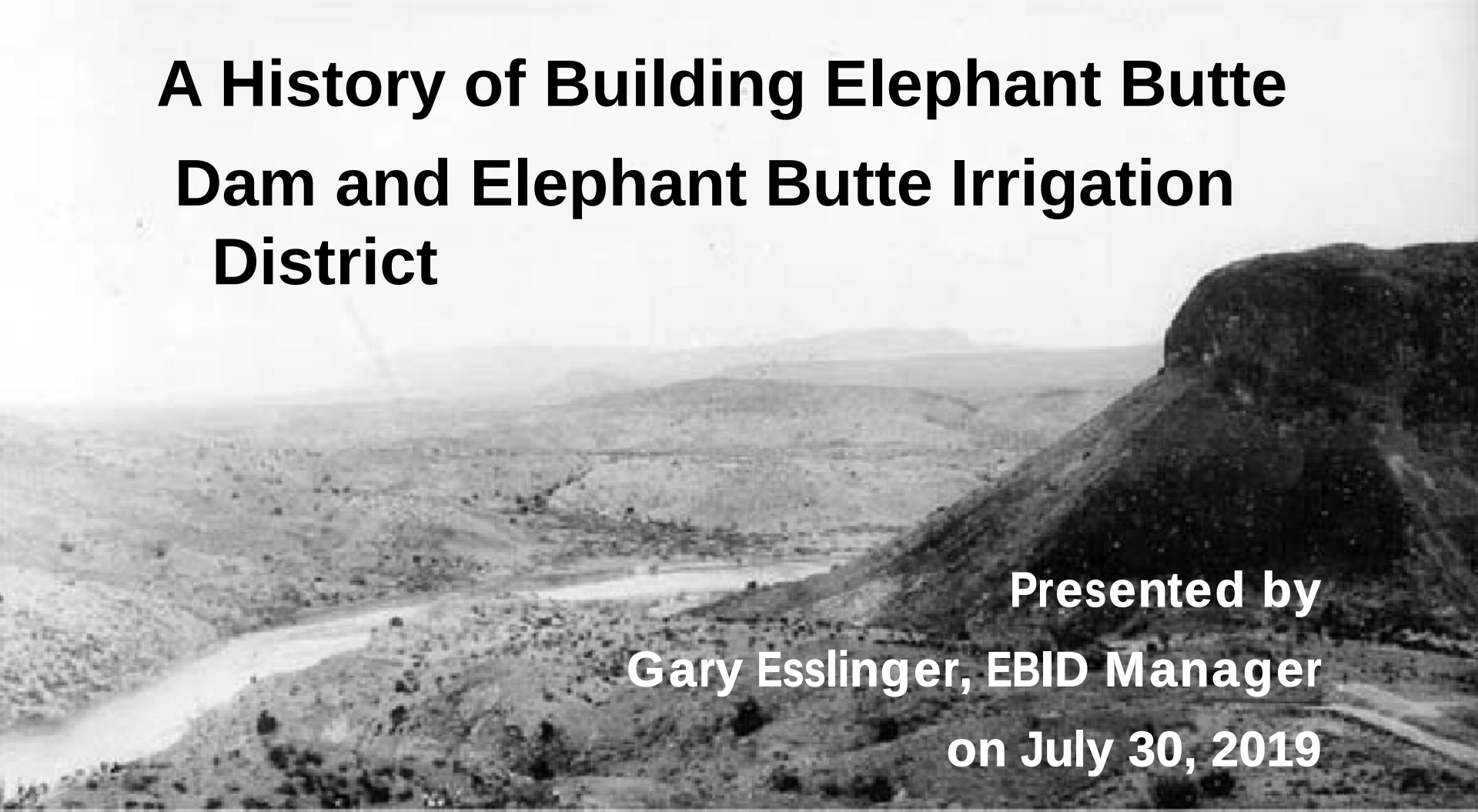
Water and Natural Resources Committee

A History of Building Elephant Butte Dam and Elephant Butte Irrigation District



Presented by

Gary Esslinger, EBID Manager

on July 30, 2019

Pre Elephant Butte Dam History

1500 Don Juan de Onate passes through the Mesilla Valley.

1600 Spanish settlers construct first acequias near present day Espanola, Santa Fe, Las Cruces, Dona Ana and Mesilla.

1848 Treaty of Guadalupe Hidalgo protects property rights of Mexican citizens in ceded territories and includes acequias. In our area some early acequias were the Mesilla, Dona Ana, Santo Tomas and Las Cruces to mention a few.

1851 Acequia custom and traditions were preserved under US Territorial Law but what was lost was the cultural significance such as the fiestas and day of cleaning. The significant gain was the preservation of the community ditch associations (acequias) and the commitment to cooperate with the US in developing a sustainable supply of surface water for irrigated ag for the future.

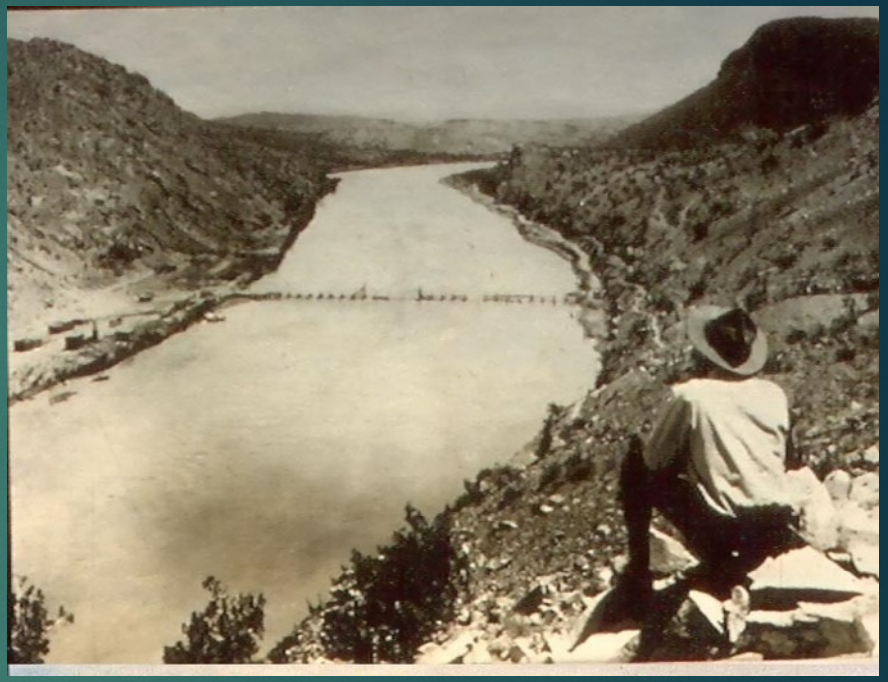
1880-1901

Construction of a Dam site on the Rio Grande in Southern NM/West Texas was driven by 3 major considerations

- Resolving a dispute over water shortages between US and Mexico and how to establish an international boundary.
- Torrential flooding continually changed the character of the course of the RG making it difficult to develop highly fertile lands along the river.
- Serious drought conditions in the 1890's resulted in the uncertainty and unreliable supply of water

1888-1909

- Controversy arose over where a "New Dam" of enormous size should be located and constructed.
- Ft. Bliss Army Engineer, Anson Mills argued for El Paso, TX that is should be located near the Mexican border at the "pass of the North".



1888-1909

- RG Dam & Irrigation Company, Director/General Nathan E Boyd representing his company had received application from the Secretary of Interior in 1895 for ROW for the dam near Engle, NM.
- United States intervened and passed a resolution to approve a commission to study the international boundary and equitable distribution of the Rio Grande, later Congress passed a resolution requesting the President to enter into negotiations with Mexico
- Years of litigation passed; however, the USSC prevailed in 1903
- The controversy still remains in the courts today and other water conflicts in the Lower Rio Grande.

Post Elephant Butte Dam History

1902 Reclamation Act is passed into law

1906 Construction is approved for Elephant Butte Dam

1906 US/Mexico sign treaty providing 60,000 ac/ft of water in perpetuity

1907 NM State Water Code adopted. Acequia water rights recognized as protected by Treaty and governed by Spanish and Mexican water law and custom and tradition.

1912 NM State Constitution confirms existing water rights.

1916 EB Dam Completed

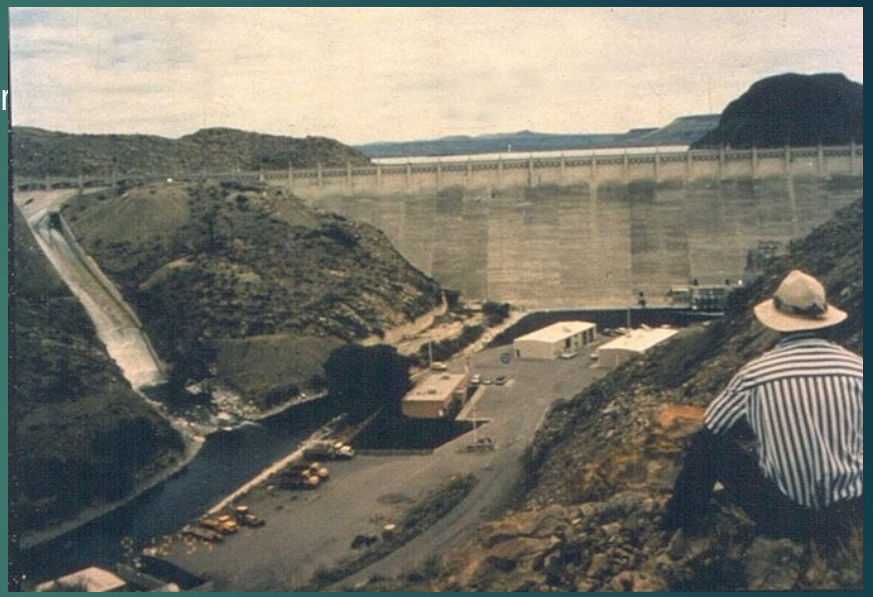
1918 Irrigation Districts such as EBID were formed from Water Users Associations to better represent the farming interests.

1933 RG below Caballo authorized for IBWC canalization.

1938 Caballo Dam Completed

1938 Rio Grande compact was authorized

1971 EBID pays final payment of construction charges on the RGP.



Elephant Butte Dam

- Victoria Land and Cattle Co. owned ¾ of the land that new dam and reservoirs would occupy
- During real estate negotiation ranch foreman for VL&C, JA Jostros, would fire waring shots over the construction site
- The United States finally realized they were trespassing
- VL&C asking $17/ac. US offered $2/ac. They both settled for $6.66/ac
- Final acreage for the dam and reservoir was approx. 30,000 ac.

Ca. 1920

From a Vision, to a Reality

Suggested Reservoir Names

- Lake Esperanza (Hope, Promise, Prospect)
- Lake Hall (USRS Project Engineer BM Hall)
- Lake Engle (RR site at Engle, NM)

Chosen

- Elephant Butte Reservoir

Suggested Dam Site Names

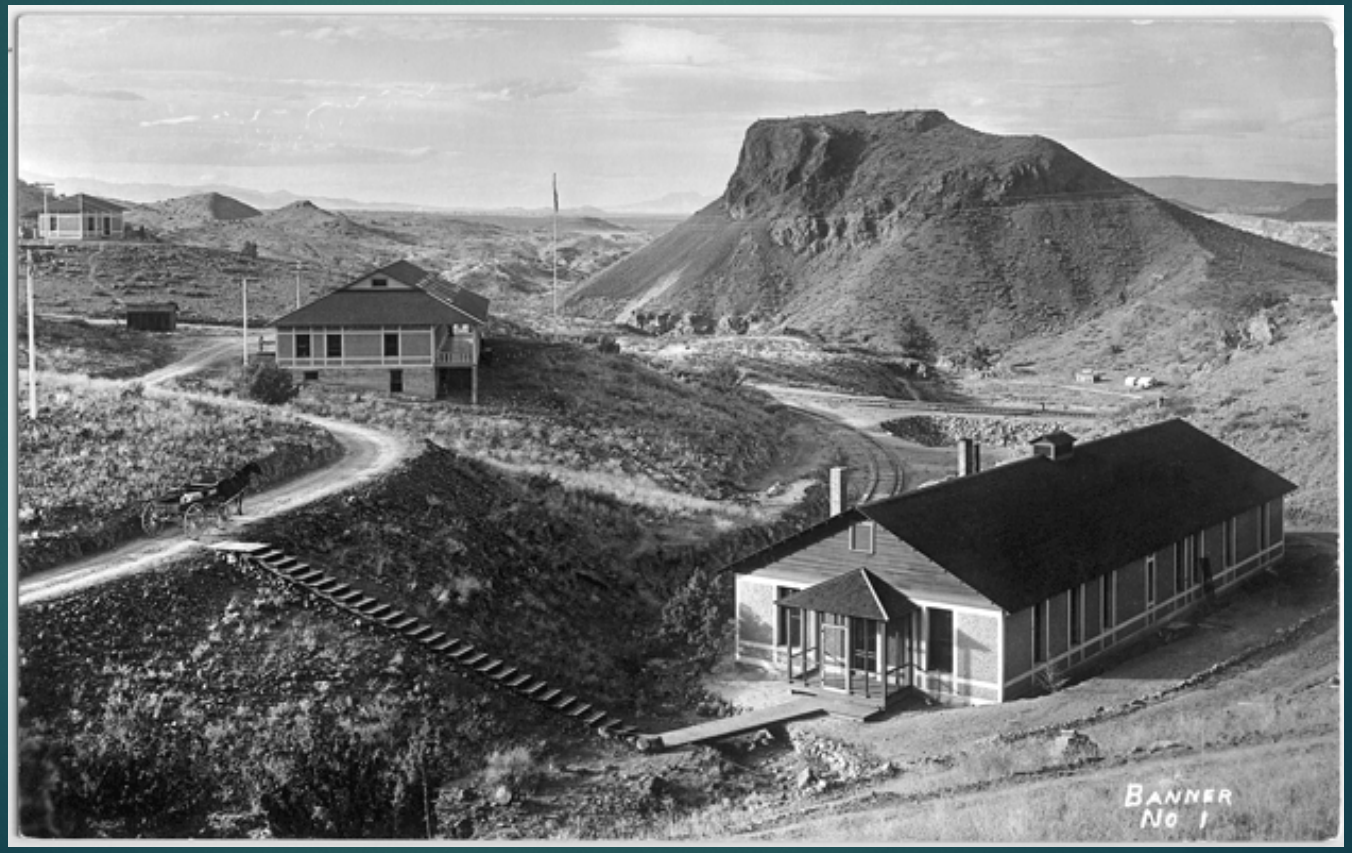
- Engle Dam (RL Engle Construction Engineer)
- Eagle Dam (Bald Eagles in the area)
- Woodrow Wilson Dam (President of US)

Chosen

- Elephant Butte Dam

Elephant Butte Dam

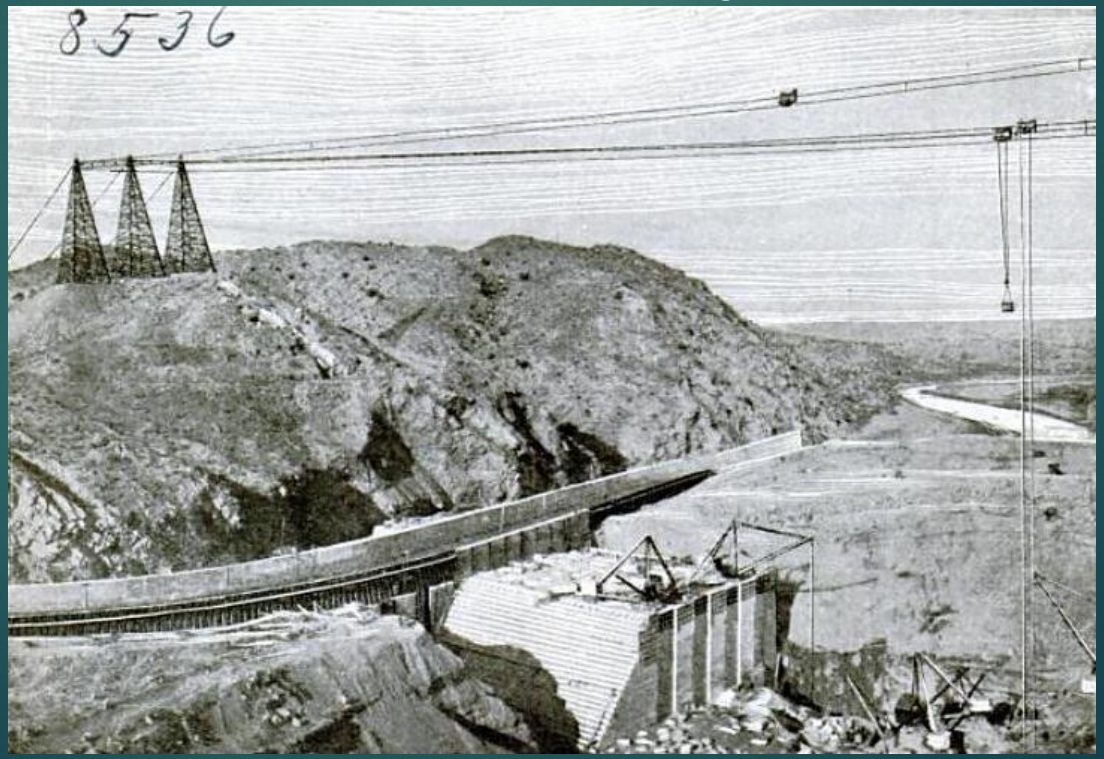
- Workers lived on the site while the dam was being constructed.
- Average of 1000 workers on site
- Camp town avg 3000 to 5000 population including, farmers, business, families, stores, churches and other venues such as boxing



Elephant Butte Dam

Construction Site included

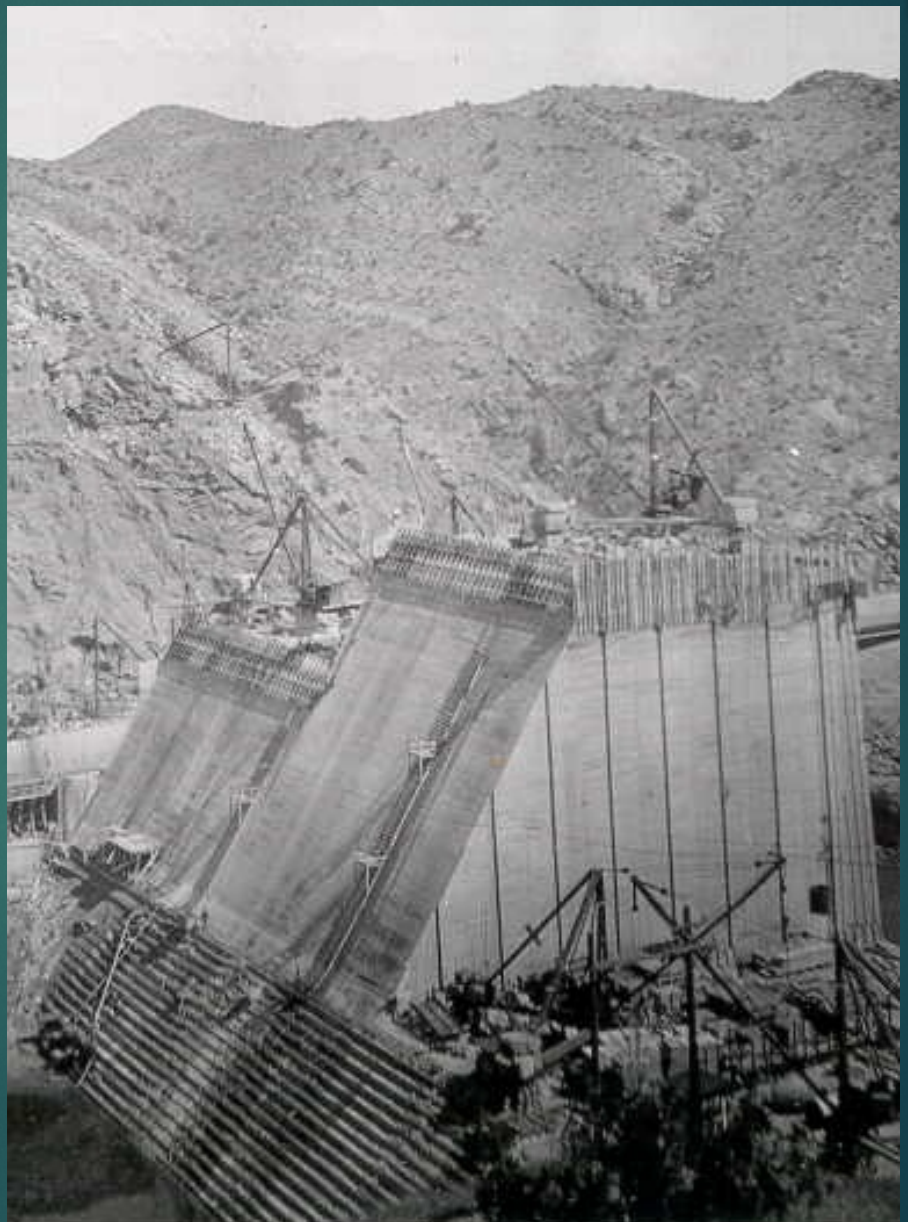
- Government operated power plant for concrete mix, hoists and other machinery powered by 3 steam turbine generators
- Government operated sand-cement plant to be mixed with 300,000 barrels of Portland Cement brought by rail from El Paso, TX produced 410,000cu/yrds of concrete
- Two railroad sites were established; one at Engle and one at the Dam site



Elephant Butte Dam

"...from the sand of the riverbed to the crest, one hundred and ninety feet."

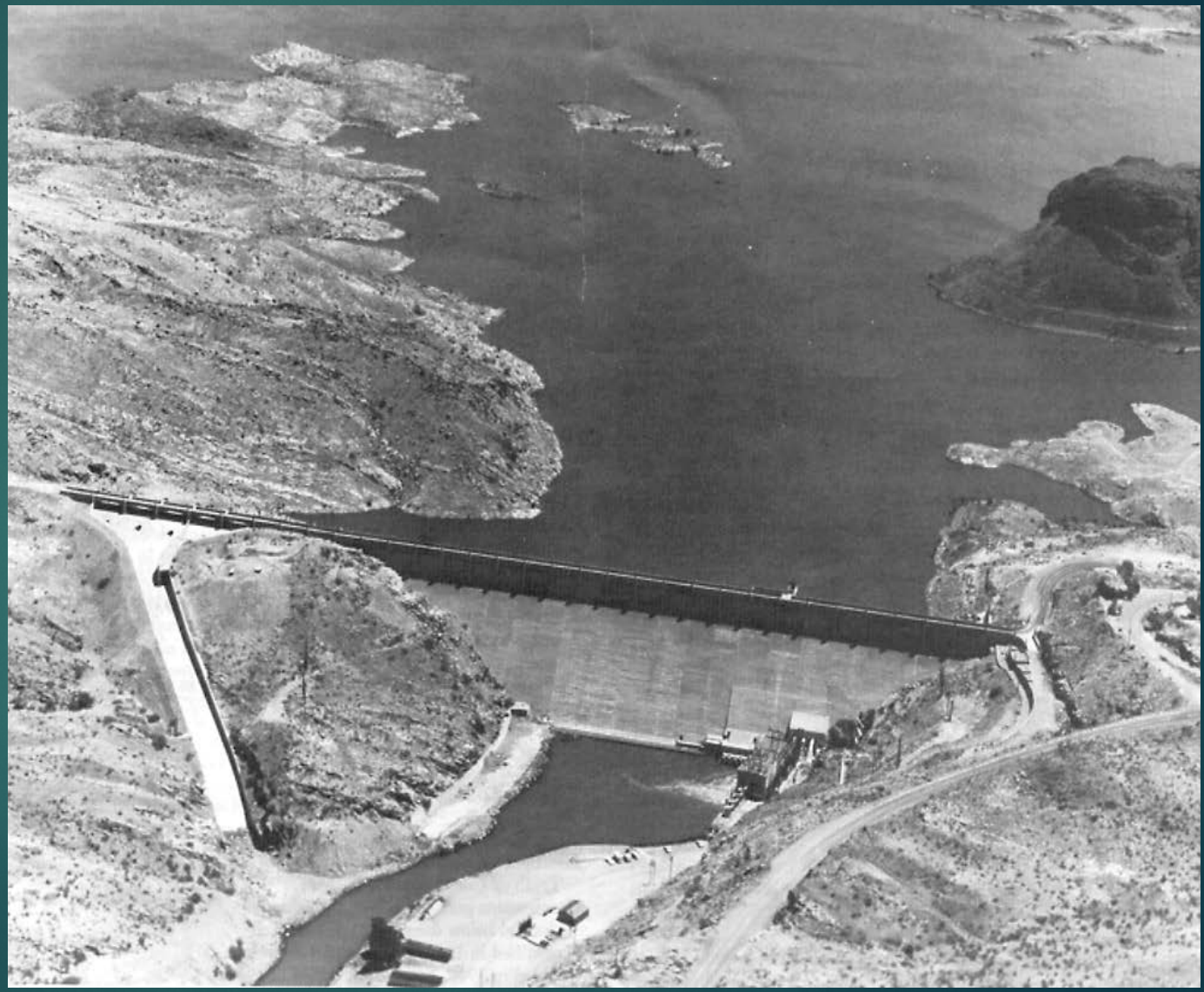
"The concrete dam will be one hundred eighty feet thick at the bottom"



Elephant Butte Dam

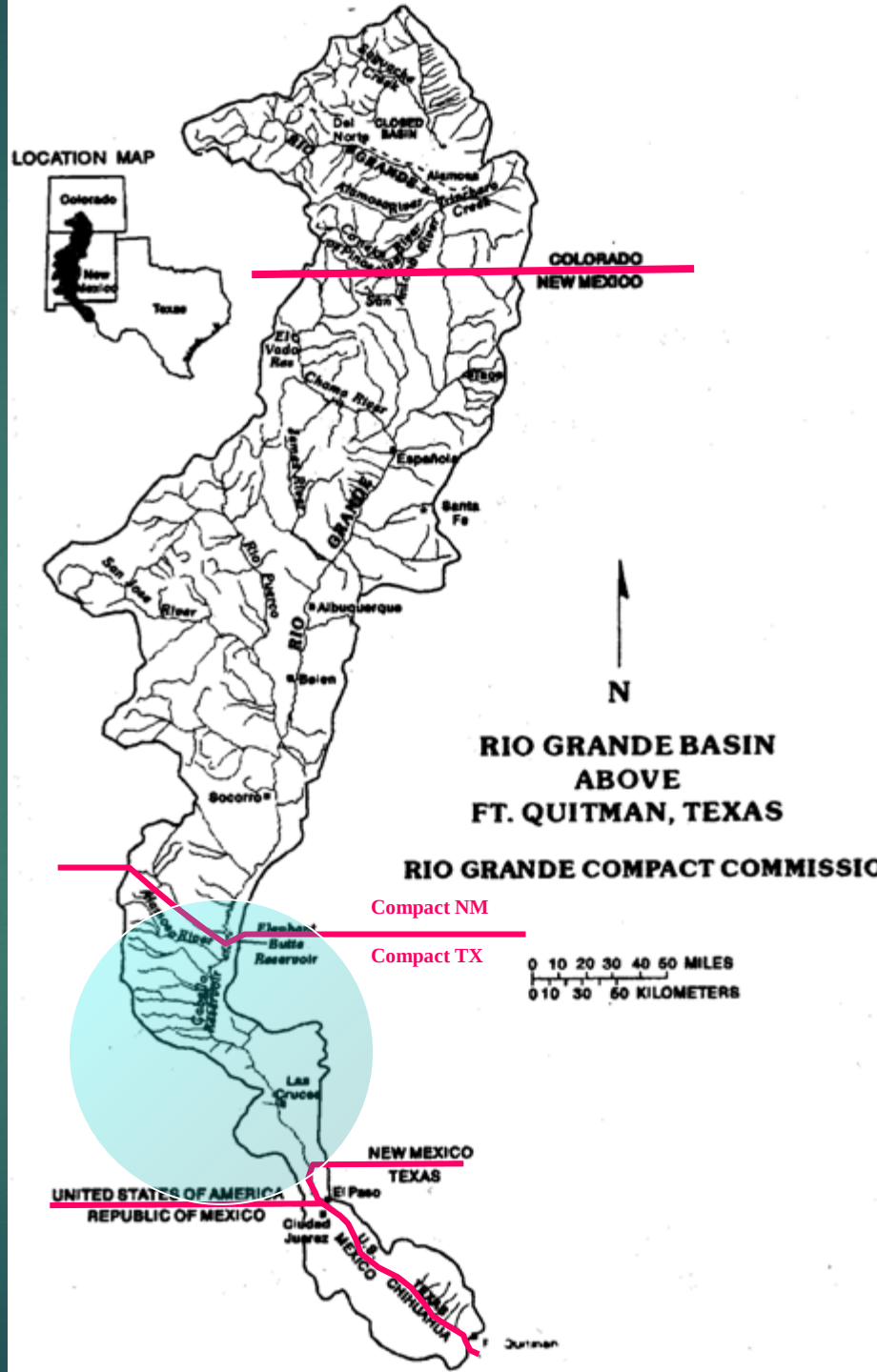
"Floodwaters to be held in storage in this gigantic dam, if suddenly loosed, would cover an area equal to that of Rhode Island to the depth of about three feet."

- Storage Capacity 2,600,00 ac/ft
- Submerge 42,000 ac of land extended to maximum length of 45 miles
- Designed as a single purpose dam for agricultural irrigation only
- 180,000 acres in the both NM and TX and 20,000 acres in Mexico

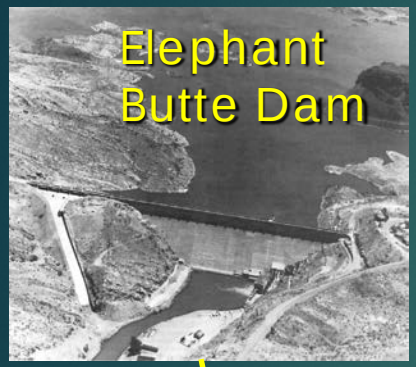


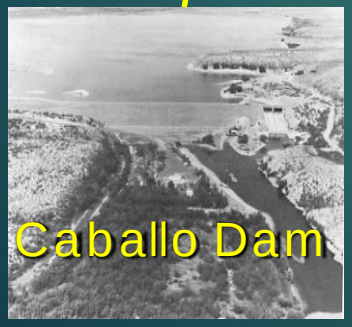
The Rio Grande Compact

- International Compact for Surface Water Allocation
  - New Mexico
  - Texas
  - Mexico
- Colorado delivery to New Mexico
- New Mexico Delivery to Texas
- No man's land: EBID
  - Geographic New Mexico
  - Compact accounting Texas
  - Surface water managed by EBID
  - Groundwater managed by OSE



EBID Release and Diversion Points





Hatch

Las Cruces

Rio Grande

TX

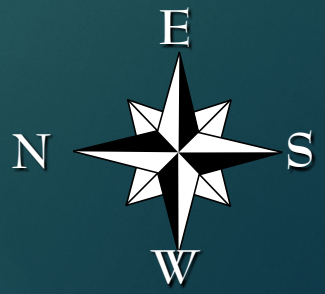
Texas

Mexico

Rincon Valley
18,165 acres

Mesilla Valley
72,485 acres

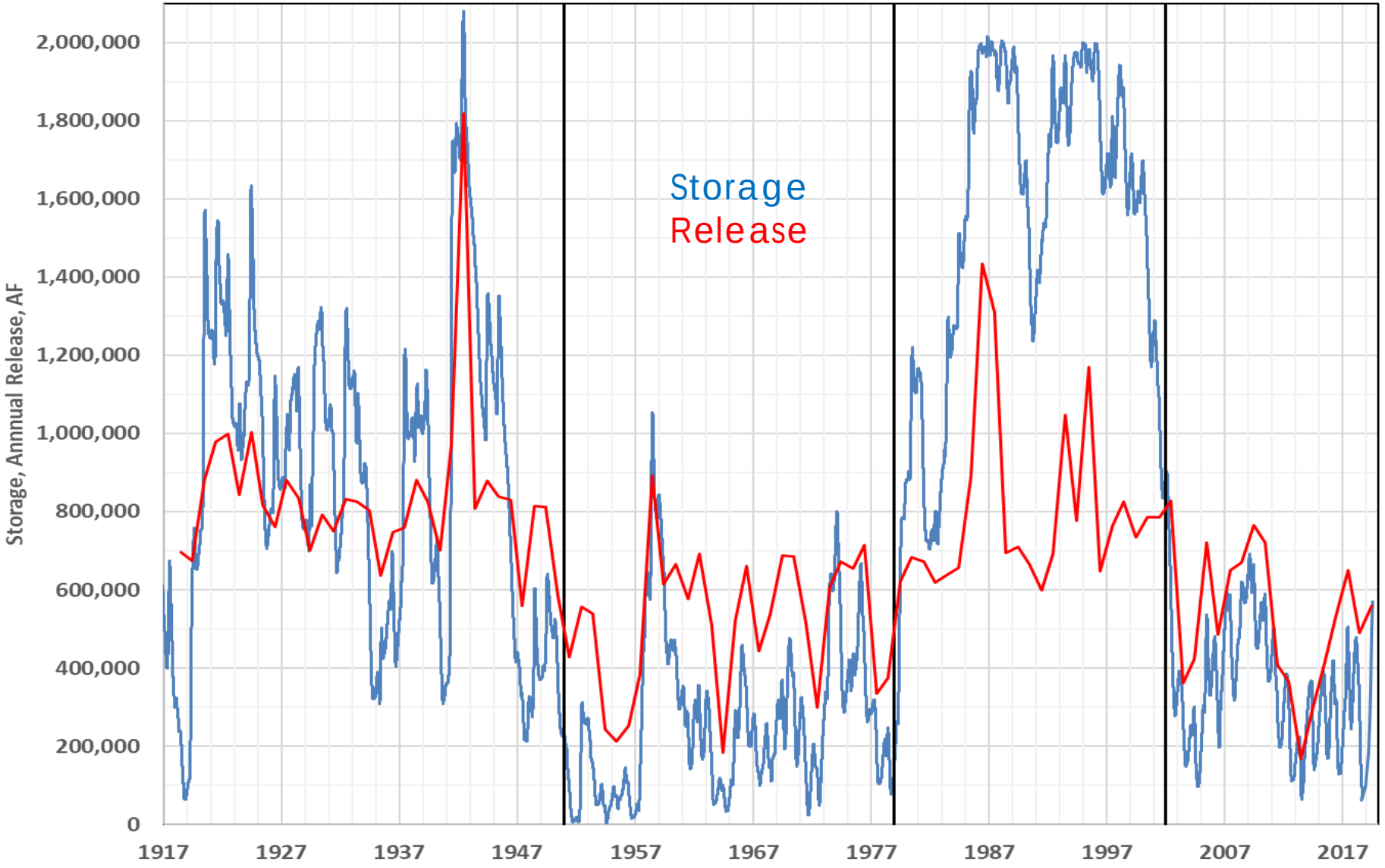
Anthony



Important Historical Events
in EBID History 1971-Present

- 1978 EBID takes over from Bureau of Reclamation the operation and maintenance of the District by contract
- 1986 EBID files for Stream Adjudication against the New Mexico State Engineer Office
- 1987 EBID takes over from Bureau of Reclamation the operation and maintenance of Percha, Leasburg, and Mesilla diversion dams by contract
- 1996 Bureau of Reclamation deeds canals, laterals, drains and wasteways to Elephant Butte Irrigation District by Quitclaim deed
- 1996 Elephant Butte Irrigation District files Federal Suit regarding misc. revenues from project
- 1997 Bureau of Reclamation files quiet title suit against District and local entities
- Present - Stream Adjudication, Federal USSC Lawsuits continue

Elephant Butte Storage and Annual Release 1917-2019



EBID's Climate Change Experience

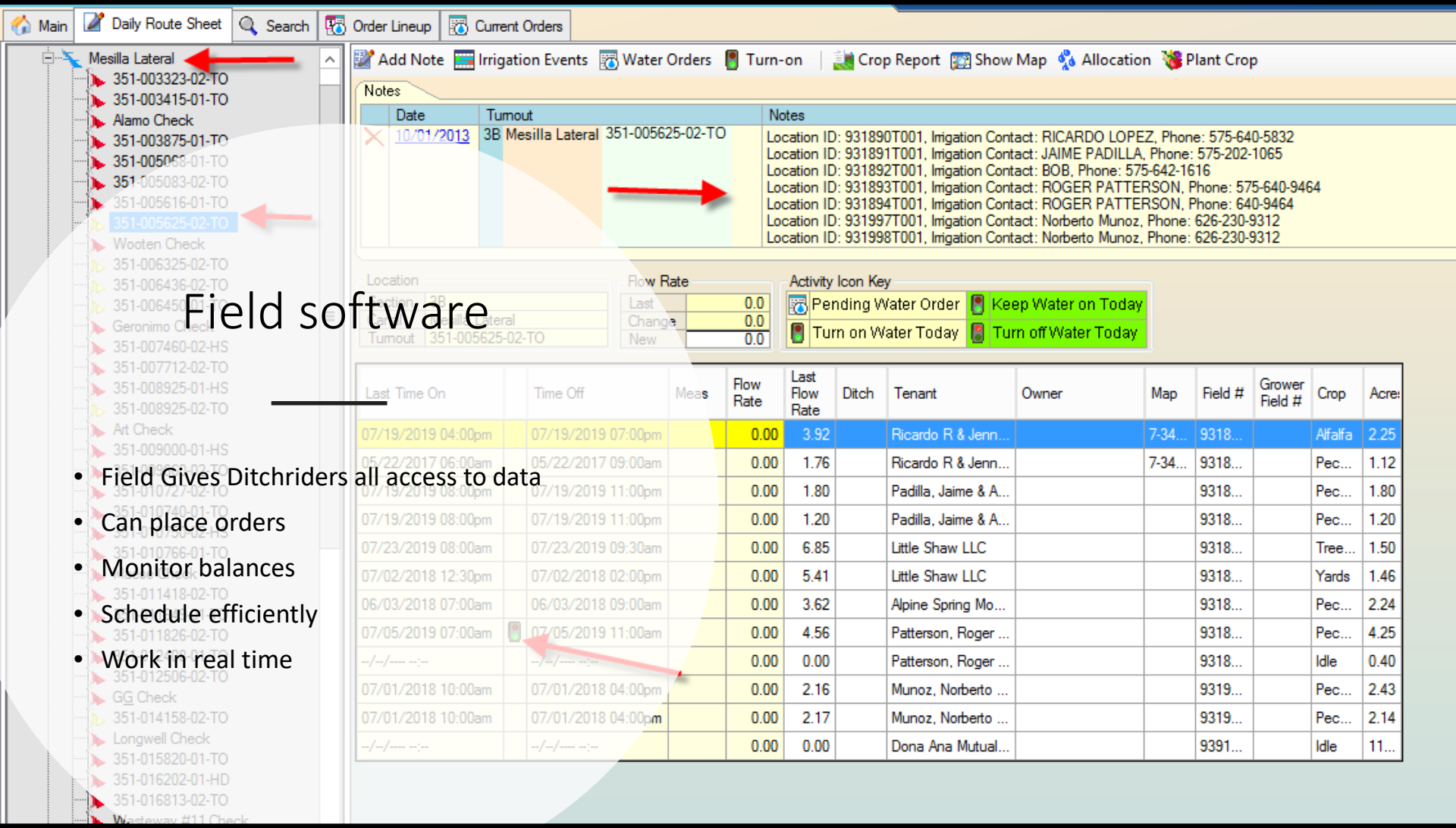
100-year history of climate change response

- Construction of Rio Grande Project – 1910s
- Drainage system for groundwater table control, return flows - 1920s
- River canalization for conveyance, flood protection – 1930s
- Drought response, Farmer wells – late 1940s to 1970s
- Flood control dams on tributary arroyos– 1950s to 1970s
- Deep well program – 1970s
- District Takeover, rehabilitation of delivery and drainage system – 1980s to 1990s
- Measurement of surface water and groundwater – 1990s
- Storm water management strategies – 2000s
- Rio Grande Project Operating Agreement - 2008


EBID
Innovation

EBID Water Software Technology True Point Highlights

- 2014 FULLY CONVERTED OFFICE AND FIELD WATER ORDERING TECHNOLOGY
  - Laptops for all Ditchriders with real-time connection to EBID servers
- 2016 INTEGRATED GIS APPLICATIONS TO WORK WITH TRUE POINT
  - Allows for District Maps and Flow data to integrate
- 2017 DEVELOPMENT OF SMART PHONE APPS TO ASSIST WITH MONITORING
- OVER ALL IMPROVEMENTS TO SCHEDULING, DELIVERY AND EFFICIENCY.
- CONTINUED INTEGRATION WITH SCADA SYSTEMS TO BUILD AUTOMATION

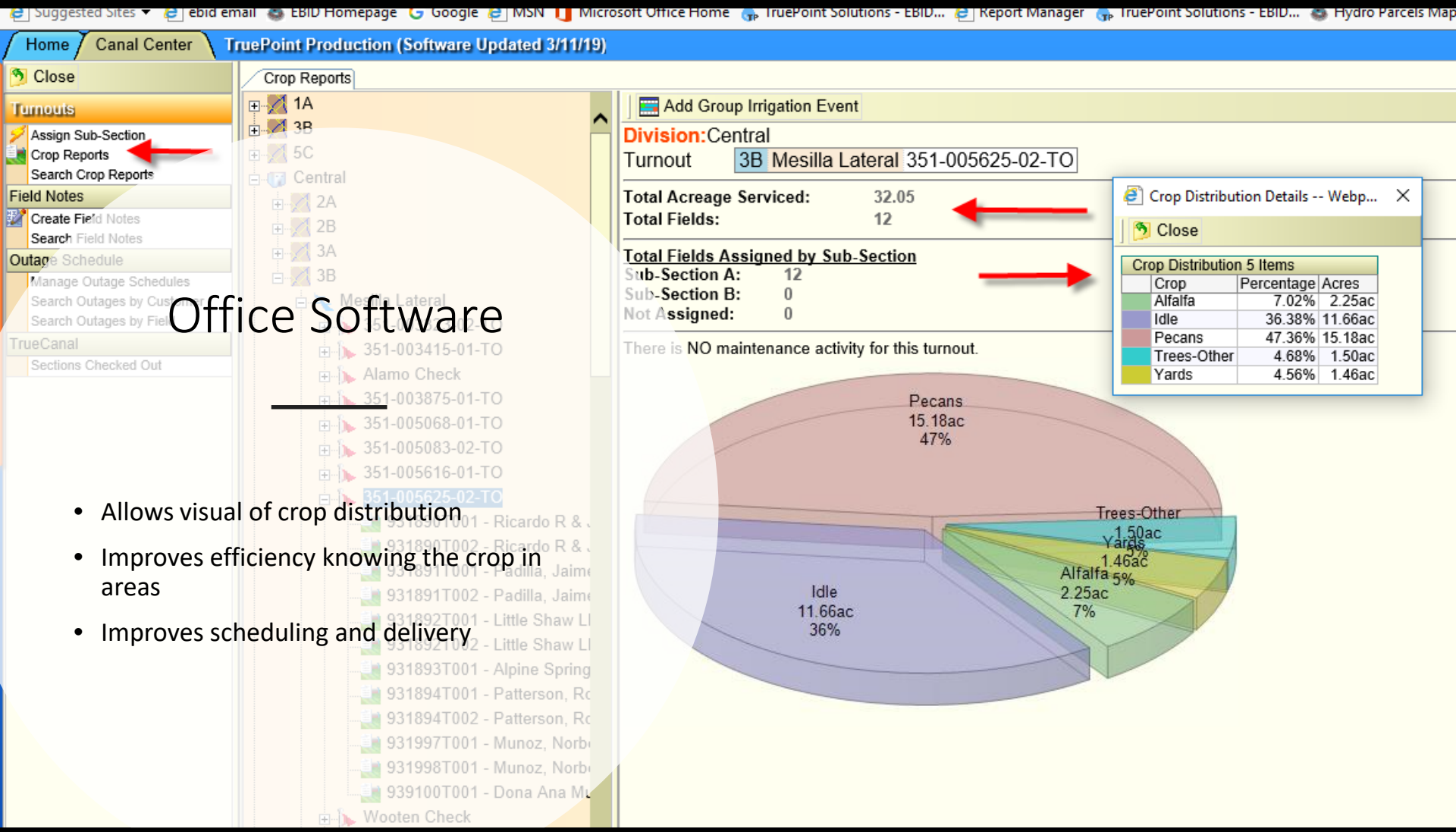


Field software

- Field Gives Ditchriders all access to data
- Can place orders
- Monitor balances
- Schedule efficiently
- Work in real time

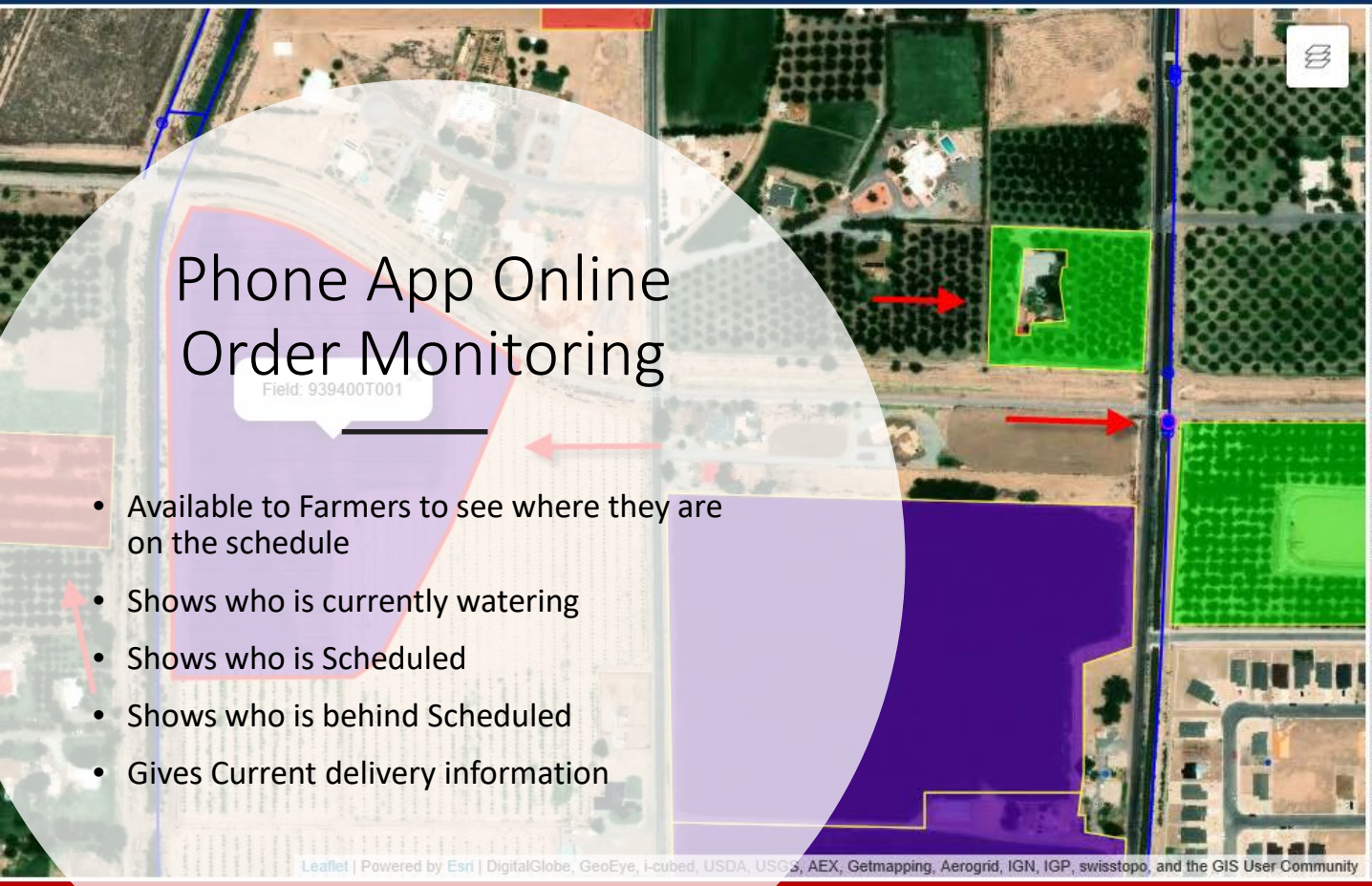
Office Software

- Allows visual of crop distribution
- Improves efficiency knowing the crop in areas
- Improves scheduling and delivery



Phone App Online Order Monitoring

- Available to Farmers to see where they are on the schedule
- Shows who is currently watering
- Shows who is Scheduled
- Shows who is behind Scheduled
- Gives Current delivery information

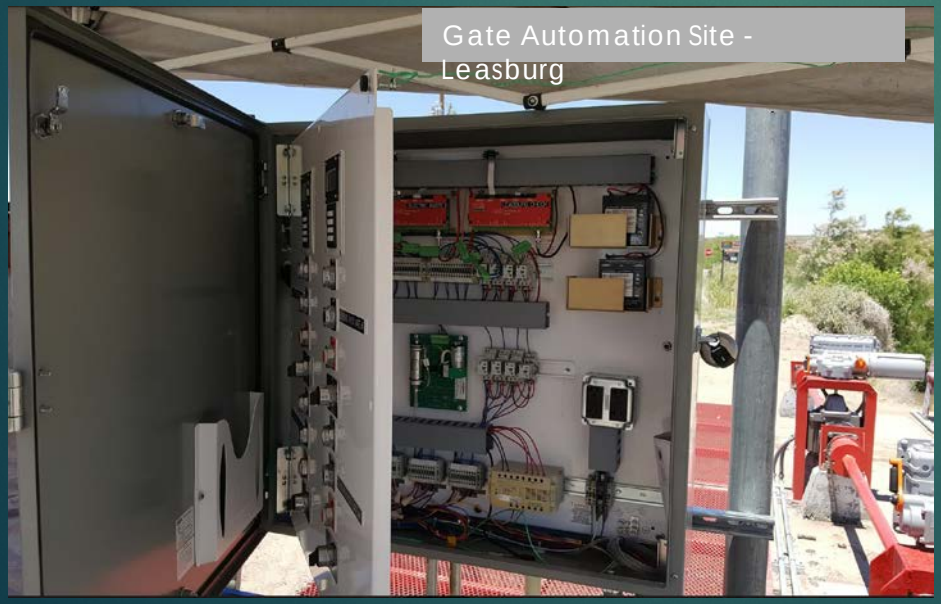


Events

Field: 939300T001	**Turnout:** 351-006436-02-TO	**Shut off irrigation:**
Field: 939400T001	**Turnout:** 351-006436-02-TO	**Shut off irrigation:**
Unit: 3B	**Lateral:** Mesilla Lateral	**Start:** 2019-07-17 07:00:00
Order: 145492	**Crop:** Alfalfa	**Acres:** 15.43
Initial CFS: 1.52000	**Current CFS:** .00000	**Max CFS:** 2.94000
Field: 939200T001	**Turnout:** 351-006436-02-TO	**Shut off irrigation:**
Field: 829400T001	**Turnout:** 353-002021-01-TO	**Shut off irrigation:** 2019-07-25 13:00:00
Field: 834400T001	**Turnout:** 351-041676-02-TO	**Shut off irrigation:** 2019-07-25 15:00:00
Field: 861600T001	**Turnout:** 351-045434-01-TO	**Shut off irrigation:** 2019-07-25 19:00:00
Field: 868100T001	**Turnout:** 356-002020-02-T0	**Shut off irrigation:** 2019-07-25 21:00:00
Field: 911400T001	**Turnout:** 356-002020-02-T0	**Shut off irrigation:** 2019-07-25 21:00:00
Field: 868200T001	**Turnout:** 356-002020-02-T0	**Shut off irrigation:** 2019-07-25 21:00:00
Field: 867900T001	**Turnout:** 356-002020-02-T0	**Shut off irrigation:** 2019-07-25 21:00:00
Field: 929000T001	**Turnout:** 362-001756-02-TO	**Shut off irrigation:** 2019-07-28 14:47:00
Field: 929300T001	**Turnout:** 362-001756-02-TO	**Shut off irrigation:** 2019-07-28 14:47:00
Field: 929400T001	**Turnout:** 362-001756-02-TO	**Shut off irrigation:** 2019-07-28 14:47:00
Field: 929400T003	**Turnout:** 362-001756-02-TO	**Shut off irrigation:** 2019-07-28 14:47:00
Field: 870700T001	**Turnout:** 351-006436-02-TO	**Shut off irrigation:** 2019-07-28 23:16:00

EBID RTU SYSTEM

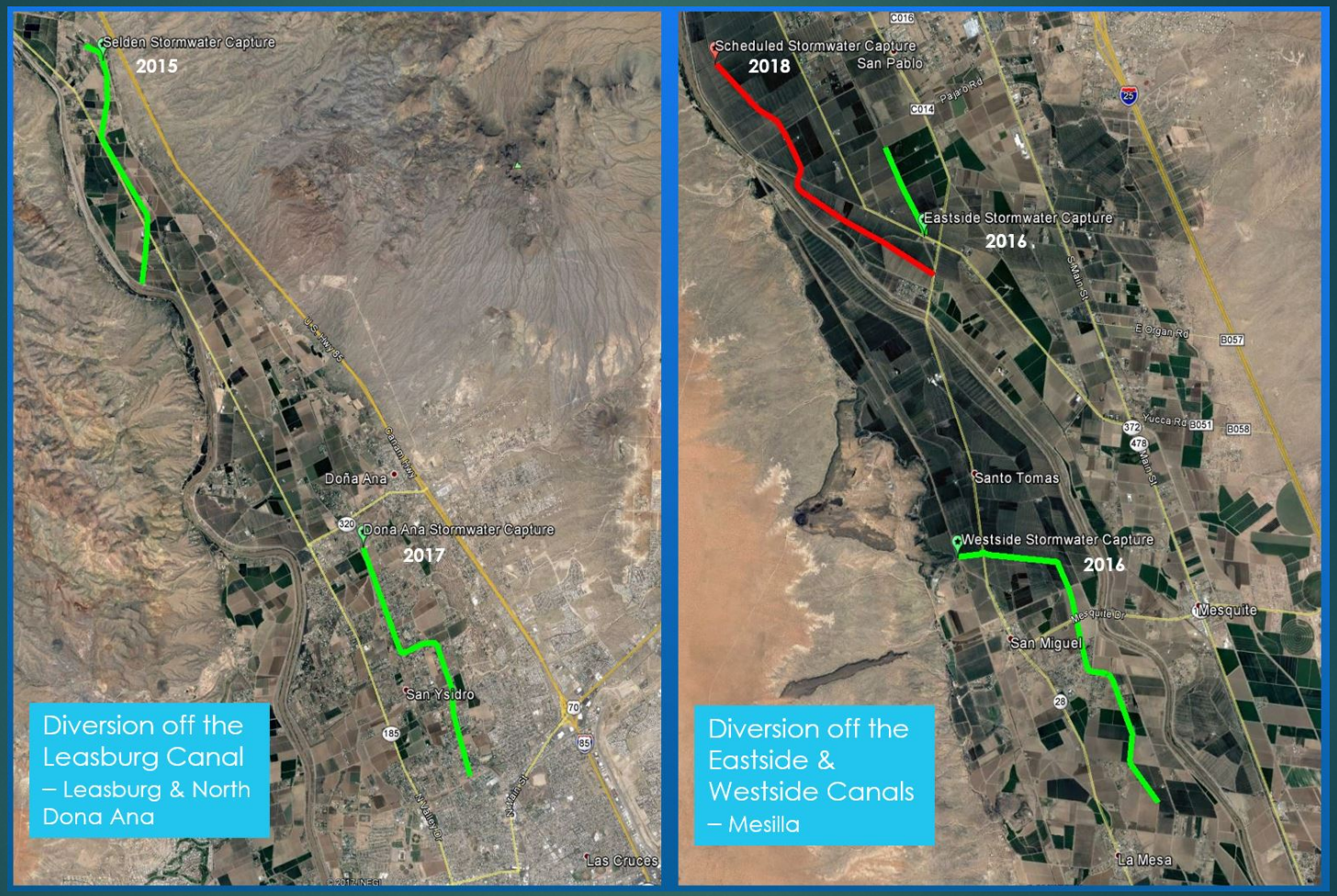
- 470 total field sites
- Sites polled every 30 minutes
- Line of sight FCC radio frequencies
- Six mountain repeater sites



Types of Monitoring Sites

- Dam Releases
- River Stations
- Diversion Canals
- Lateral Headings
- Spillways and Drains
- Farmer Irrigation Wells
- Groundwater Wells
- Weather Stations
- Rain Gauges
- Flood Control Dams

Groundwater Modeling - Targeted Capture Sites



Environmental Benefits of EBID Drain Storage for Stormwater

- Habitat support
  - Diverse depth
  - Diverse velocity
  - Shallow depth to groundwater
- E. Coli mitigation
- Flood flow effects
  - Slowing, retention
  - Infiltration
- Agricultural Drainage
  - Water table control
  - Salt removal
- Habitat Establishment & Open Space
- Storm water storage and regulation
- E. Coli mitigation from runoff

Selden Drain Flood Control Project

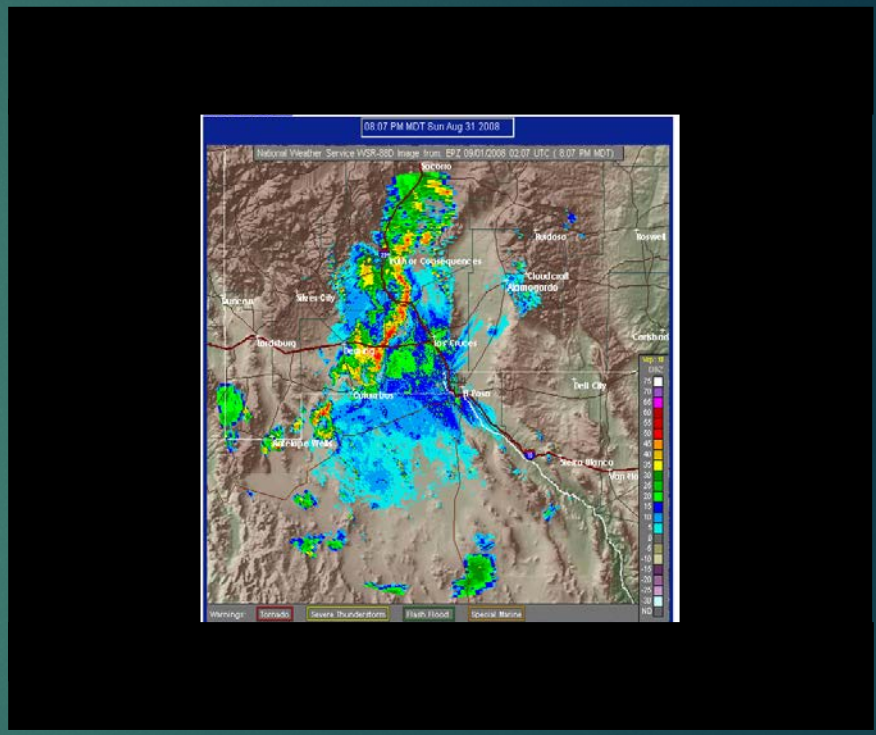
Selden Drain – Before
Limited Holding Area

Selden Drain – After
New Holding Area

EBID's Advance Warning System Real-time Monitoring

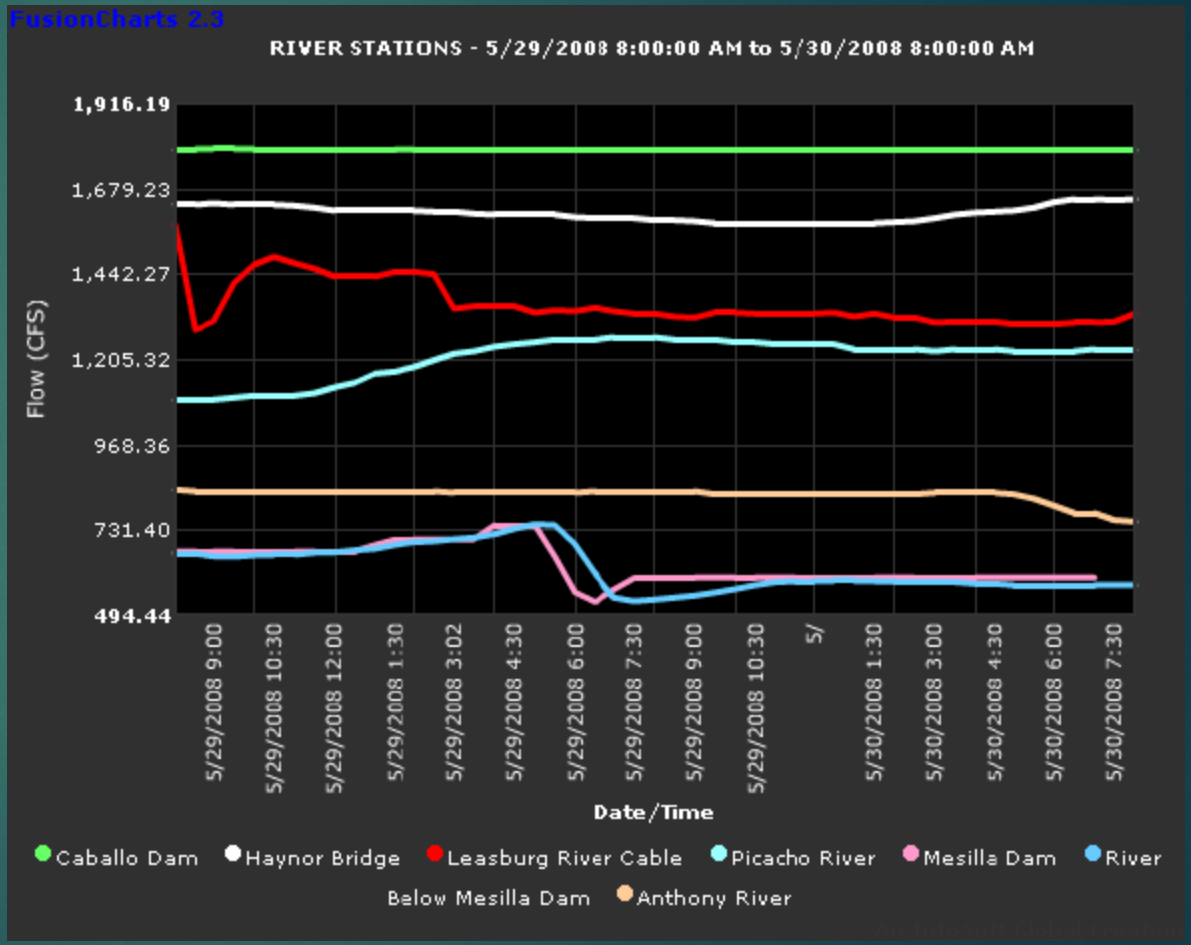
Early warning:

- Satellite and Radar monitoring – days to hours before a runoff event
- Identify preferential storm paths for optimal instrumentation location
- Monitor trajectory and intensity of storms real-time for flood response
- Develop image processing algorithms for short-term forecasting (NMSU)
- Retain or release floodwater based on incoming weather



EBID's Rapid Response to close Caballo Dam gates during Storm Flows

- 7 operational stations from Caballo Dam to the Texas State Line
- 20 minute real-time data, radio telemetry
- Operations management
- Flood tracking and warning
- Available on web, used by many local agencies



Diez Lagos
Multi-objective project

- Flood control: Protect local neighborhoods
- Water supply: Storm water capture. Release storm water for downstream demand, keep more water in upstream reservoir storage
- Habitat: Topography and vegetation create riparian meadow, forest zones
- Water Quality: Mitigate E. coli loading
- Research/Education: Partners from NSF and NMSU

Flood Control Facilities

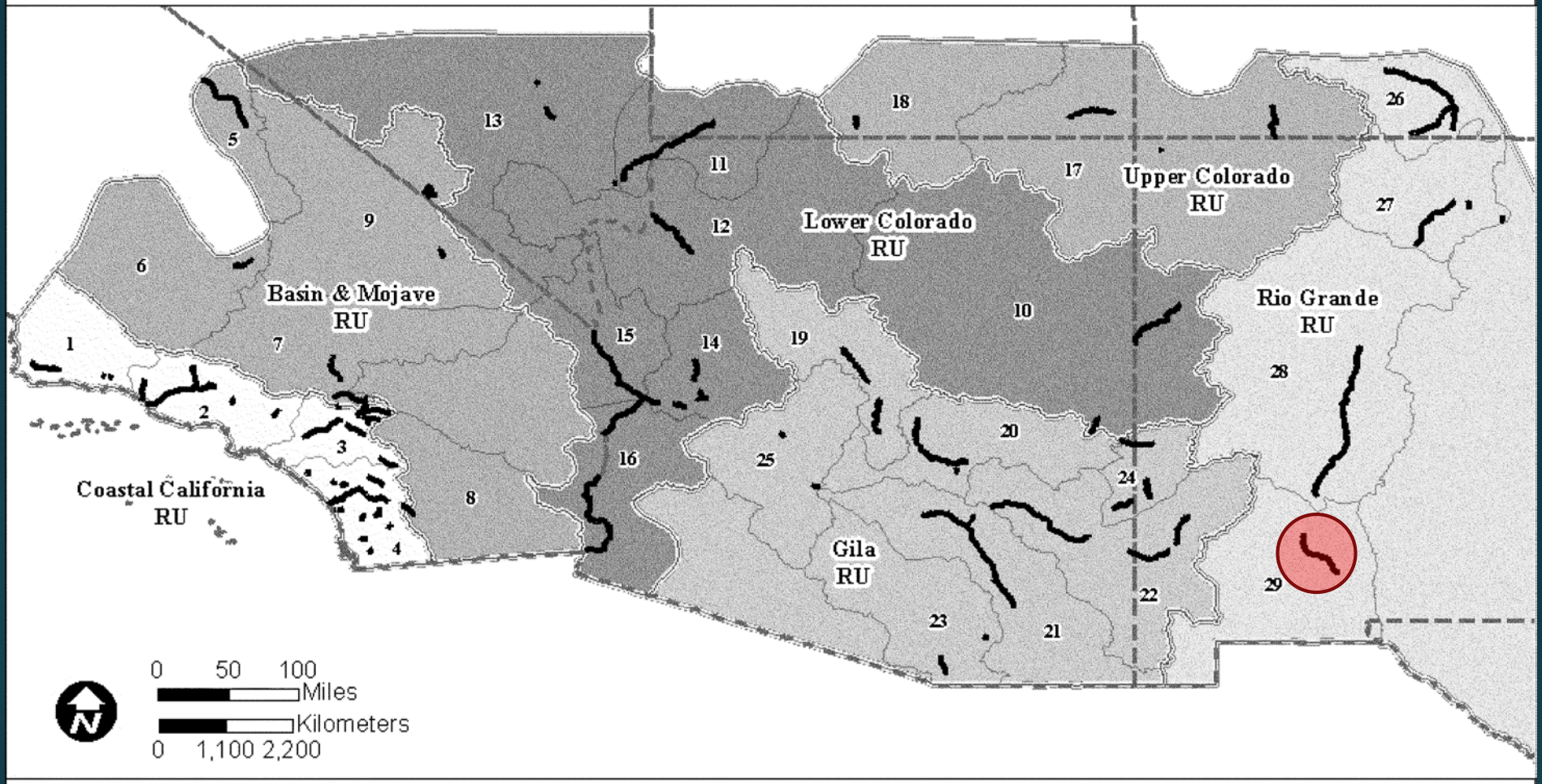
- Over 100 aging, under-designed PL-566 flood control dams
- False sense of security
- Inadequate laws on development below dams
- Rehab, upgrade is $$$, logistically impossible
- Watershed management is necessary
- Consequences of failure

Challenges of Storage

- Flood control dams are inadequate for normal operations, not designed for storage
- Storing water increases likelihood of failure
- New operations may increase liability
- Poor watershed conditions result in steep hydrographs, high debris and sediment concentrations

Living with the SWFL (“Swiffle”)

General Locations of Critical Habitat for the Southwestern Willow Flycatcher
Overview Map



Critical Habitat

State Boundaries

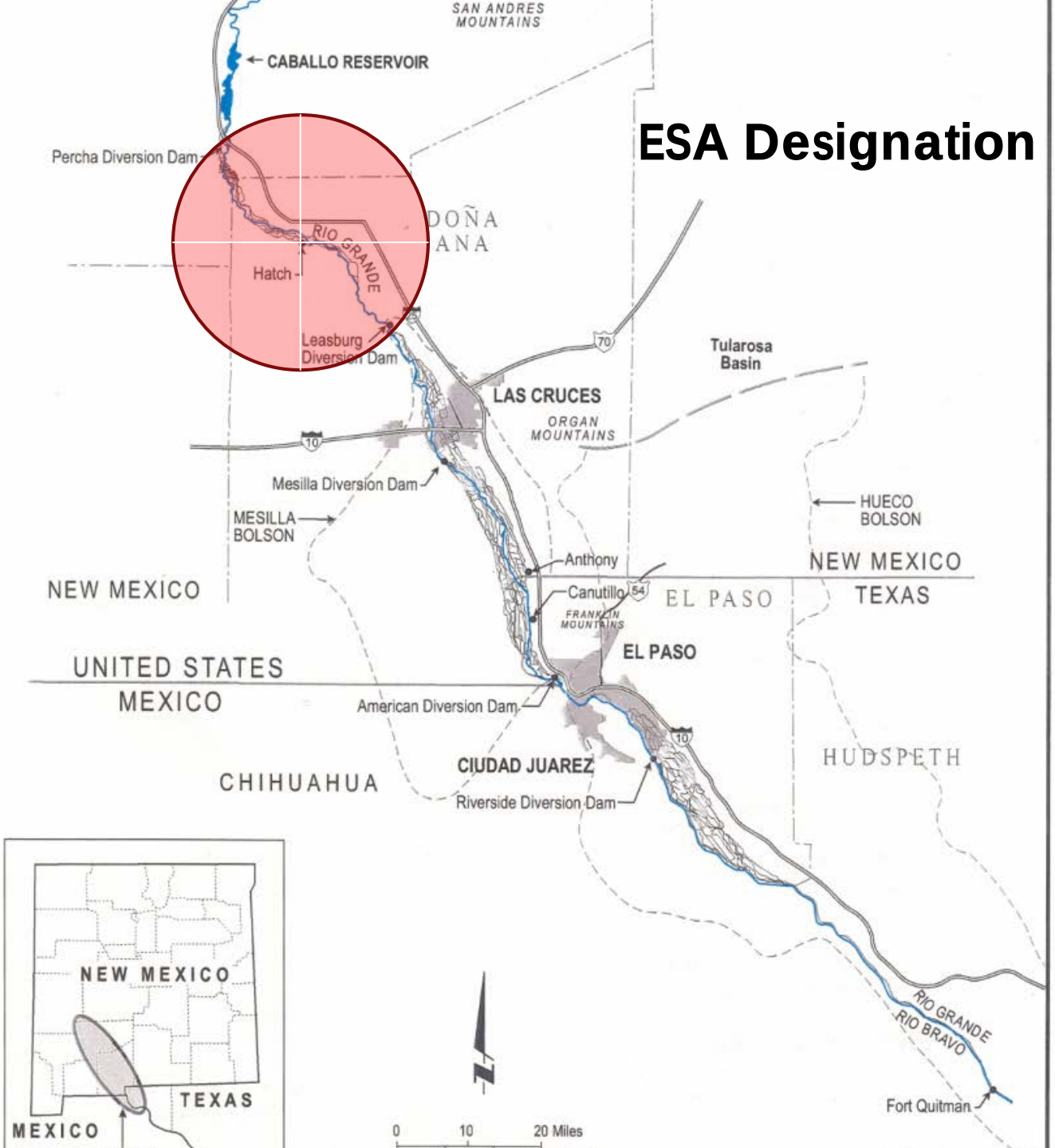
Recovery Units

- Coastal California
- Basin & Mojave
- Lower Colorado
- Upper Colorado
- Gila
- Rio Grande

Management Units

- 1 - Santa Ynez
- 2 - Santa Clara
- 3 - Santa Ana
- 4 - San Diego
- 5 - Owens
- 6 - Kern
- 7 - Mojave
- 8 - Salton
- 9 - Amargosa
- 10 - Little Colorado
- 11 - Virgin
- 12 - Middle Colorado
- 13 - Pahranagat
- 14 - Bill Williams
- 15 - Hoover-Parker
- 16 - Parker-Southerly International Boundary
- 17 - San Juan
- 18 - Powell
- 19 - Verde
- 20 - Roosevelt
- 21 - Middle Gila/San Pedro
- 22 - Upper Gila
- 23 - Santa Cruz
- 24 - San Francisco
- 25 - Hassayampa/Agua Fria
- 26 - San Luis Valley
- 27 - Upper Rio Grande
- 28 - Middle Rio Grande
- 29 - Lower Rio Grande

ESA Designation



Sequence of Events

- 2002 – WWF examines agricultural water conservation for environmental supply
- 2003 – USIBWC releases EIS for channel maintenance
- 2004 – Final EIS, ROD delayed by stakeholders: EBID and WWF
- 2005 – EBID and WWF submit a proposal to USIBWC to launch a collaborative effort to work through differences
- 2006 – Hydrologic/hydraulic analyses of river and potential restoration projects
- 2007-2008 – Stakeholder meetings
- 2009 – Restoration plan and Water transaction program completed
- June 2009 – USIBWC issues Record of Decision
- 2011 – USF&WS plans Critical Habitat Designation for vast areas of southwest, including much of EBID

Institutional Framework for Environmental Water Management

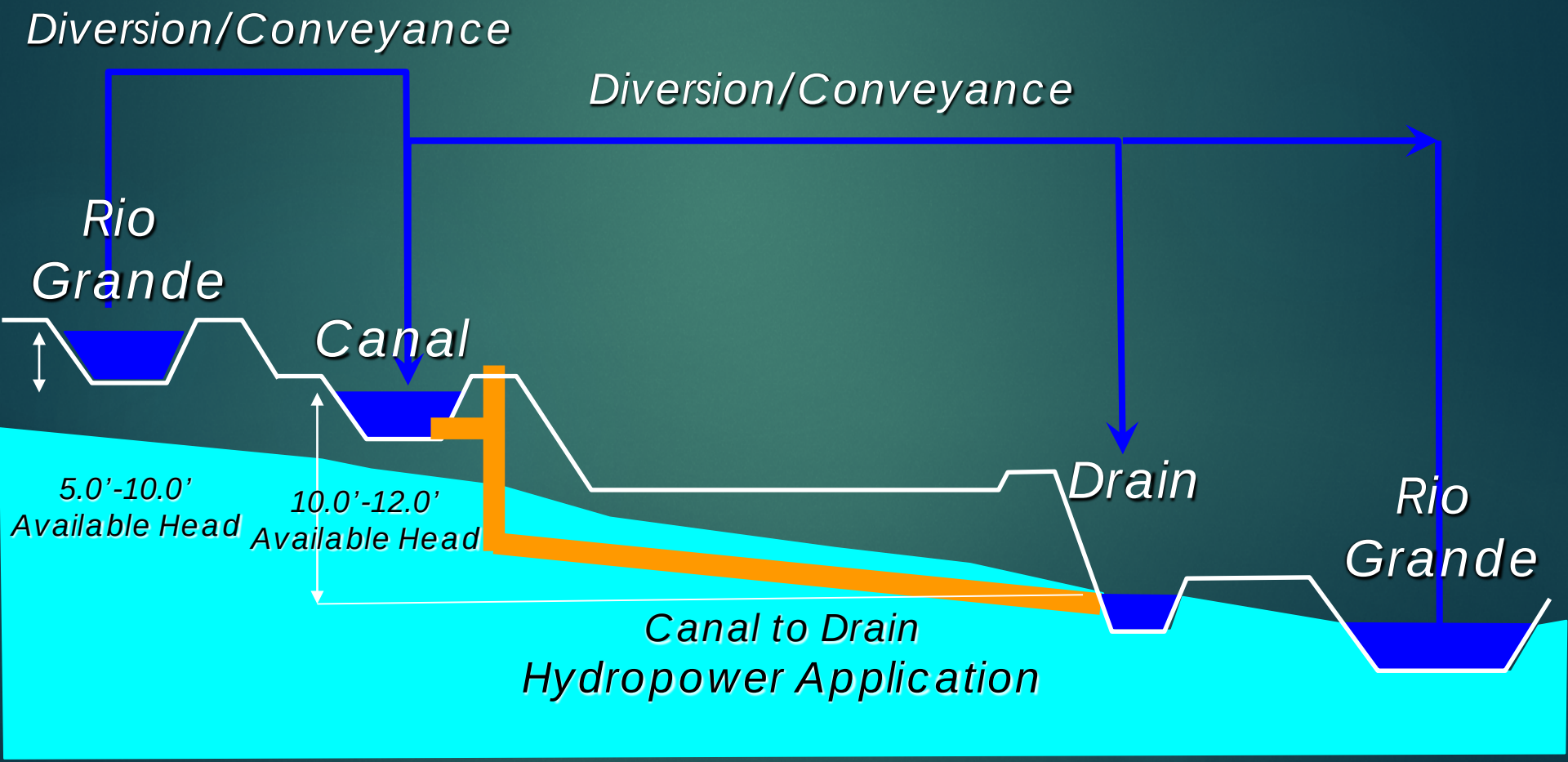
- Developed by EBID, Audubon New Mexico, and USIBWC
- Growing riparian vegetation acknowledged as an “agricultural” use
- Restoration sites with increased depletions would be water-righted
- ESA Incidental Take statement protection
- District Board approval of environmental water transfers
- Market-based water rights transactions, lands continue to be assessed
- Shared shortages in low water years, deliveries on irrigation schedule
- USF&WS excluded EBID from Critical Habitat designation March 2013
- EBID environmental water transfer policy passed June 2013


April 2013

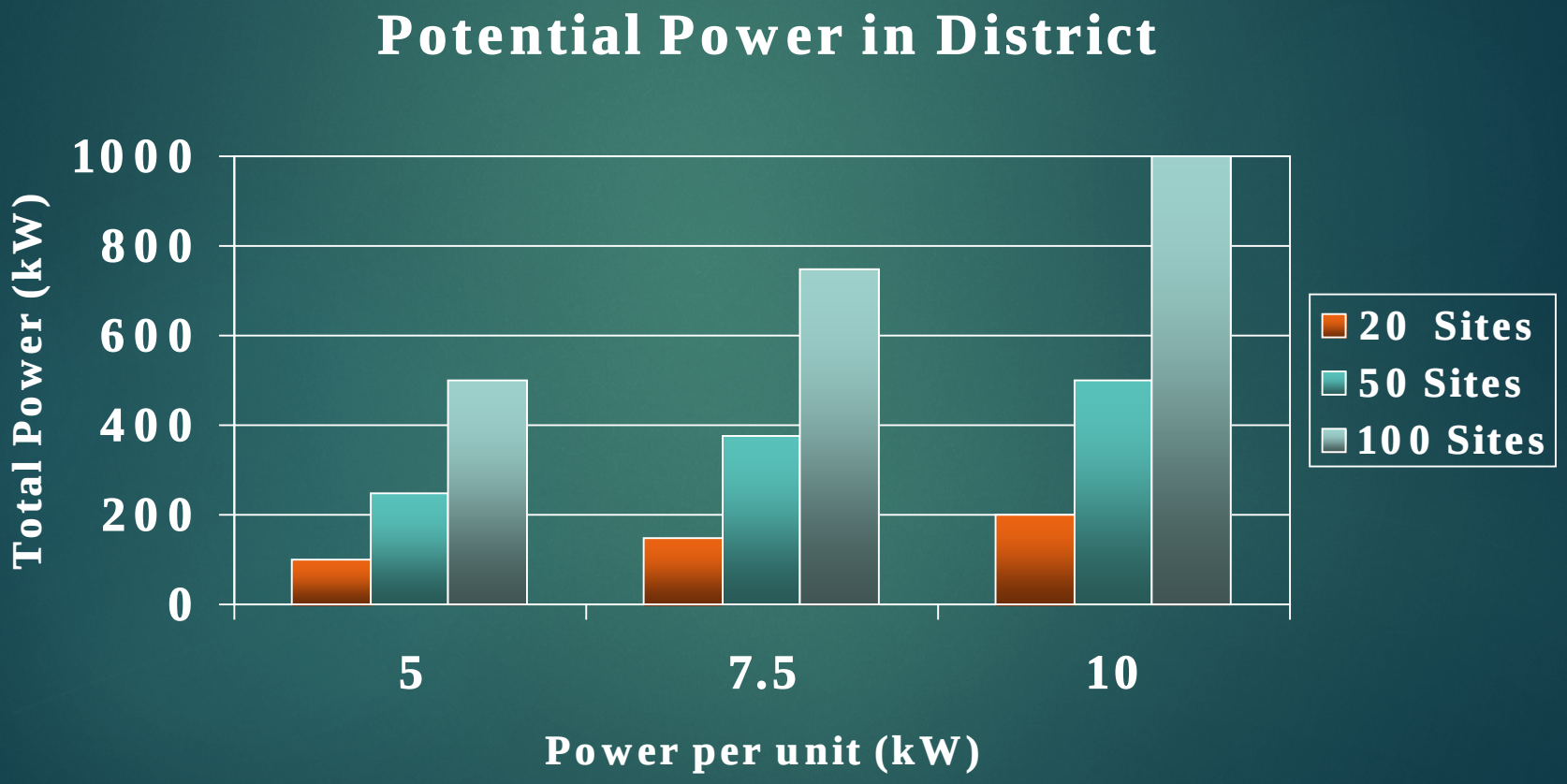

June 2014
Liz Verdecchi


October 2015
Liz Verdecchi

Hydroelectric Application Opportunity For Irrigation Conveyance

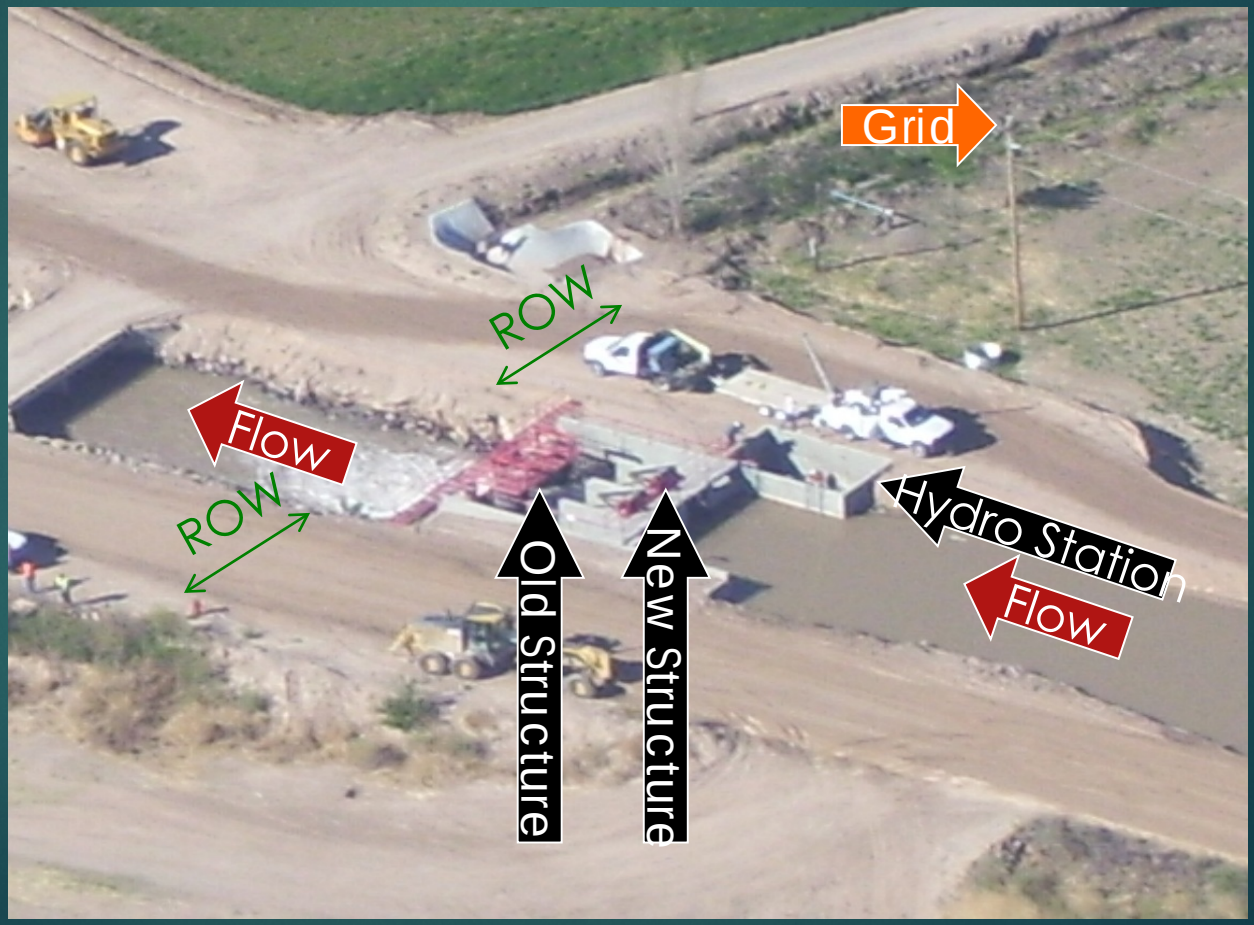


Projections



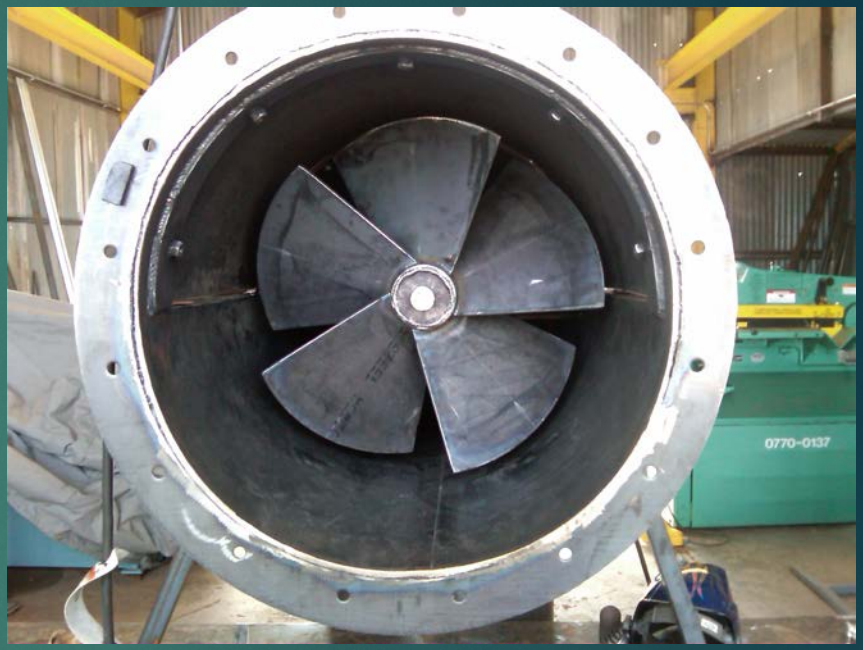
Site Location Drop 8

Arial view of site 7/2009



Turbine 4

- Axial flow
- 24” throughout system
- 23” five blade fixed pitch Kaplan style impellor
- All fabricated at EBID
- Chain and sprocket drive



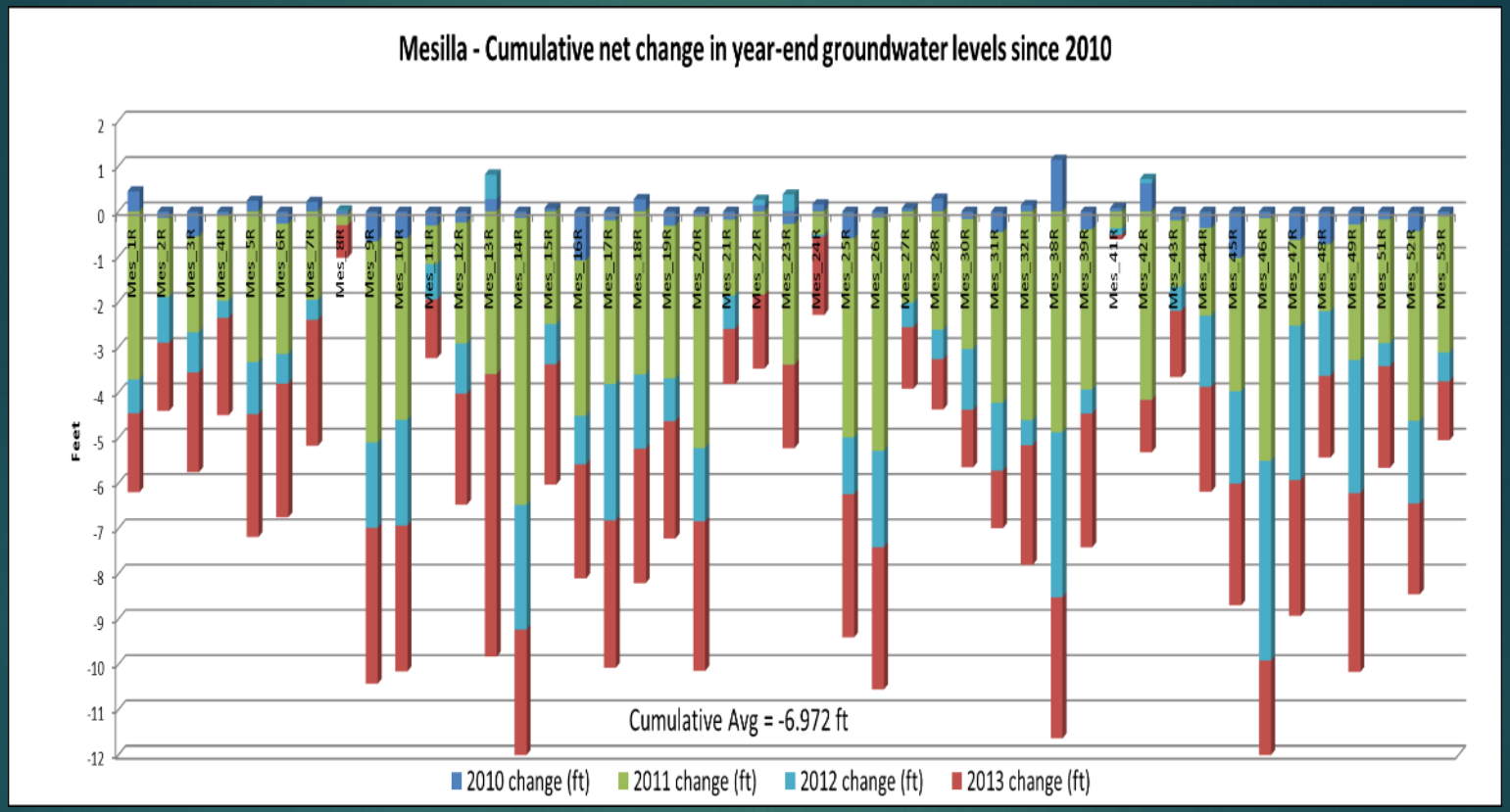
10/2009

FERC Licensing and Legislation

- Production of power requires either a license or exemption from the Federal Energy Regulatory Commission (FERC)

- HR 5892, Hydropower Regulatory Efficiency Act of 2012- Passed the full House by unanimous vote
  - Creates “regulatory off-ramp” for non controversial projects on existing conduits
  - <5MW
- Low Head Hydropower Working Group
  - Working to change FERC regulations from within
  - Proposing streamlined process for small conduit projects
  - <5MW

Groundwater Status:



2010:
24" allotment; 0.153 ft avg drop, ~2,800 ac-ft net loss from storage

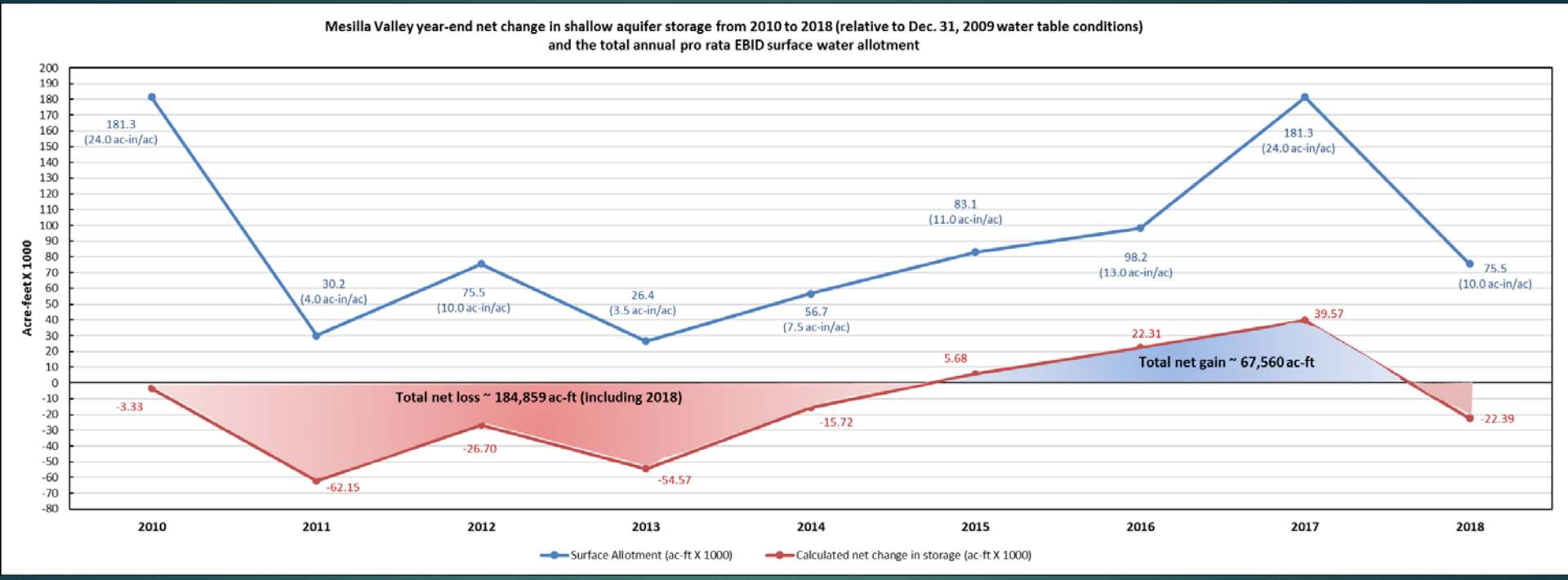
2011:
4" allotment 3.0 ft avg drop, ~67,000 ac-ft net loss from storage

2012:
10" allotment 1.21 ft avg drop, ~29,000 ac-ft net loss from storage

2013:
3.5" allotment 2.43 ft avg drop, ~57,000 ac-ft net loss from storage

- Cumulative net loss from storage since 2010: ~155,000 acre-feet. (Thiessen polygon estimation technique)

Department of Groundwater Resources



- 2017 helped a bunch in terms of recharge, but not as much as hoped. The aquifer currently isn't recharging as fast as we can (and do) dewater it in response to drought of late, and pumping effects from greater depths in the Mesilla tend to linger…
- Gains realized as of 2017 were exhausted (and them some) in 2018, so deficit is highly likely to deepen in 2019.
- Capacity to successfully adapt, if even temporarily in the context of aquifer resilience to a 10-inch or thereabouts SW allotment (or worse) has been demonstrated (2014 and 2015).
- Adaptive capacity is highly likely to be tested again this year (2019), and perhaps for years to come…

Aquifer Management Plan Goals

- Maintain the viability of irrigated agriculture in the LRG of NM (EBID) for as long as it is economically sensible to do so.
- Promote understanding among all water users that the cost of water and water service necessarily is going to increase because the resource is, for the foreseeable future, increasingly limited (supply and demand).
- Provide mechanisms for M&I users to offset their impact on the Rio Grande Project surface water supply while maintaining and growing the local economy.
- Provide for resilience and responsiveness to the area's variable climate, weather, and hydrology.
- Provide mechanisms based on sound hydrology (monitoring and measurement, rather than uncertain computer simulations that depend on monitoring and measurement for calibration anyway) for voluntary market-driven transfers between irrigation and M&I users that allow flexibility and adaptation to changing conditions.
- Develop strategies to comply with relevant obligations to assure equity among NM LRG and downstream users.
- Establish a collaborative culture and shared understanding among NM LRG water users of basin hydrology and legal constraints that will guide policy development and implementation by negotiation and consensus rather than litigation.
- Develop strategies that avoid and/or replace otherwise uncertain Supreme Court outcomes.
- Document the Aquifer Management Plan in a clear, concise statement agreed to by the water use community of the NM LRG.

Implementation Mechanisms

- Coordination by existing agencies through contracts, JPAs, etc.
- Changing purpose of use of Rio Grande Project surface water otherwise authorized only for irrigation may necessitate 1920 Misc. Purposes Act through US Bureau of Reclamation.
- Potential formation of Groundwater or Conservancy District.
- Cash flow inducing intersectoral transfers must be planned for effectiveness and efficiency.
- Currently divided authority over surface water and groundwater must be closely coordinated or combined (EBID and OSE working together?)