



Santa Cruz River Master Plan

Presented to the Arizona Floodplain Management Association Spring Conference June 8-10, 2011







Introduction

• Who is FICO?









Project Team

Kimley-Horn and Associates, Inc.

River Master Plan, Civil Engineering, Water, WasteWater & Drainage

J.E. Fuller
River Hydraulics

Larson, Voss, Assoc.

Land Planning

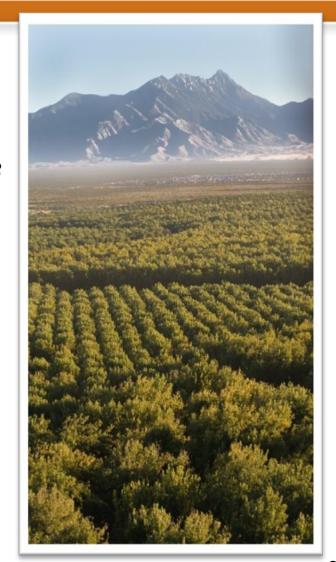
Crown Community
Development
Partner in FICO since 1948

Frank Thomson & Associates
Planning
The Caliber Group
Public Relations & Outreach

Strategic Issues
Management Group
Public Affairs



Kimley-Horn and Associates, Inc.





FICO's 6,000 Acres: Comprise One-Third of Sahuarita



Sahuarita Farms Land/River

MASTER PLAN



FARMERS INVESTMENT CO. SAHUARITA FARMS SPECIFIC PLAN APPENDIX F: CONCEPT SANTA CRUZ RIVER MASTER PLAN

VOLUME 1 OF IV RIVER MASTER PLAN RECOMMENDED PLAN REPORT

Prepared for:



FARMERS INVESTMENT CO. 1625 E. Salvaarita Road Sahuarita, Arizona 85629

Prepared by:

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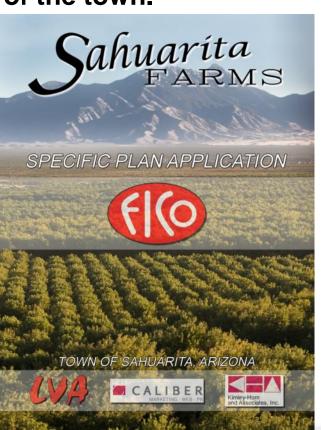


What is a Specific Plan?

Specific Plan is a document that regulates land use and development within a specified area of the town.

Specific Plan Documents include:

- Site Analysis
 - Existing Conditions
- Map and Text Elements
 - Land Uses
 - Open Space
 - Streets/Circulation
 - Drainage/Hydrology
 - Water and Sewer
 - Public Facilities & Services
 - Development Standards
- Must satisfy technical requirements

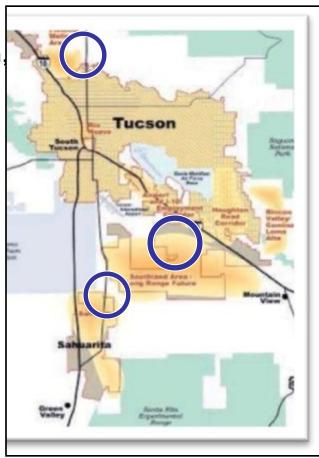




Why Plan Now?

- History has proven that if you do not plan for growth, growth will plan for you
- FICO experiencing growth pressures now infrastructure, ROW, utilities, community facilities
- 1990's: Rancho Sahuarita Specific Plan Adopted
- 2000-2010: Town grew from 3,200 25,000 pop.
- What would area look like without Master Plan?
- Example: San Antonio River
- Santa Cruz River: 12 linear miles-single land owner
- · Vision for river and blueprint for quality growth
- Proactive long-range planning allows for better decision-making for all

Regional Growth Areas

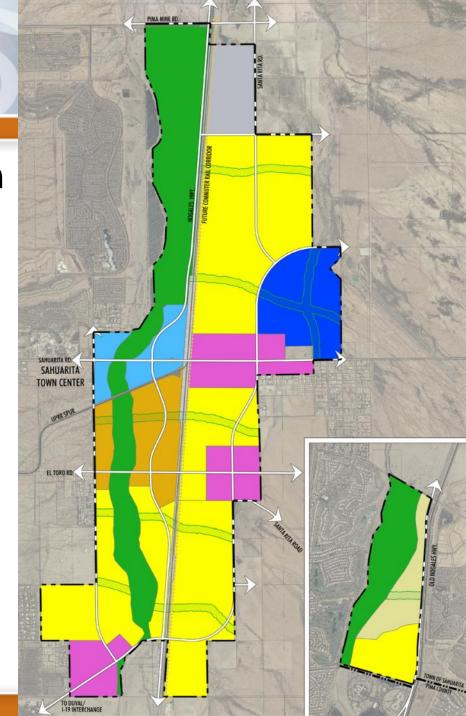




Community Land Use Plan

6,000 acres in Sahuarita and adjoining Green Valley: 40-50 year plan

- River Park/Open Space
- Rural Neighborhoods
- Village Neighborhoods
- Urban Neighborhoods
- Employment Campus
- Campus Park Industrial
- Mixed Use Activity Centers
- River Center District





Open Space and Trails

- Approx. 2,100 acres of open space (over 1,000 in river corridor)
- 37% of total project area
- Consistent with O.S. Plans
- Linear Greenway Park
- Additional O.S. Corridors
- ~50 miles of trails
- 2 community / district parks
- Neighborhood parks
- ¼ mile walking distance





Community Villages

6,000 acres, 40-50 year build-out

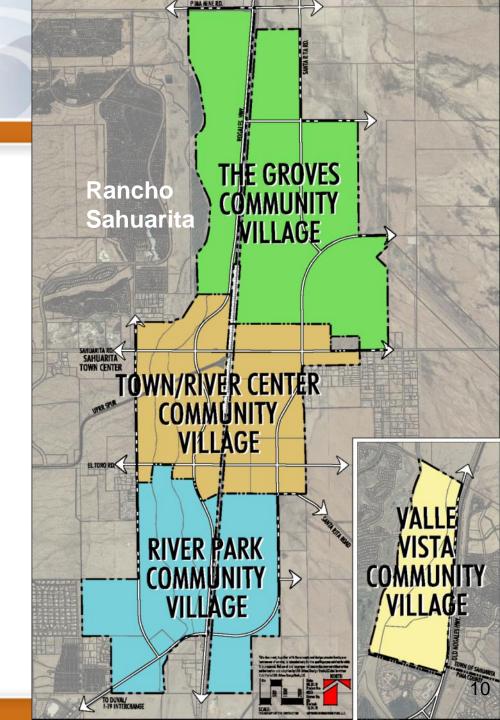
The Groves: Employment

focus

Town/River Center: Urban core, primary activity centers

River Park: Residential neighborhoods-district park

Valle Vista: Rural character

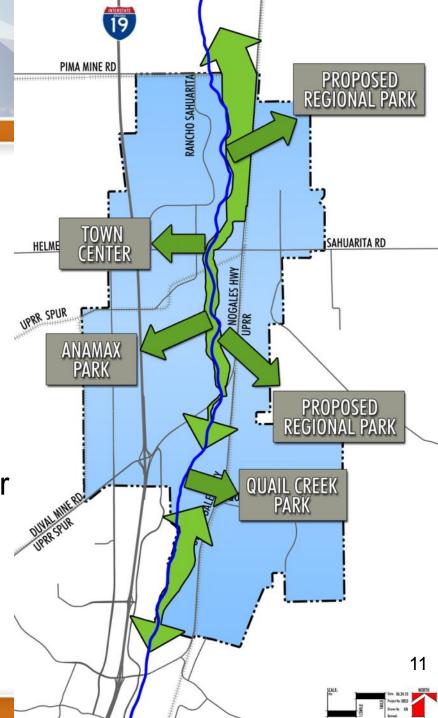




Santa Cruz River

The Common Thread - Linkage

- This makes property unique and special
- 12 linear miles single owner
- Over 1,000 acres of contiguous open space
- Regional recreational amenity for all
- Directly through center of town
- Ability and motivation to develop the plan now





Purpose

Develop a conceptual river master plan for the Santa Cruz River through Sahuarita Farms







Objectives

- Provide for safe development within the floodplain of the Santa Cruz River
- Provide for conveyance of the 100-year flood event







Objectives

Design of a sustainable river corridor that provides cost-effective multi-use opportunities for habitat enhancement, recharge, and flood control, while minimizing the costs for future public and private infrastructure located within the footprint of the river corridor.







Objectives

• Enhance the river corridor as a benefit and amenity to the local community.







FICO SAHUARITA FARMS









FICO CONTINENTAL FARMS







Project Background – Existing Conditions

Previous Flooding (1977/1983/1993)

Environmental/Biology

Cultural Resources

Offsite Tributaries

Floodplain/Floodway







USGS Gage at Continental Road

Peak Discharges from 1948 through 2006

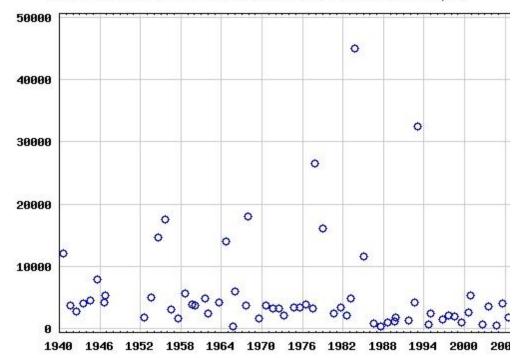
Oct 1977 - 28,500 cfs

Oct 1983 - 45,000 cfs

Jan 1993 - 32,400 cfs

USGS

USGS 09482000 SANTA CRUZ RIVER AT CONTINENTAL, AZ









OCT 1977 FLOOD PHOTOS

Discharge = 28,500 cfs

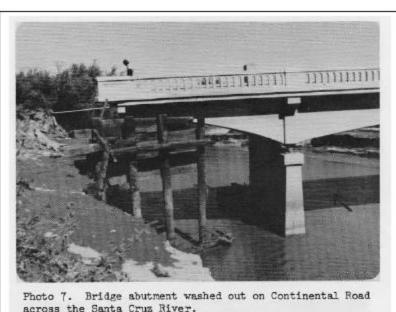






Continental Road Bridge – West Abutment **Failure**







1983 AERIAL FLOOD PHOTOS

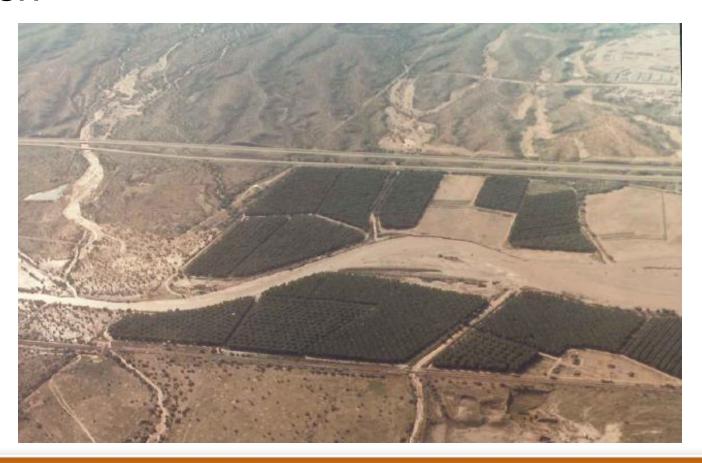
Discharge = 45,000 cfs 100-year FEMA regulatory discharge





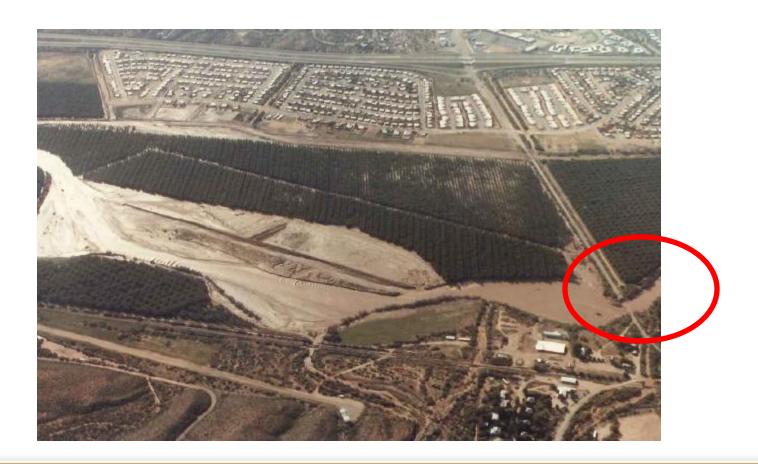


1983 Flood Continental Farms/Esperanza Wash





1983 Flood Continental Road





1983 Flood Continental Road





1983 Flood Confluence with Box Canyon Wash





1983 Flood Sahuarita Road





1983 Flood Sahuarita Road/Nogales Hwy





1983 Flood Pima Mine Road





1983 Flood Sahuarita Ranch @ Pima Mine Road





1993 FLOOD - AERIAL PHOTOS

Discharge = 32,400 cfs





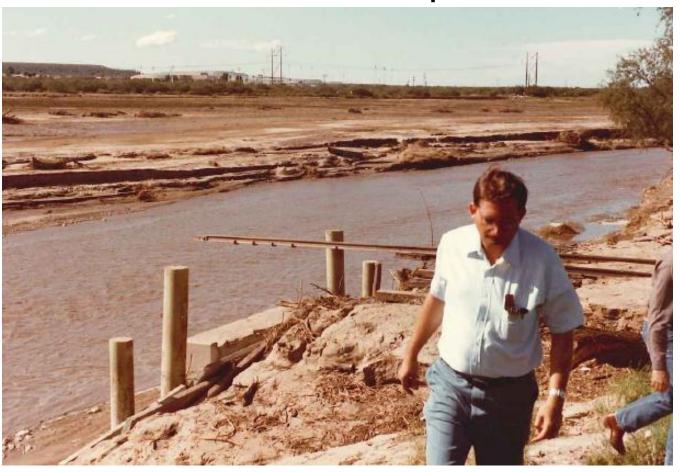


1993 Flood Continental Farms/Green Valley WWTP



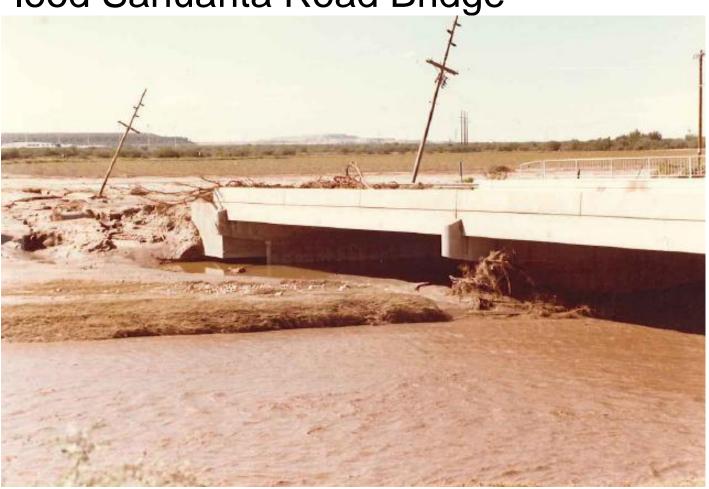


1993 Flood UPRR Railroad Spur





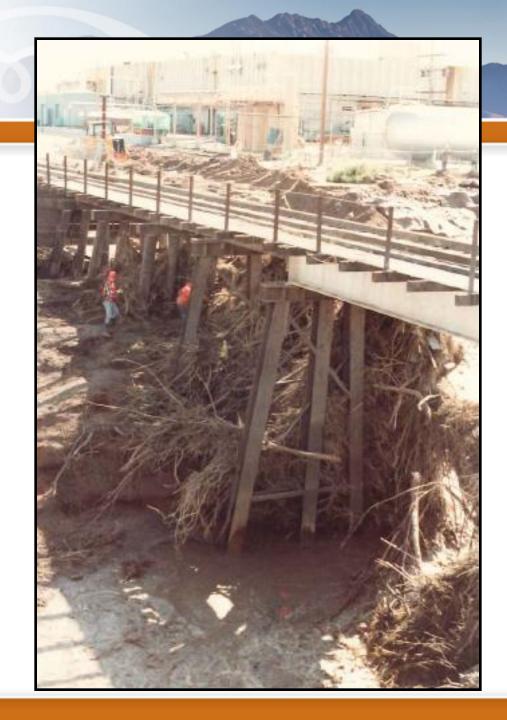
1993 Flood Sahuarita Road Bridge





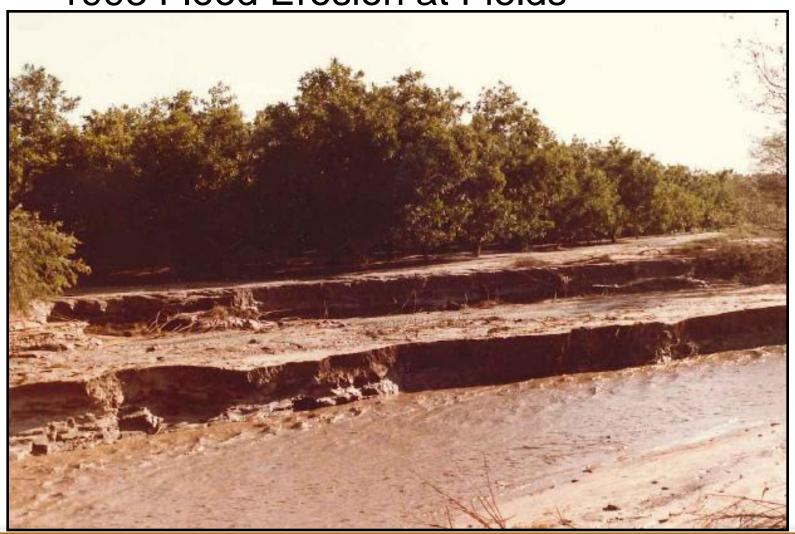
1993 Flood

Pima Mine Road Railroad Bridge





1993 Flood Erosion at Fields





1993 Flood-Debris buildup on trees and sediment deposited in field





1993 Flood Sahuarita Road at Nogales Hwy





1993 Flood Pima Mine Road (looking south)





SANTA CRUZ RIVER









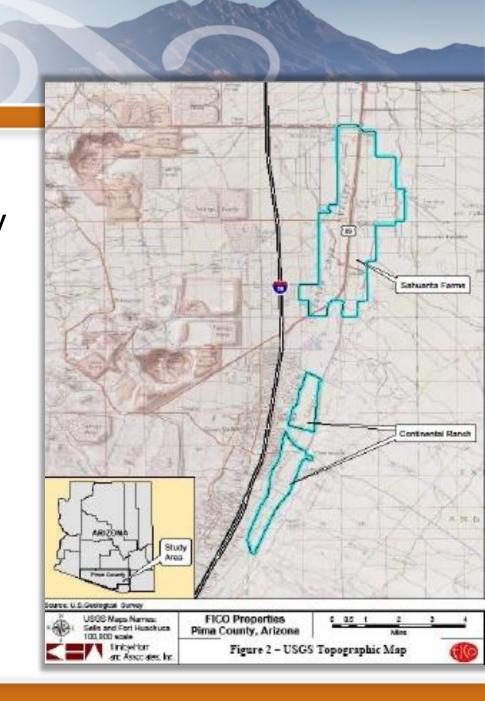
- Purpose:
- 1. Identify potential environmental planning constraints, issues and sensitive areas
- 2. Address environmental surveying, permitting, and agency coordination





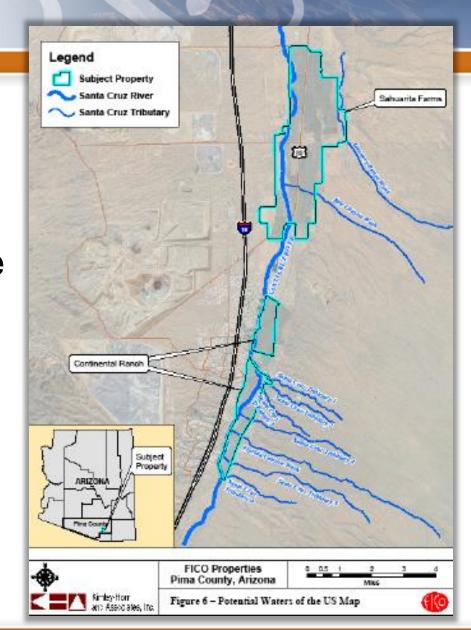
- Topography/Physiography
- Biotic Communities and Vegetation
- Wildlife and Wildlife Movement Corridors
- Threatened, Endangered, and Sensitive Species/Habitat







- Natural Resource Zone Map
- Potential Jurisdictional Waters of the US

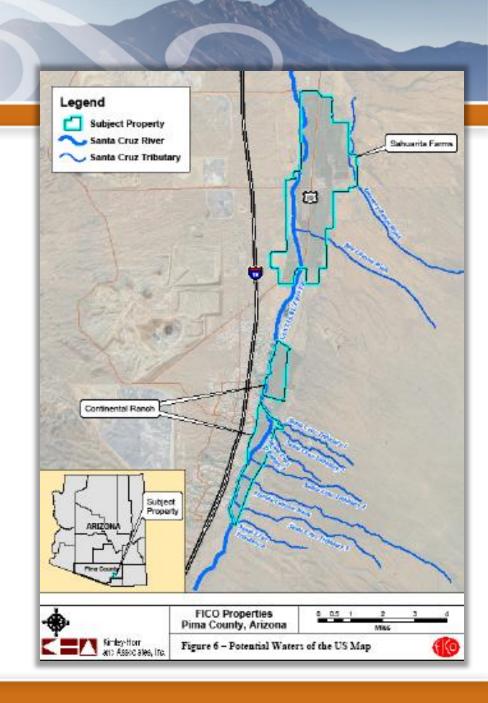






- Recommendations:
- Conduct Native Plant Survey
- Enhance vegetation along drainages for habitat
- Species specific survey for Pima Pineapple cactus
- Potential Clean Water Act Section 404 permit for tributaries







Cultural

- Conducted a Class I Records Search
- 1 mile radius along river corridor
- Area of Potential Effect (APE) 10,300 acres





Cultural

- Recommendations:
- Full cultural survey any areas not field checked in last 10 years before necessary mitigation for river improvements
- Assess historical properties outside project area not directly impacted by development; effects for setting, feel, and association with surrounding landscape





Offsite Tributaries



- Purpose:
- Conduct drainage study to determine the offsite 100-year flows at locations along the Santa Cruz River at the FICO property boundaries.
- Analyze the capacity of the tributaries vs. the 100-year flow.





WEST WATERSHED

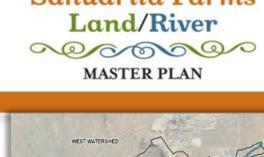
Drainage Area Map

EAST WATERSHED

Soils Mapping



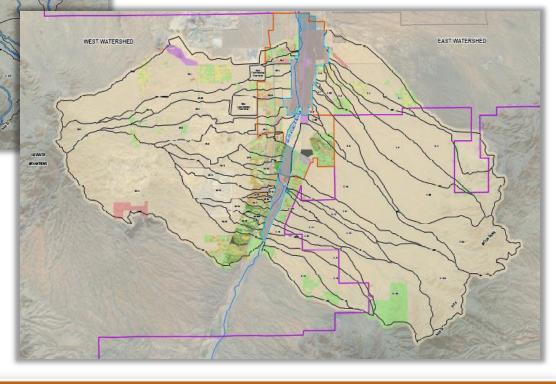




Flowpath Map

Land Use Map

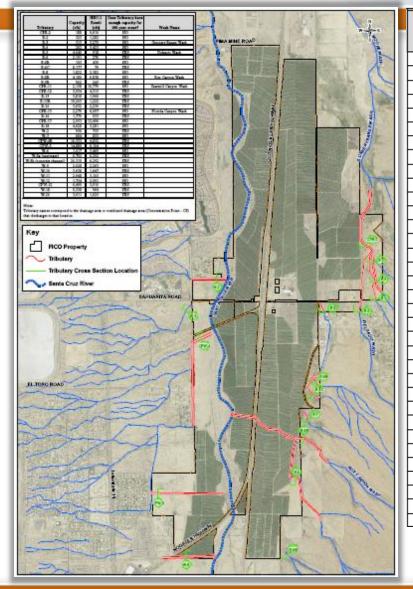




Sahuarita Farms Land/River



MASTER PLAN



		HEC-1	Does Tributary have	
	Capacity	Result	enough capacity for	
Tributary	[cfs]	[cfs]	100-year event?	Wash Name
CPE-2	188	9,610	NO	
E-2	325	1,282	NO	
E-3	315	5,275	NO	Gunnery Range Wash
E-4	202	5,423	NO	
E-5	4,040	918	YES	Delgado Wash
E-6	2,191	270	YES	
E-6B	195	439	NO	
E-6C	8,177	79	YES	
E-8	1,822	2,382	NO	
E-8B	4,180	6,838	NO	Box Canyon Wash
E-9B	902	245	YES	
CPE-11	2,158	10,779	NO	Sawmill Canyon Wash
CPE-12	5,954	4,515	YES	
E-13	3,818	1,966	YES	
E-13B	19,205	1,222	YES	
E-14	5,652	2,250	YES	
CPE-15	2,279	6,097	NO	Florida Canyon Wash
E-16	1,779	933	YES	
CPE-17	2,953	15,496	NO	
E-18	4,628	5,281	NO	
W-2	956	735	YES	
W-3	664	855	NO	
CPW-4B	10,553	4,852	YES	
CPW-5	14,889	6,104	YES	
W-6	1,017	5,469	NO	
W-8a (upstream)	6,792	6,292	YES	
W-8b (concrete channel)	20,319	6,292	YES	
W-9	2,028	2,263	NO	
W-10	5,638	1,647	YES	
W-11	2,948	3,105	NO	
W-12	1,734	2,991	NO	
CPW-12	6,499	3,910	YES	
W-18	9,338	964	YES	
W-20	3,611	1,625	YES	



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Offsite Tributary Analysis Findings

- 3-hr 100-year storm
- 16 out of 34 tributaries do not have the capacity of the 100-year event





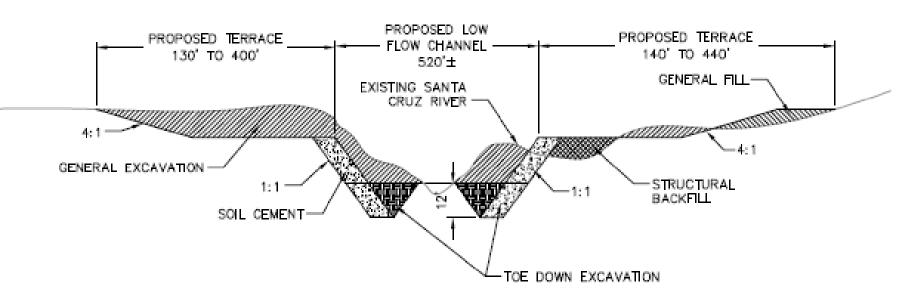
PLANNING CONSTRAINTS AND OPPORTUNITIES

- • $Q_{100} = 45,000 \text{ cfs (regulatory)}$
- •Q_{design} = 55,000 cfs (Pima County Floodplain Ordinance)
- Existing Floodplain/Floodway
- Land Ownership/Town and County Jurisdictions
- Jurisdictional Waters of the US for river and Tributaries
- Tributaries





Terraced Channel Typical Section



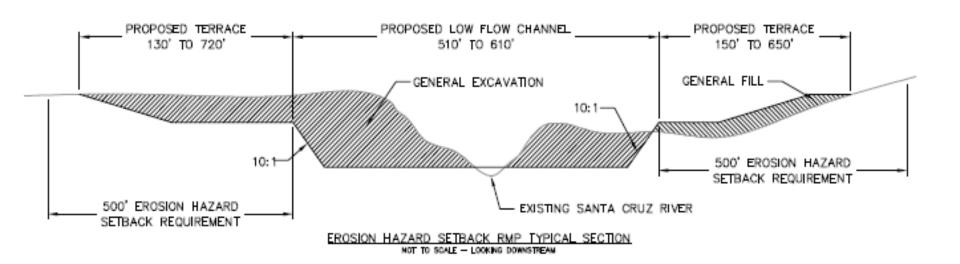
STRUCTURAL RMP TERRACED CHANNEL TYPICAL SECTION

HOT TO SCALE - LOOKING DOWNSTREAM





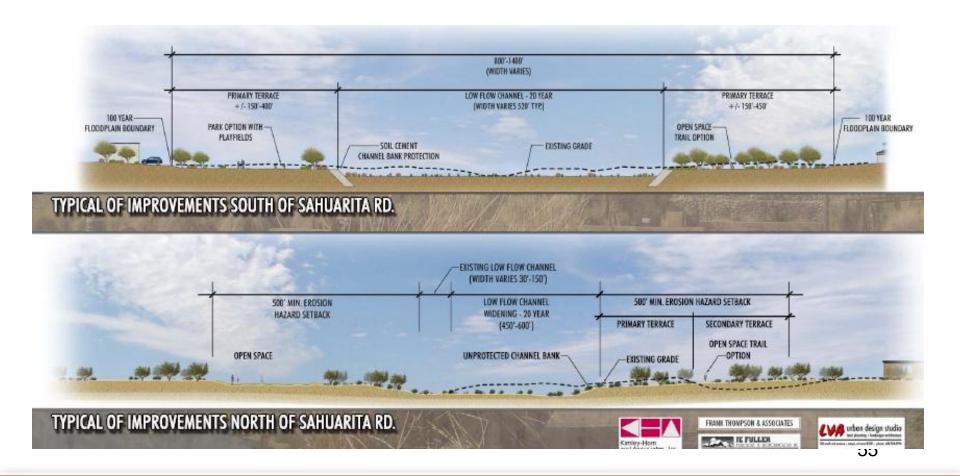
Erosion Hazard Setback Typical Section







Terraced and Erosion Hazard Sections





River Master Plan Elements

Erosion Hazard Section

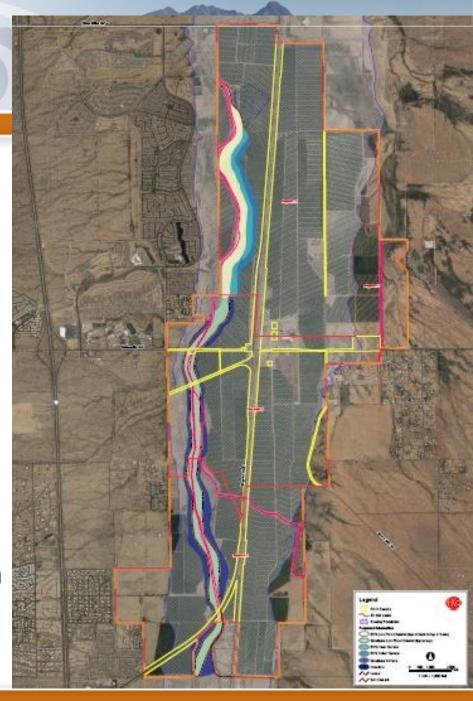
- Elimination of West Overbank
- •EHS overbank 500 -600 ft
- Lateral Weir to return flow to floodplain

Structural Section

- •Terraces on both banks 150-200 ft wide
- Low flow channel: 20-25 year flood
- Bank protected
- Levee to capture active east overbank flows

Recover Lands from Floodplain







Santa Cruz River
Sediment Transport
Scour Evaluation
Long Term Analysis

Technical Data Notebook for Santa Cruz River Sediment Transport, Scour, and Long Term Analyses: Demetrie Wash to Pima Mine Road

Prepared for Farmers Investment Corporation

March 2010

By Ian P. Sharp, P.E., CFM JE Fuller Hydrology & Geomorphology Inc.







Facing upstream from Pima Mine RR Bridge.



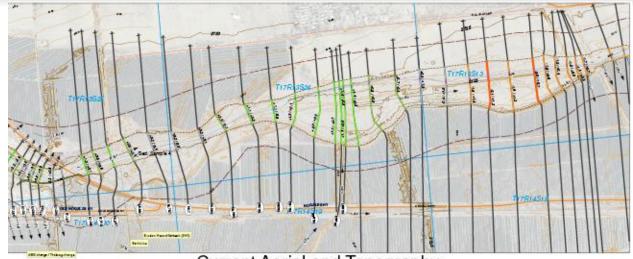
Scour of Pima Mine Road Bridge piers. The Scoured bank upstream of Pima Mine Road bottom of the pier base (top of pile shafts) is now 3 feet above the channel but was originally 6 feet below the channel bed when built in 1969-1970.



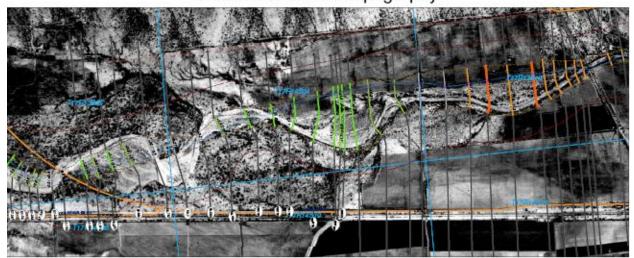
Facing downstream from Pima Mine Rd.







Current Aerial and Topography

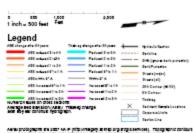


Current Conditions Over 1936 NRCS Aerial Map

Current vs Historic Aerials

FICO - Santa Cruz River Sediment Transport

Plate 1 - Field and Summary Map

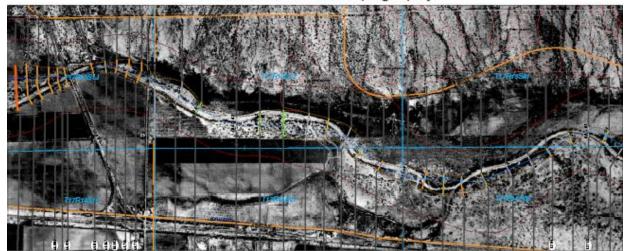


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Current Aerial and Topography

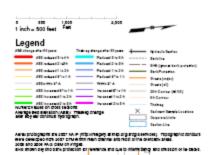


Current Conditions Over 1936 NRCS Aerial Map

Current vs Historic Aerials

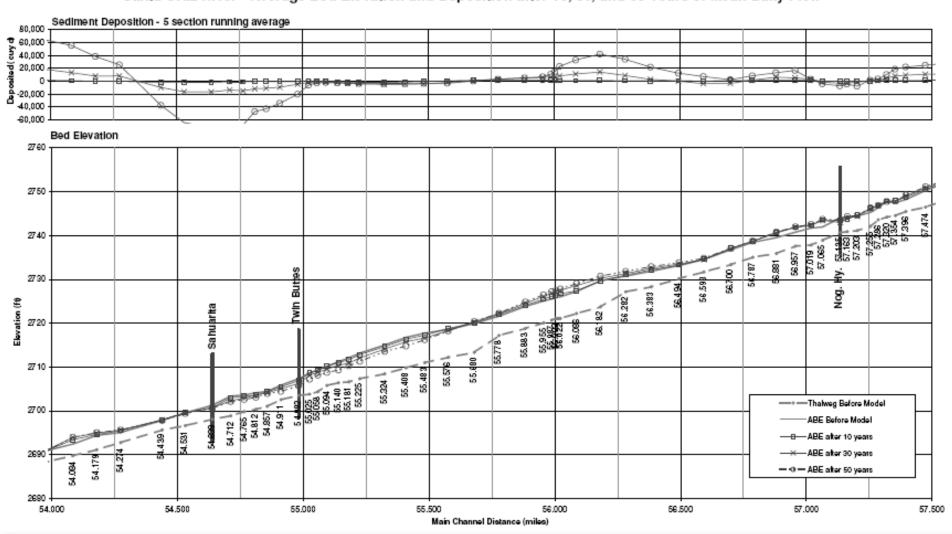
FICO - Santa Cruz River Sediment Transport

Plate 1 - Field and Summary Map





Santa Cruz River - Average Bed Elevation and Deposition after 10, 30, and 50 Years of Mean Daily Flow





Santa Cruz River Hydrograph Attenuation Analysis

Santa Cruz River Hydrograph Attenuation Analyses: Nogales Highway to Pima Mine Road

Prepared for Farmers Investment Corporation

May 2010

By Ian P. Sharp, P.E., CFM JE Fuller Hydrology & Geomorphology Inc.







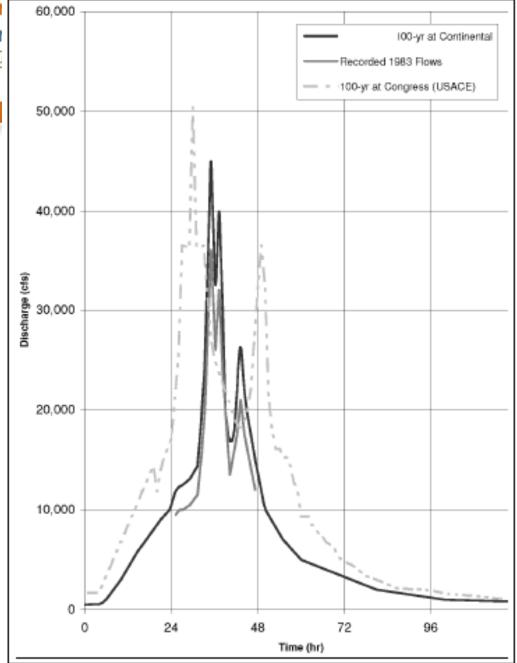


Figure 3 - 100-year Hydrograph

Sahuarita Farms

Table 1 - Peak discharge values at key locations within unsteady flow models					
Model and Location	Peak discharge (cfs)				
	2-уг	10-уг	100-уг		
At RM 62.335 (d/s of Continental Road)					
All models	3,740	13,010	45,000		
V olume (oc-ft)	6,632	20,895	72,073		
At RM 60.046 (over 2.2 miles upstream of RMP)					
Existing Conditions	3,664	12,755	44,309		
At RM 57.814 (upstream end of RMP)					
Existing Conditions	3,524	11,875	42,259		
RMP	3,521	11,882	42,260		
At RM 57.104 existing & 57.062 RMP (d/s of Nogales Highway)					
Existing Conditions	3,478	11,691	41,776		
RMP	3,485	11,852	41,952		
At RM 54.619 existing & 54.582 RMP (d/s of Sahuarita Road)					
Existing Conditions	3,271	11,269	40,410		
RMP	3,367	11,620	40,930		
At RM 51.534 (0.2 mile u/s of Pima Mine Road)					
Existing Conditions	3,196	11,074	38,469		
RMP	3,252	11,358	38,981		
At RM 50.447 (0.9 mile d/s of Pima Mine Road)					
Existing Conditions	3,186	11,053	38,133		
RMP	3,233	11,303	38,473		



Proposed Conditions
 Hydraulics,
 Sediment,
 Scour

River Master Plan Modeling along the Santa Cruz River: Nogales Highway to Pima Mine Road

Prepared for Farmers Investment Corporation

May 2010

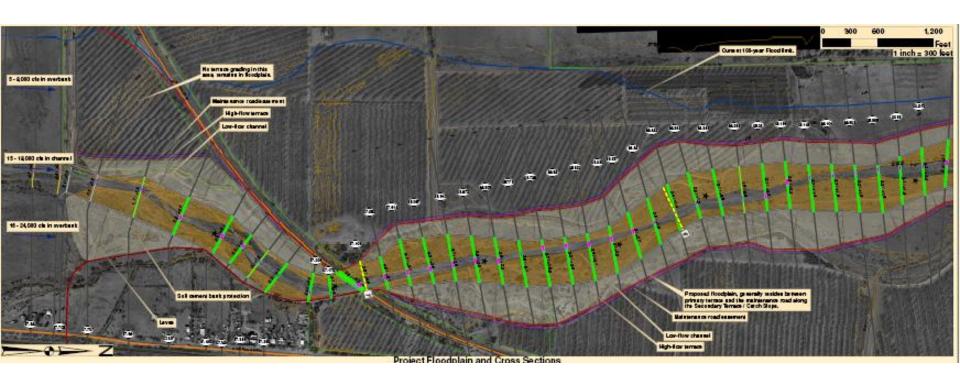
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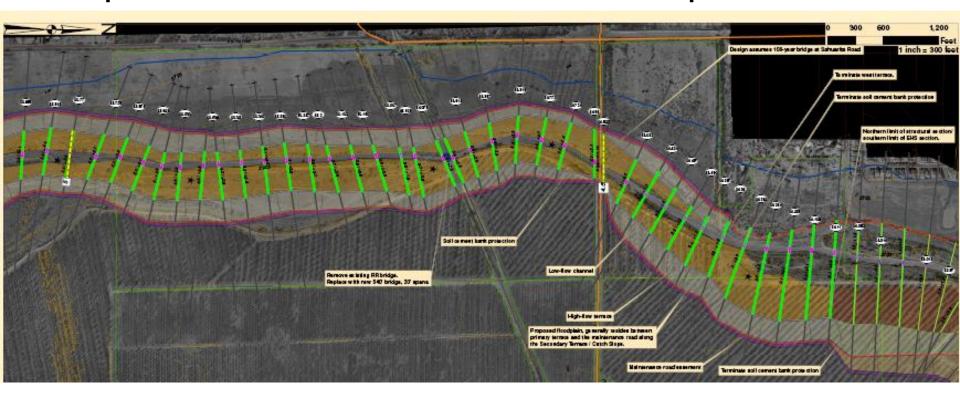
Proposed River Conditions Work Map







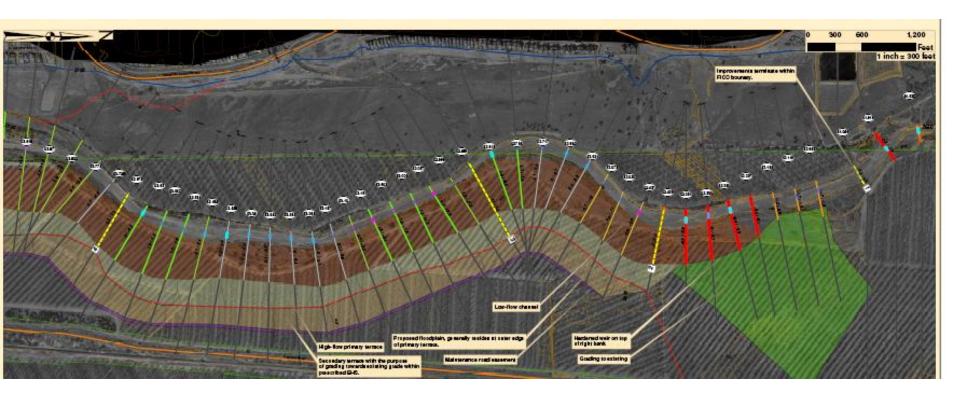
Proposed River Conditions Work Map







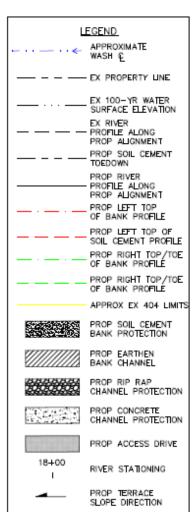
Proposed River Conditions Work Map







CONCEPT SANTA CRUZ RIVER MASTER PLAN



SAHUARITA, ARIZONA RECOMMENDED CONCEPT PLANS



LIST OF ABBREVIATIONS

APPROXIMATELY
AVENUE
BOULEVARD
CENTERLINE
CORRUGATED METAL PIPE
DRIVE
ELEVATION
EXISTING
FEET
LANE
MINIMUM
PLACE
PROPOSED
RIGHT-OF-WAY
ROAD
RIVER MASTER PLAN
STATION
WATER SURFACE ELEVATION
YFAR



PREPARED FOR:

FARMERS INVESTMENT CO. 1625 E. SAHUARITA ROAD SAHUARITA, ARIZONA 85629

NOTES

- THESE PLANS ARE FOR PLANNING PURPOSES ONLY. NOT FOR CONSTRUCTION.
- THIS DOCUMENT, TOGETHER WITH THE CONCEPTS
 AND DESIGNS PRESENTED HEREIN, AS AN INSTRUMENT
 OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC
 PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED.
 REUSE OF AND IMPROPER RELIANCE ON THIS DOCUMENT
 WITHOUT WRITTEN AUTHORIZATION AND ADAPTION
 BY KIMLEY-HORN AND ASSOCIATES, INC. SHALL BE
 WITHOUT LIABILITY TO KIMLEY-HORN AND ASSOCIATES, INC.
- ALL FLOWS USED FOR HYDRAULIC PROFILES USE A FLOW OF 45,000 CFS.
- ALL TRIBUTARY FLOWS PROVIDED ON PLANS REFER TO THE PROPOSED 100-YEAR PEAK DISCHARGE.
- THESE PLANS ARE SUBMITTED AS PART OF THE SAHUARITA FARMS SPECIFIC PLAN.
- 6. THE PROPOSED TRIBUTARY IMPROVEMENTS DEPICTED IN THE PLANS ARE FOR DRAINAGE PURPOSES AND DO NOT NECESSARILY REFLECT MULTI—USE AMENITIES PROVIDED IN THE SPECIFIC PLAN. THE DRAINAGE CORRIDORS ARE INTENDED TO SERVE AS JOINT FACILITIES FOR MULTI—USE.

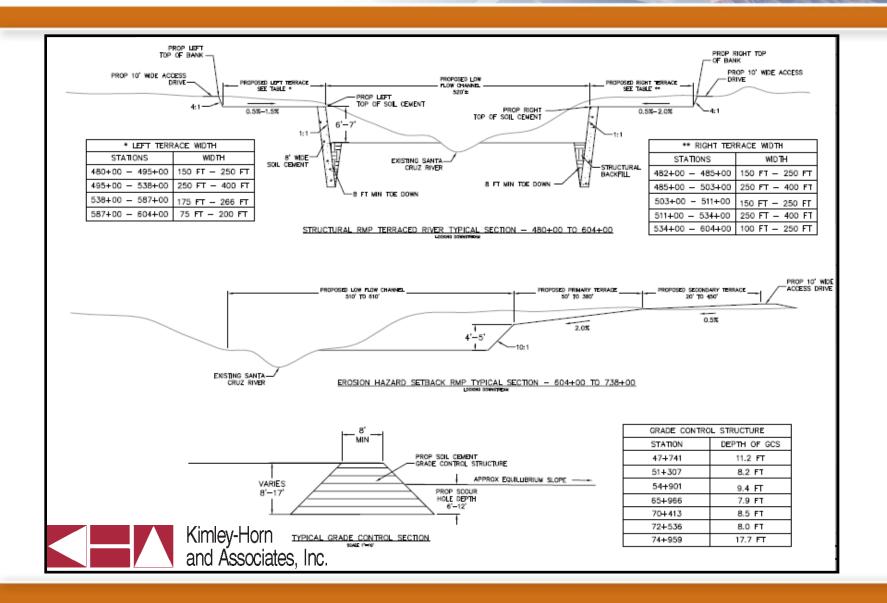


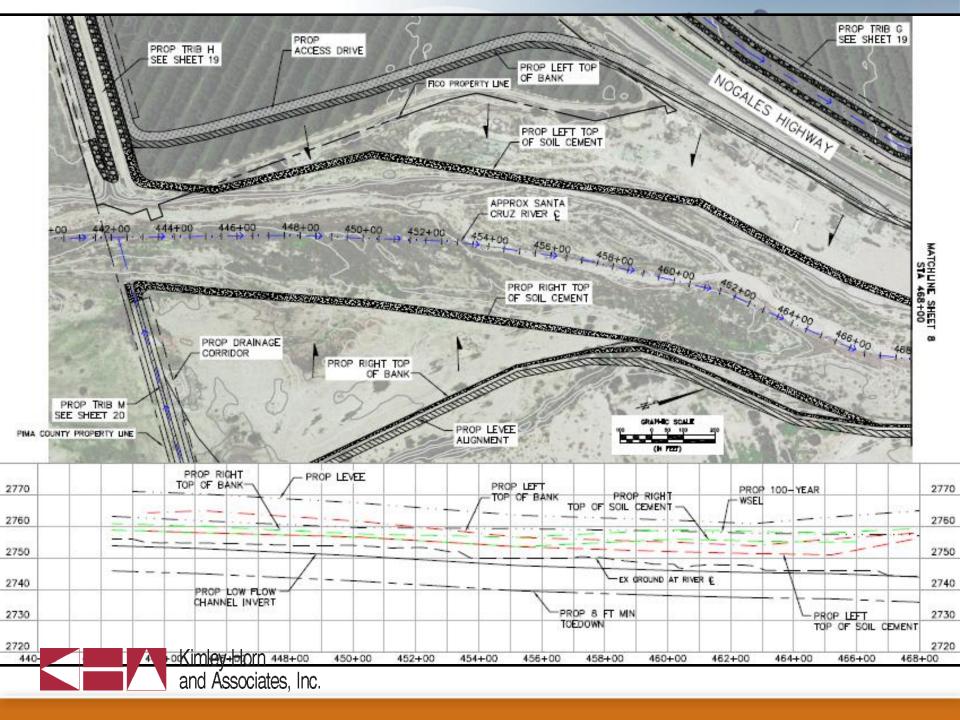
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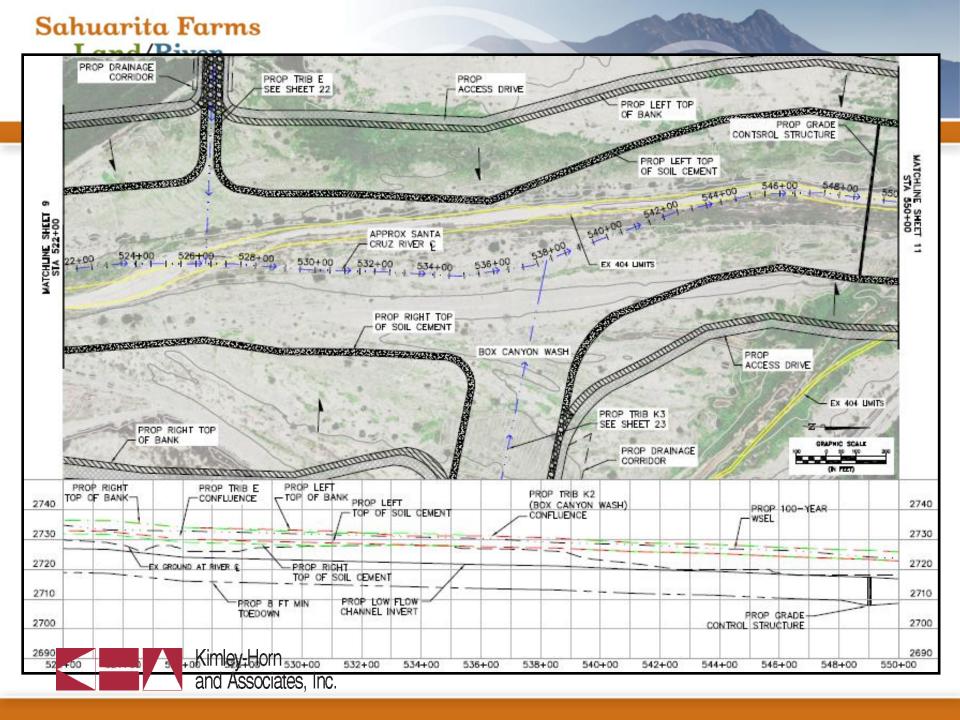


MASTER PLAN

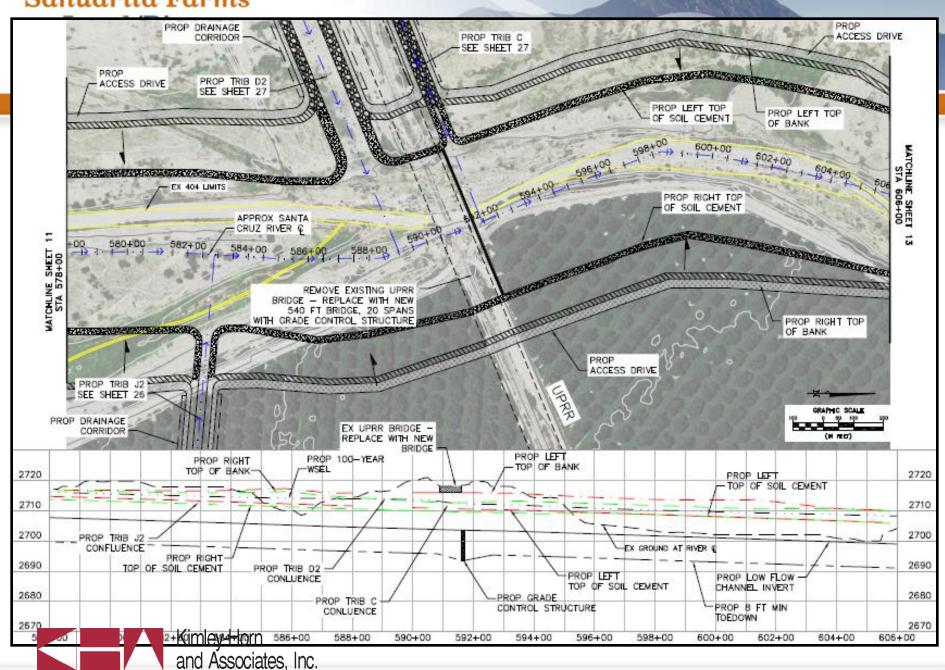
River Master Plan Typical Sections

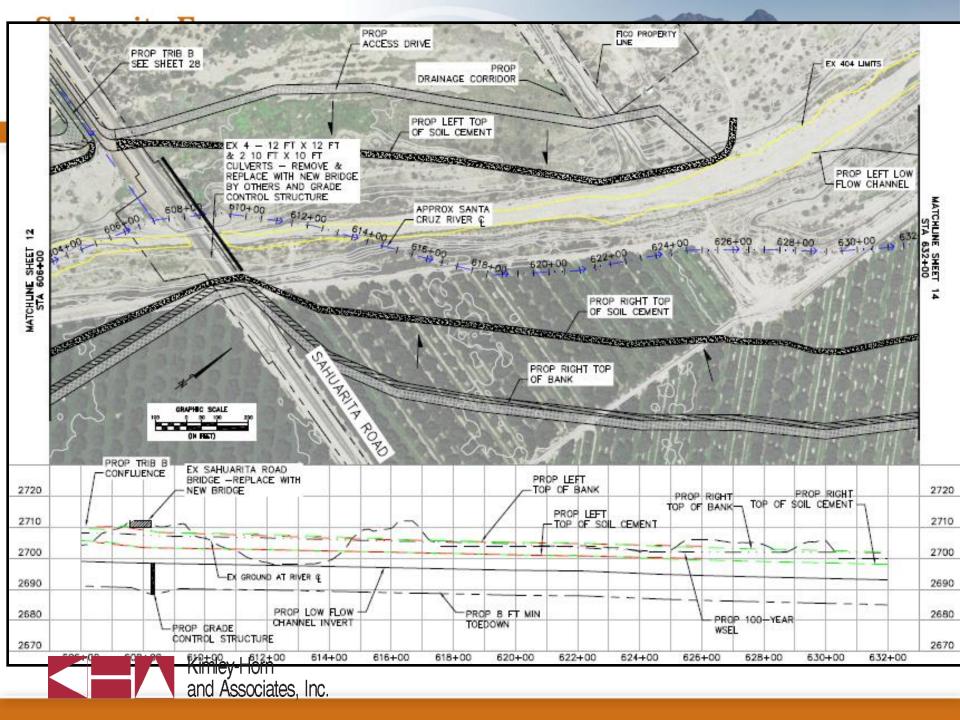




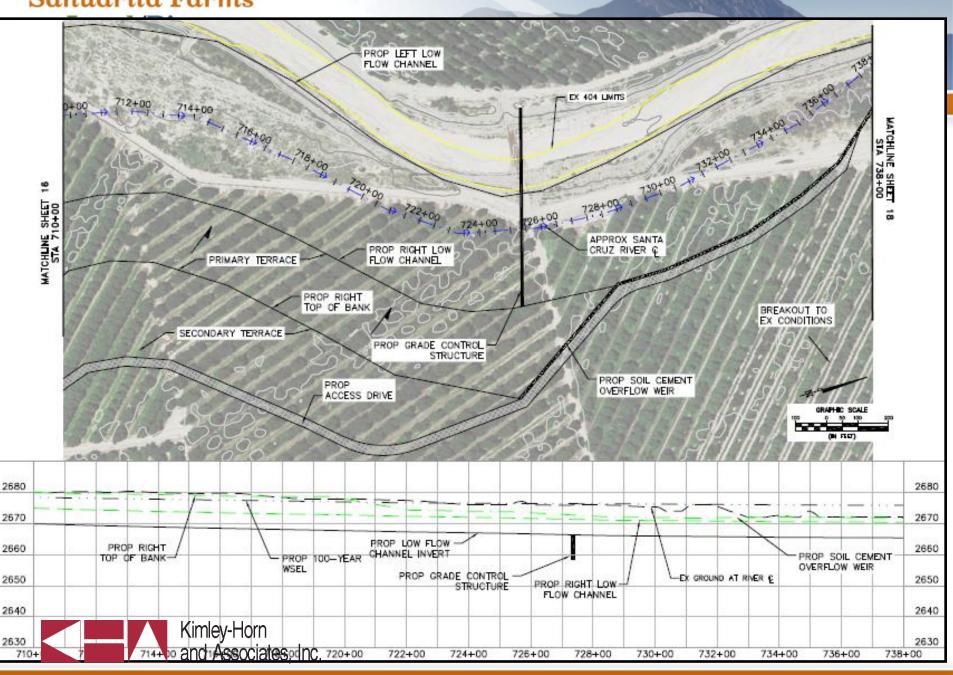


Sahuarita Farms





Sahuarita Farms





Improvement Concepts (upper terrace)

- Wetland and natural water recharge
- Native vegetation and wildlife corridors
- Trails and tranquil open spaces
- Active recreation
- Gateway and trailheads













Re-establish Habitat





Passive Recreation



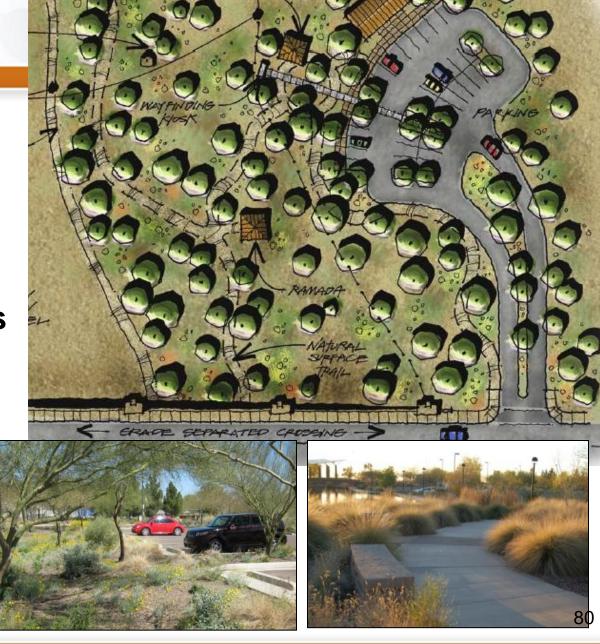


Active Recreation





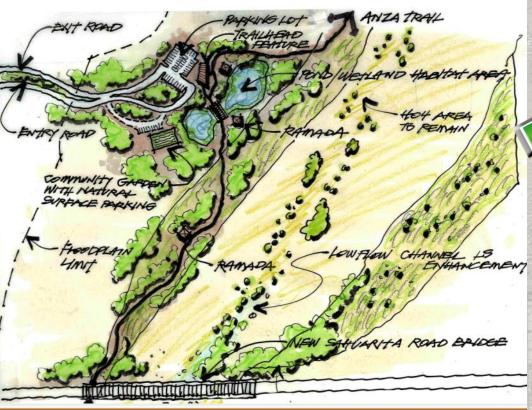
Gateway/Trailhead
Connection to trails

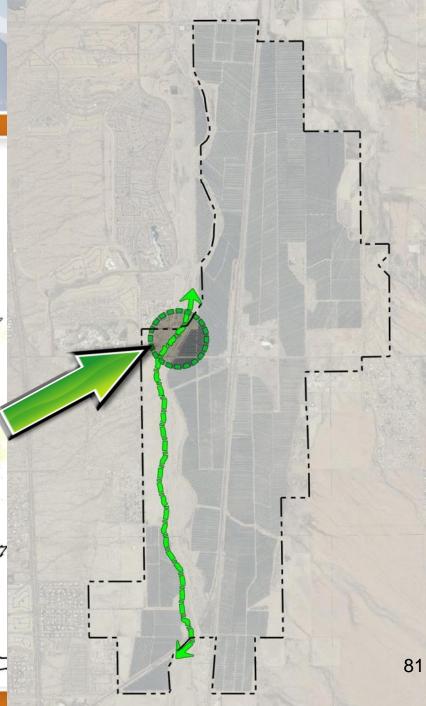






Early Phase: River Park Trailhead and Anza Trail







SANTA CRUZ RIVER MASTER PLAN

- Project Benefits
 - ✓ Public Safety
 - √ Regional Flood Control
 - ✓ Recreation
 - ✓ Habitat and Wildlife
 - ✓ Regional Access and Connectivity
 - ✓ Water Conservation and Recharge Opportunities





Questions???



