

Restoring the Pecos River at Bitter Lake National Wildlife Refuge



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Gains

- 1) Ground Water Inflow
from adjacent aquifers
- 2) Recharge to bottom land
from precipitation
- 3) Drain and tributary inflow
to river
- 4) Recharge to bottom land
from upstream Dam releases
and flood inflow



Losses

- 1) Evaporation from river surface,
wet sand bars, and bare ground
- 2) Evapotranspiration from
phreatophytes
- 3) Irrigation diversion and pumping
from river
- 4) Pumpage from wells in bottomland
- 5) Loss to river side drains

**HYDROLOGIC EFFECTS OF
PHREATOPHYTE CONTROL,
ACME-ARTESIA REACH OF THE PECOS RIVER,
NEW MEXICO, 1967-82**

By G.E. Welder

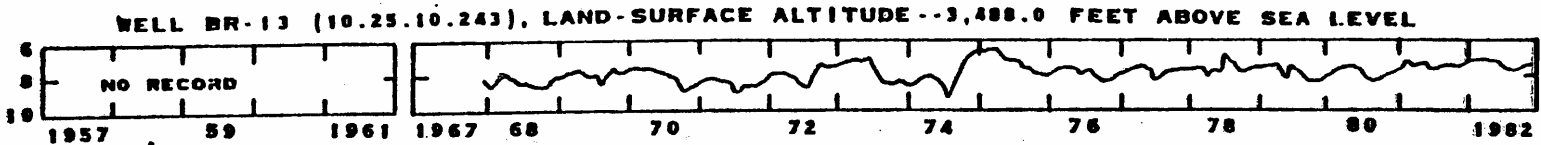
U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 87-4148

Prepared in cooperation with the
PECOS RIVER COMMISSION

Albuquerque, New Mexico

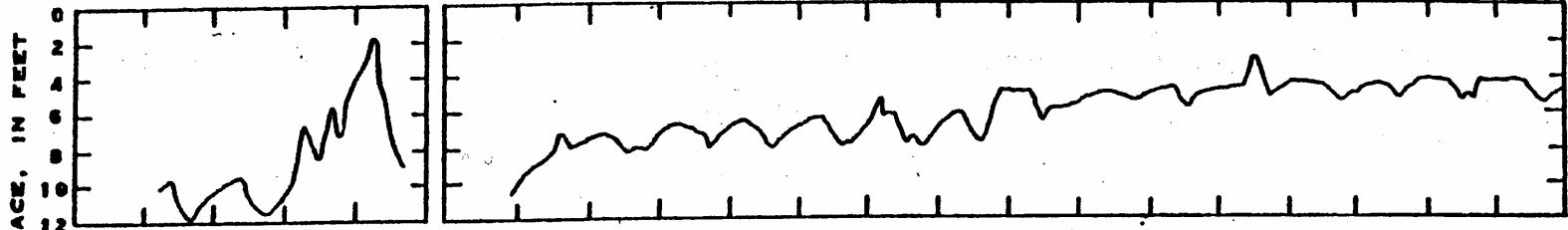
1988



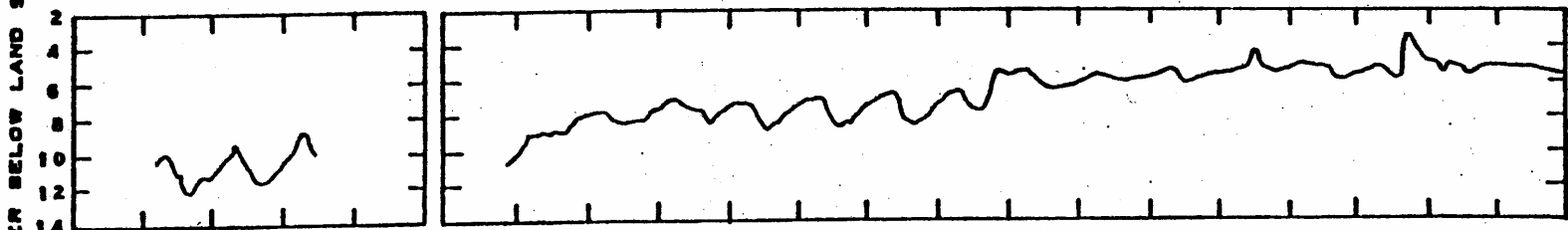


BITTER LAKES SITE

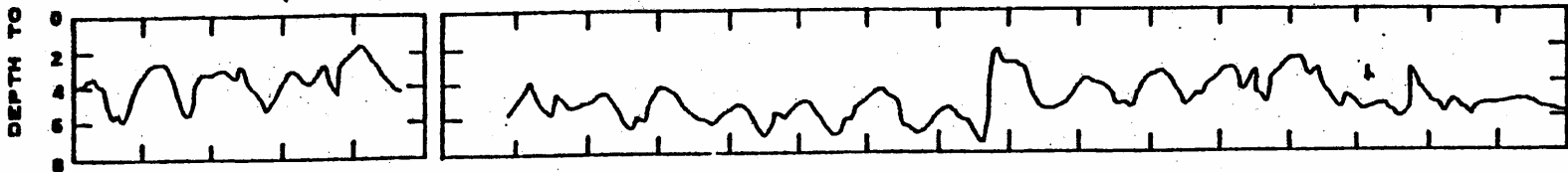
WELL TR-1 (11.25.36.142344), LAND-SURFACE ALTITUDE --3,431.14 FEET ABOVE SEA LEVEL



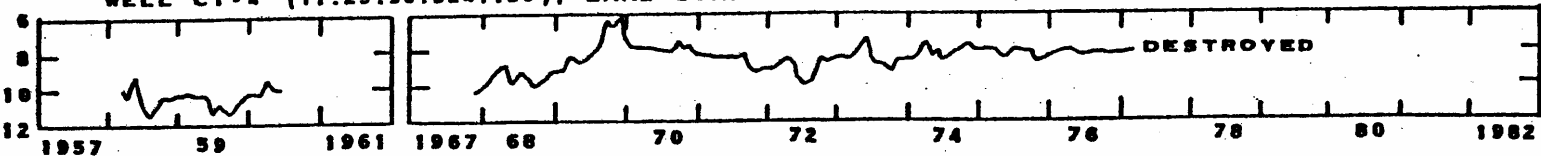
WELL CI-2 (11.25.36.411221), LAND-SURFACE ALTITUDE --3,433.54 FEET ABOVE SEA LEVEL



WELL 4 (11.25.36.242323), LAND-SURFACE ALTITUDE --3,439.02 FEET ABOVE SEA LEVEL



WELL CI-4 (11.25.36.3241120), LAND-SURFACE ALTITUDE --3,431.69 FEET ABOVE SEA LEVEL



BOTTOMLESS LAKES WEST SITE

Figure 12.--Water levels in observation wells at the Bitter Lakes and Bottomless Lakes West sites, 1957-61 and 1967-82.

Aquatic Species of Bitter Lake NWR

24 fish species, 19 are native

3 Federally Threatened or Endangered

52 Amphibians and Aquatic Reptile species

50+ dragonfly species

Most diverse in North America

**Most biologically significant wetland in New Mexico
The Roswell Area Spring System and Pecos River are
Unsung National Natural Treasures**

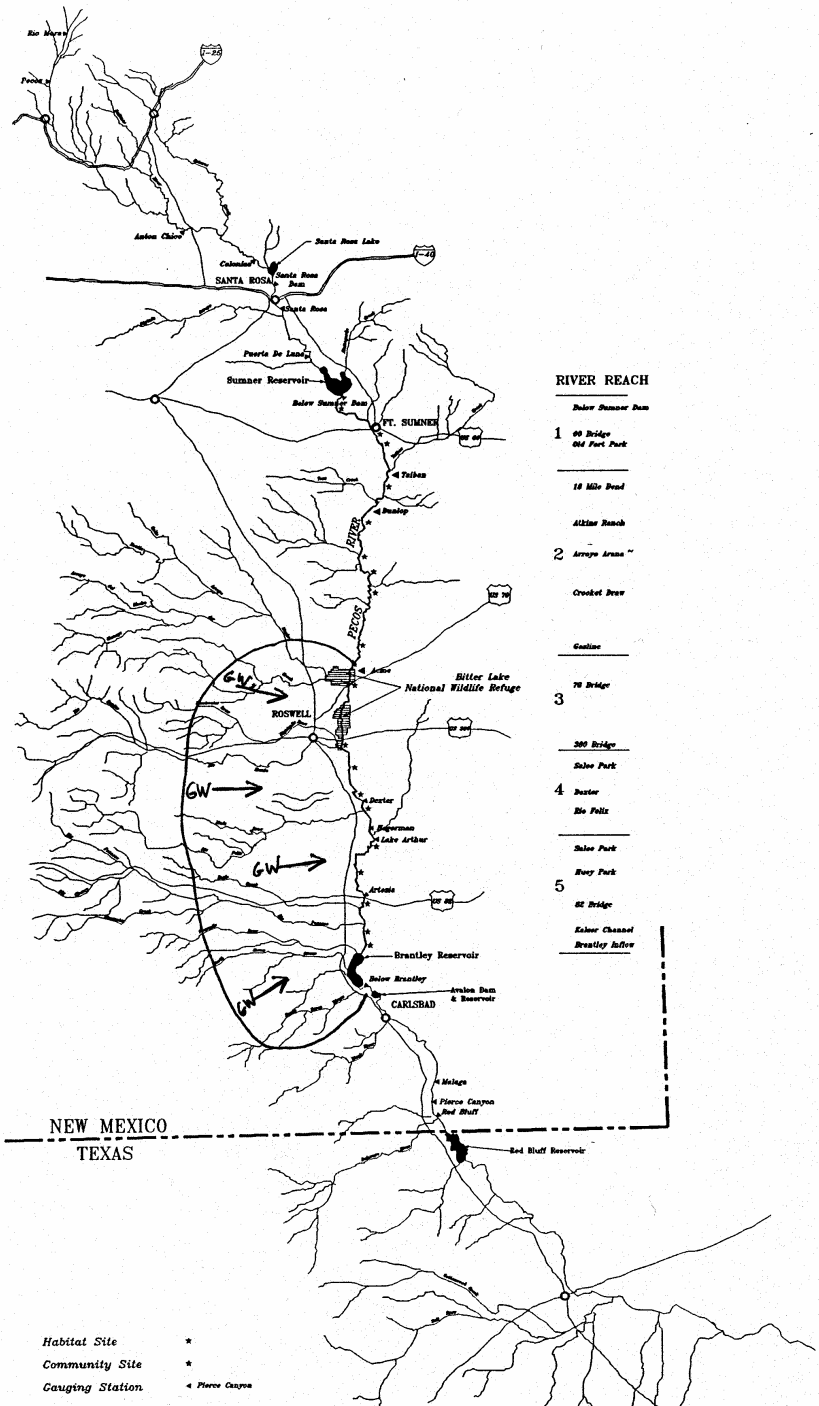
Migratory Birds

Sandhill Cranes, Snow Geese, Canadian Geese

Snowy Plover nesting area (only site in New Mexico)

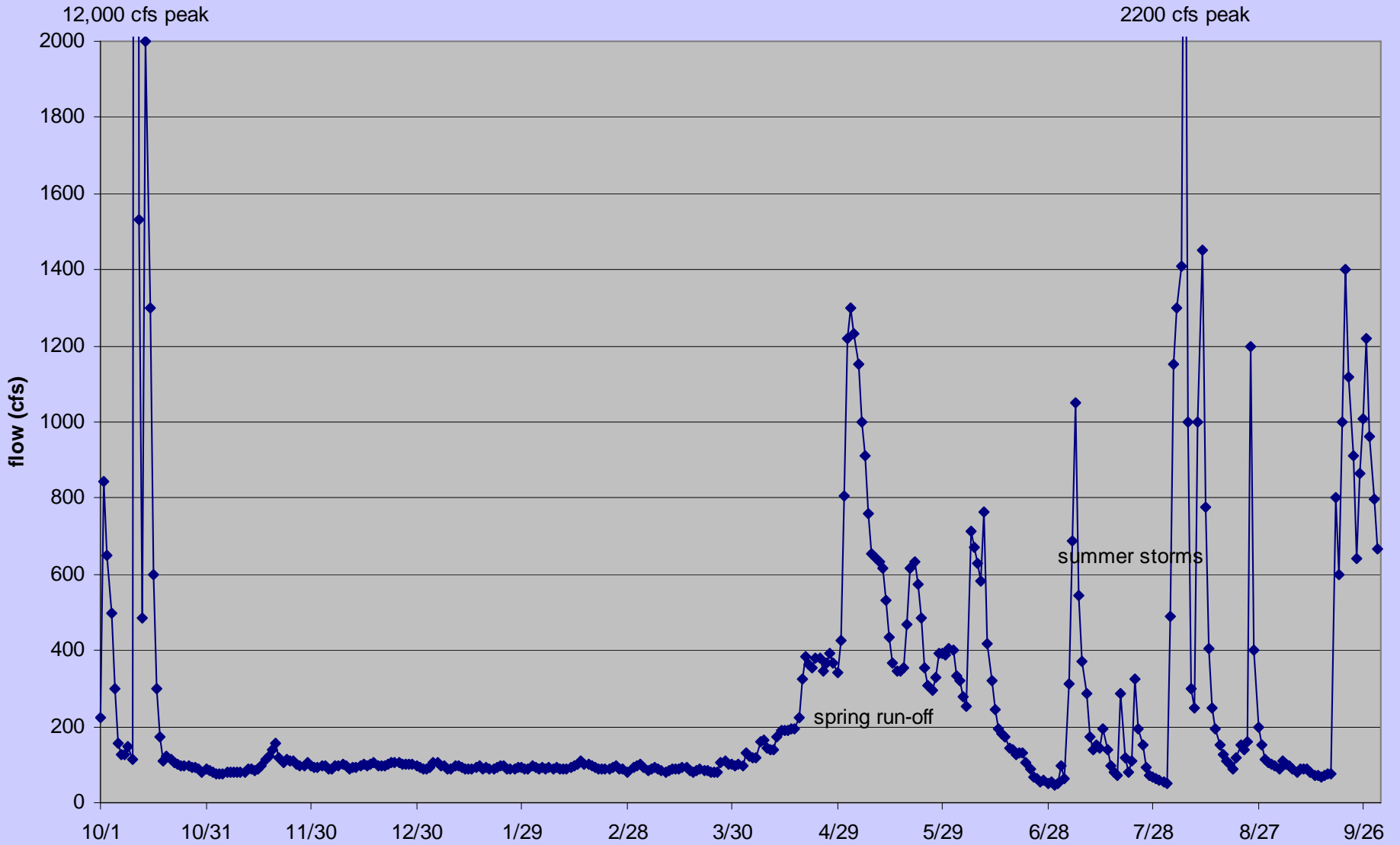
Wetland Plant Species: saltgrass marsh community,
Endangered Pecos Puzzle Sunflower



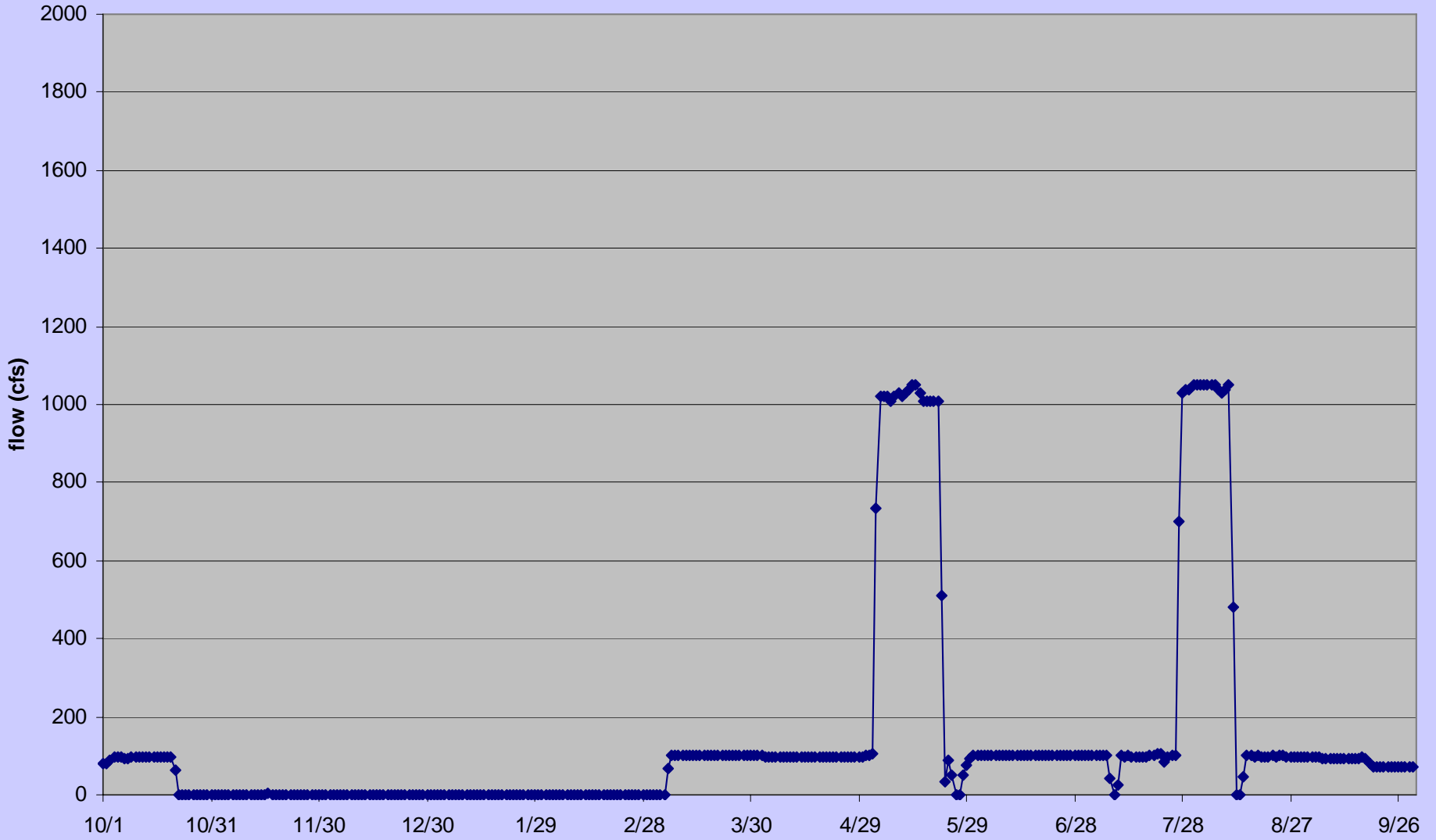


NEW MEXICO
 TEXAS

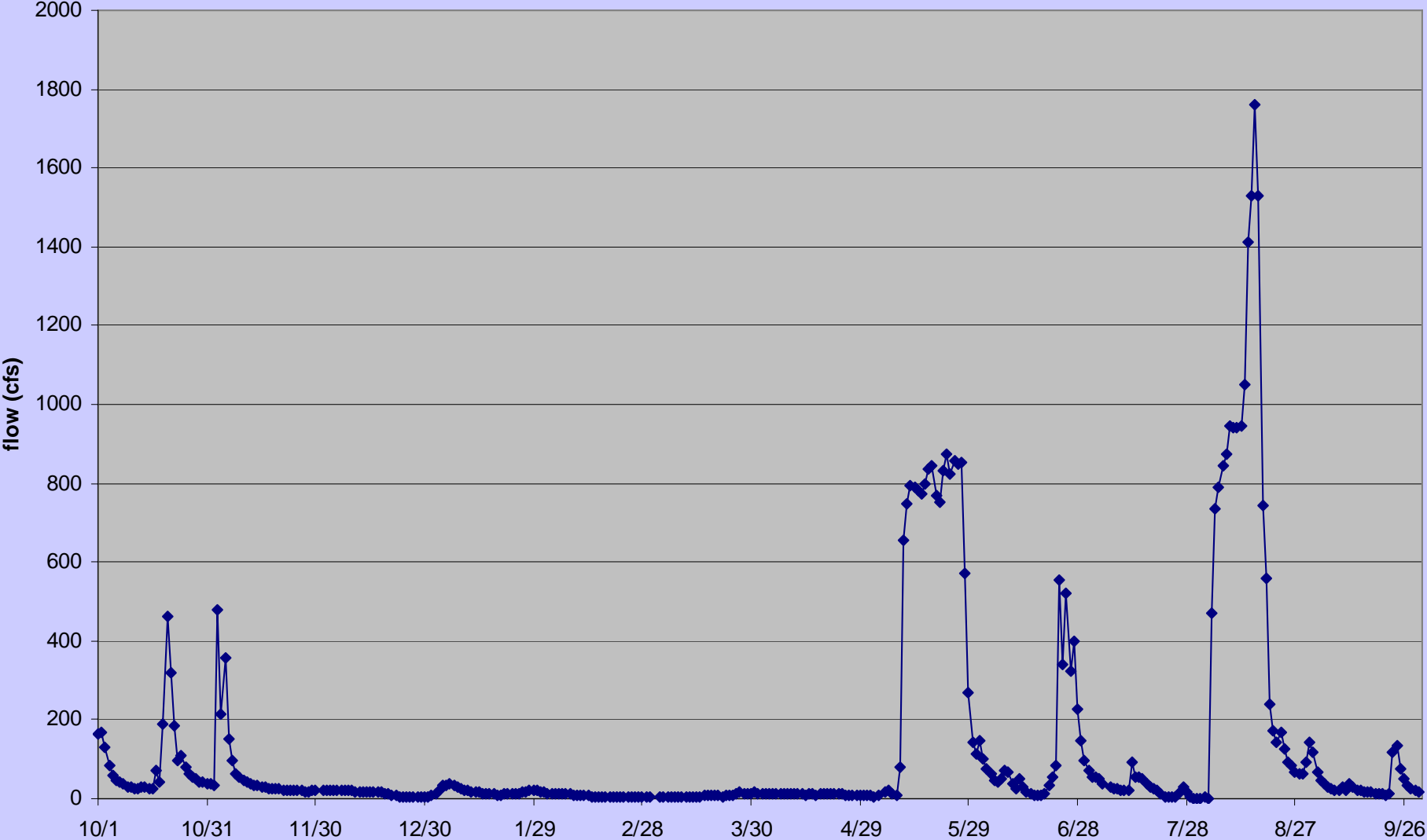
Pecos River at Fort Sumner Water Year 1928 Hydrograph

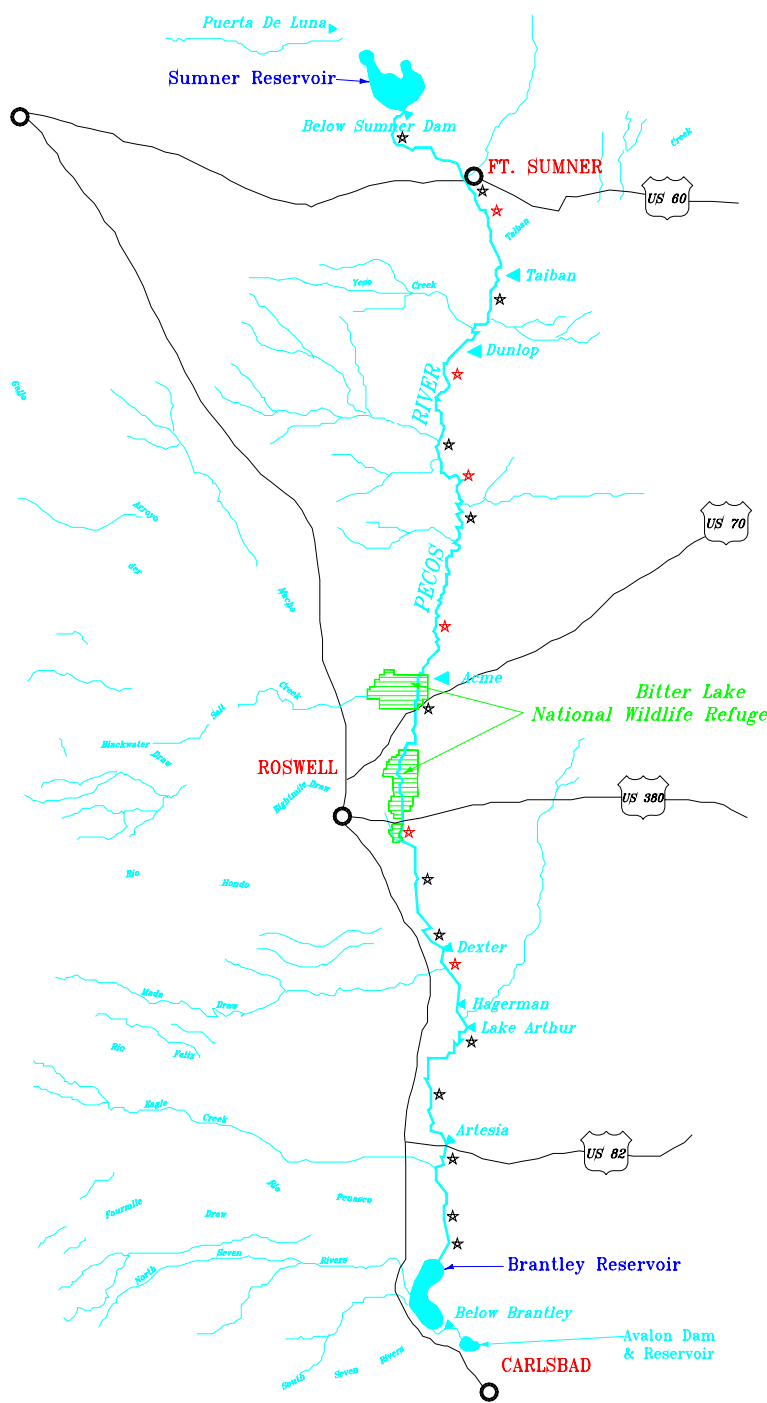


Pecos River at Fort Sumner Water Year 1984 Hydrograph



Pecos River at Acme 1984 Hydrograph





RIVER REACH

Below Sumner Dam

1 *60 Bridge*
Old Fort Park

18 Mile Bend

Cedar Creek

Arroyo Araña
Atkins Ranch

2 *Crocket Draw*

Gasline

70 Bridge

380 Bridge

Salee Park

Dexter
Rio Felix

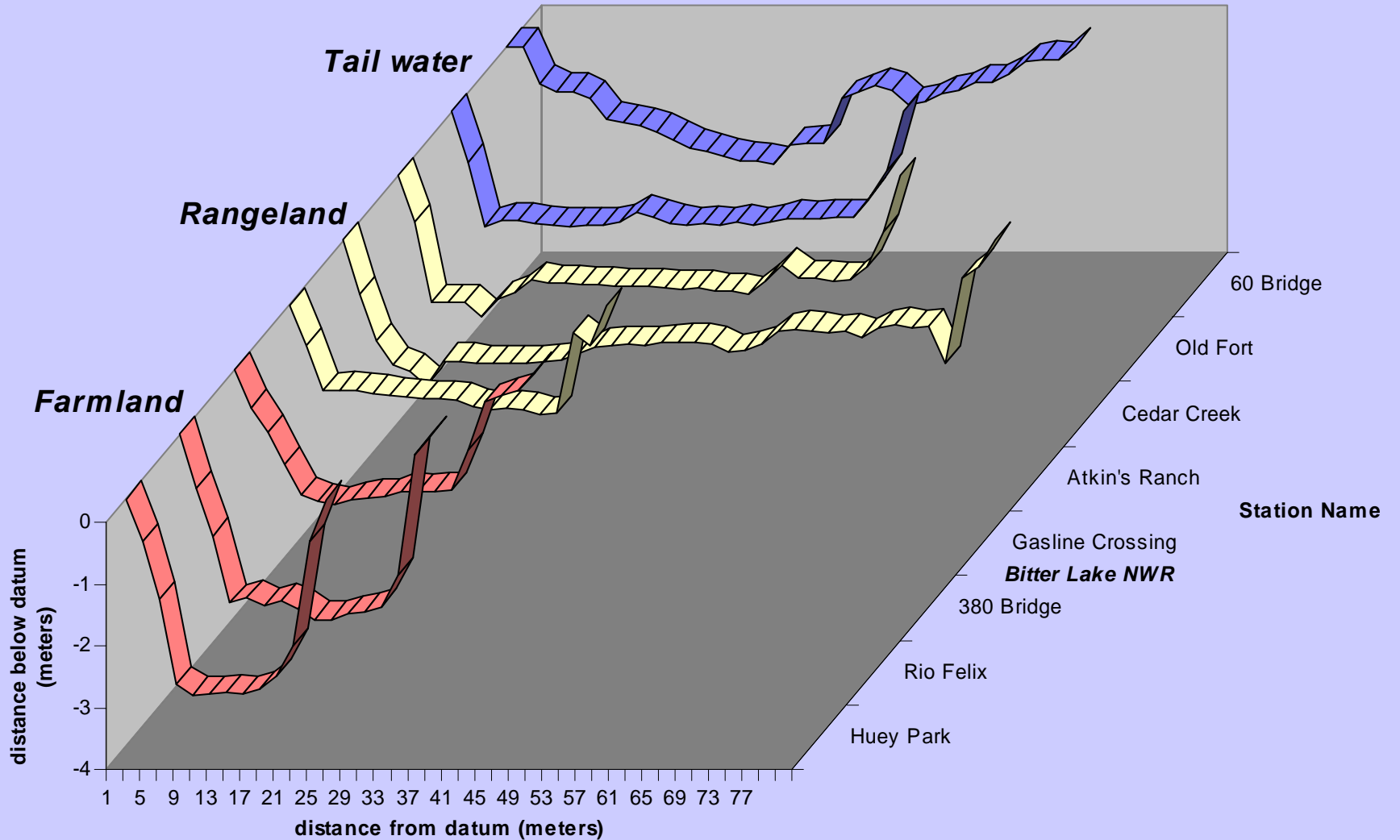
3 *Lake Arthur*

Huey Park

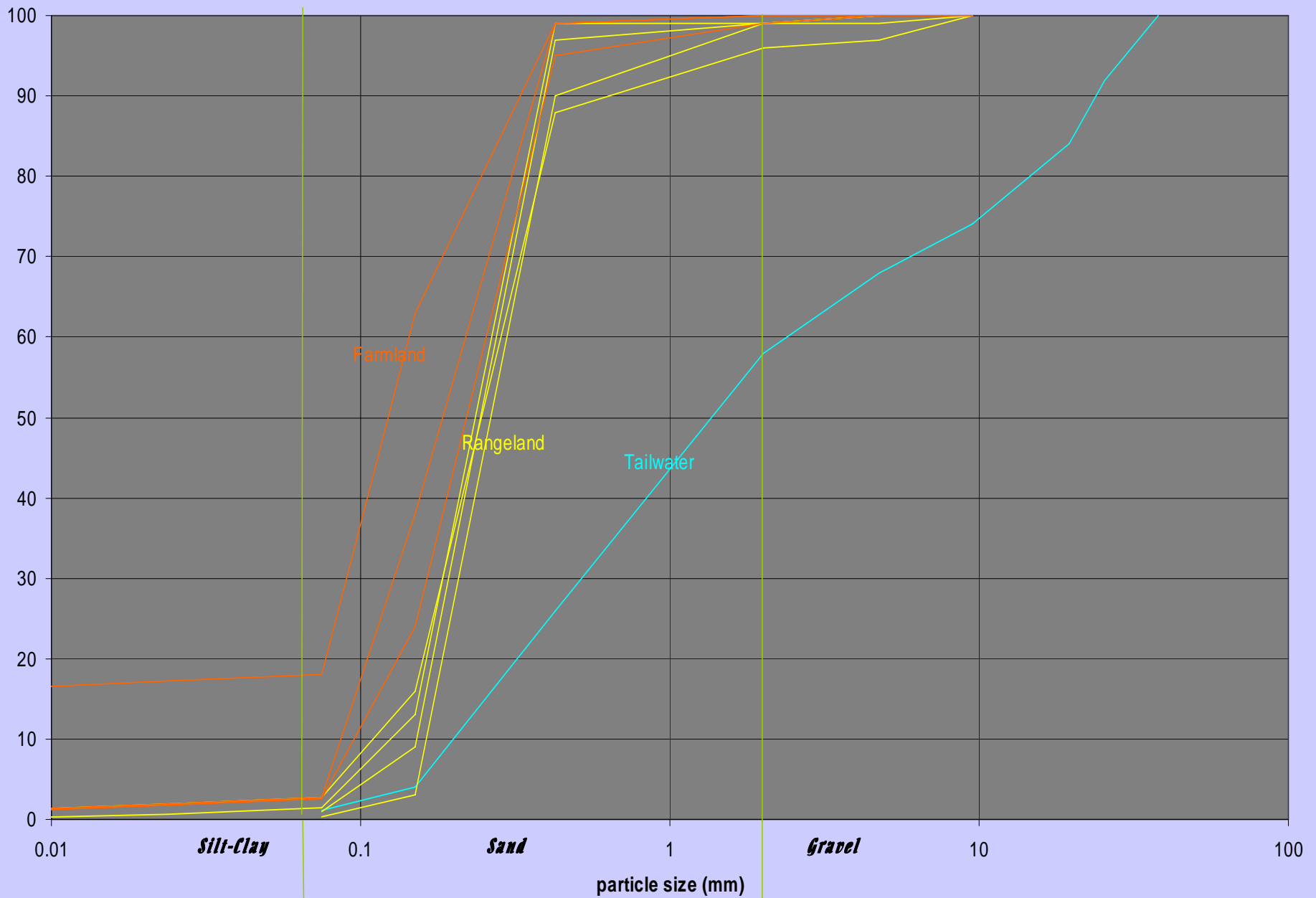
82 Bridge

Kaiser Channel
Brantley Inflow

Pecos River Between Sumner and Brantley Reservoirs: Channel Morphology Overview



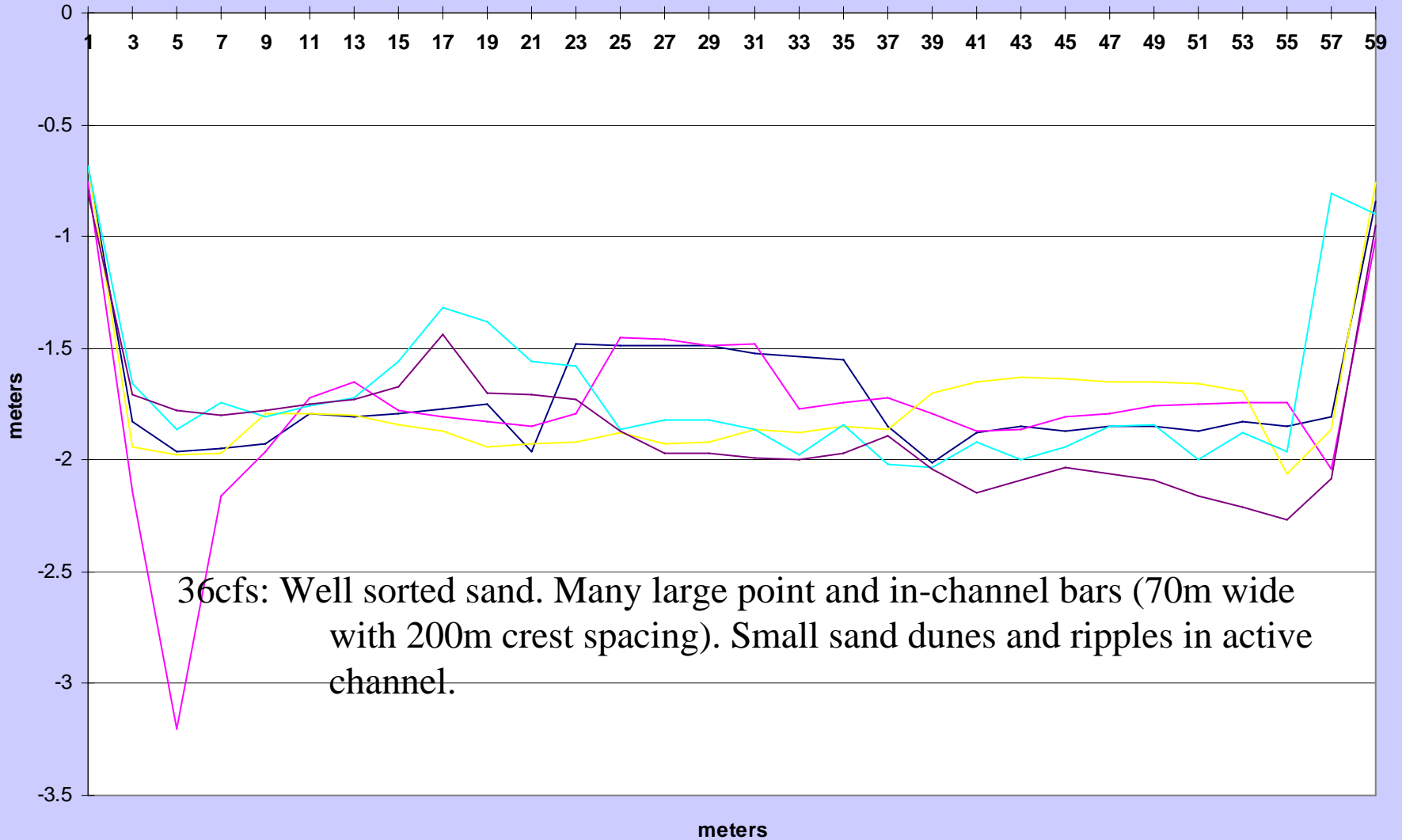
Middle Pecos River Sediment Overview







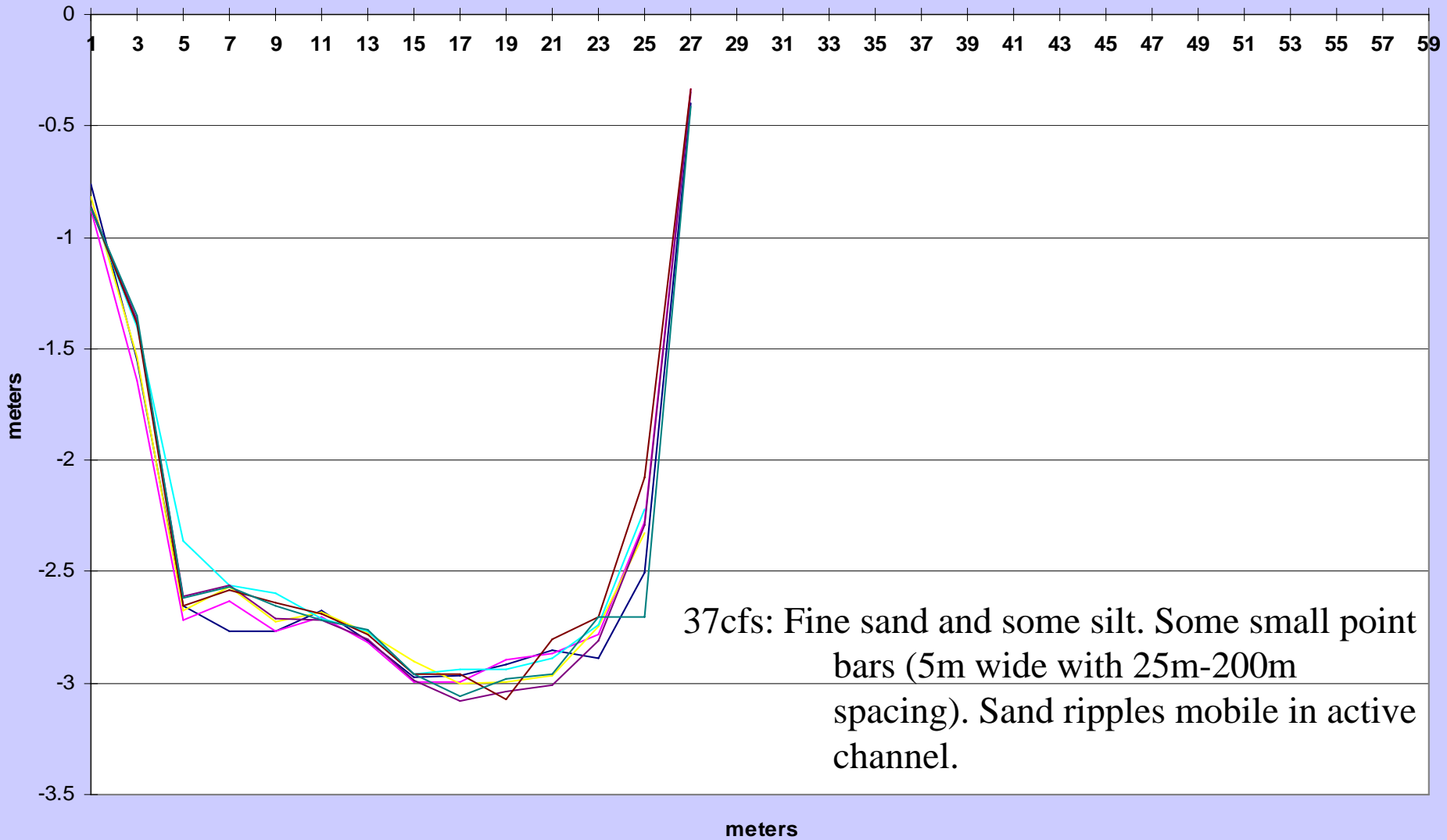
Atkins Ranch Habitat Site: 1995 and 1996 Cross Sections



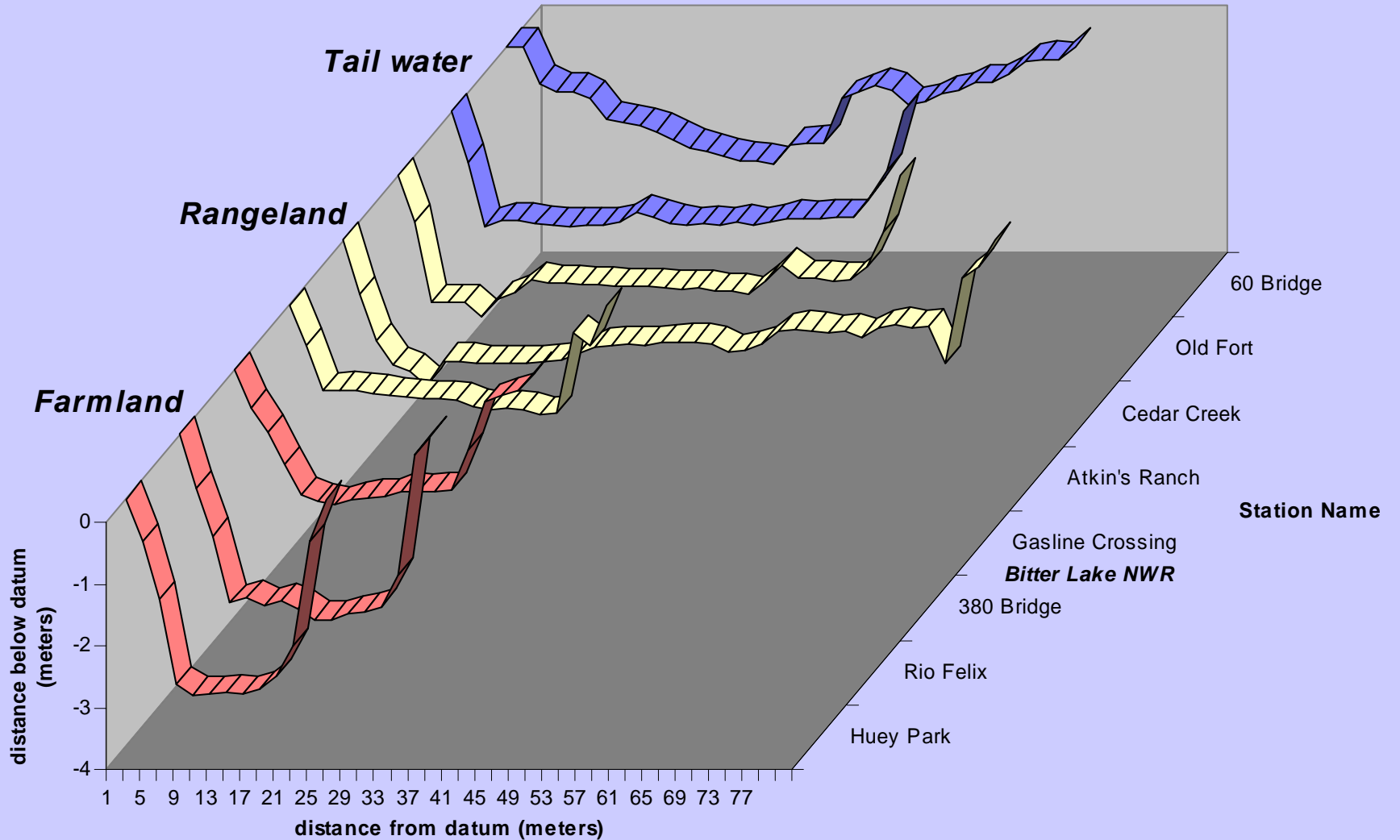




Rio Felix Habitat Site: 1992-1996 Cross Sections



Pecos River Between Sumner and Brantley Reservoirs: Channel Morphology Overview







Pecos River Geomorphic Setting of the Refuge


- Junction between quality habitat to the north and poor habitat to the south
 - quality habitat marked by higher width to depth ratios and active sand bed
 - poorer habitat marked by low width to depth ratios, tamarisk lined, inactive sand/silt bed
- River incised on Refuge 1942-1953
- Modern River is very active on Refuge

Why do Pecos River Restoration at Bitter Lake NWR?

- At transition between quality and poor habitat on Middle Pecos River.
- Channel is very active. Restoration will nudge it towards a healthier system.
- The Pecos at the Refuge is always wet: Perennial flows on the Pecos begin at Bitter Lake NWR
- Ideal location for pelagic fishes habitat: acts as a catchment for upstream fish eggs
- Establish greater continuity in habitat with upper quality reach.
- Ties Refuge into Pecos River conservation.
- Refuge can act as a showcase for the Pecos.
- Potential societal benefits: ecotourism, water salvage, flood control, fire control.

Restoration Alternatives - General Strategies

- Vegetation removal
- Bank lowering
- Reworking channel morphology
- Native vegetation plantings
- Diverting river into original meanders



Salt Cedar removal
Reactivate channel mobility
Bank lowering: connecting the floodplain better in areas where river is active
Native vegetation planting

An aerial photograph of a river landscape. The river flows from the top left towards the center. The surrounding land is a mix of brown and tan, with some green patches. A blue text box is overlaid on the lower-left portion of the image.

Reconnect Oxbow 4

Improves spring connection to Pecos River

Salt Cedar Removal

Native vegetation planting

Allow River to establish habitat under with hydrology

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Water Budget

- Groundwater gradient is towards river
 - Gaining rivers are locations of accrument for riparian ET reductions
- Increased water:
 - Reconnection of springs in Oxbow 4
 - Reduction of ET from tamarisk removal
- Decreased water:
 - Increase in area of base flow from connecting Oxbow 4
 - Increase in overbank flows from removing bankline levees
- Net estimate: 2000af/ammum increase in water budget

Water Budget (continued)

- Net estimate: 2000af/annum net increase in water budget
- Estimate takes a very conservative approach
 - The future condition of the removed salt cedar acres will be a mix of salt cedar, willow and grassland. This percent is estimated to be 20% salt cedar, 30% willow, 20% Saltgrass and 30% other grassland.
 - Increase in overbank flows assumes flows greater than 200cfs will result in a complete flooding of 43 additional acres. In reality flows greater than 1200cfs will inundate these areas and flows greater than 5000cfs will result in complete flooding.
 - Assumes a current condition for spring contribution to Oxbow 4 of 6 acres. This is about half of what the lowest acreage is as obtained from aerial photography for the period 1996-2004.



10/97: 15 acres of open water

Re-vegetation Issues

- What was the native riparian vegetation community of the Pecos River at Bitter Lake NWR?
- Coyote Willow reveg techniques
 - Conceptual reveg design being conducted by Parametrix (Todd Caplan)
- Grassland component
 - *Sporobolus aridus* (alkali sacaton)
 - *Distichlis spicata* (salt grass)
- What examples are there of native revegetation successes along Middle Pecos River?

QUESTIONS?

