



STATUS UPDATE ON THE SEDIMENT TRANSPORT AND CHANNEL MAINTENANCE ALTERNATIVES STUDY ALONG THE RIO GRANDE CANALIZATION PROJECT

**Padinare Unnikrishna, Ph.D., P.E., CFM
Supervisory Civil Engineer**

**International Boundary and Water Commission
United States Section**

Engineering Services Division

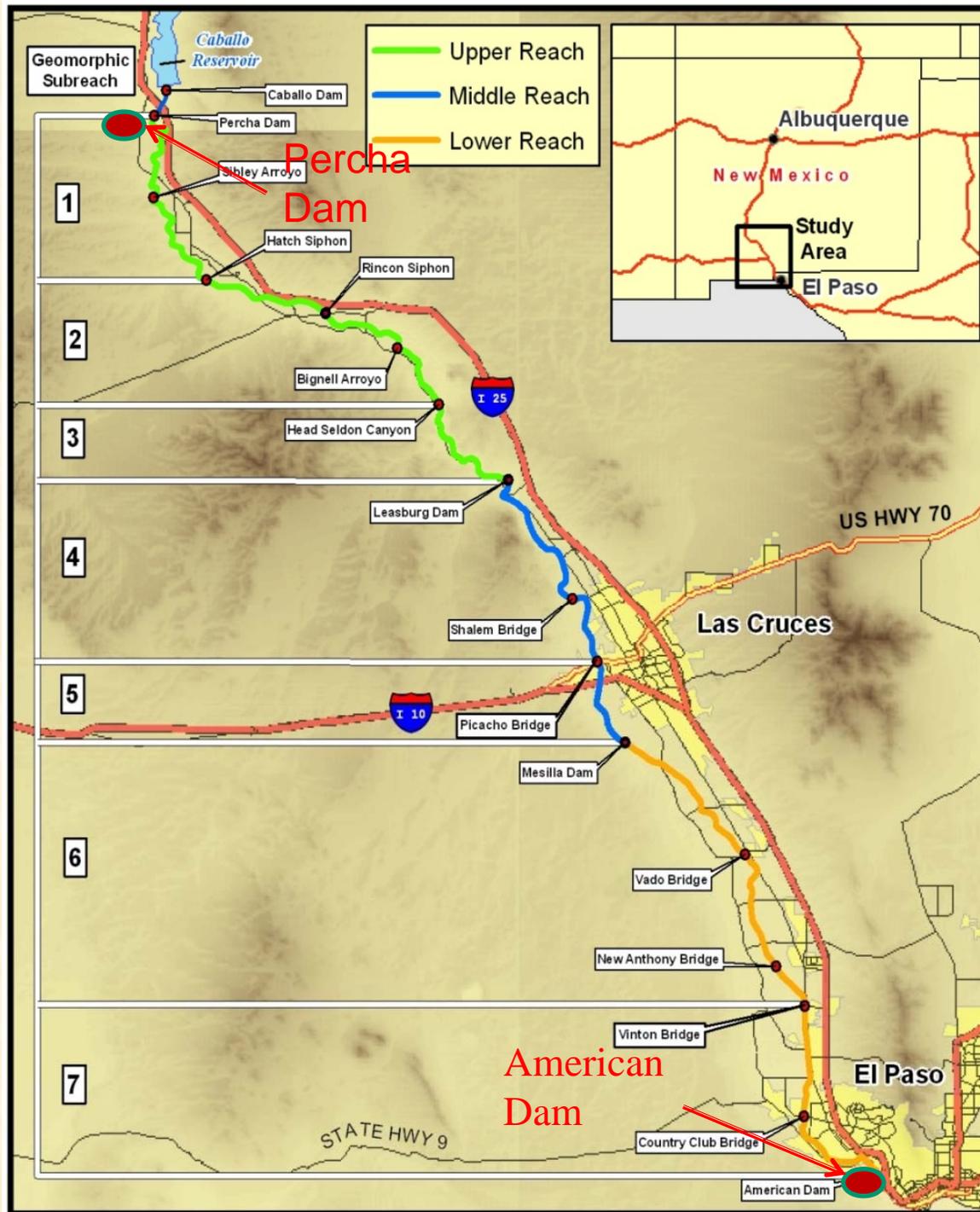
October 22, 2015



Study Area

Rio Grande Canalization Project (RGCP)

- **From Percha Dam to American Dam**
 - **Reach of 105.4 miles**





Motivation for the Study

- **Sedimentation Issues**
 - **Increased water surface elevations**
 - **Levee freeboard**
 - **Flooding**
 - **Island formation**
 - **Sediment plugs**
 - **Reduced irrigation return flow efficiencies**
- **2009 Record of Decision (ROD)**



Study Objectives

- **Identify and evaluate five (5) Channel Management Alternatives (CMAs) at nine (9) representative problem locations (PL) along the RGCP, and recommend the two CMAs that provide the highest expected benefit relative to cost and consequence.**

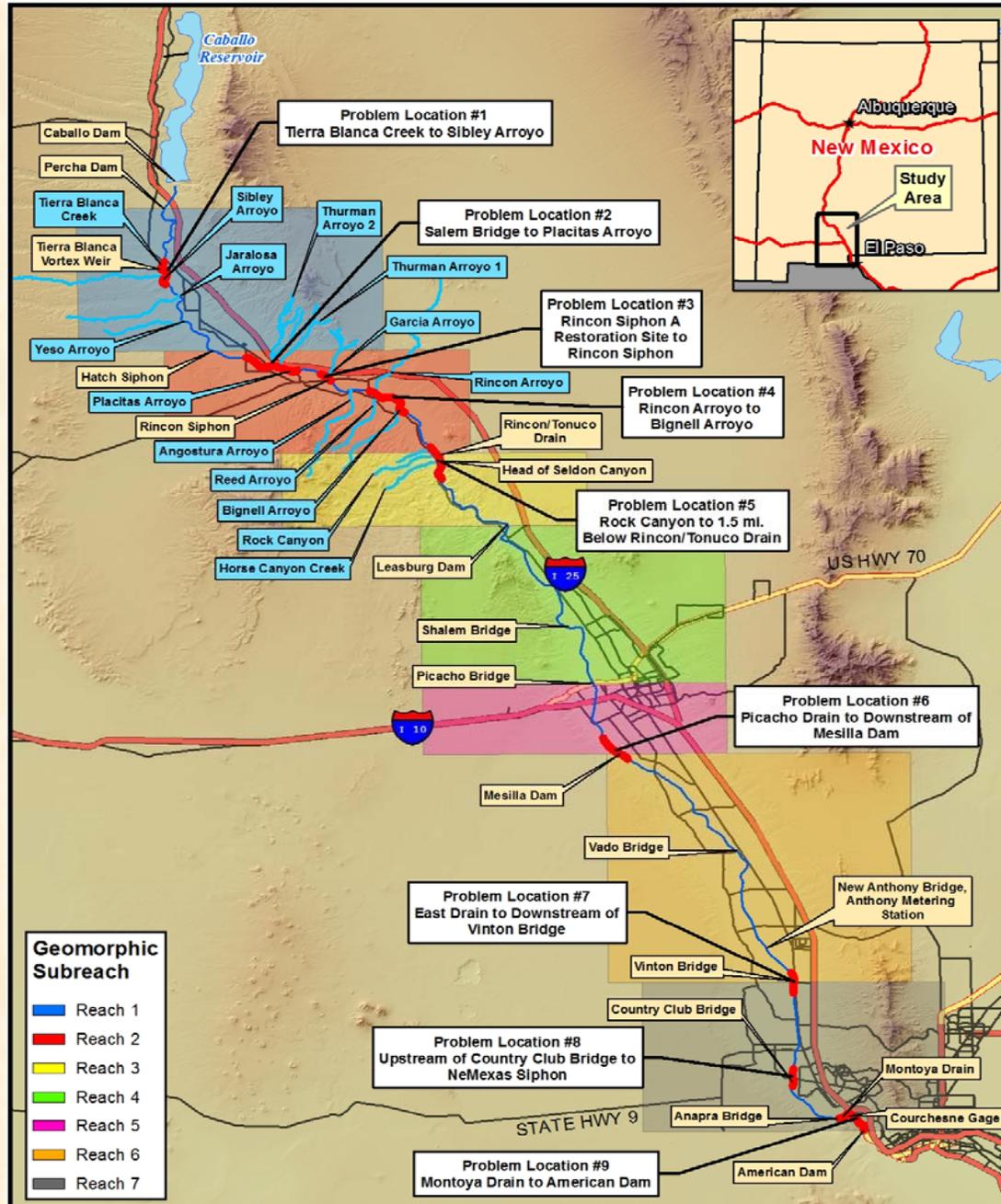


Study Team

- **Mr. Derrick O'Hara, USIBWC Project Manager**
- **CONSULTANT: TETRA TECH, INC.**
- **Mr. Stu Trabant, Project Manager**
- **Dr. Bob Mussetter, Program Manager**
- **Dr. Mike Harvey, Principal Geomorphologist**
- **Mr. Mike Pierce, Technical Development Team Lead**
- **Dr. Lyle Zevenbergen, QA/QC**

Problem Locations

	PL	Identification	Representation	Length (miles)	Comment
	1	Tierra Blanca Creek to Sibley Arroyo	Vortex Weir	2.3	Draft Channel Maintenance Plan Low Priority Area; includes vortex weir below Tierra Blanca.
	2	Salem Bridge to Placitas Arroyo	Arroyos and Islands	3.8	Draft Channel Maintenance Plan Low and High Priority Areas; includes Hatch Bridge, Thurman Arroyo and numerous islands.
	3	Rincon Siphon A Restoration Site to Rincon Siphon	Restoration Sites and Siphon	0.8	Draft Channel Maintenance Plan Low and High Priority Areas; includes Garcia Arroyo
	4	Rincon Arroyo to Bignell Arroyo	Arroyos and Islands	3.5	Draft Channel Maintenance Plan Low and High Priority Areas; includes Reed Arroyo
	5	Rock Canyon to 1.4 mi below Rincon/Tonuco Drain Confluence	Drain and Mouth of Seldon Canyon	2.9	Draft Channel Maintenance Plan Medium Priority Area; Includes Horse Canyon Creek
	6	Picacho Drain to below Mesilla Dam	Drain, Canals and Dam	2.4	Draft Channel Maintenance Plan Medium Priority Area; includes California Lateral
	7	East Drain to below Vinton Bridge	Drain and Arroyo	1.8	Not a Draft Channel Maintenance Plan Priority Area but issues with sedimentation and flooding.
	8	Upstream of Country Club Bridge to NeMexas Siphon	No Inputs, Bridge, Populated Area, Levee Encroachments	1.5	Draft Channel Maintenance Plan High Priority Area; Levee encroachment and freeboard concerns
	9	Montoya Drain to American Dam	Drain	2.7	Draft Channel Maintenance Plan High Priority Area; Below Anapra Bridge



**Sitemap
RGCP Problem Areas**





CHANNEL MAINTENANCE ALTERNATIVES (CMAs)

SEDIMENT REMOVAL ALTERNATIVES:

- **Localized Excavation**
- **Short Excavation**
- **Long Excavation**

NON- SEDIMENT REMOVAL ALTERNATIVES:

- **Arroyo Sediment Traps**
- **Low-Elevation Spur Dikes**
- **Island Destabilization and Vegetation Removal**



Study Steps

- **Field reconnaissance and site surveys**
- **Identify channel maintenance alternatives**
- **Hydraulic modeling**
- **Sediment-transport modeling**
- **Alternative evaluation**



Field Reconnaissance and Site Surveys

- **Field Reconnaissance**
 - **Sediment sampling**
 - **Hydraulic and geomorphic controls**
 - **Sediment sources**

- **Cross-section Surveys**
 - **Monument cross section endpoints**
 - **Del Survey and Tetra Tech Surveyors (PL 1-5, 9)**
 - **USIBWC Surveyors (PL 6-8)**

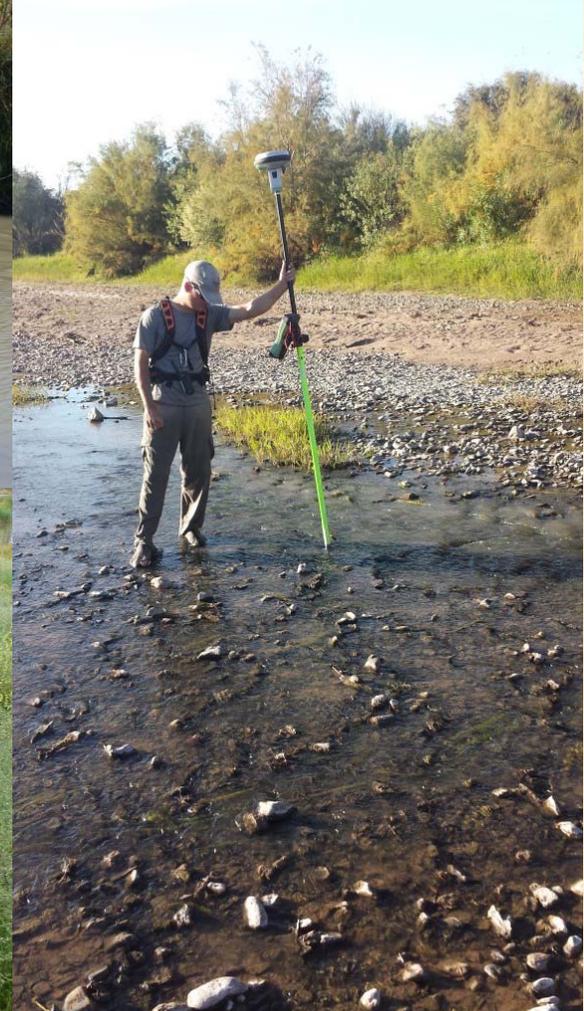


Sediment Sampling

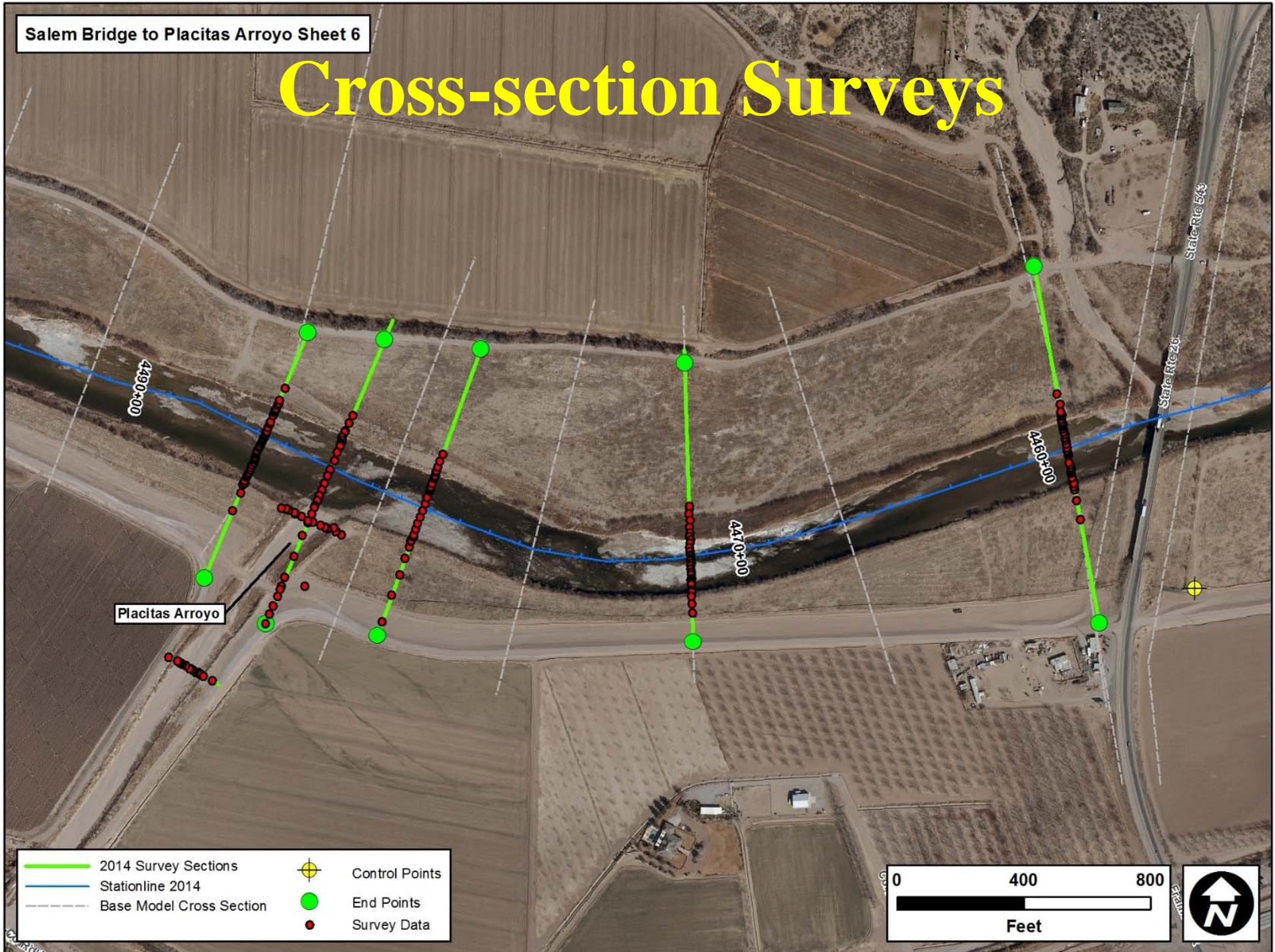




Cross-section Surveys



Cross-section Surveys

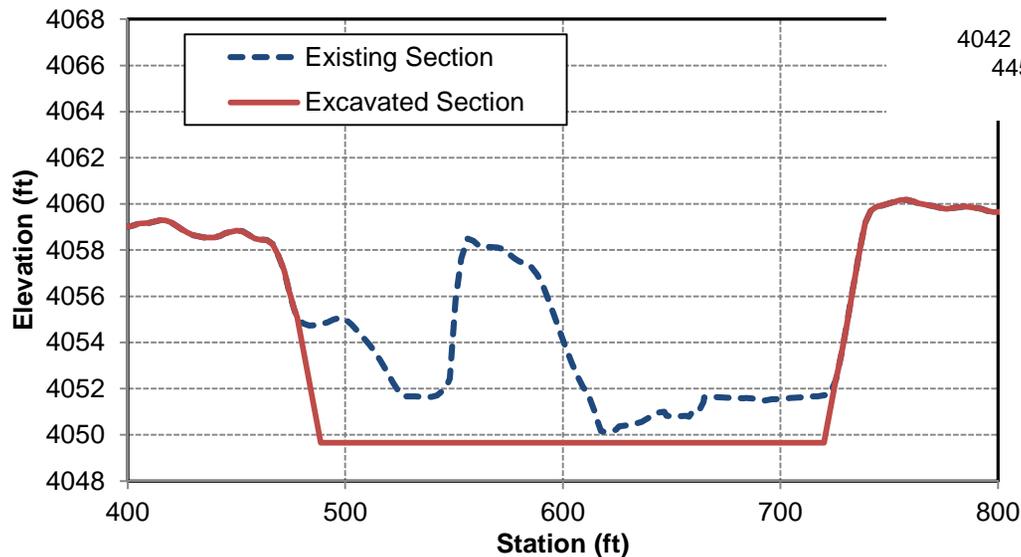
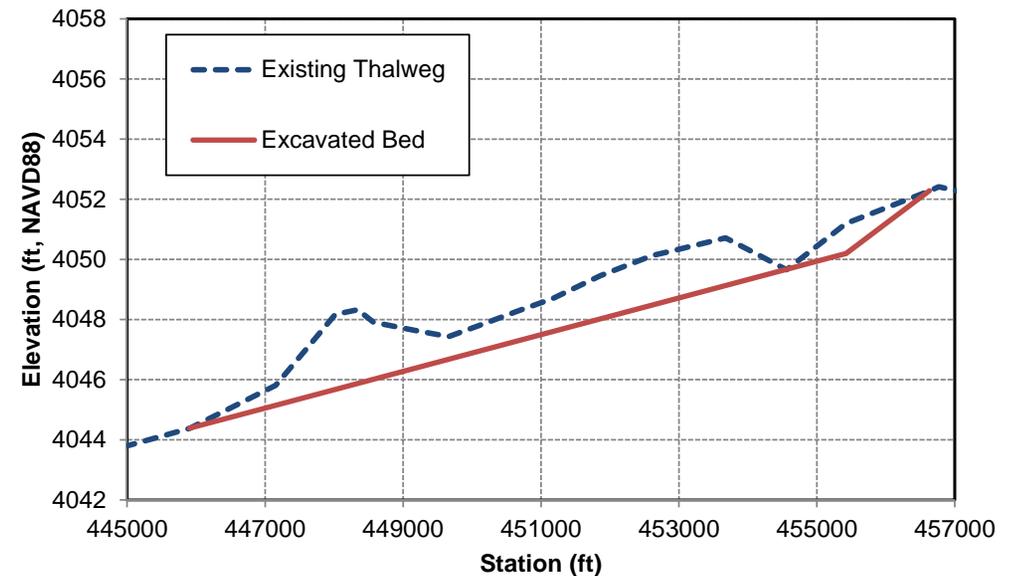




General Alternatives

Sediment Removal Alternatives

- Localized excavation
- Short excavation
- Long excavation





Sediment-Removal Alternatives

Problem Location	Alternative	Excavated Length (ft)	Avg. Excavated Depth (ft)	Avg. Excavated Width (ft)	Excavated Volume (CY)	Problem Location	Alternative	Excavated Length (ft)	Avg. Excavated Depth (ft)	Avg. Excavated Width (ft)	Excavated Volume (CY)
1	Localized Sediment Removal	250	2.9	130	5,750	6	Channel Excavation Short	4,710	3.9	50	35,540
	Channel Excavation Short	2,300	3.1	75	20,550		Channel Excavation Long	8,860	4.1	50	58,170
	Channel Excavation Long	7,440	4.0	60	48,520	7	Localized Sediment Removal	450	3.4	200	4,330
2	Localized Sediment Removal	1,070	2.7	220	46,180		Channel Excavation Short	5,030	4.2	80	38,050
	Channel Excavation Short	4,590	2.7	165	84,580		Channel Excavation Long	8,920	4.3	60	48,160
	Channel Excavation Long	9,500	3.0	110	126,890	8	Localized Sediment Removal	370	4.2	300	8,770
3	Localized Sediment Removal	410	2.5	150	11,330		Channel Excavation Short	1,620	4.4	70	21,520
	Channel Excavation Short	2,280	2.1	90	17,220		Channel Excavation Long	5,970	4.5	60	43,000
	Channel Excavation Long	3,780	2.5	110	36,370	9	Localized Sediment Removal	210	2.5	200	15,650
4	Localized Sediment Removal	750	3.4	193	38,040		Channel Excavation Short	2,600	2.4	280	38,130
	Channel Excavation Short	3,690	3.5	70	65,290		Channel Excavation Long	11,530	3.7	100	176,250
	Channel Excavation Long	16,150	4.3	60	221,590	5	Localized Sediment Removal	1,000	4.3	315	71,240
Channel Excavation Short	2,990	3.9	75	100,920	Channel Excavation Long		13,480	4.2	70	221,880	
Channel Excavation Long	13,480	4.2	70	221,880							



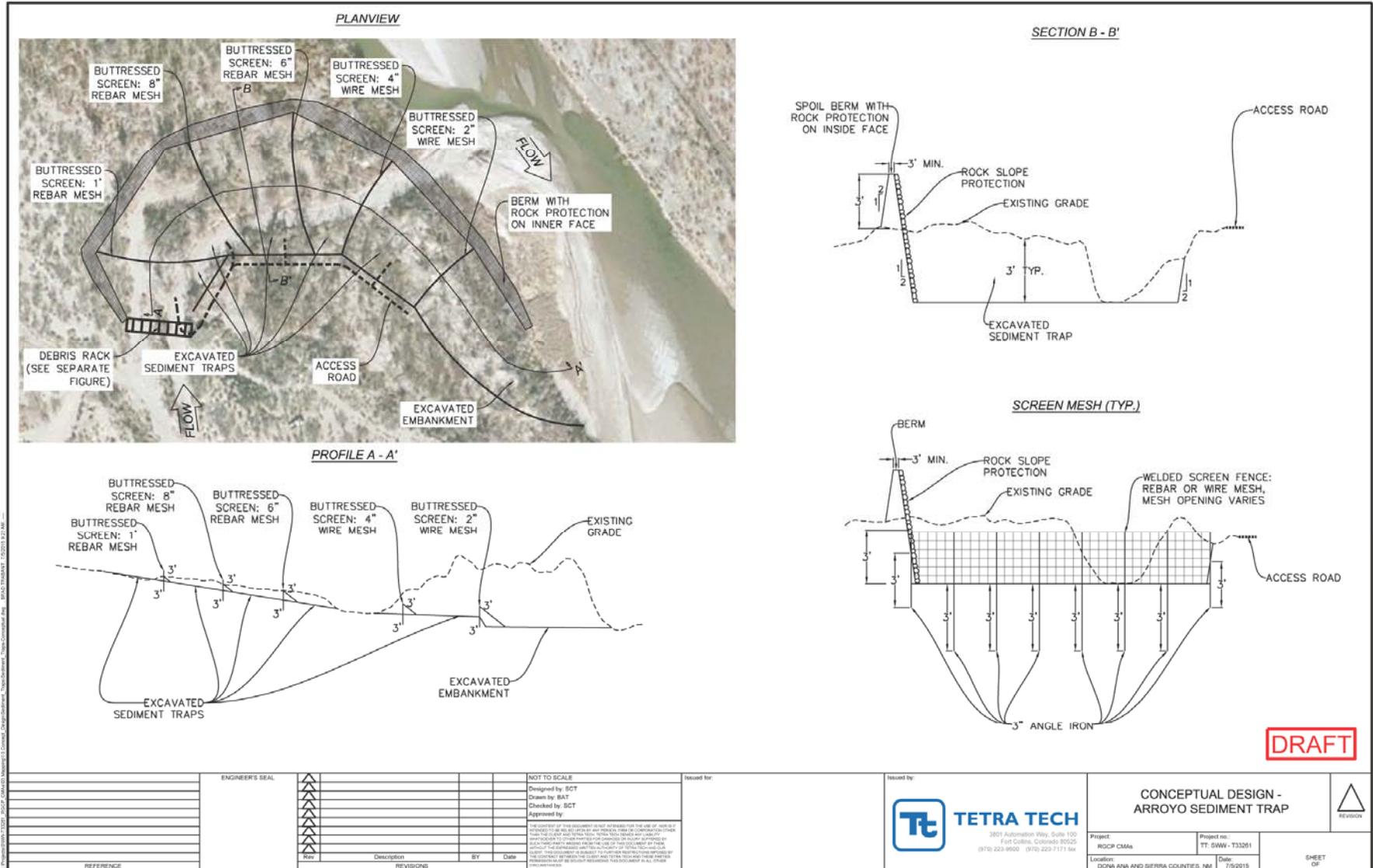
Non-sediment Removal Alternatives

General Alternatives

- **Arroyo sediment traps**
- **Low-elevation spur dikes**
- **Island destabilization and vegetation removal**



Arroyo Sediment Traps



DRAFT

ENGINEER'S SEAL		NOT TO SCALE		Issued by:	TETRA TECH 3801 Automation Way, Suite 100 Fort Collins, Colorado 80525 (970) 223-8920 (970) 223-1717 fax	CONCEPTUAL DESIGN - ARROYO SEDIMENT TRAP		
		Designed by: BCT Drawn by: BAT Checked by: BCT Approved by:	Project: RGCP CMA6			Project no: TT-SWW-133261	Date: 7/5/2015	
REFERENCE		Rev Description BY Date	REVISIONS			Location: DOWA ANA AND SIERRA COUNTIES, NEA		

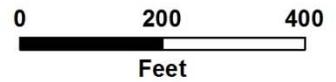
P:\Projects\2015\20150715 RGCP CMA6\31 Concept Design\31 Concept Design.dwg, 7/5/2015 9:21 AM, BCT/BAT/BAT



Low-elevation Spur Dikes

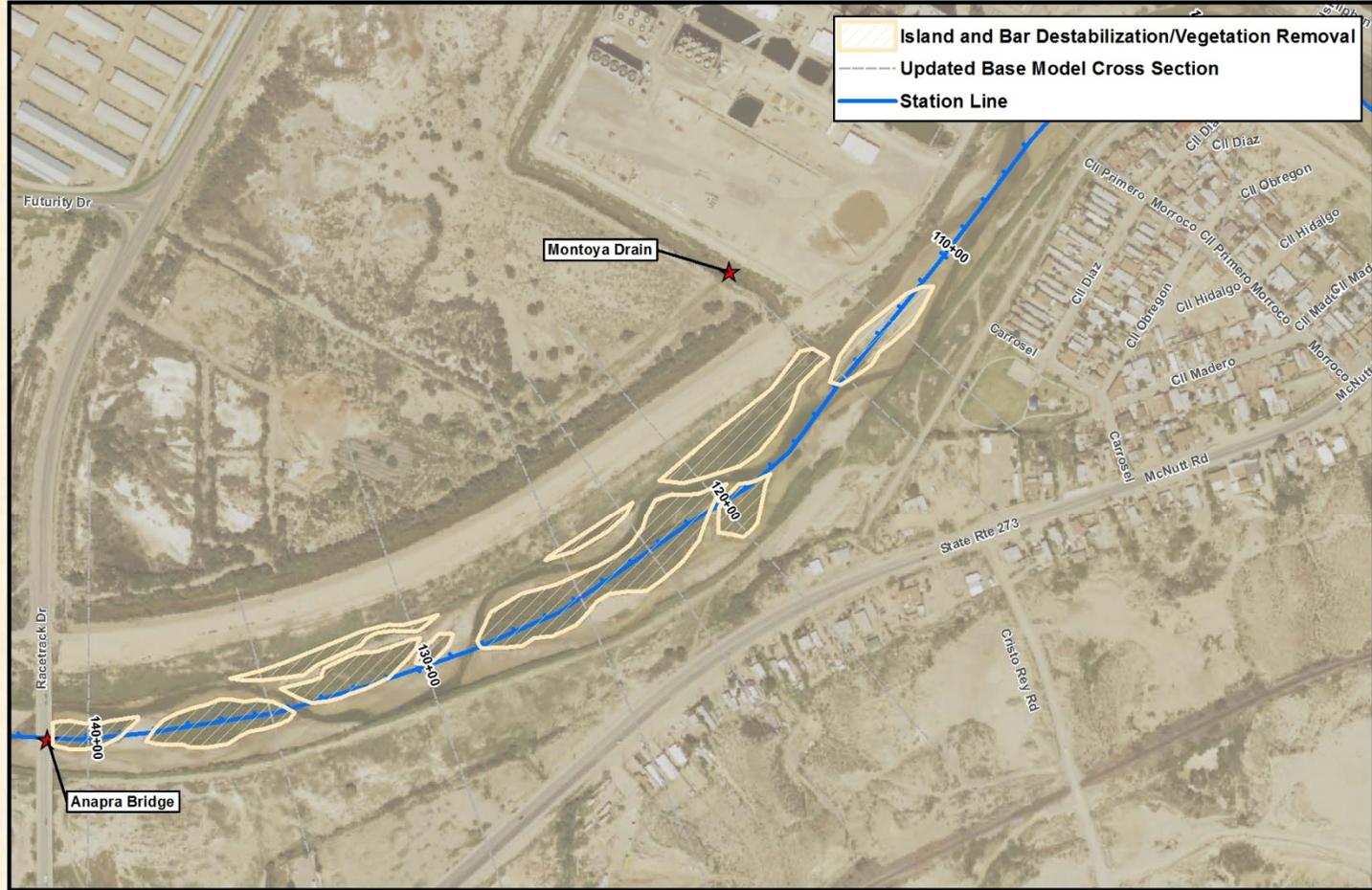


Conceptual Design:
Low-Elevation Spur Dikes
— Low Elevation Spur Dikes

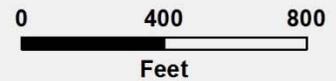




Island Destabilization and Vegetation Removal



Conceptual Planview Layout for Island and Bar Destabilization/Vegetation Removal:
Problem Location 9 - Sheet 1



Basemap: National Agricultural Imagery Program (NAIP) 2014

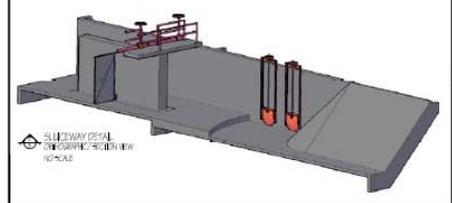
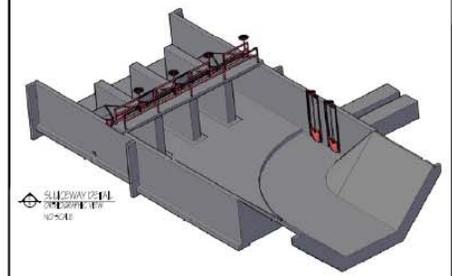
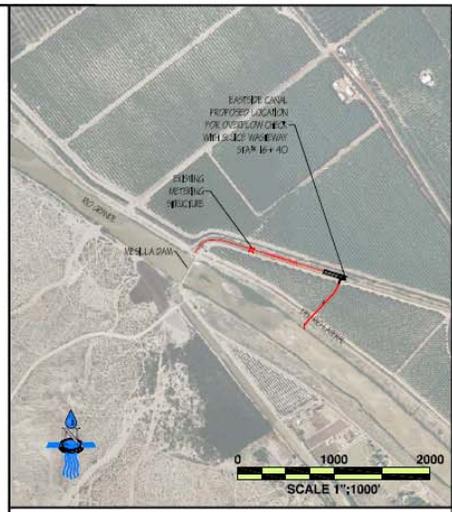
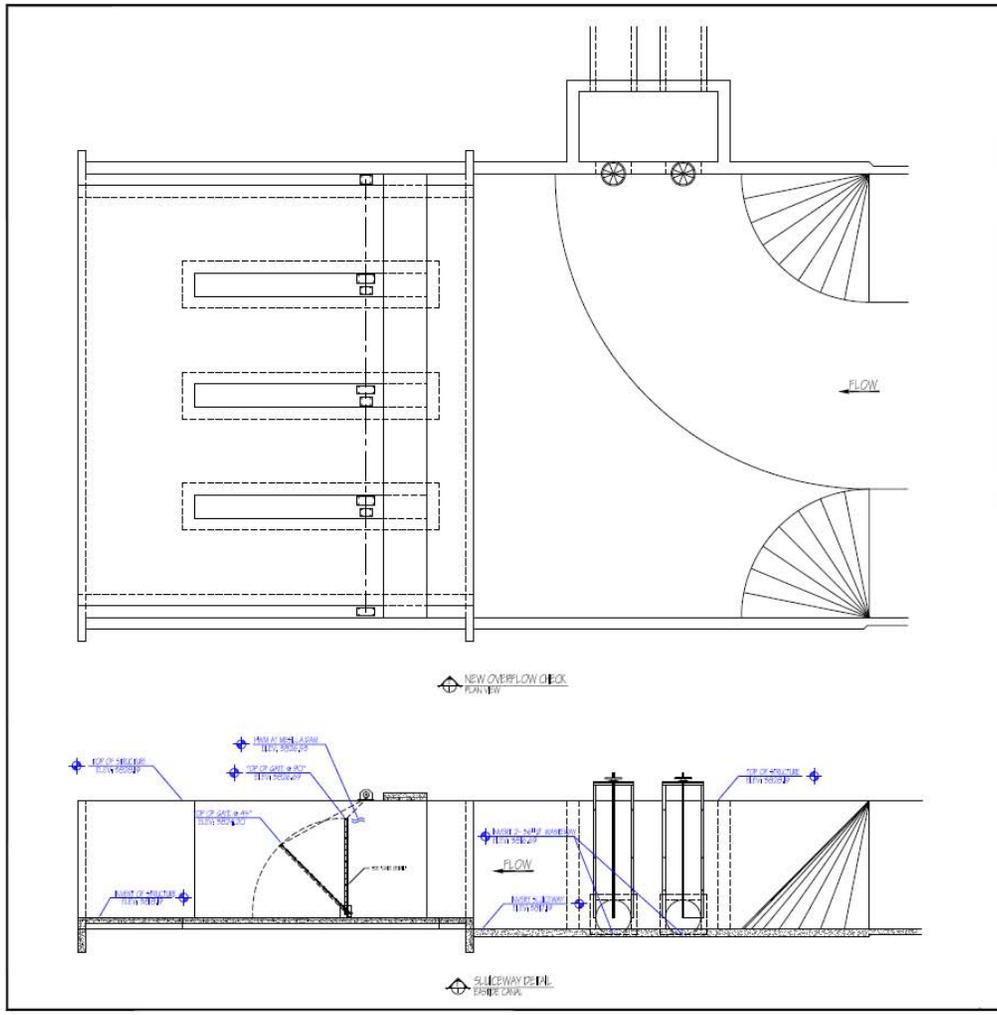


Site Specific Non-Sediment Removal Alternatives

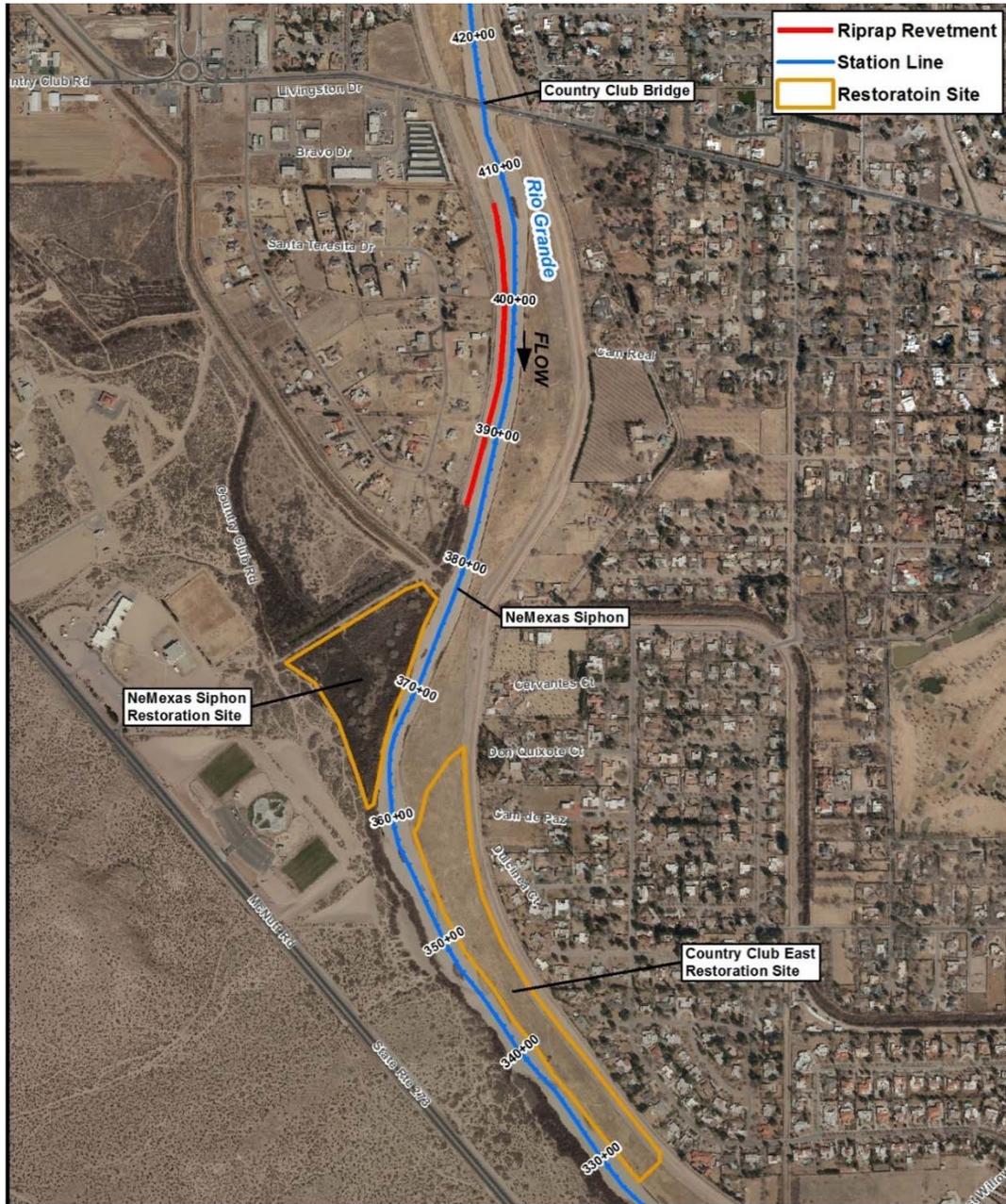
- Modifications to Tierra Blanca Vortex Weir
- Mesilla Dam sediment management alternatives
- Riprap below Country Club Bridge
- Combination spur dike and island destabilization/vegetation removal above Montoya Drain



Check/Sluice Structures in Canals



E1		SHEET 1 OF 3
REVISIONS		
DATE	BY	REVISIONS
ELEPHANT BUTTE IRRIGATION DISTRICT		
PROPOSED OVERFLOW CHECK AND BYPASS EASTSIDE CANAL STA# 16+40		
PROJECT NO.	DATE	SCALE
DRAWN BY	CHECKED BY	DATE
EBID		



Riprap Revetment Below Country Club Bridge



Proposed Layout For Riprap
Bank Protection -
Problem Location 8





Base Model of the RGCP

- **HEC-RAS model of 2007 by MEI**
- **About 1,200 cross sections for entire RGCP**
- **Updates to bridges, in-line structures, roughness values, etc.**



Base Modeling of the RGCP

Scenarios Run

- Normal operating flows (2,350 cfs above Mesilla Dam; 1,400 cfs below)
- Bankfull discharges (3,000 cfs mid range channel capacity; 3,500 cfs upper range)
- 100-yr routed peak flow



Updated Base Model of the RGCP

- **Base model updated with year 2014 survey cross sections**
- **Updates only made at the nine problem locations**
- **Updated base model was run for same three flows as base model**

Comparison of Water Surface Elevations (Base vs Updated Base Models)

Problem Location	Type of Change	Thalweg Elev. Change (ft)	Change in Predicted Water-surface Elevation (ft)			
			2,350/1,400 cfs*	3,000 cfs	3,500 cfs	100-yr Peak
1	Average	2.68	1.67	1.55	1.46	0.74
	Maximum	8.05	2.85	2.63	2.44	1.18
	Minimum	-1.34	-0.32	-0.25	-0.19	-0.13
2	Average	0.45	1.18	1.23	1.28	1.08
	Maximum	2.38	2.01	2.06	2.08	1.68
	Minimum	-2.26	-0.02	0.13	0.23	0.47
3	Average	3.54	3.01	2.92	2.80	1.45
	Maximum	5.14	4.35	4.23	4.13	2.31
	Minimum	1.95	1.39	1.46	1.43	0.05
4	Average	1.01	0.97	1.05	1.08	1.09
	Maximum	3.90	1.78	1.82	1.79	1.54
	Minimum	-0.45	0.02	0.03	0.03	0.03
5	Average	0.18	0.67	0.65	0.64	-0.21
	Maximum	1.09	1.25	1.25	1.24	0.26
	Minimum	-1.25	0.01	0.01	0.00	-1.32
6	Average	1.82	0.20	0.20	0.15	0.21
	Maximum	3.84	0.95	0.95	0.90	0.61
	Minimum	-0.87	-0.79	-0.77	-1.46	-0.29
7	Average	1.57	0.38	0.24	0.22	0.20
	Maximum	2.51	0.69	0.36	0.32	0.42
	Minimum	-0.59	0.01	-0.06	-0.08	-0.23
8	Average	1.99	0.95	0.64	0.62	0.56
	Maximum	3.52	1.46	0.92	0.89	0.85
	Minimum	0.78	-0.06	-0.03	-0.05	-0.04
9	Average	0.20	0.79	0.67	0.63	0.53
	Maximum	2.10	1.44	1.21	1.17	1.01
	Minimum	-1.69	0.00	0.00	0.00	0.00



Localized Models at Problem Locations

- **Used cross sections of the updated base model**
- **CMA included**
- **Were run for same three flows as base model**
- **Short term changes in water surface elevations were evaluated.**



Localized Sediment-transport Models

- **CMAs included**
- **Flow based on year 2013 release since it was a very dry year**
- **Flow repeated for 10 years to assess long term effects of alternatives**



Sediment-transport Model Results

Long-term Effects on Water-surface Elevation

- **Showed locations of sediment erosion (degradation) and sediment build up (aggradation) at problem locations**
- **Showed the difference between the CMAs**



Alternative Evaluation

Benefits versus Costs and Consequences

- **Effect on water-surface elevation**
- **Effect on levee freeboard encroachments**
- **Effect on groundwater levels**
- **Effect on aggradation, downstream sediment loads**
- **Improved irrigation return flows**
- **Durability**



Alternative Evaluation contd.

Benefits versus Costs and Consequences (cont.)

- **Monetary costs (annualized costs over a project life span of 50 years)**
- **Increased bank erosion potential**
- **Habitat/restoration benefits and consequences**
- **Site specific benefits and consequences**



Identification of Top Two Alternatives

Problem Location	Alternative	Difference b/w Benefits and Costs/Consequences	Rank
1	Arroyo Sediment Traps	14.8	1
	Vortex Weir	9.9	2
2	Arroyo Sediment Traps	27.5	1
	Island Destabilization/Vegetation Removal	19.2	2
3	Arroyo Sediment Traps	12.4	1
	Rincon Siphon Modifications	12.2	2
4	Long Excavation	14.2	1
	Island Destabilization/Vegetation Removal	7.2	2
5	Arroyo Sediment Traps	12.1	1
	Long Excavation	4.7	2
6	Gate Automation	13.8	1
	Sluiceway and Check Structures	11.1	2
7	Arroyo Sediment Traps	26.6	1
	Long Excavation	9.3	2
8	Riprap	6.1	1
	Spur Dikes	2.5	2
9	Island Destabilization/Vegetation Removal	19.8	1
	Long Excavation	18.1	2



DISCUSSION/QUESTIONS