Missouri River
FLOOD TASK FORCE

CHANNEL CONVEYANCE

By James Pennaz
Chief, Hydrologic Engineering Branch
Kansas City District

25 April 2012

MISSOURI RIVER

CREATION OF SELF SCOURING CHANNEL

- Bank Stabilization and Navigation Project
- Typical changes from Nov 1934 to Nov 2003

Missouri River FLOOD TASK FORCE

3

9 Nov 1934

4
19 Jun 1935

5

5 Oct 1935

6

19 Aug 1936

7

23 May 1946

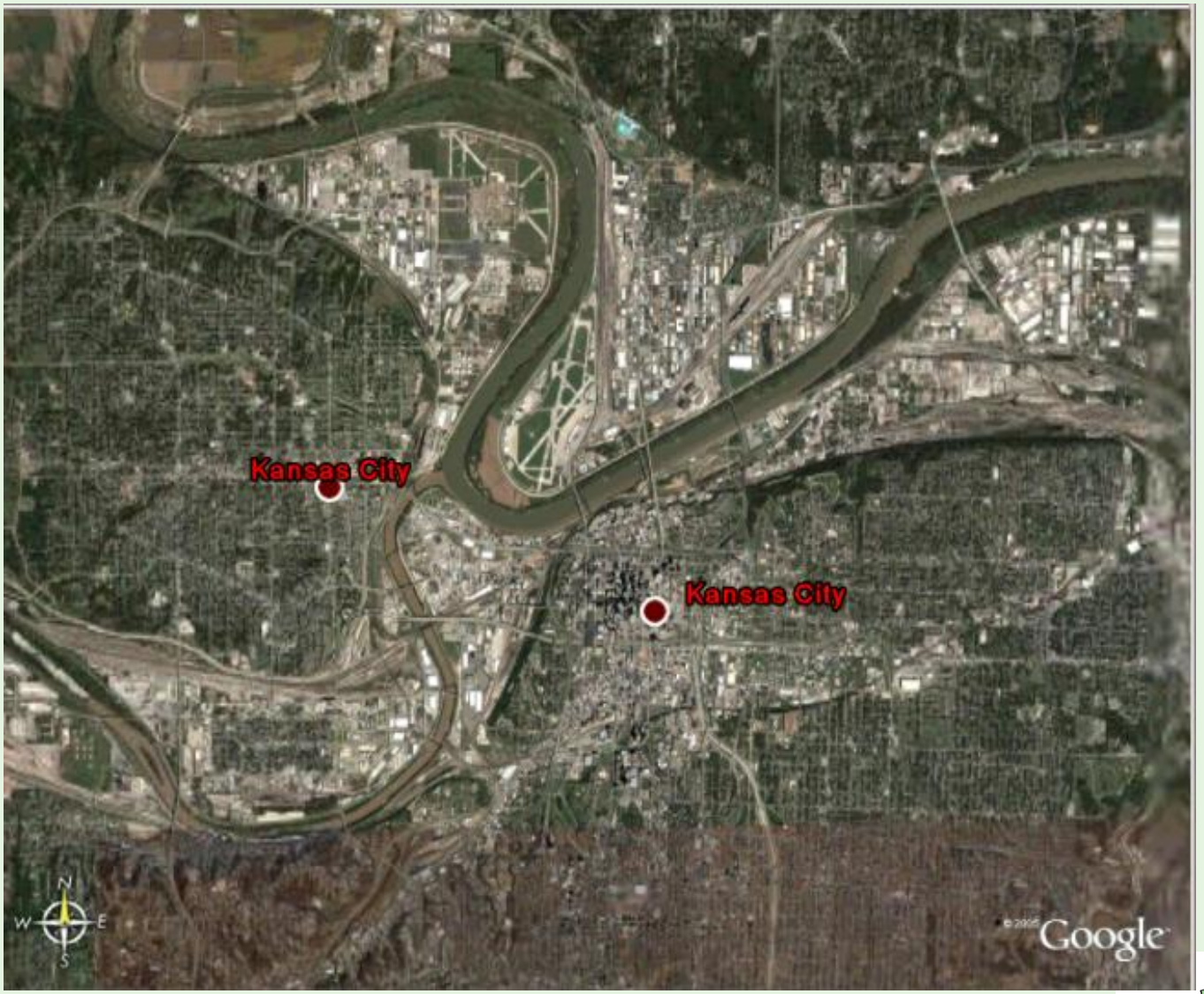
8
March1977

9

4 Nov 2003

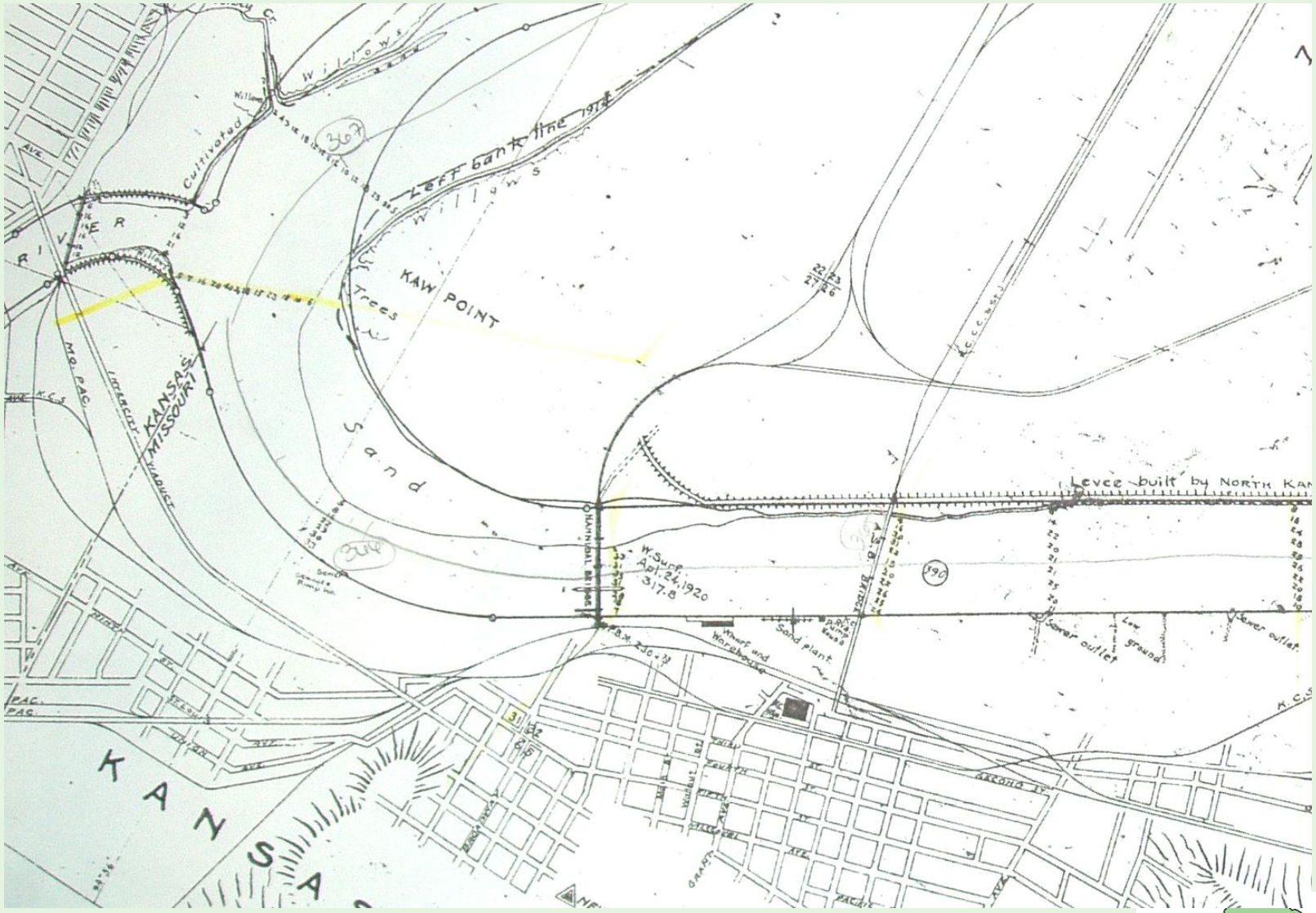
KANSAS CITY REACH

The Kansas City Reach



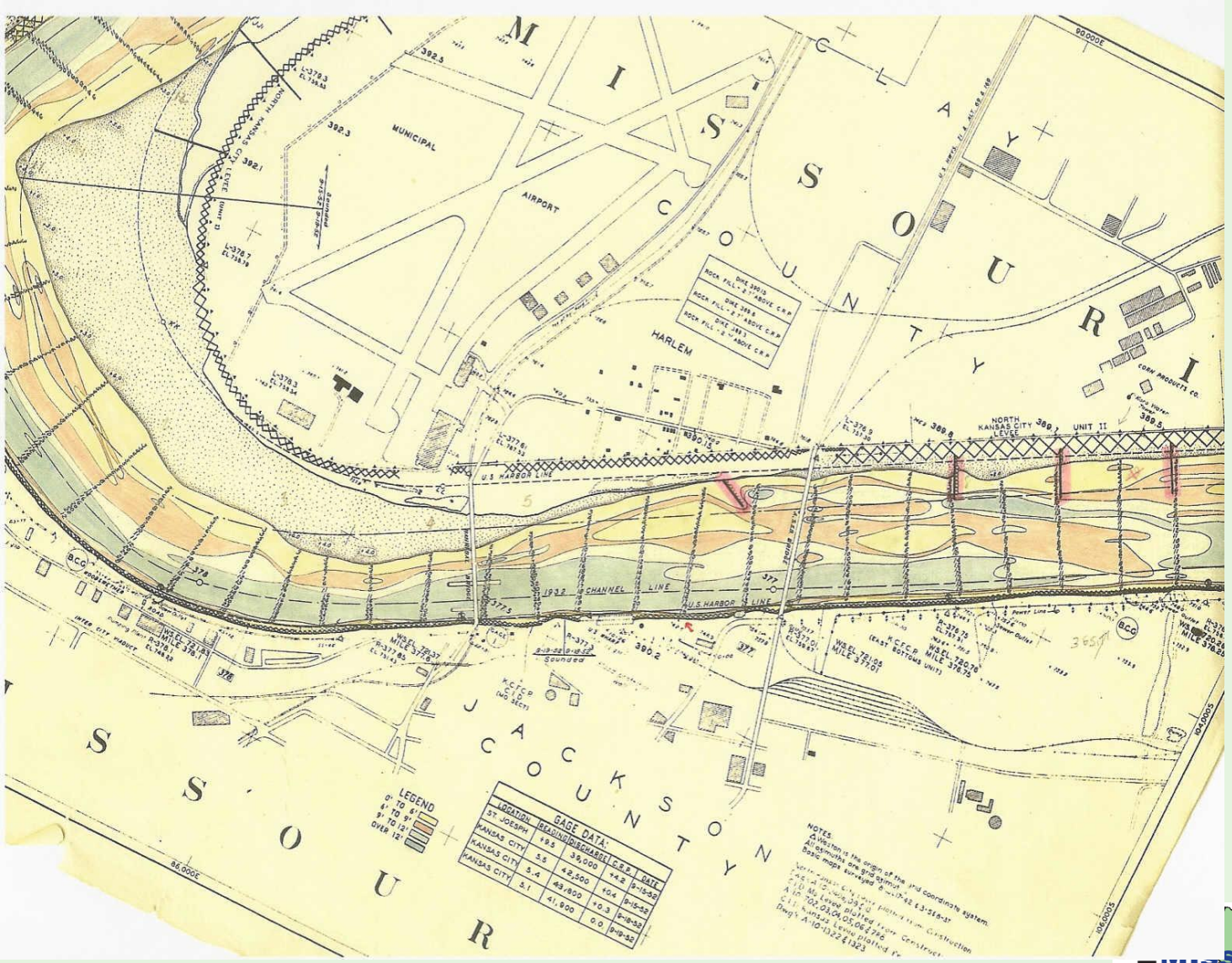
Missouri River FLOOD TASK FORCE

1920 Dikes and Revetments

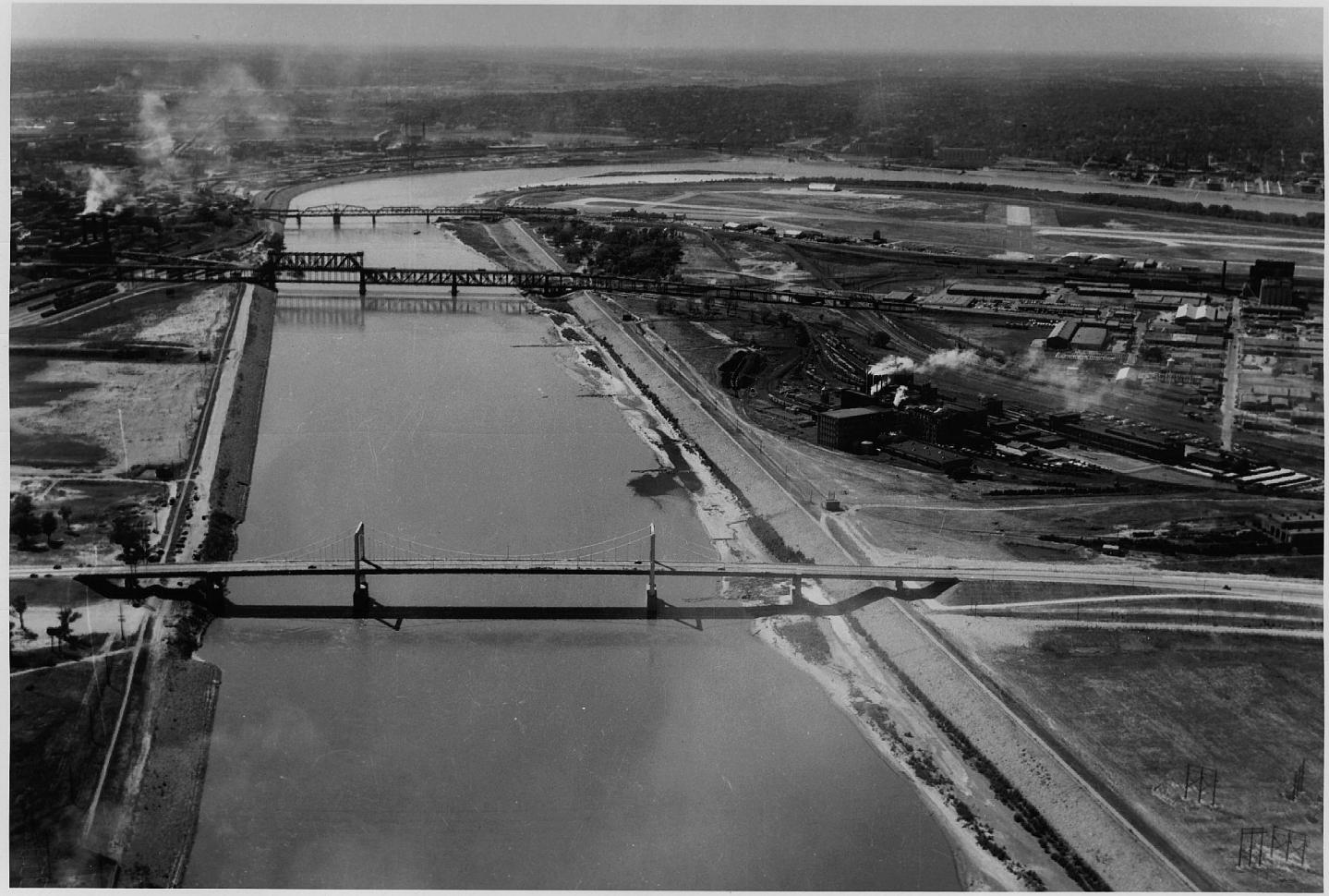


Missouri River FLOOD TASK FORCE

1952 Dikes and Revetments



Missouri River FLOOD TASK FORCE



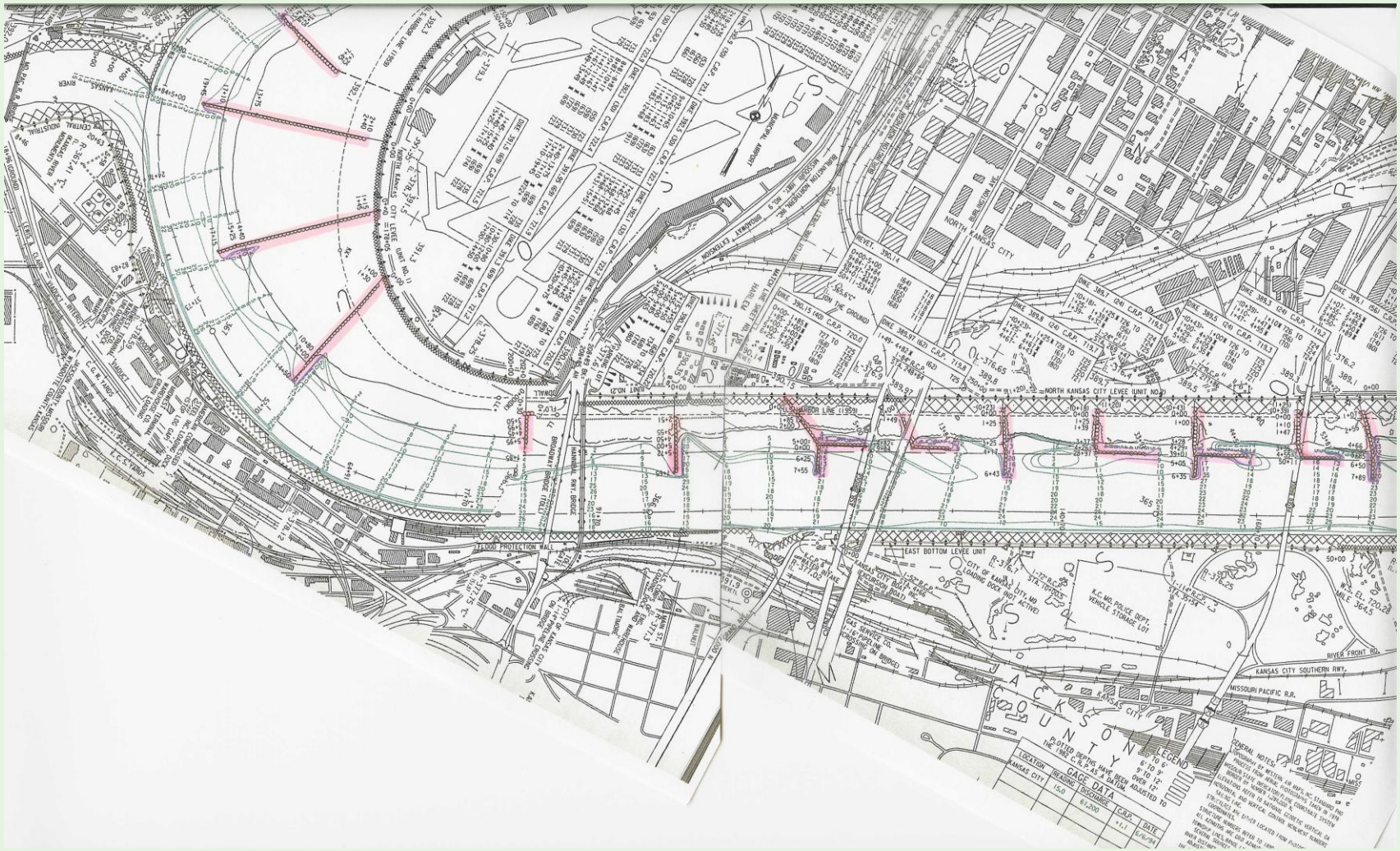
MISSOURI RIVER IMPROVEMENT

KANSAS CITY DISTRICT CHANNEL STABILIZATION AND NAVIGATION PROJECT KANSAS CITY, MISSOURI

AERIAL VIEW WEST (UPSTREAM) FROM APPROXIMATE RIVER MILE 376, SHOWING PORTION OF RIVER FROM KANSAS CITY REACH TO KANSAS RIVER BEND. LEVEE AND BANK PROTECTION ALONG LEFT BANK IN NORTH KANSAS CITY UNIT, LEVEE AND BANK PROTECTION ON RIGHT BANK IN EAST BOTTOMS UNIT. BRIDGES FROM BOTTOM UP ARE: NEW PASEO BRIDGE; (A.S.B.) HIGHWAY & RAILWAY BRIDGE AND C.B. & Q. R.R. (HANNIBAL) RAILWAY AND HIGHWAY BRIDGE. CONFLUENCE OF KANSAS AND MISSOURI RIVERS IN CENTER BACKGROUND.

23 SEPTEMBER 1954 NEG. NO. 61775

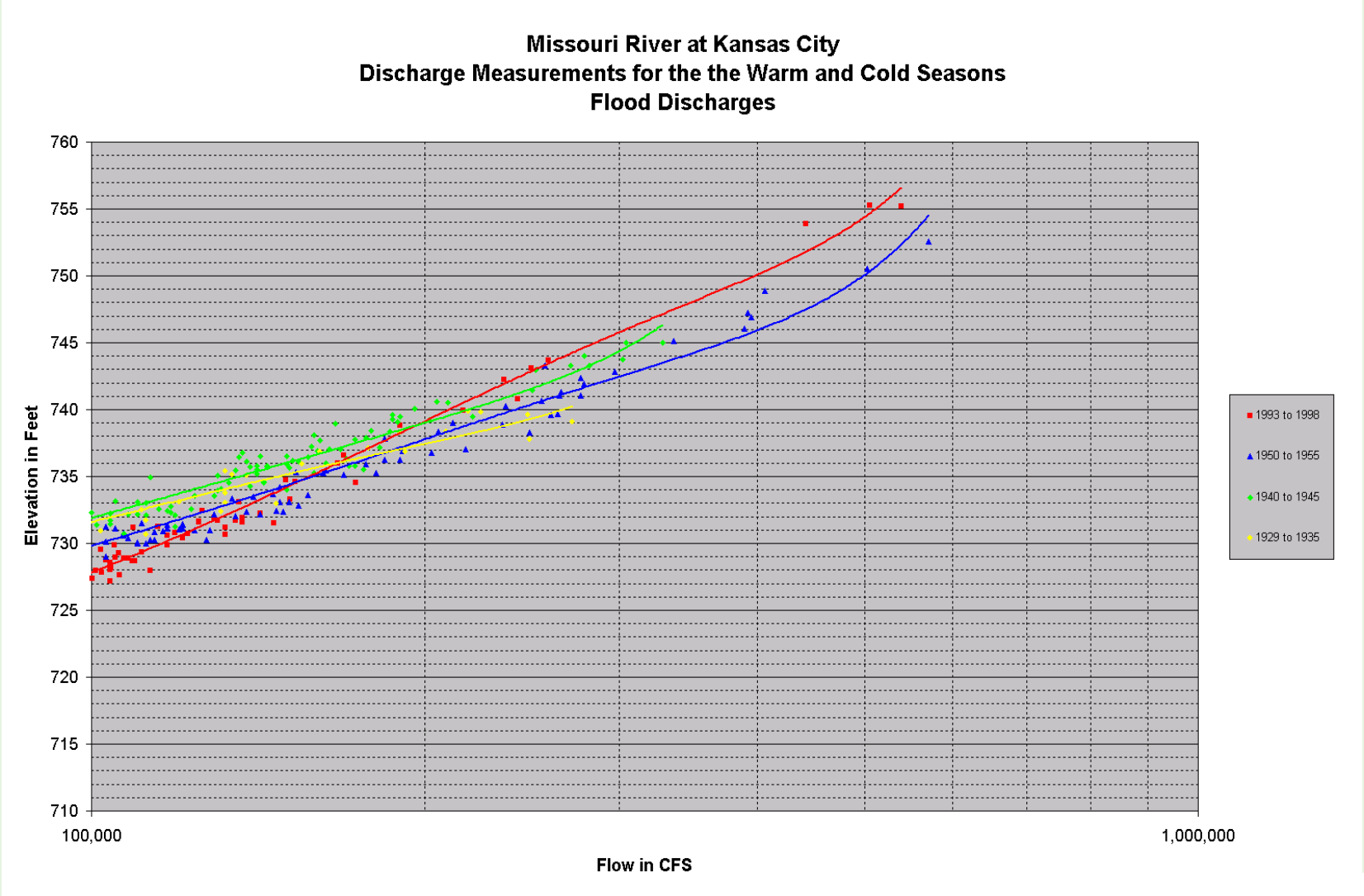
1994 Dikes and Revetments



Missouri River FLOOD TASK FORCE

Image © 2008 Sanborn

1951, 1952, and 1993 Floods



Missouri River FLOOD TASK FORCE

SAINT JOSEPH REACH

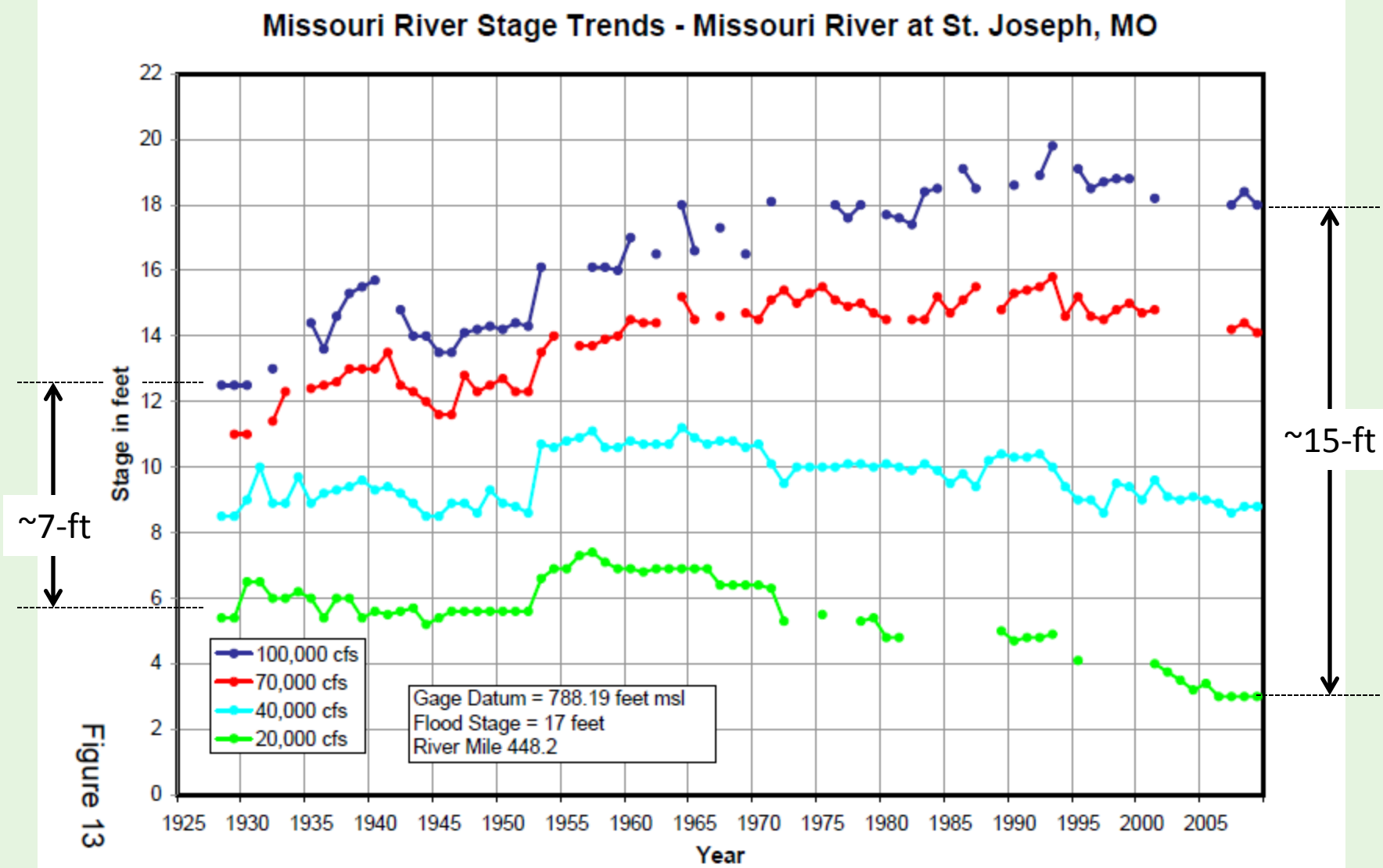
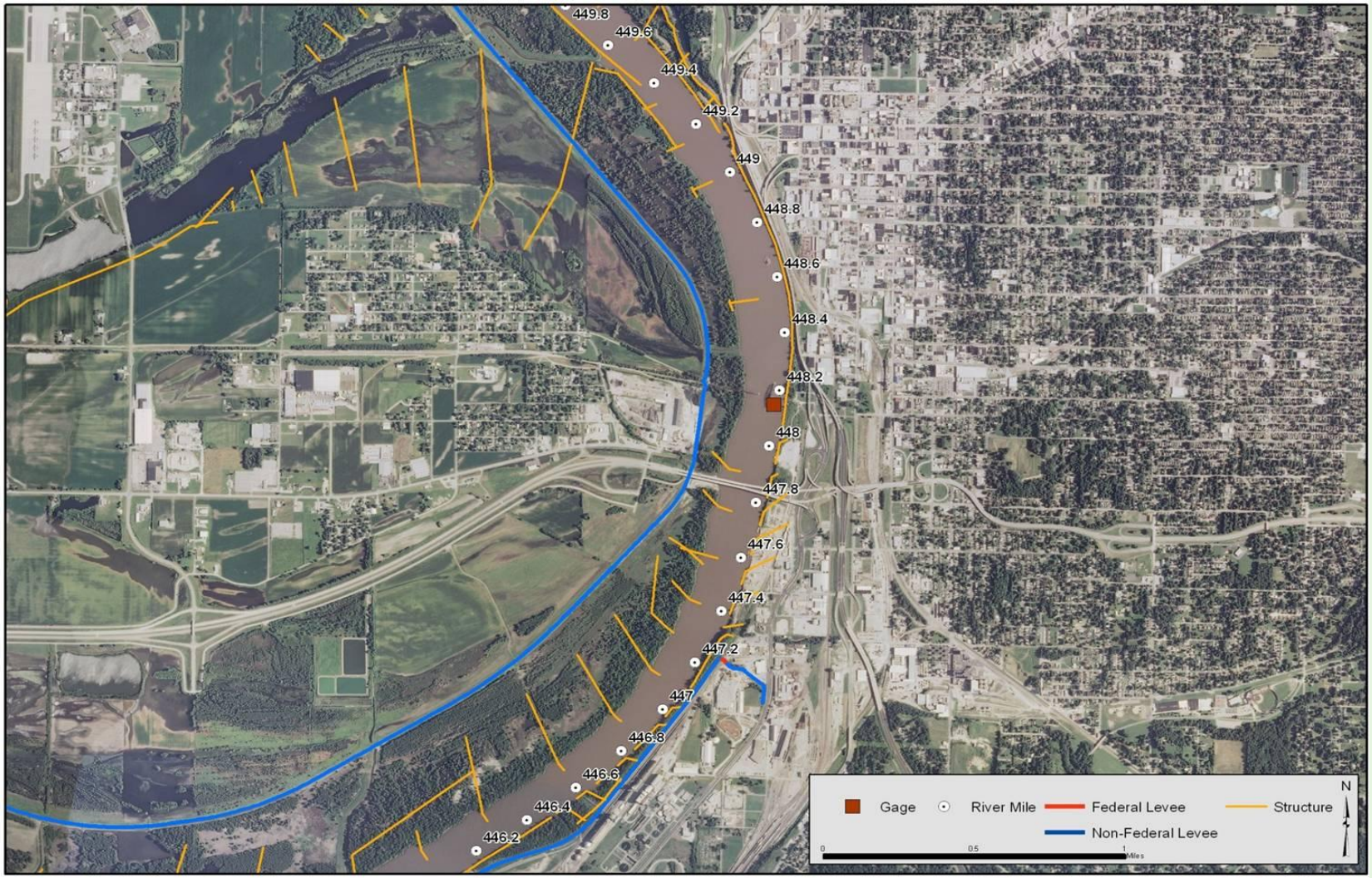


Figure 13

River FLOOD TASK FORCE

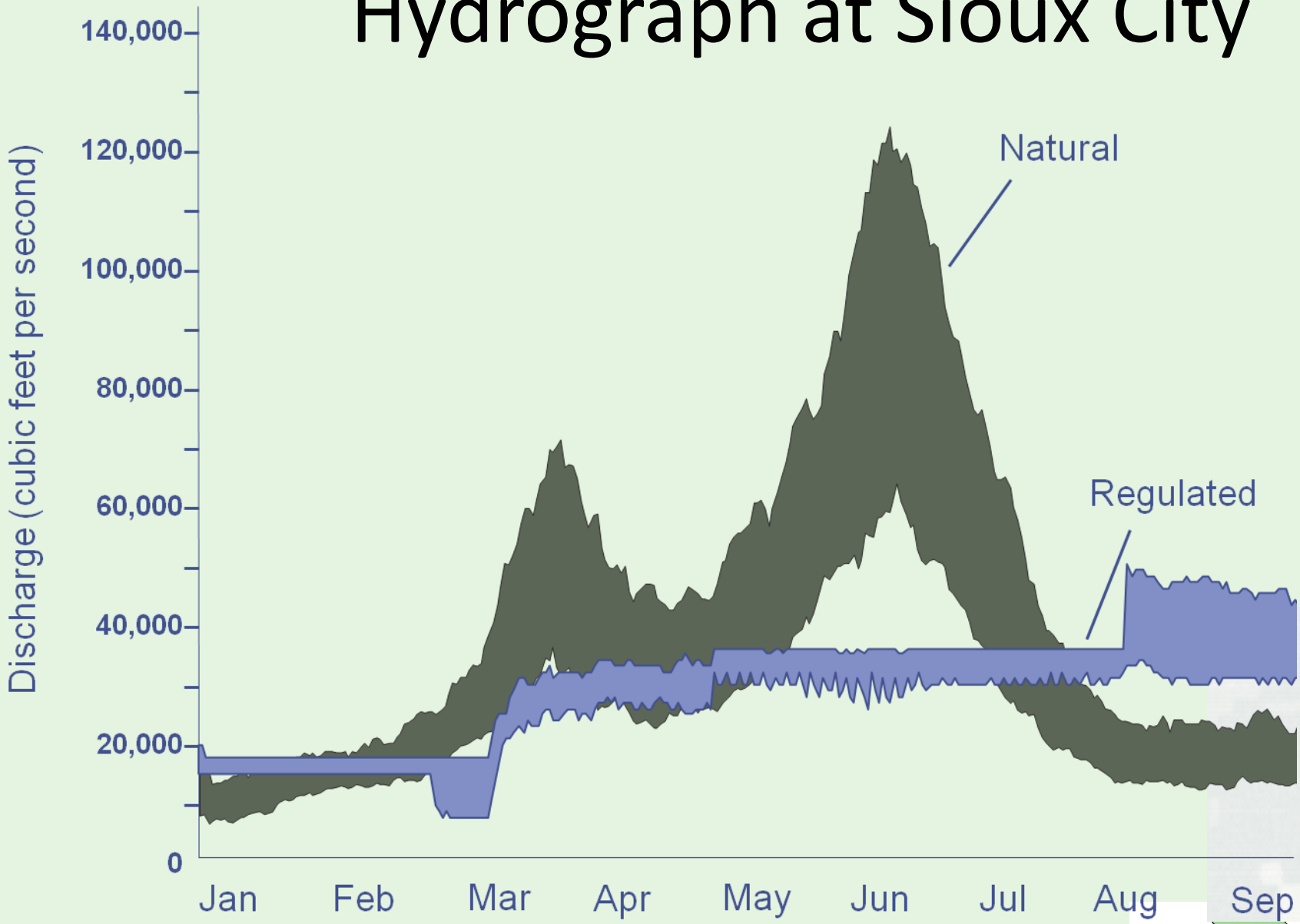


Missouri River FLOOD TASK FORCE

FLOW MODIFICATION

Large peak flows no longer occur

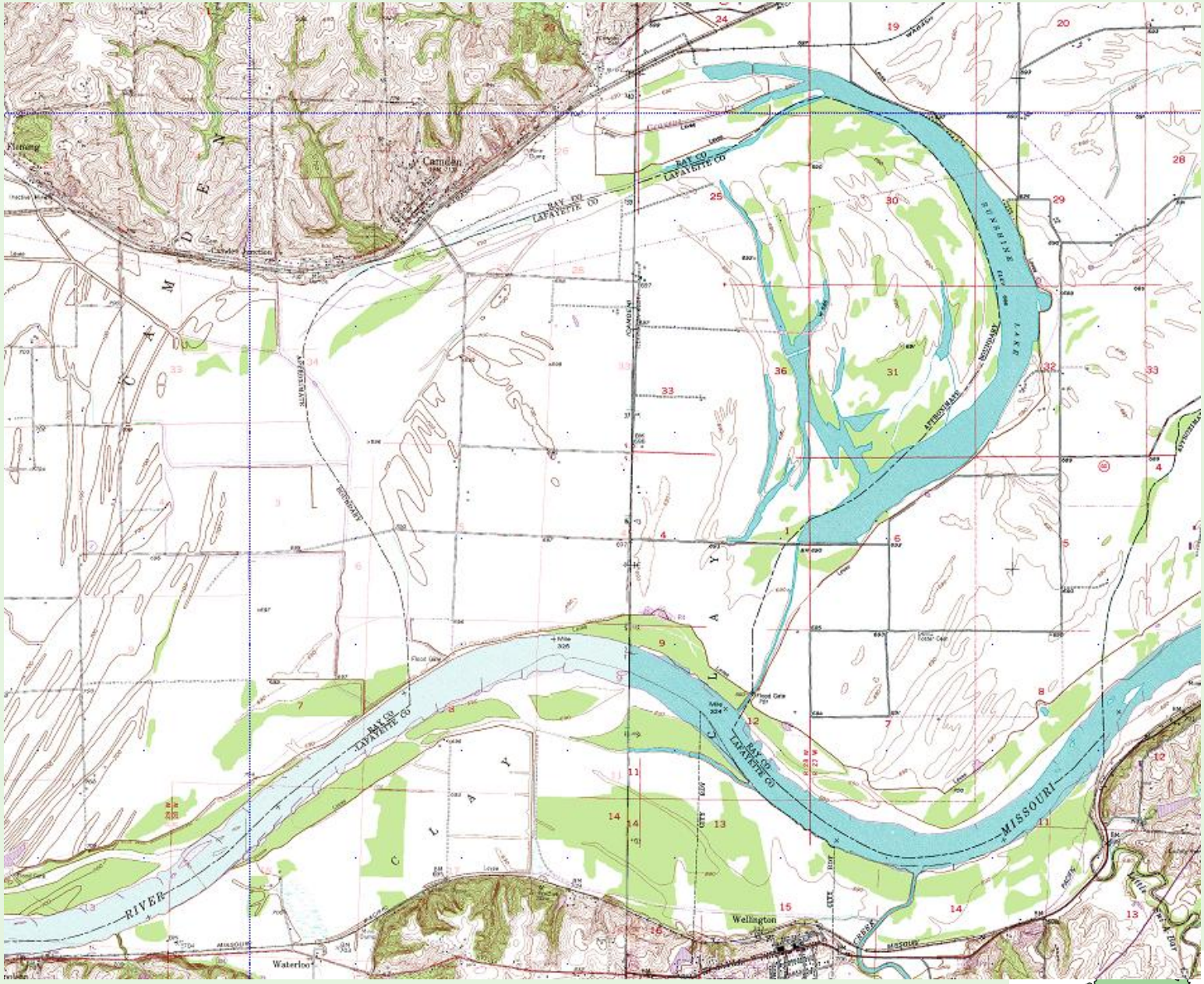
Hydrograph at Sioux City



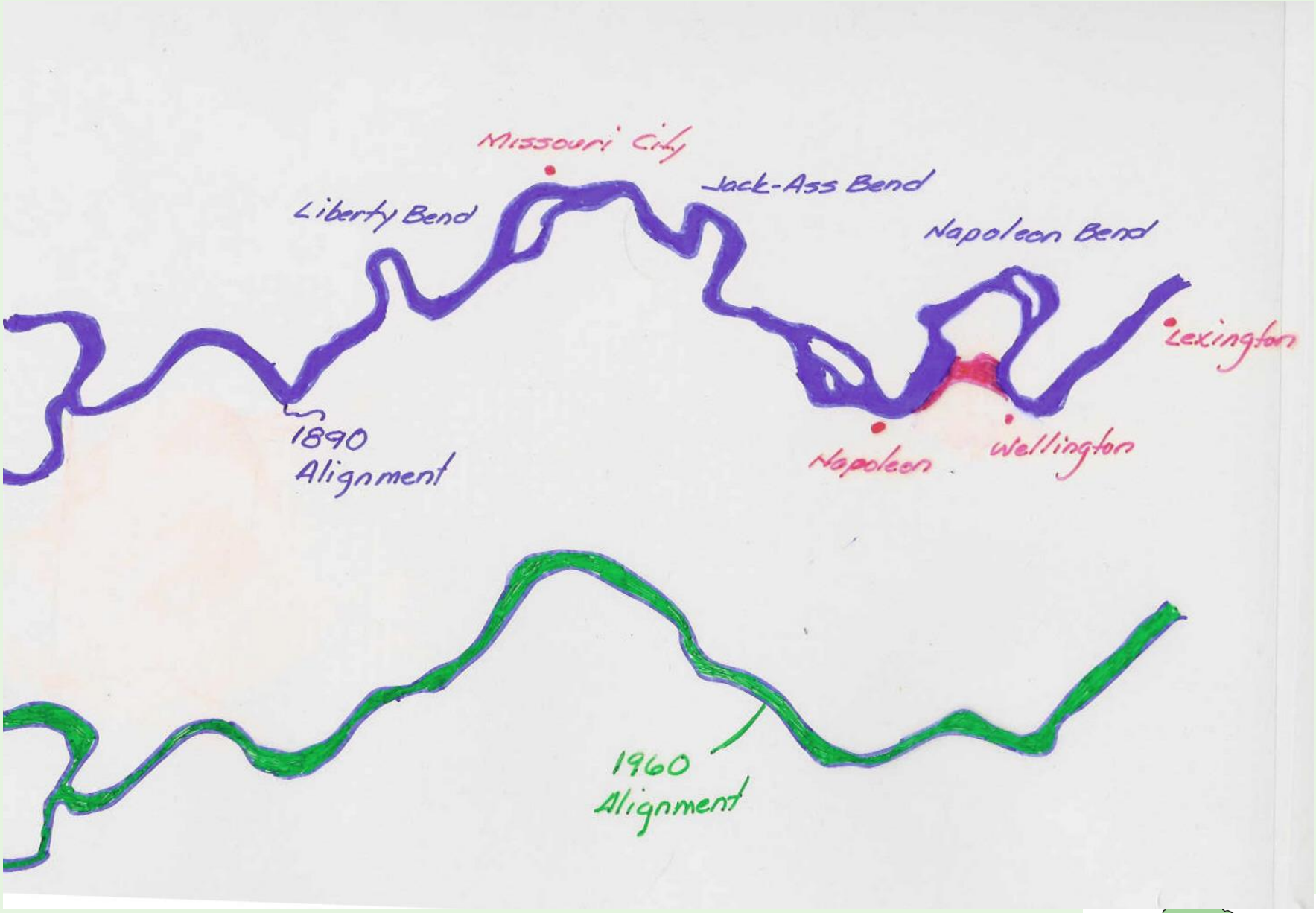
Missouri River FLOOD TASK FORCE

River Bend Cutoffs

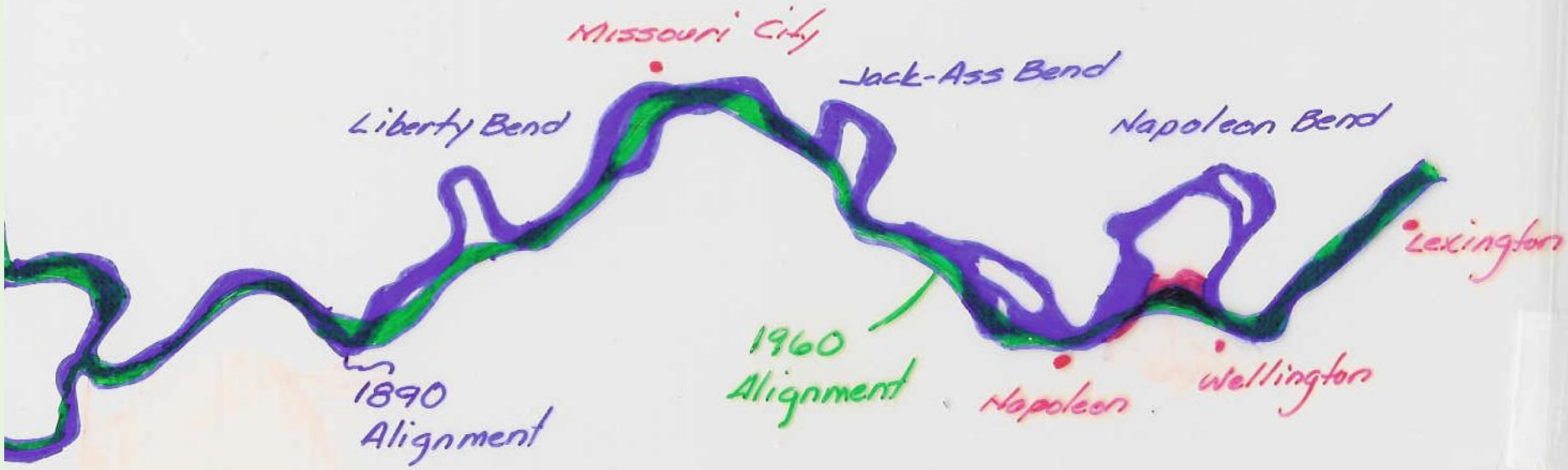
- Steeper Channel
  - Velocity Increases
  - Channel adjustments



Missouri River FLOOD TASK FORCE



Missouri River
FLOOD TASK FORCE


Missouri City
Jack-Ass Bend
Liberty Bend
Napoleon Bend
Lexington
1960
Alignment
1890
Alignment
Napoleon
Wellington

LEVEE
STORAGE AND CONVEYANCE
DURING FLOODS

WATER LEAVING LEVEE SYSTEM
2011 FLOOD

Flood of 2007:

"Scientists, government officials and environmentalists agree that a two- decade-long project to restore Missouri River habitat helped reduce flooding last month. They just don't know how much."

– Associated Press, June 8, 2007

Flood of 2011:

"Public lands along the Missouri River don't soak up nearly as much floodwater as previously believed." … "They do have some effect on downstream flooding, but in a flood as large and as long-lasting as the one this summer, that effect will be insignificant."

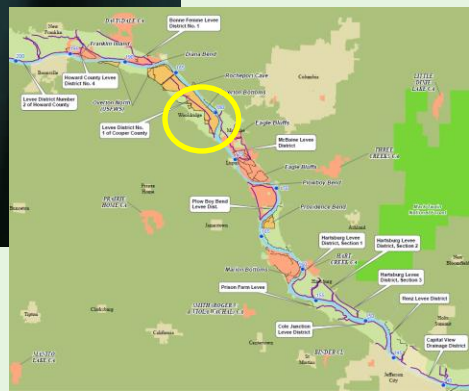
– The Missourian, July 5, 2011

Flood of 2011:

"Farmers John Sam Williamson of McBaine and Wayne Hilgedick of Hartsburg say they've noticed a difference. A high river level on the Boonville gauge doesn't seem to affect the river towns like it did before areas such as Overton Bottoms were set up. Brett Dufur, a bed and breakfast owner in Rocheport, also credited conservation areas for lessened flooding effects."

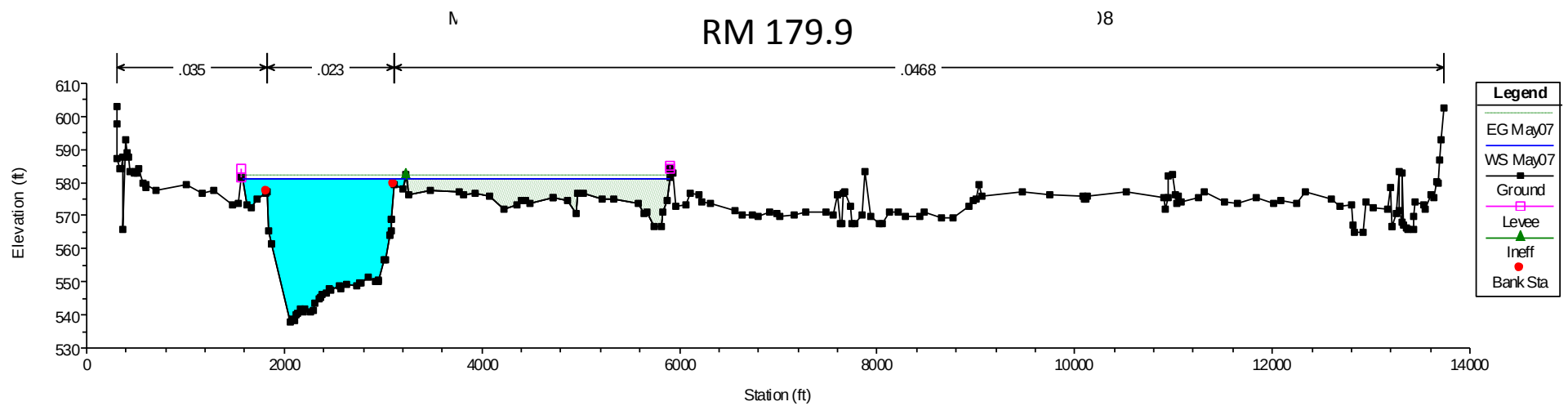
– The Missourian, July 5, 2011

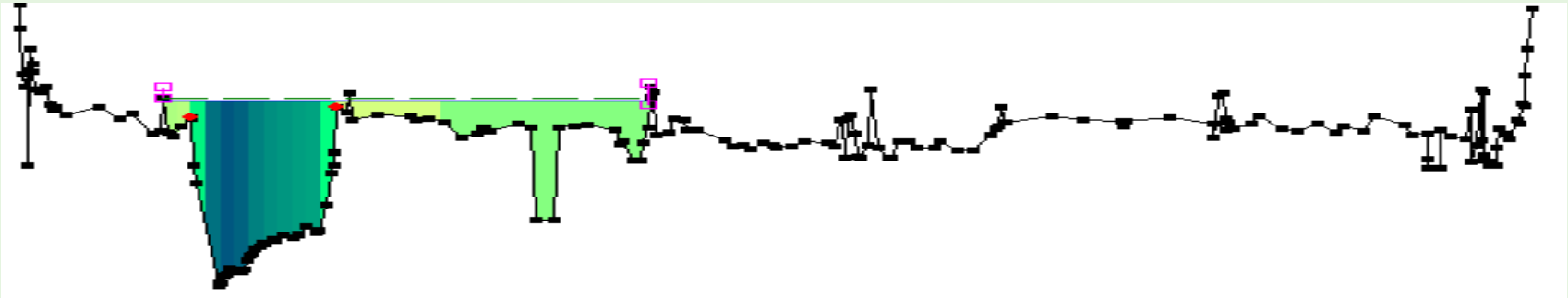
Overton South



Take away: MRRP built a chute, some SWH, abandoned 2 island levees, large scale levee setback.

Overton South

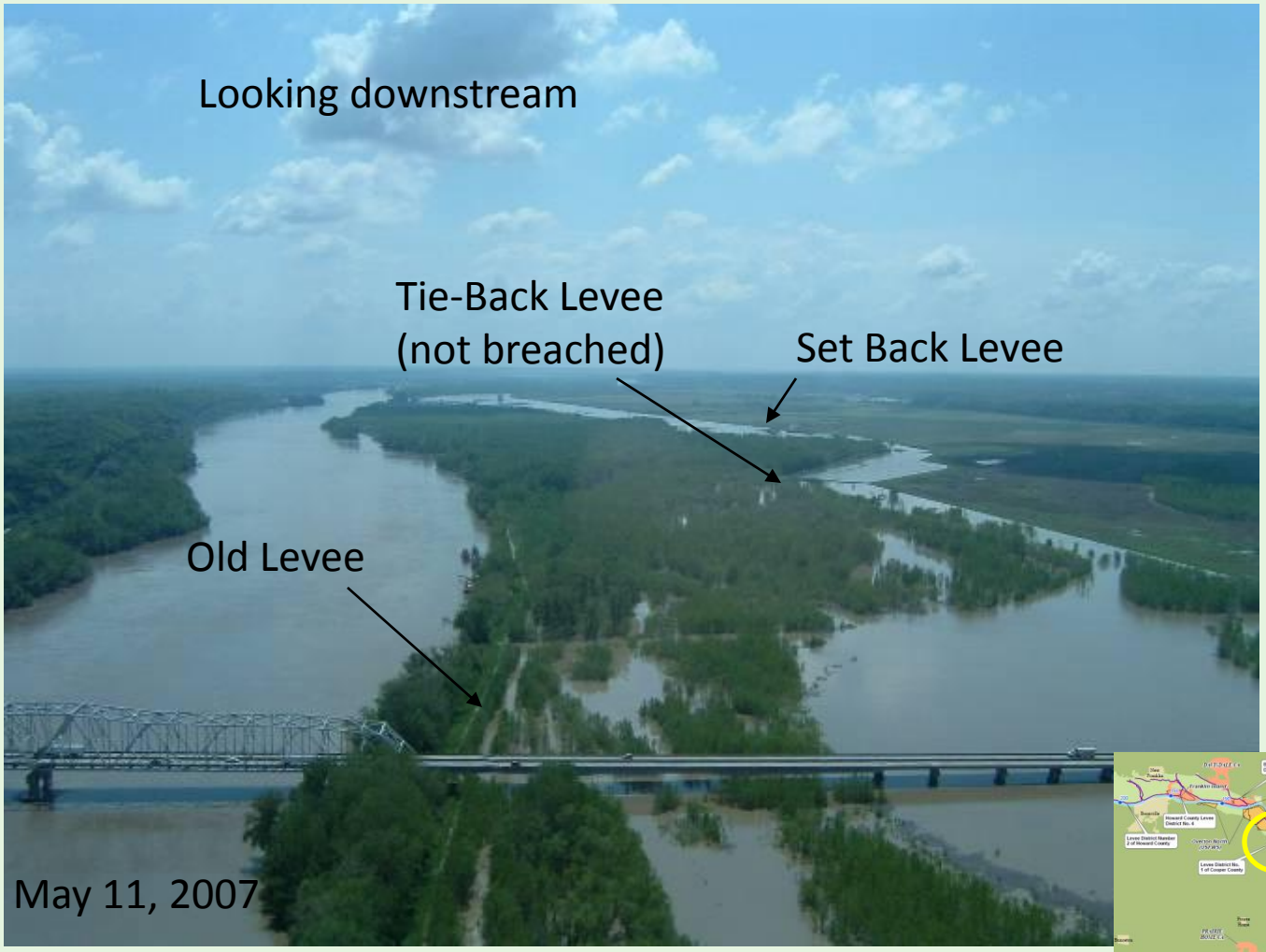




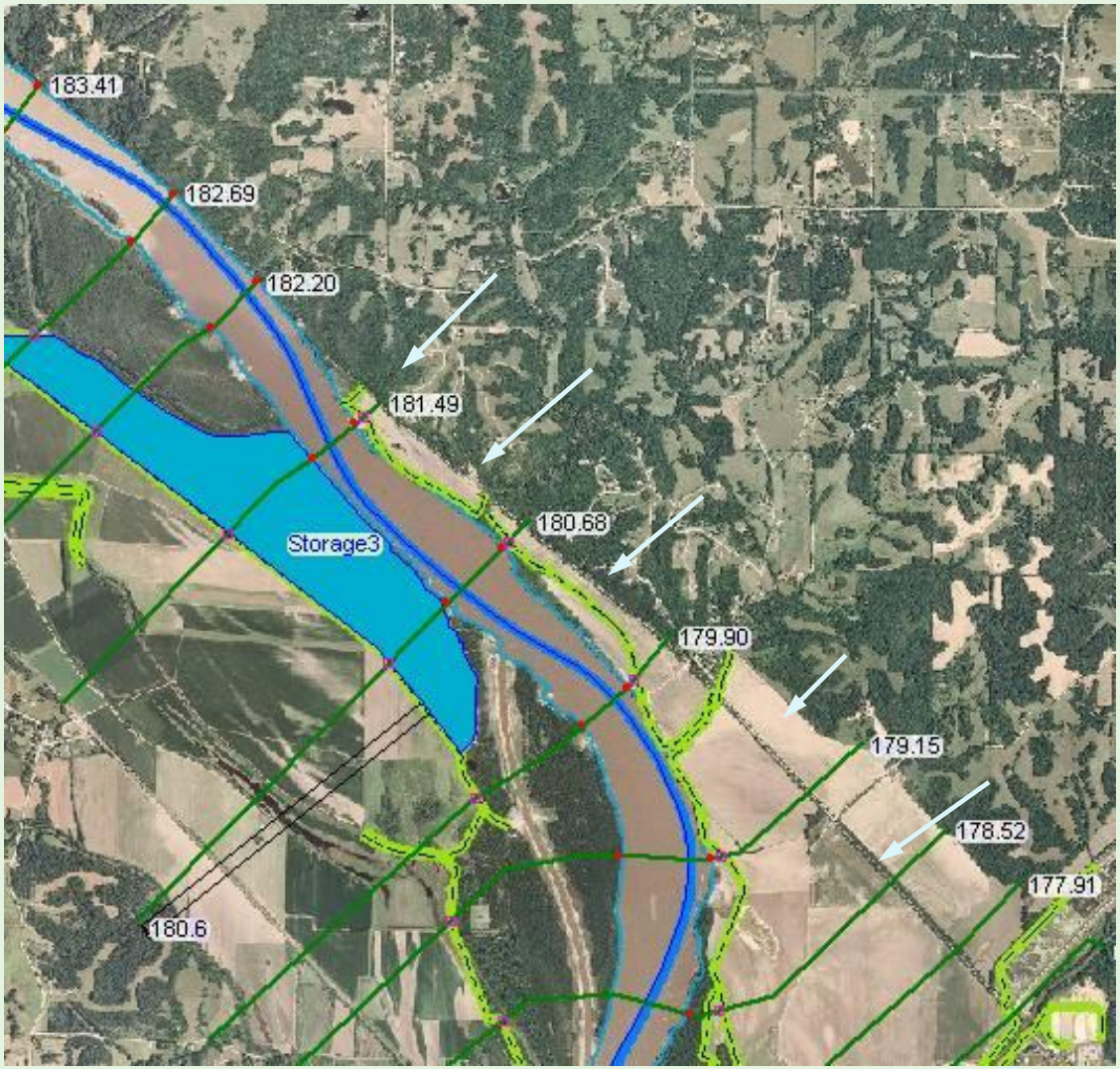
Old Island Levee abandoned after 1993. Area now floods and conveys water including Tadpole Island Chute.

Missouri River FLOOD TASK FORCE

Overton South



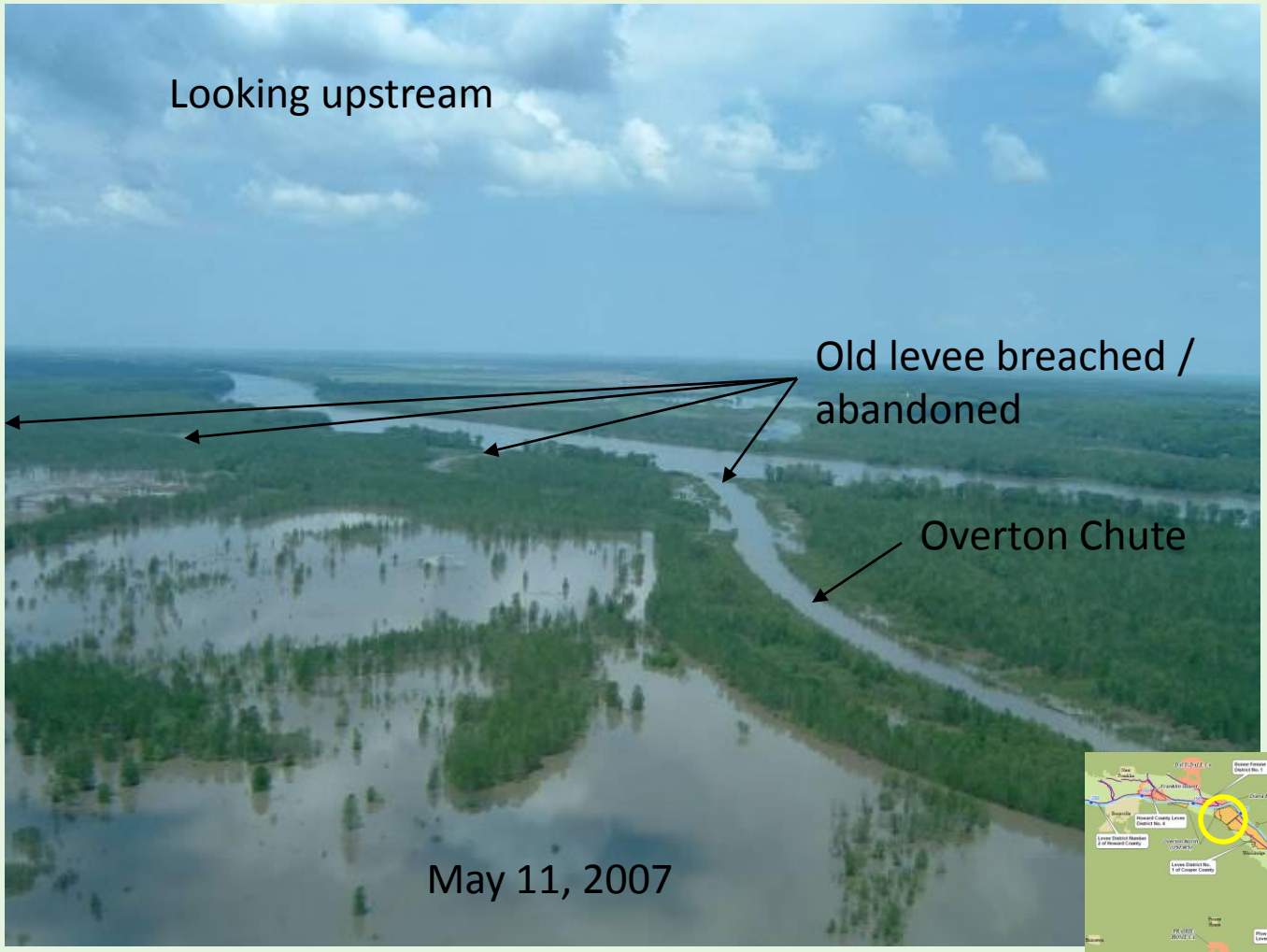
Levee set back storage area



Take away: Levee set-back functions more as a storage area than significant flow conveyance.

Missouri River FLOOD TASK FORCE

Overton North



Take away: Levee abandoned upstream of I-70, a chute and some SWH / widening completed.

BLUF

- MRRP is looking into how Flood Control and Habitat can co-exist
- River widening and levee setbacks can reduce river stages during small floods
- Ability to reduce upstream stages through increased conveyance shows more promise than downstream flow attenuation
- Results vary depending on flow magnitude, type of action (widening/setbacks), etc.

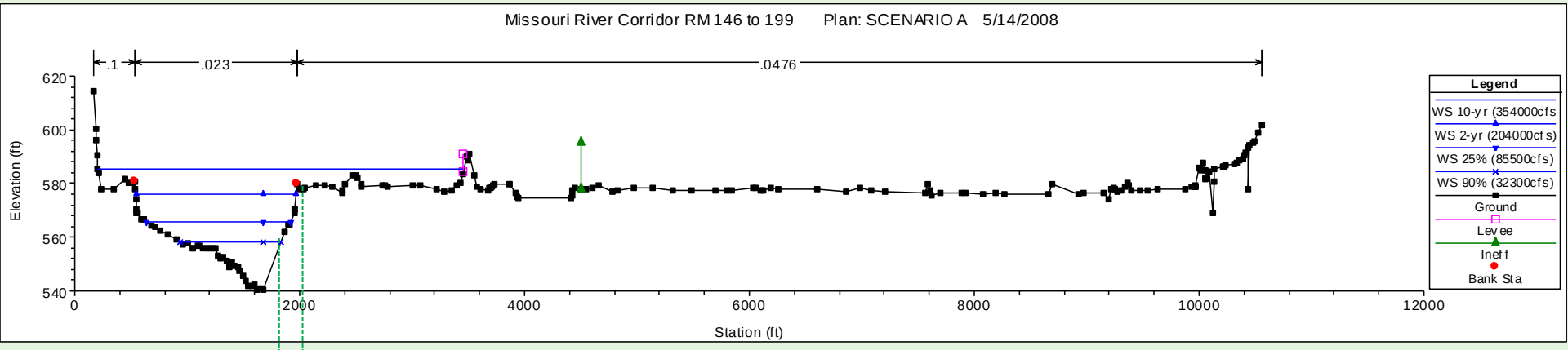
Test of Concept

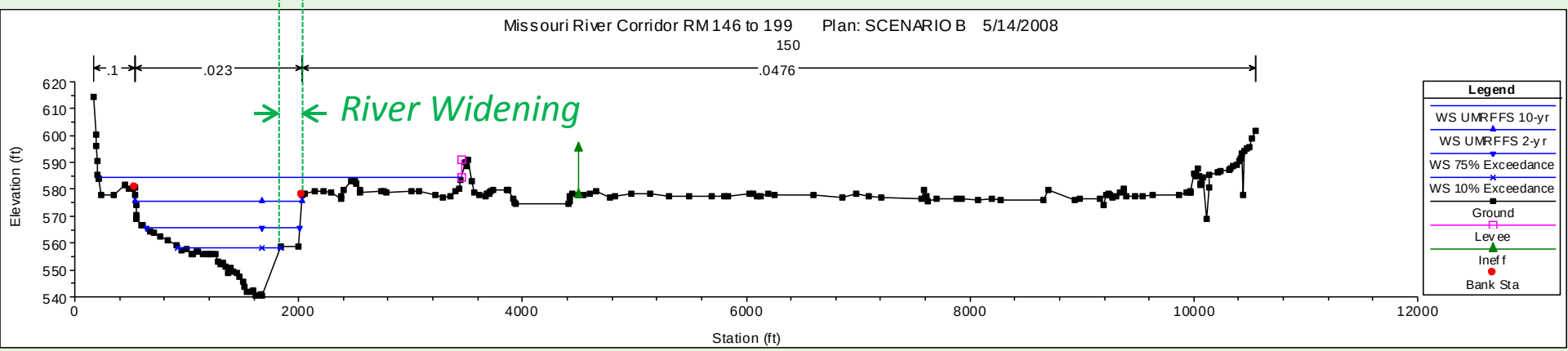
Do levee setbacks and channel widening change river stages?

Test of Concept Steady-flow Models

- Scenario A: Pre-recovery model (~1992 conditions)
- Scenario B: River widening - 150 feet
- Scenario C: B + 1,000-feet levee set back
- Scenario D: Levee set back – 1,000 feet
- Scenario E: No levees

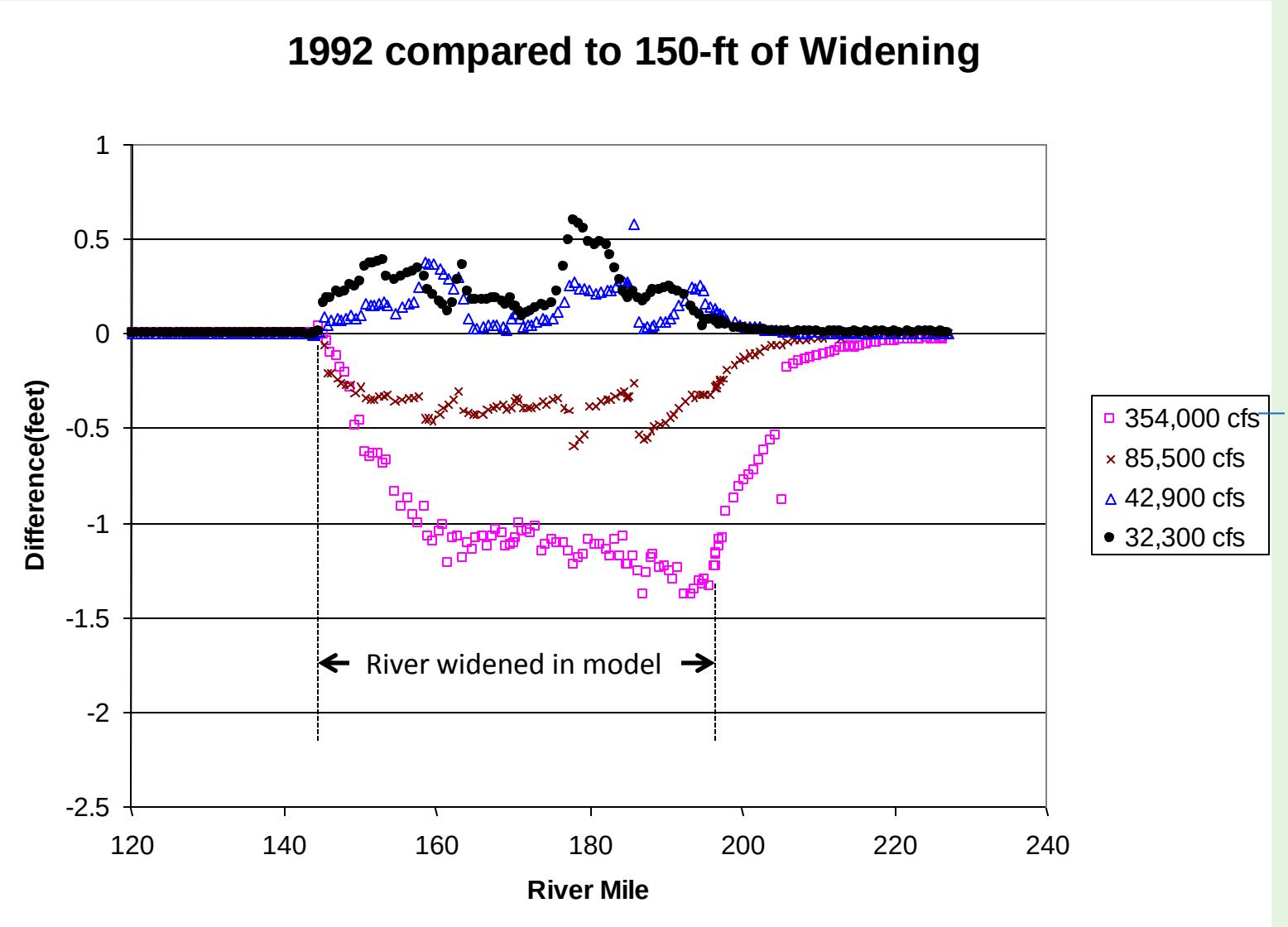
River Widening Geometry





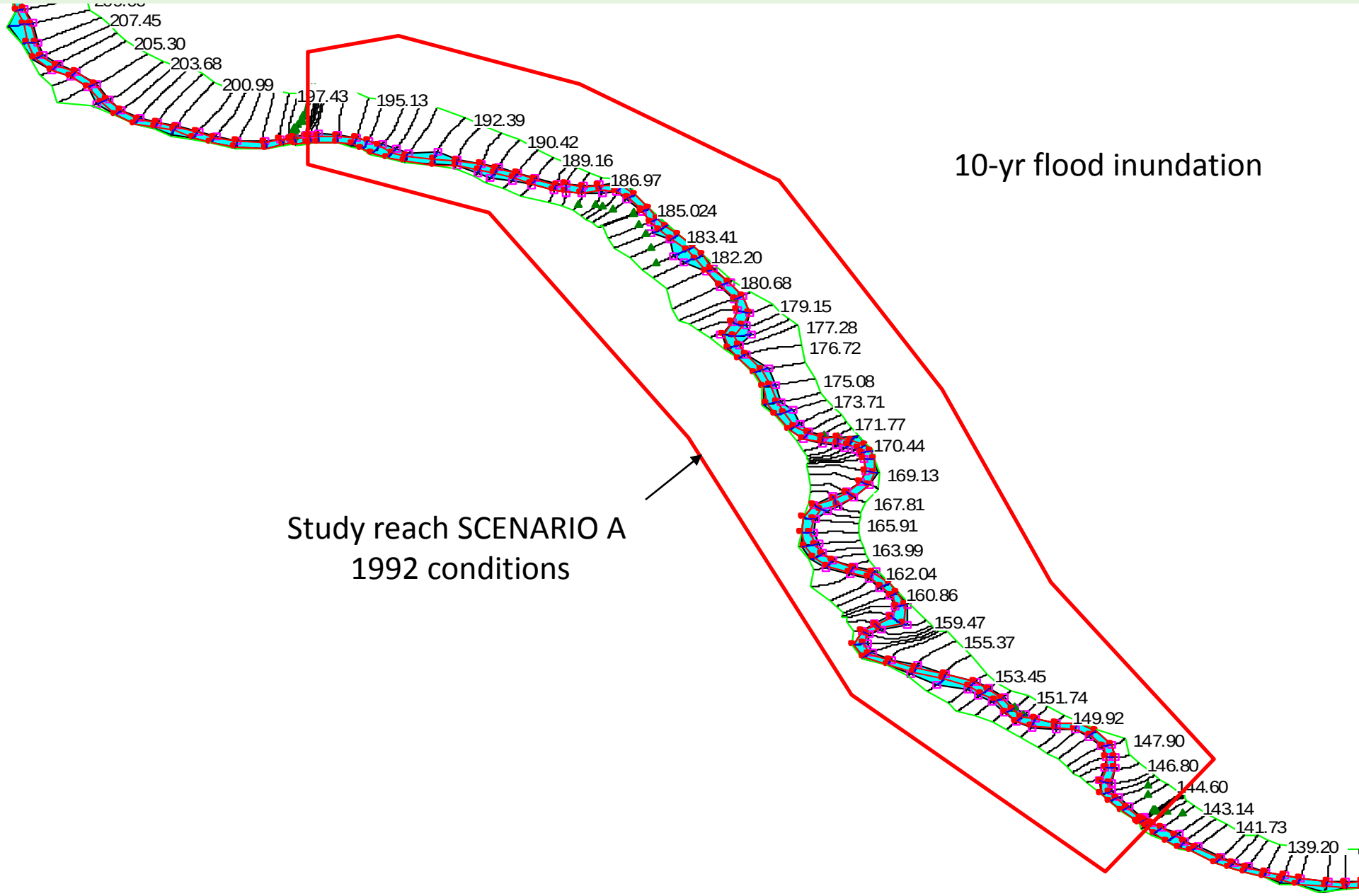
River Mile 184

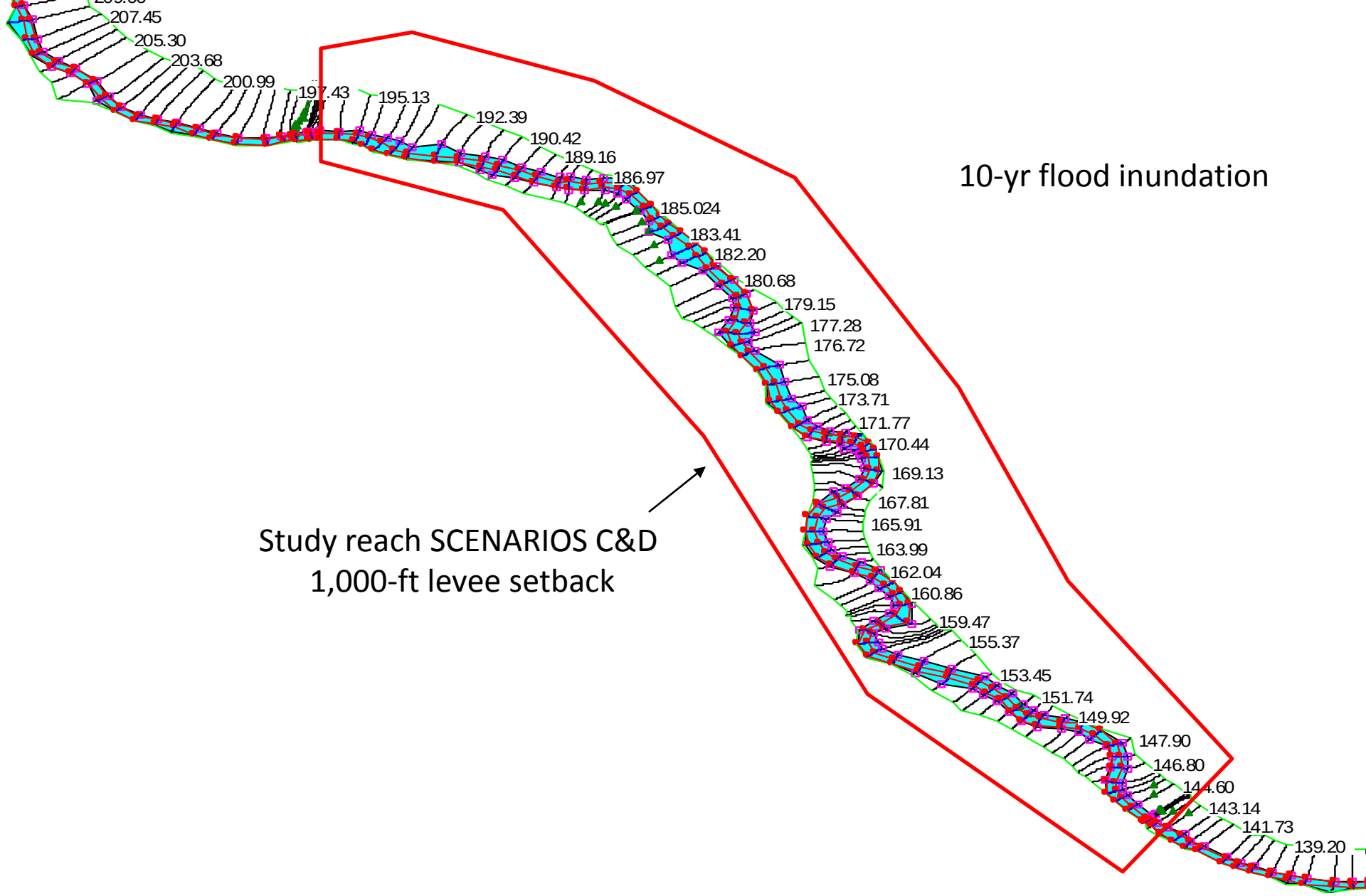
Missouri River FLOOD TASK FORCE



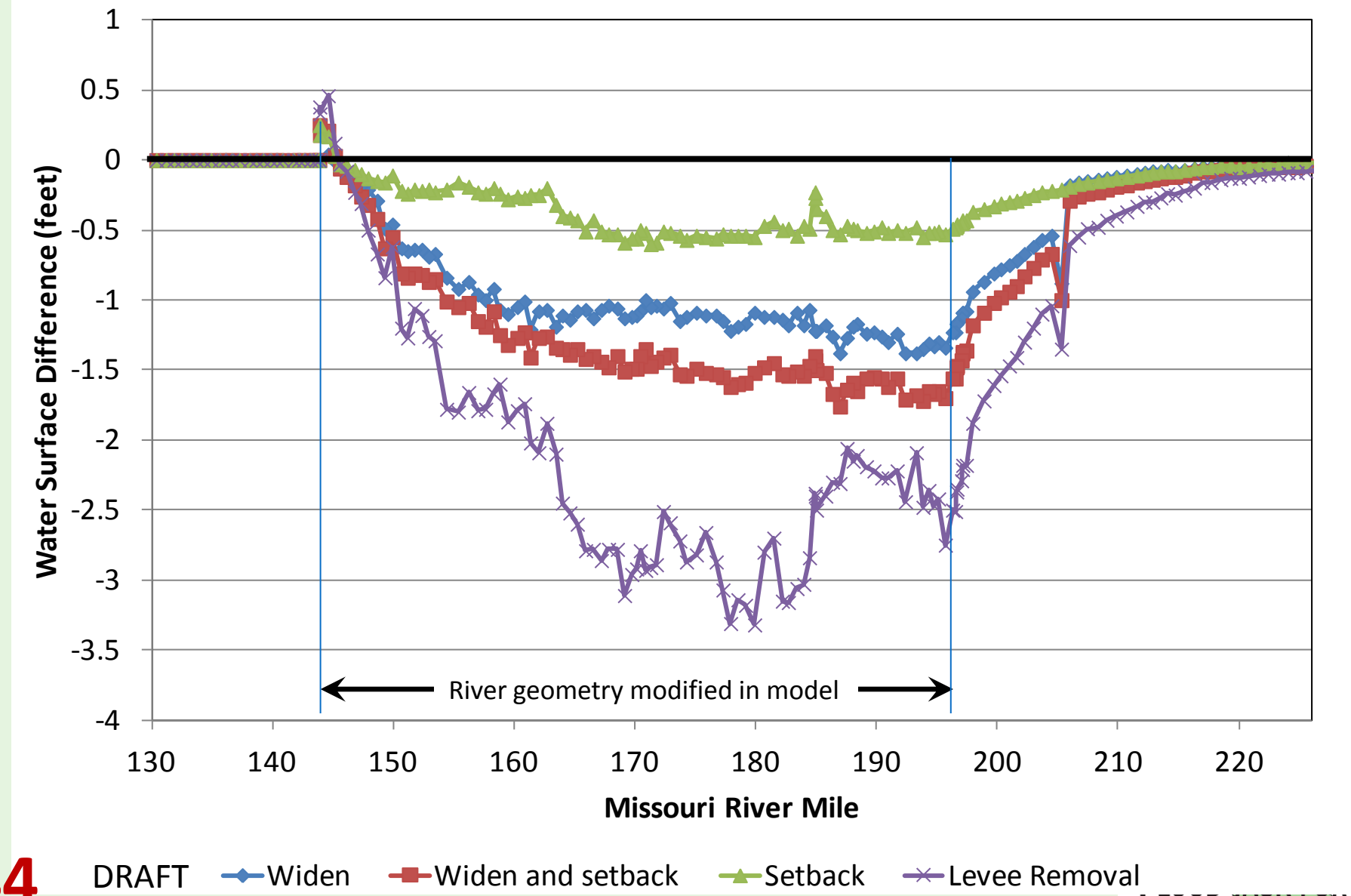
DRAFT

Missouri River FLOOD TASK FORCE


10-yr flood inundation
Study reach SCENARIO A
1992 conditions
207.45
205.30
203.68
200.99
197.43
195.13
192.39
190.42
189.16
186.97
185.024
183.41
182.20
180.68
179.15
177.28
176.72
175.08
173.71
171.77
170.44
169.13
167.81
165.91
163.99
162.04
160.86
159.47
155.37
153.45
151.74
149.92
147.90
146.80
144.60
143.14
141.73
139.20


10-yr flood inundation
Study reach SCENARIOS C&D
1,000-ft levee setback
207.45
205.30
203.68
200.99
197.43
195.13
192.39
190.42
189.16
186.97
185.024
183.41
182.20
180.68
179.15
177.28
176.72
175.08
173.71
171.77
170.44
169.13
167.81
165.91
163.99
162.04
160.86
159.47
155.37
153.45
151.74
149.92
147.90
146.80
144.60
143.14
141.73
139.20

10-yr flood Scenarios vs. 1992 Model



Additional Research Needed!

- **Impacts of Revetments and Dikes**
- **Increased Roughness from Vegetation**
- **Upstream Reservoirs Impacts**
  - **Flow modification**
  - **Sediment trapping**
- **River Bend Cutoffs (Steeper Channel)**
- **Constrictions (Levees, Bridges, Embankments)**
- **River Widening**
- **Impacts from Major Floods**

Discussion

- Next Steps
  - Do we want to do anything with this information?
  - Ideas?
  - Suggestions?

46

Thanks for your participation in today's meeting!

Missouri River FLOOD TASK FORCE

Missouri River
FLOOD TASK FORCE