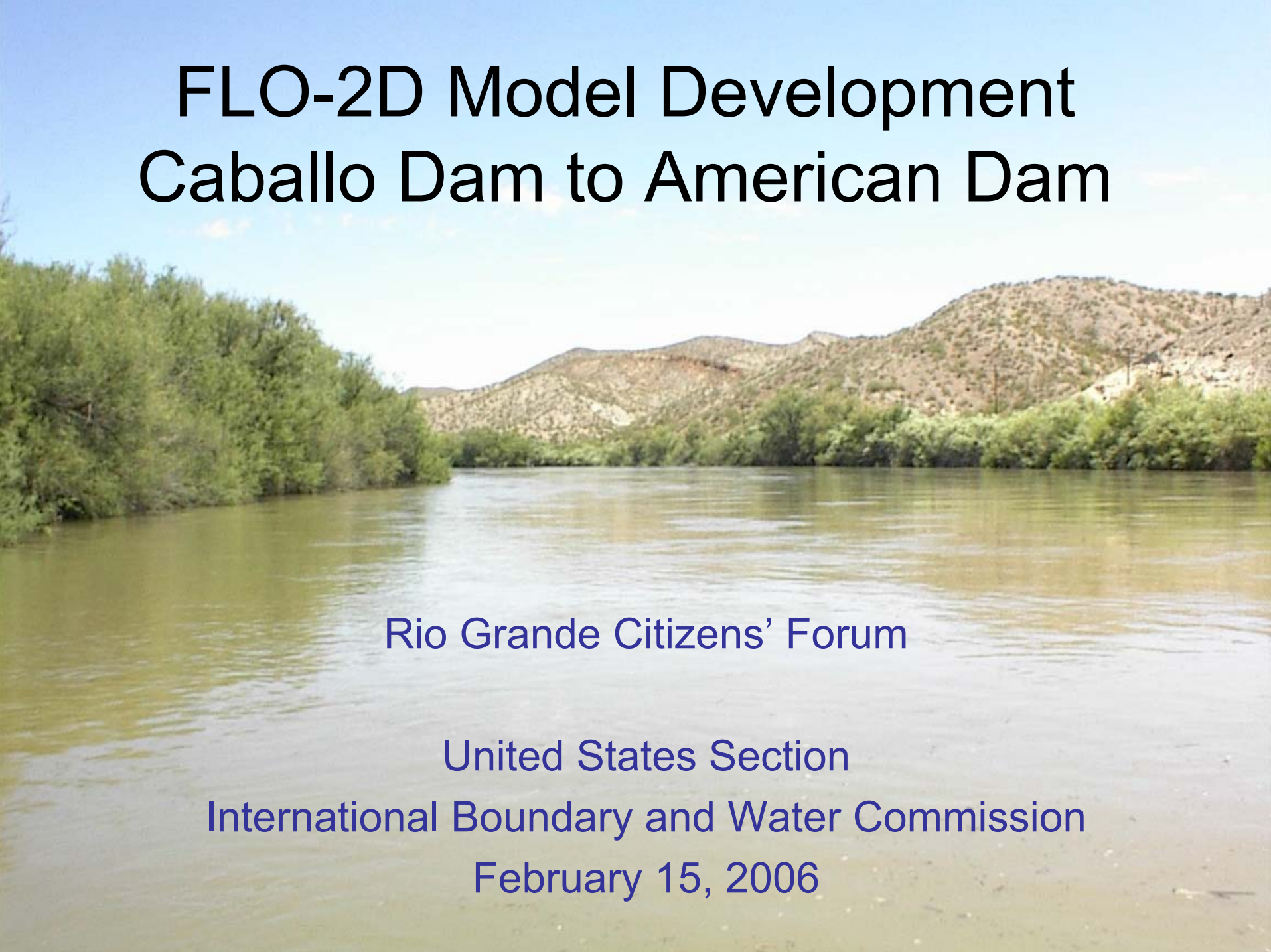
FLO-2D Model Development
Caballo Dam to American Dam



Rio Grande Citizens' Forum

United States Section
International Boundary and Water Commission
February 15, 2006

H&H Study

In 1996, the USACE conducted hydrologic (HEC-1) and hydraulic (HEC-2) analyses for the USIBWC

- Determine the channel capacity
- Determine the cause of channel scouring

USACE's 1996 study has been used by USIBWC as the guideline for flood elevations

At present FLO-2D study has been adopted as the guideline

MOA and SOW

- USIBWC and USACE signed a MOA in March 2004
- Tetra Tech, Inc. performed a new hydraulic study
- Tetra Tech, Inc. completed the final report “FLO-2D Model Development Below Caballo Dam” in Oct. 2005

FLO-2D

- Two-dimensional Unsteady Flood Routing Model
- Developed by Dr. Jim O'Brien of Tetra Tech, Inc.
- Flood hydrograph routed through a system of finite difference grid (250'x250') elements (Total 42,500)
- Study area – Caballo Dam to American Dam (105 river miles)

INPUT FILES

- Six required input files to conduct a basic flow simulation: CONT.DAT, TOLER.DAT, FPLAN.DAT, CADPTS.DAT, INFLOW.DAT, and OUTFLOW.DAT
- Additional input files: RAIN.DAT, INFIL.DAT, EVAPOR.DAT, CHAN.DAT, XSEC.DAT, HYSTRUC.DAT, STREET.DAT, ARF.DAT, MULT.DAT, SED.DAT, and LEVEE.DAT

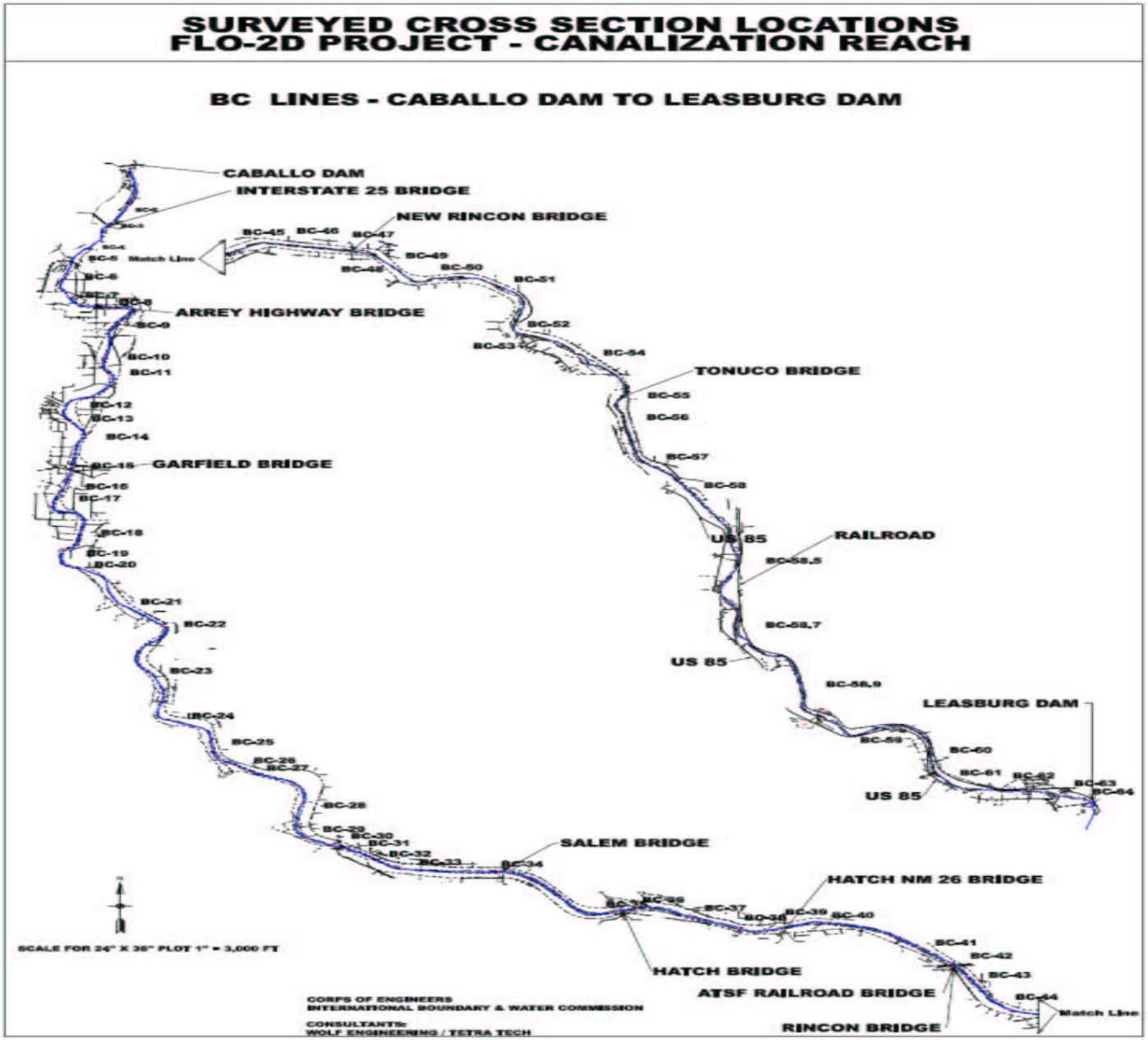


Figure 5. Location of the Survey RGCP Cross Sections - Caballo Dam to Leasburg Dam

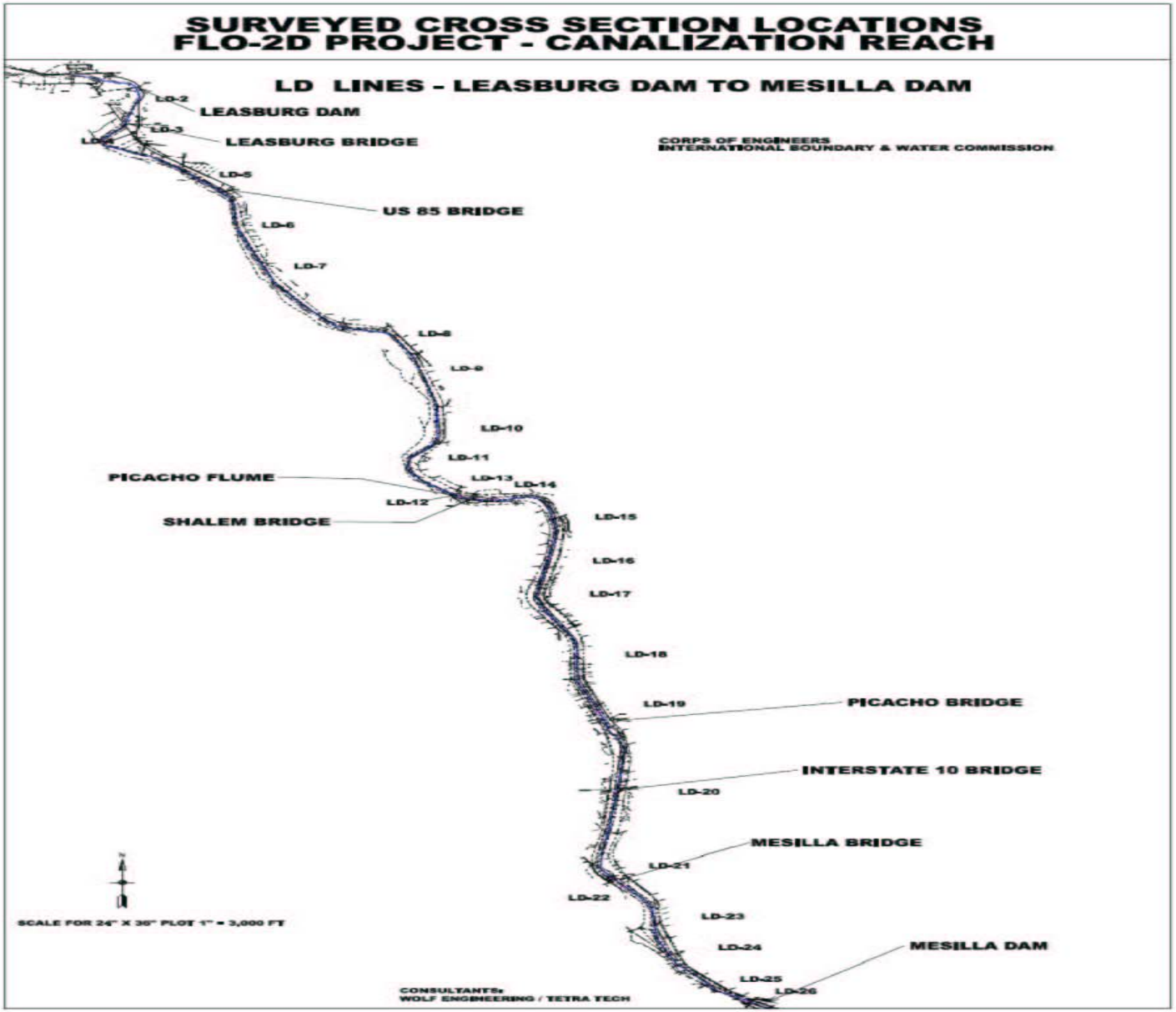


Figure 6. Location of the Survey RGCP Cross Sections - Leasburg Dam to Mesilla Dam

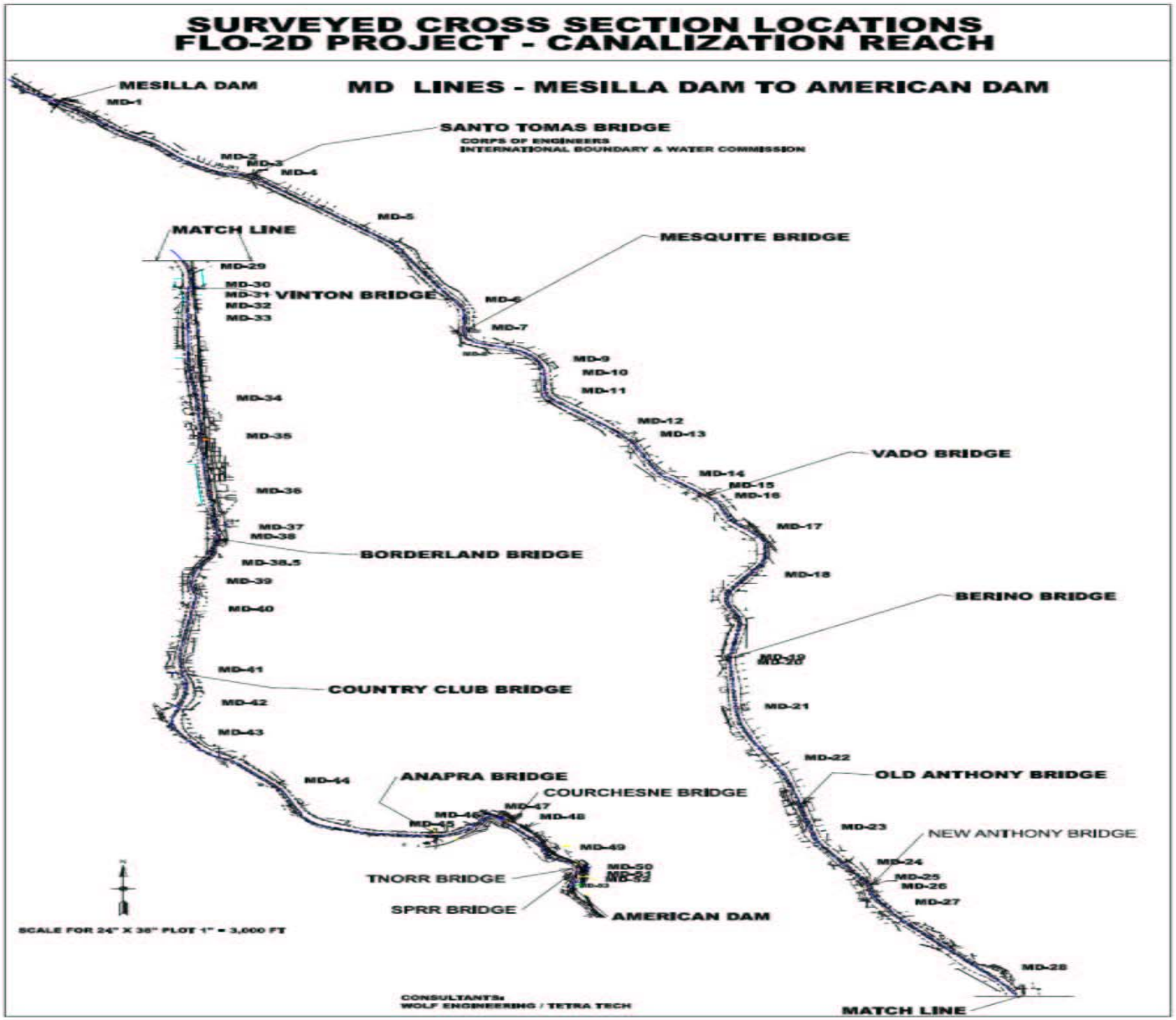


Figure 7. Location of the Survey RGCP Cross Sections - Mesilla Dam to American Dam

Flood Scenarios

Return period floods were:

2-yr, 5-yr, 10-yr, 25-yr, 50-yr,100-yr

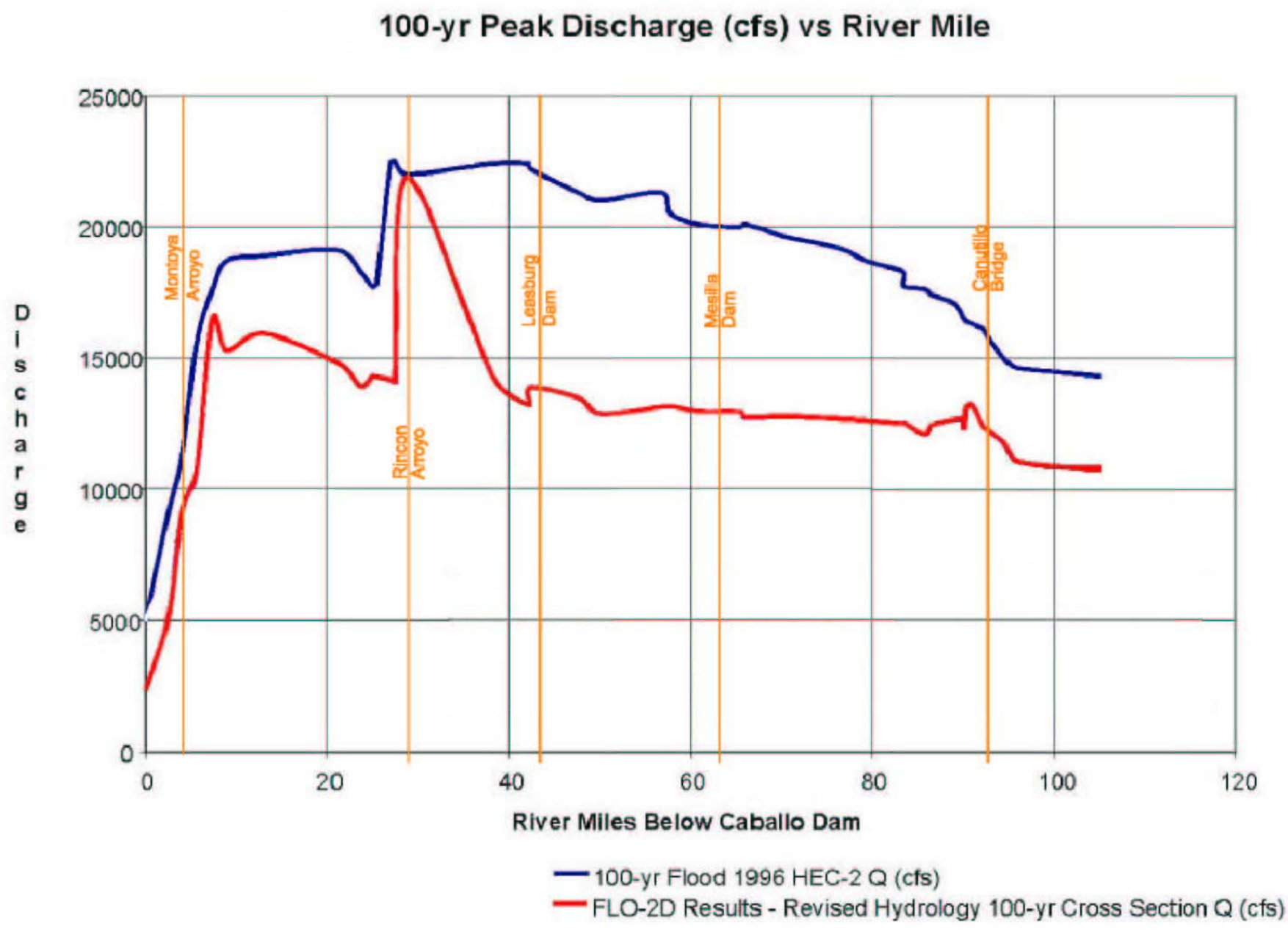
For 100-year Flood Event:

2,350 cfs release + Revised 100-year 24-hr hydrology for tributary flood inflows

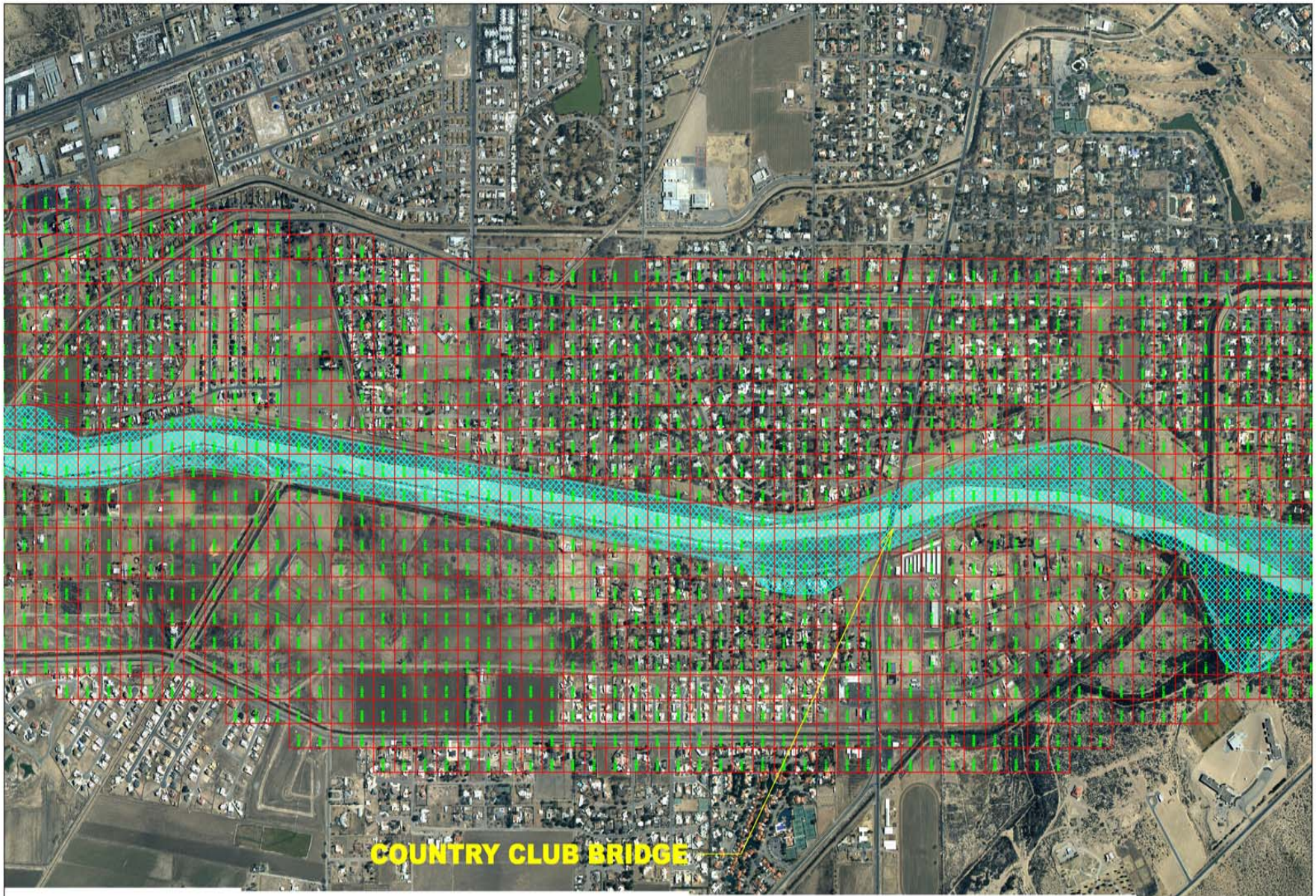
Model Results

- Flood wave attenuation
- Area of Inundation
- Levee deficiency

100-year 24-hr Peak Discharge Caballo Dam to American Dam			
Location	Distance miles	1996 Qp (cfs)	FLO-2D Qp (cfs)
Caballo Dam release	0	5,000	2,350
Trujillo Canyon	2.69	9,100	2,400
Montoya Arroyo	4.02	11,300	9,100
Green Canyon	5.63	11,700	10,400
Tierra Blanca Arroyo	5.81	15,600	10,400
Sibley Arroyo	7.33	17,600	14,000
Berrenda Arroyo	8.66	18,700	14,000
ArroyoCuervo	13.01	18,900	15,000
Placitas Arroyo	20.68	19,100	14,000
Angostura Arroyo	25.42	17,800	14,500
RinconArroyo	28.88	22,400	22,400
Reed Arroyo	31.88	22,500	20,000
Broad Canyon	37.92	22,400	14,000
Faulkner Canyon	42.46	22,200	13,000
Leasburg Dam	43.39	22,200	13,800
Shalem Bridge	54.13	20,900	13,500
Dona Ana Dam	55.44	21,000	13,500
Picacho Dam	56.76	21,300	13,400
Mesilla Dam	63.07	20,000	13,400
Vinton, Texas	89.68	16,500	12,100
Nuway, Texas	91.33	16,300	12,100
Canutillo, Texas	92.71	15,900	12,000
Borderland, Texas	94.76	15,000	11,100
Courchesne Bridge	103.77	14,400	11,000
American Dam	105.44	14,000	11,000


100-yr Peak Discharge (cfs) vs River Mile
Discharge
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
120
River Miles Below Caballo Dam
Montoya Arroyo
Rincon Arroyo
Leasburg Dam
Mesilla Dam
Canutillo Bridge
100-yr Flood 1996 HEC-2 Q (cfs)
FLO-2D Results - Revised Hydrology 100-yr Cross Section Q (cfs)

UPPER RIO GRANDE WATER OPERATIONS MODEL - REACH 16 FLO-2D FLOOD ROUTING MODEL



CABALLO DAM TO AMERICAN DAM

RIO GRANDE CANALIZATION REACH

FLO-2D GRID / AREAS OF LEVEE DEFICIENCY
100 YR - 24 HR EVENT WITH 2,350 CFS CABALLO RELEASE

SCALE : 1"=500'
22" x 34"

SHEET NO.
33 OF 36

IMAGERY AND MAPPING:
2004 DONA ANA COUNTY FLOOD COMMISSION
MAP PRODUCTION:
WOLF ENGINEERING, LLC

MODEL DEVELOPMENT:
WOLF ENGINEERING, LLC / FLO-2D SOFTWARE
TETRA TECH, INC

U.S. ARMY CORPS OF ENGINEERS - ALBUQUERQUE DISTRICT
INTERNATIONAL BOUNDARY & WATER COMMISSION - U. S. SECTION

SEPTEMBER 2005

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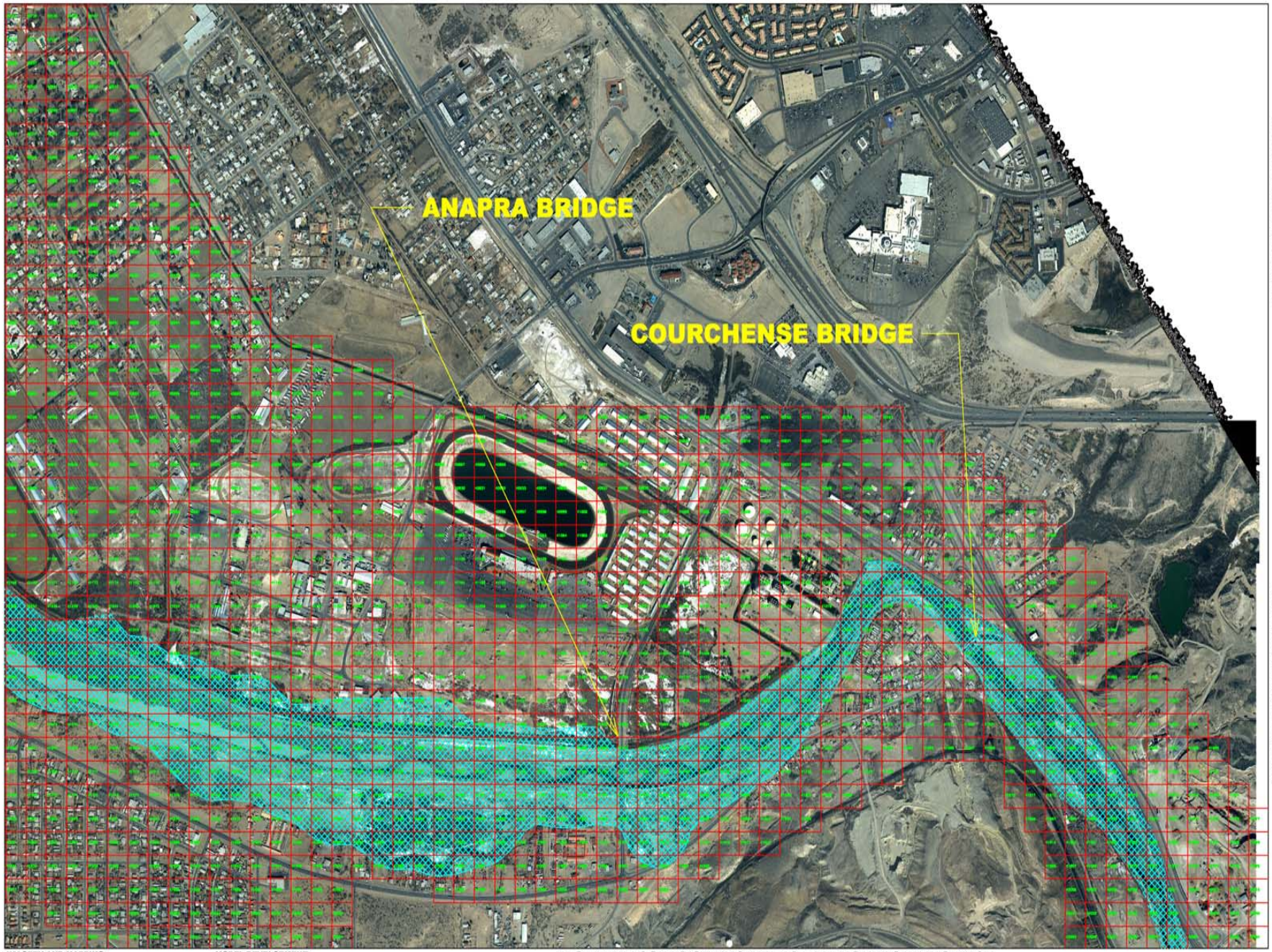

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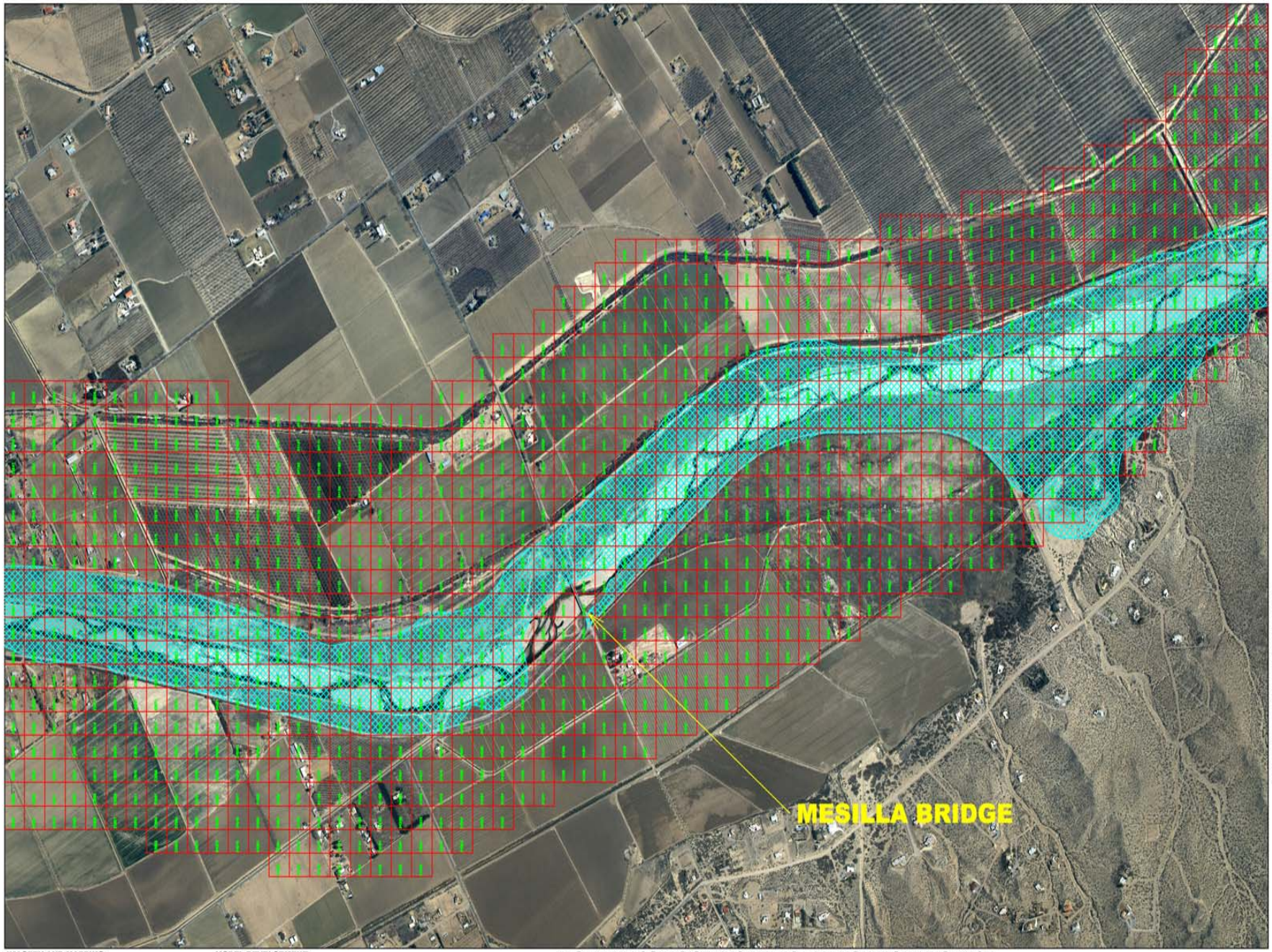

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Levee Freeboard

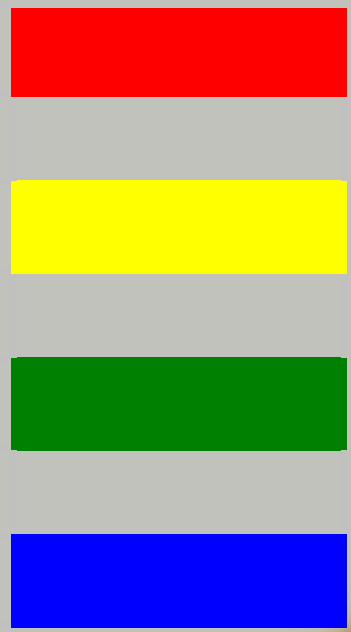
Code was written to track the levee freeboard

OVERTOPPED

0 FT < FREEBOARD < 1 FT

1 FT < FREEBOARD < 2 FT

2 FT < FREEBOARD < 3 FT



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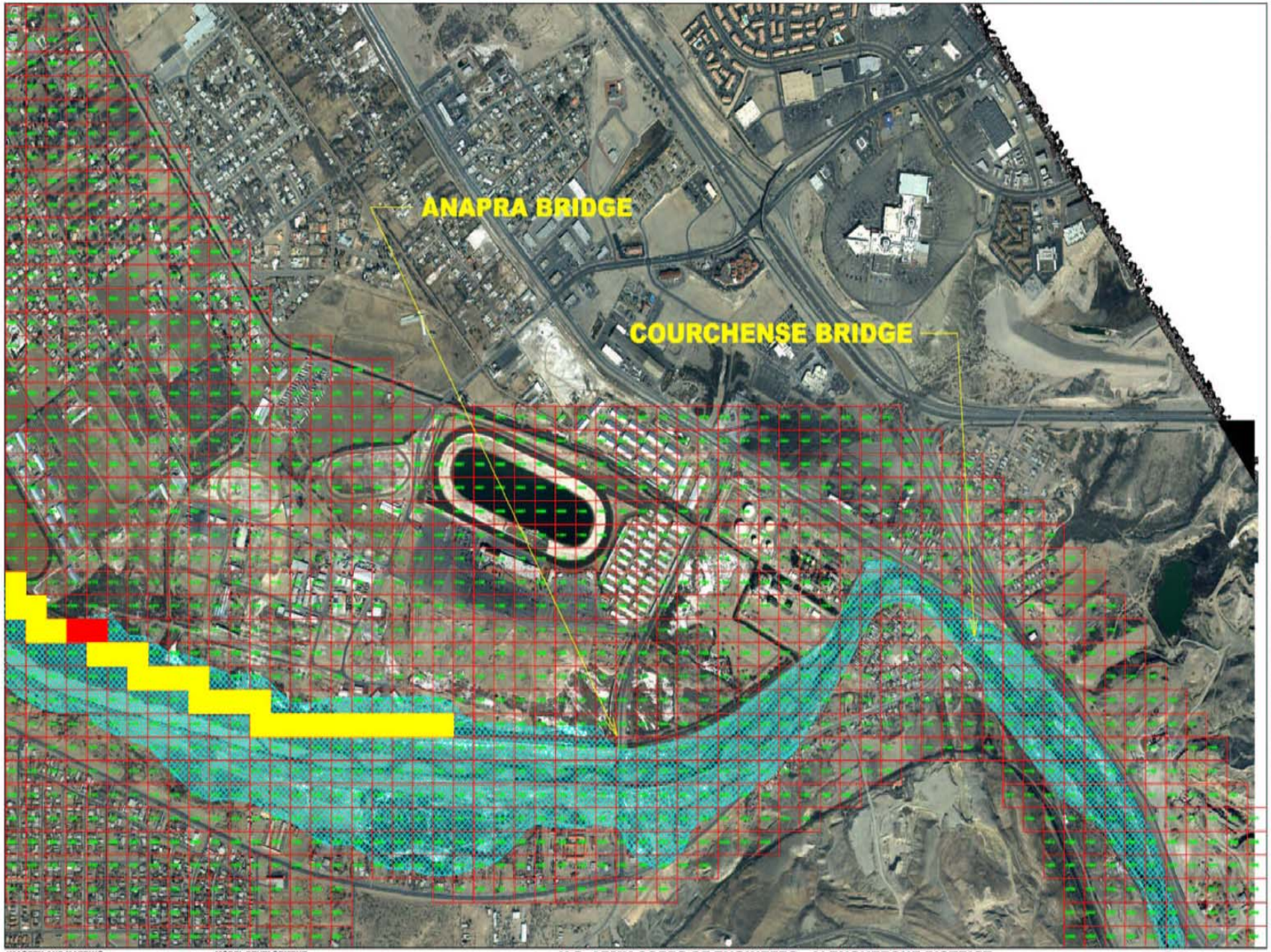

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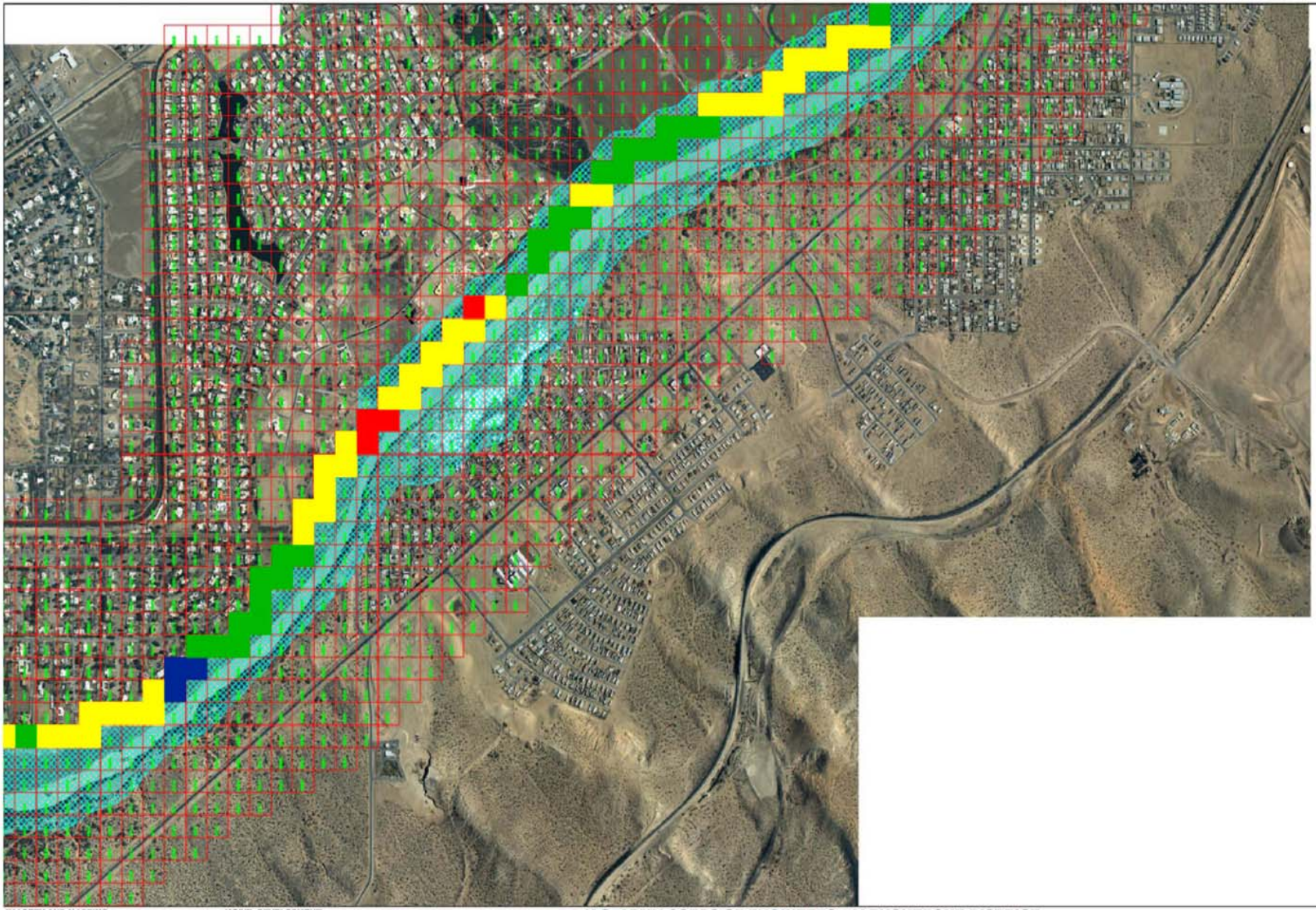

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SEPTEMBER 2005

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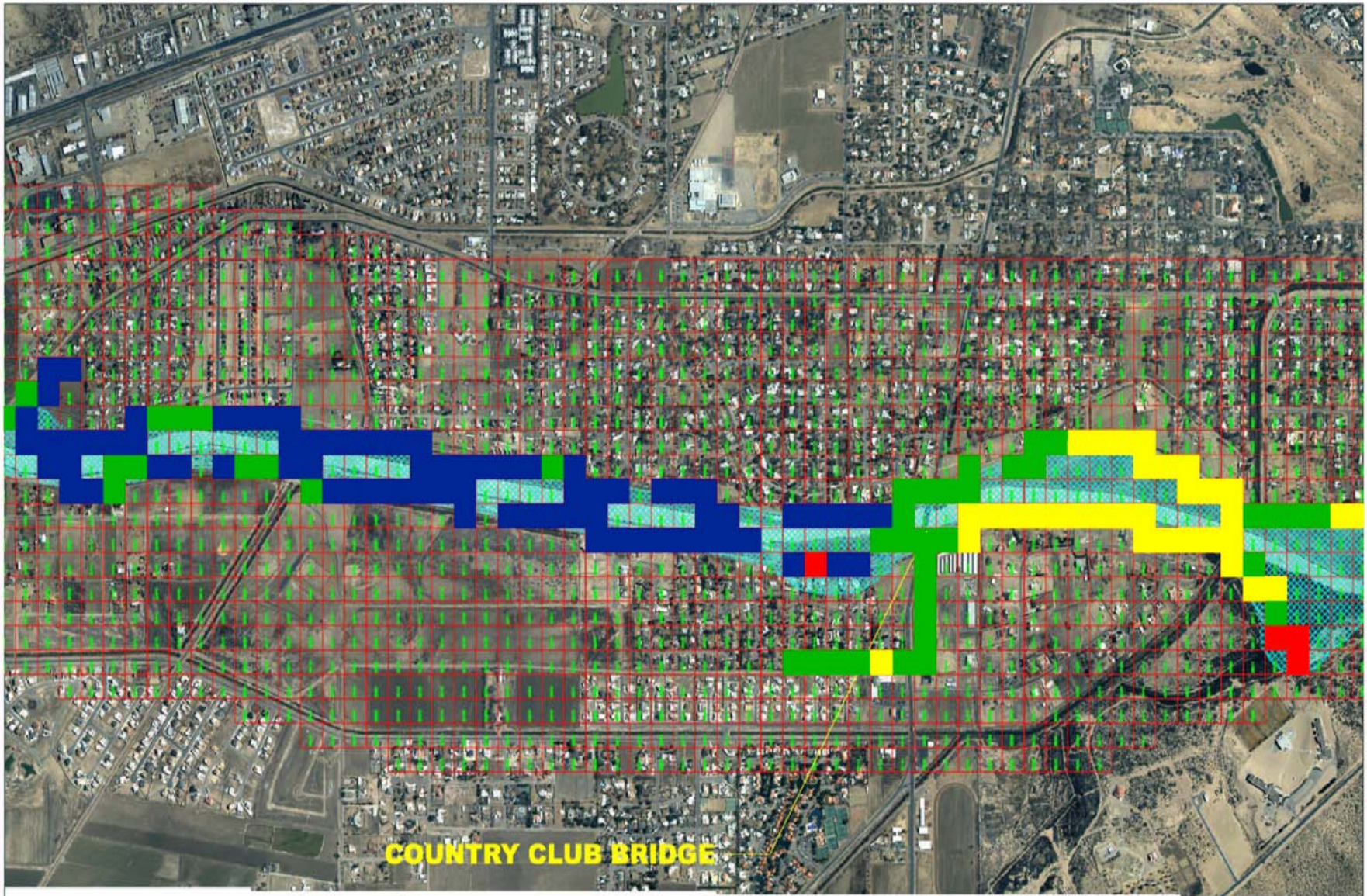

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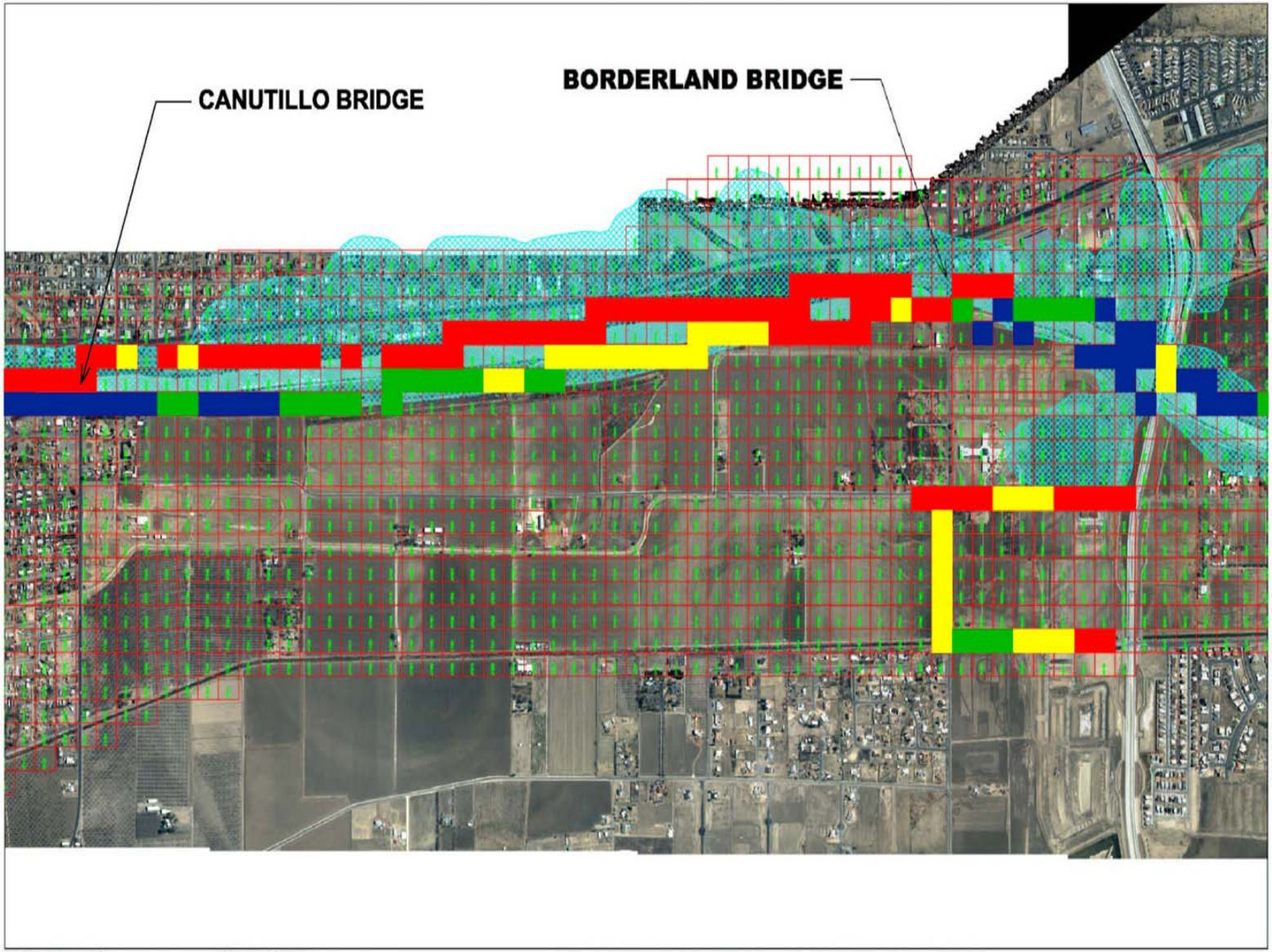

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SEPTEMBER 2005

Additional Model Runs

- Dredging at select locations
- Routing the 100-year flood flow with the entire levee system sufficiently high to contain the flood

Flood Control Improvements in the Canutillo Area

- 14,000 ft of floodwall construction on the east side
- 8,000 ft of levee raising on the west side
- Design of improvements based on the FLO-2D model results


The End
February 15, 2006