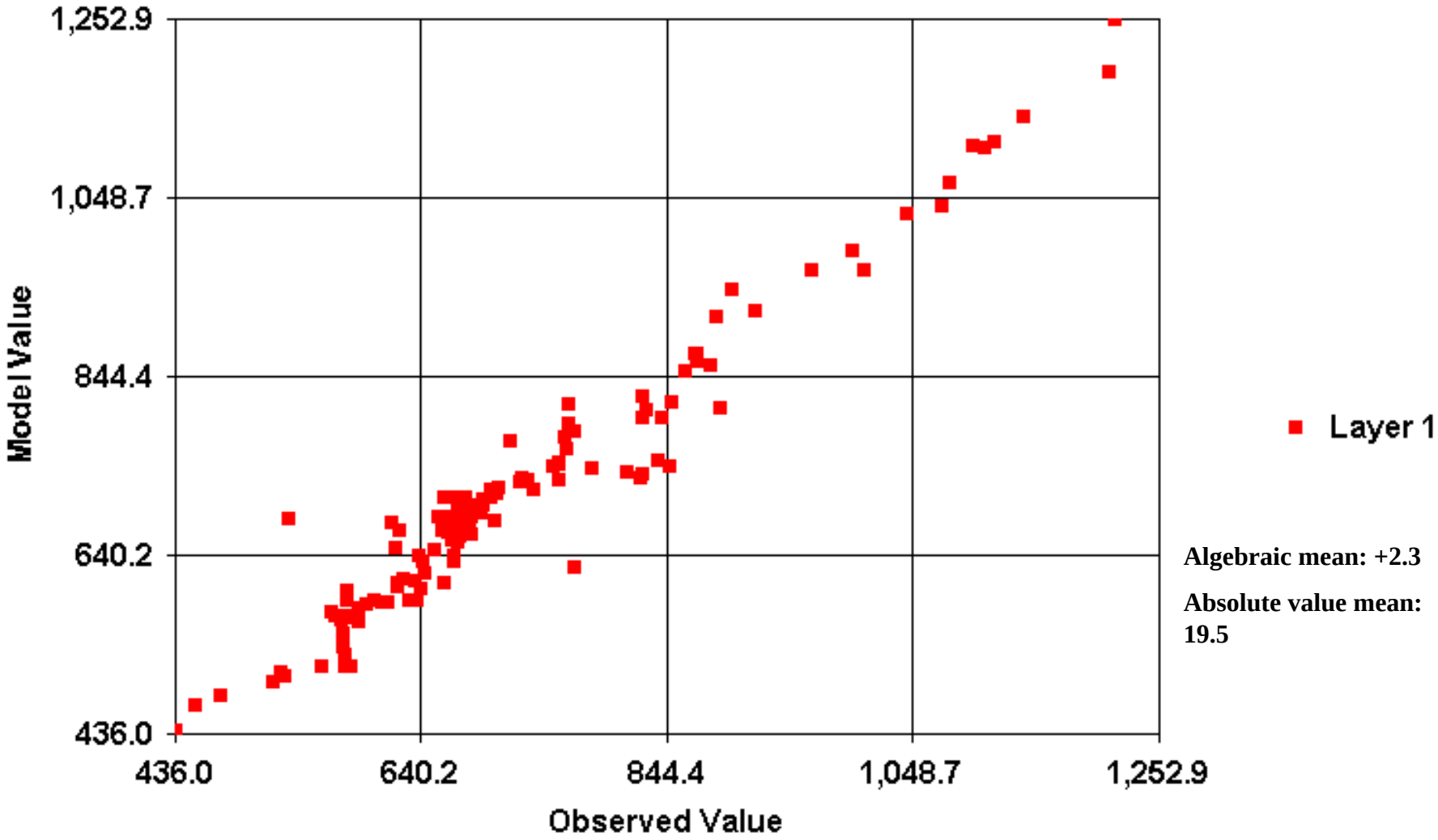
HYDRAULIC HEAD RESIDUALS

(As of 6/14/02 – Subject to revision)



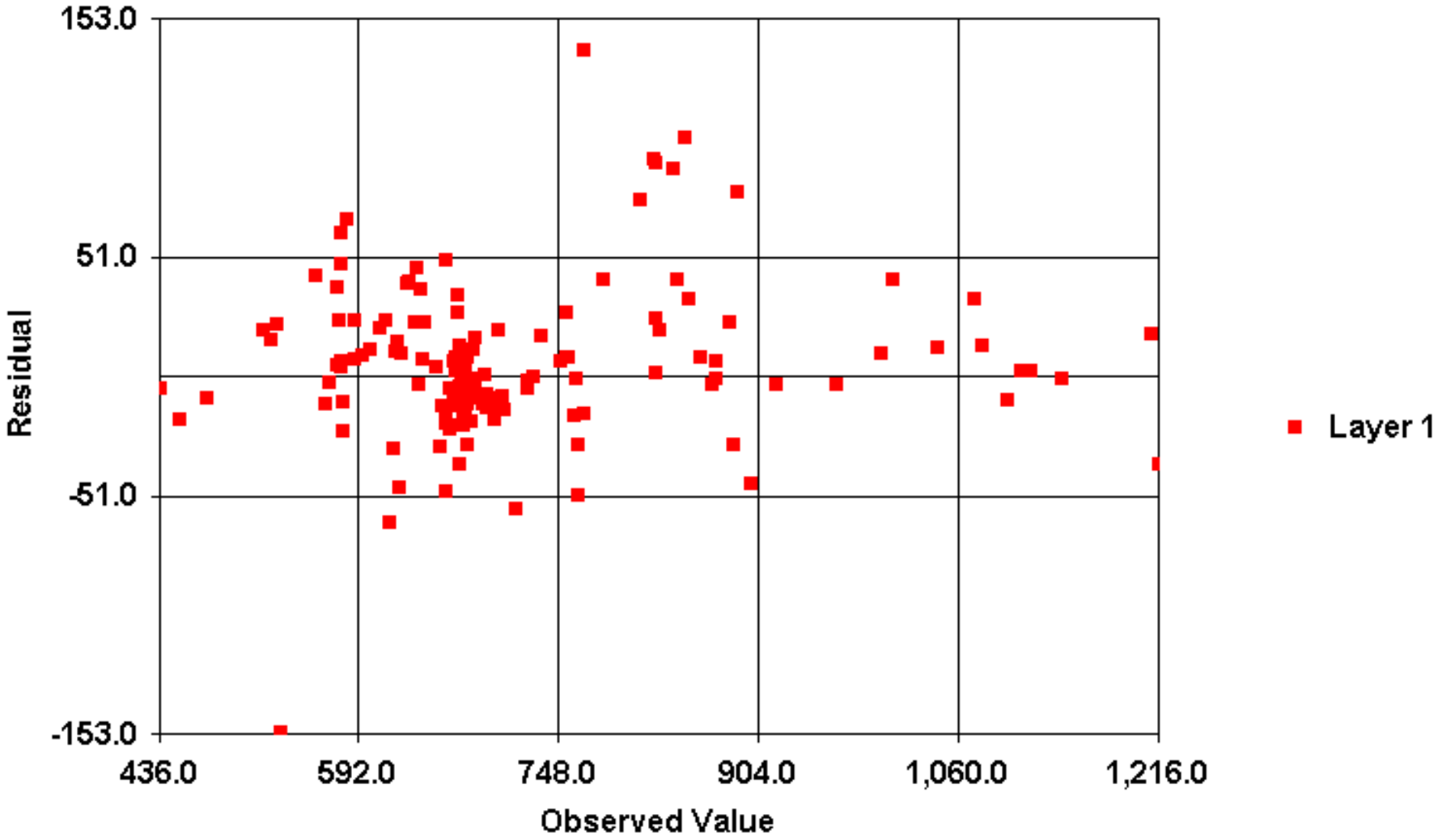
Observed vs. Computed Target Values

(As of 6/14/02 – Subject to revision)



Observed vs. Residuals

(As of 6/14/02 – Subject to revision)



STEADY-STATE CALIBRATION SPRINGFLOW

- 5 springs simulated:

	Measured (1939-46)			Simulated**
	Mean	Median	Range***	
Comal	333	330	297 to 363*	332
San Marcos	156	152	137 to 167	145
Leona	16.2	15.5	14 to 17	12.7
San Antonio	15.4	10.2	9.2 to 11.2	7.9
San Pedro	6.6	6.3	5.7 to 6.9	9.2

*(Range of medians: 274 to 358)

**(As of 6/14/02– Subject to revision)

***(± 10 percent of median – GAM guideline)

STEADY-STATE SIMULATION RESULTS

Parameter	Target	Calibrated December 2001 GWMAP	Calibrated March 2002 GWMAP	Calibrated SWRI (aq tests) & Conduits	SWRI (aq tests + heads + springflows)	Maclay K Minimum 1.0	Maclay K Minimum 1.0 & Conduits	Calibrated Maclay K & Conduits
Residual (ft)	<5	-2.5	-8.2	5.9	-119	-329	-0.9	2.3 (1.7)
Abs Res (ft)	<20	17.7	24.8	22.3	121	331	27.2	19.5 (17.5)
GHB (percent)	~10	8.2	8.9	8.1	7.2	3.2	7.4	8.0
Springs (ft³/sec)								
Comal	Mean: 333							
	Median: 330	347	315	349	116	228	361	332
	Range: 297-363							
San Marcos	Mean: 156							
	Median: 152	142	165	171	110	33	138	145
	Range: 137-167							

STAGES IN MODELING PROCESS

- Conceptual model
- Model construction
- Calibration
  - steady-state
  - transient
- Verification
- Prediction

TRANSIENT DATA COMPILATION

TRANSIENT DATA COMPILATION MODEL INPUTS

- STORAGE COEFFICIENT/SPECIFIC YIELD

  (1) Maclay and Land (1988)

  - Confined zone of aquifer – $1x10^{-4}$
  - Unconfined zone of aquifer – 0.05

  (2) Specific storage x Aquifer thickness

  (3) Conduits – high storativity values

TRANSIENT DATA COMPILATION MODEL INPUTS

- RECHARGE
  (1) San Antonio segment
    (a) USGS monthly recharge rates by basin
  (2) Barton springs segment
    (a) Scanlon and others (2000)
    (b) Based on Barton Springs flow prior to 1979

TRANSIENT DATA COMPILATION MODEL INPUTS

- PUMPAGE
  - Preliminary data set developed by BEG
  - Subject to refinement during transient calibration
  - Types of wells:
    (1) Municipal and public water supply
    (2) Irrigation
    (3) Industrial
    (4) County-other (domestic)

TRANSIENT CALIBRATION TARGETS HYDRAULIC HEADS

- Calibration targets

(1) Hydraulic heads - long-term record wells

- County Index wells
- match hydrographs

(2) Hydraulic heads - selected time periods

- periods of above- and below-normal precipitation
- match hydraulic heads for a set of wells

TRANSIENT CALIBRATION TARGETS SPRINGFLOW

- 5 springs simulated:

San Marcos	compiled
Comal	compiled
Leona	compiled
San Pedro	compiled*
San Antonio	compiled*

*Based on relation with index well J-17