Missouri River Reported Channel Problem Areas

- 7 Problem Areas Reported

First Question: Are the existing rock structure elevations at the current height criteria ?

MISSOURI RIVER NAVIGATION PROJECT
STRUCTURE HEIGHT CRITERIA

	Channel Width	Channel Width to Sills	Dike Height Concave	Dike Height Convex	Revetment L-Head	Revetment SFR	Sills	Crossing Control Structures
KANSAS CITY DISTRICT								
Rulo - Kansas R. (Mile 498 to 367)	800′	550′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Kansas R. - Grand R. (Mile 367 - Mile 250)	900′	600′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Grand R. - Osage R. (Mile 250 - Mile 130)	1000′	650′	+4.0	+2.0	+2.0	+4.0	-2.0	+5.0
Osage R. - Mouth	1100′	750′	+5.0	+3.0	+3.0	+5.0	-1.0	+6.0
Percent of time proposed height criteria is exceeded during the navigation season	--	--	30%	50%	50%	30%	>95%	20%

NOTE: The above structure height criteria is referenced to Q_{75} as defined below.

Station	$Q_{75} = Q_{CRP}$	CPR Elev*	Q_{30}	Q_{50}	Q_{20}	Q>95%
Hermann	54,000	489.6	110,000	92,000	71,000	41,000
Boonville	46,000	574.9	88,000	74,000	58,000	37,000
Waverly	43,500	657.0	76,000	65,000	53,000	32,500
Kansas City	43,000	721.9	74,000	63,000	52,000	32,000
St. Joe	37,500	798.4	56,000	52,000	44,000	30,500
Rulo	36,500	847.9	55,000	50,000	43,000	30,000

*These elevations to be reviewed annually to reflect current rating curve conditions, based on a summer rating curve.

Second Question: Is our current structure height criteria still valid ?

Recalculated

MISSOURI RIVER NAVIGATION PROJECT
STRUCTURE HEIGHT CRITERIA

	Channel Width	Channel Width to Sills	Dike Height Concave	Dike Height Convex	Revetment L-Head	Revetment SFR	Sills	Crossing Control Structures
KANSAS CITY DISTRICT								
Rulo - Kansas R. (Mile 498 to 367)	800′	550′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Kansas R. - Grand R. (Mile 367 - Mile 250)	900′	600′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Grand R. - Osage R. (Mile 250 - Mile 130)	1000′	650′	+4.0	+2.0	+2.0	+4.0	-2.0	+5.0
Osage R. - Mouth	1100′	750′	+5.0	+3.0	+3.0	+5.0	-1.0	+6.0
Percent of time proposed height criteria is exceeded during the navigation season	--	--	30%	50%	50%	30%	>95%	20%

NOTE: The above structure height criteria is referenced to Q_{75} as defined below

Stayed the same

Station	$Q_{75} = Q_{CRP}$	CPR Elev*	Q_{30}	Q_{50}	Q_{20}	Q>95%
Hermann	54,000	489.6	110,000	92,000	71,000	41,000
Boonville	46,000	574.9	88,000	74,000	58,000	37,000
Waverly	43,500	657.0	76,000	65,000	53,000	32,500
Kansas City	43,000	721.9	74,000	63,000	52,000	32,000
St. Joe	37,500	798.4	56,000	52,000	44,000	30,500
Rulo	36,500	847.9	55,000	50,000	43,000	30,000

Third Question: Were the dikes built to full design dimension ?

MISSOURI RIVER NAVIGATION PROJECT
STRUCTURE HEIGHT CRITERIA

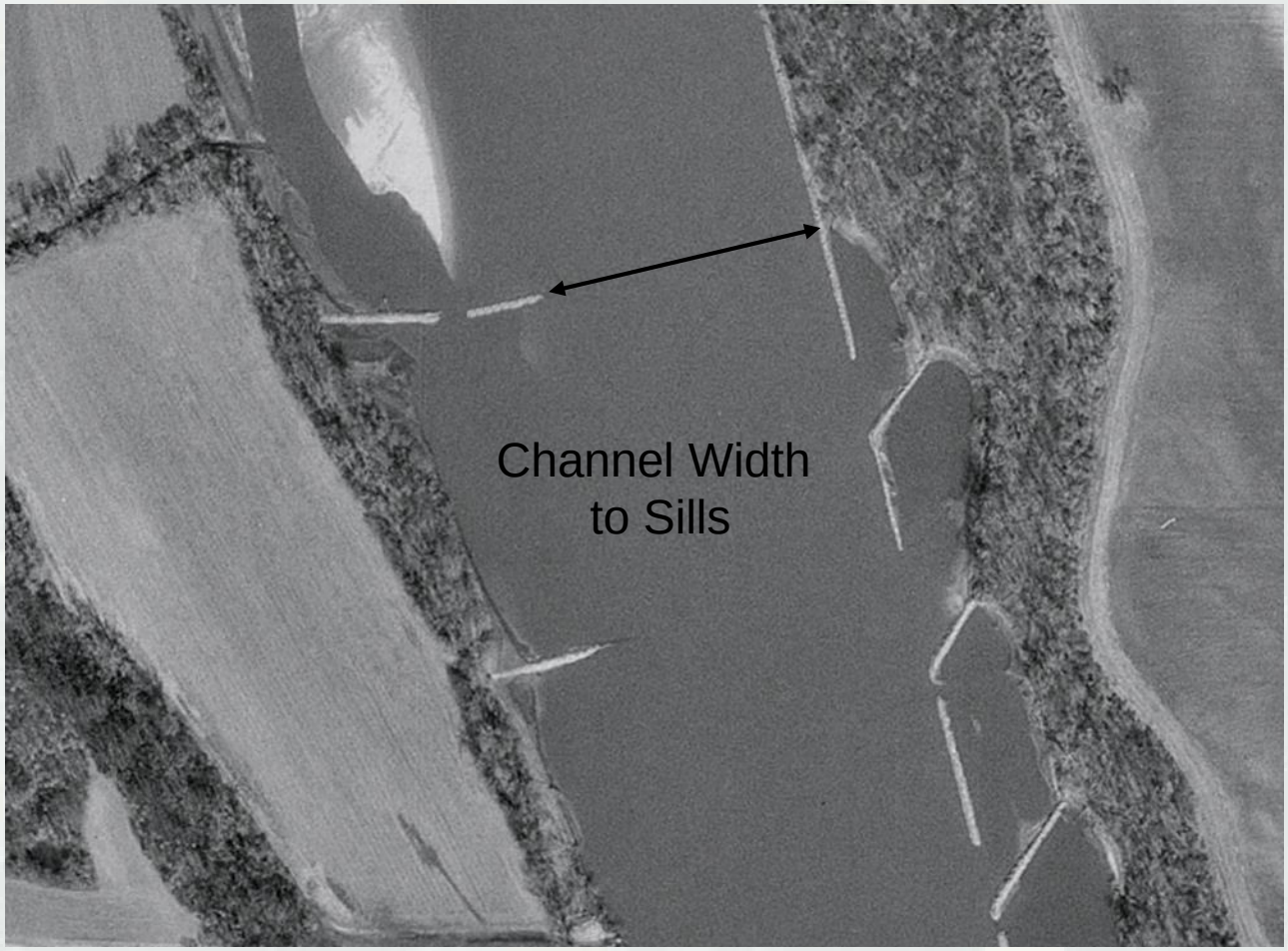
	Channel Width	Channel Width to Sills	Dike Height Concave	Dike Height Convex	Revetment L-Head	Revetment SFR	Sills	Crossing Control Structures
KANSAS CITY DISTRICT								
Rulo - Kansas R. (Mile 498 to 367)	800′	550′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Kansas R. - Grand R. (Mile 367 - Mile 250)	900′	600′	+3.0	+1.0	+1.0	+3.0	-2.0	+4.0
Grand R. - Osage R. (Mile 250 - Mile 130)	1000′	650′	+4.0	+2.0	+2.0	+4.0	-2.0	+5.0
Osage R. - Mouth	1100′	750′	+5.0	+3.0	+3.0	+5.0	-1.0	+6.0
Percent of time proposed height criteria is exceeded during the navigation season	--	--	30%	50%	50%	30%	>95%	20%

NOTE: The above structure height criteria is referenced to Q_{75} as defined below.

Station	$Q_{75} = Q_{CRP}$	CPR Elev*	Q_{30}	Q_{50}	Q_{20}	Q>95%
Hermann	54,000	489.6	110,000	92,000	71,000	41,000
Boonville	46,000	574.9	88,000	74,000	58,000	37,000
Waverly	43,500	657.0	76,000	65,000	53,000	32,500
Kansas City	43,000	721.9	74,000	63,000	52,000	32,000
St. Joe	37,500	798.4	56,000	52,000	44,000	30,500
Rulo	36,500	847.9	55,000	50,000	43,000	30,000

*These elevations to be reviewed annually to reflect current rating curve conditions, based on a summer rating curve.

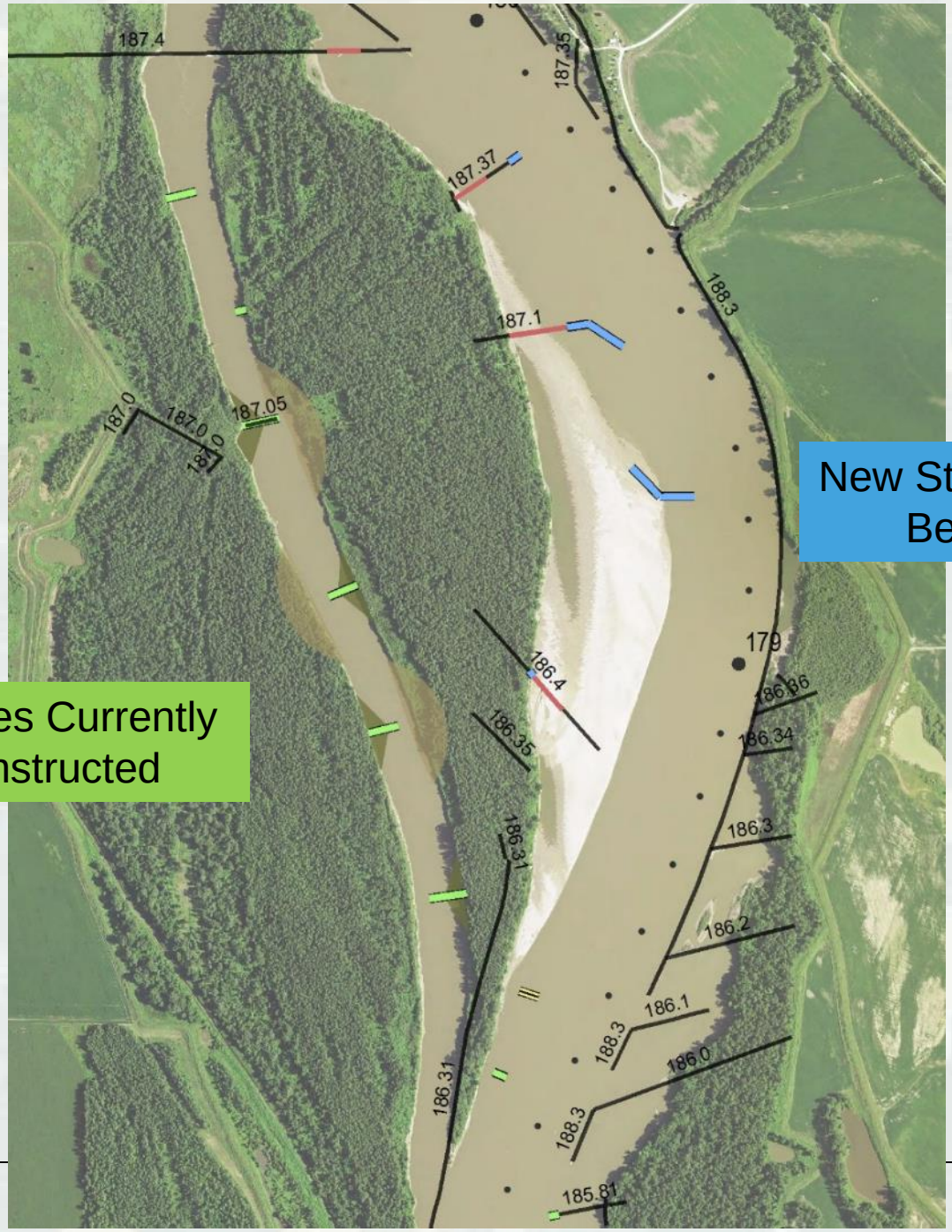
Constructed Channel Width to sills distance



Areas of Concern

- River Miles 178-180 Tadpole
- River Mile 25.5
- River Mile 57
- River Mile 44
- River Mile 48.5
- River Miles 10 -10.5
- River Miles 51- 53

Tadpole



New Structures Currently Being Designed

New Structures Currently Being Constructed

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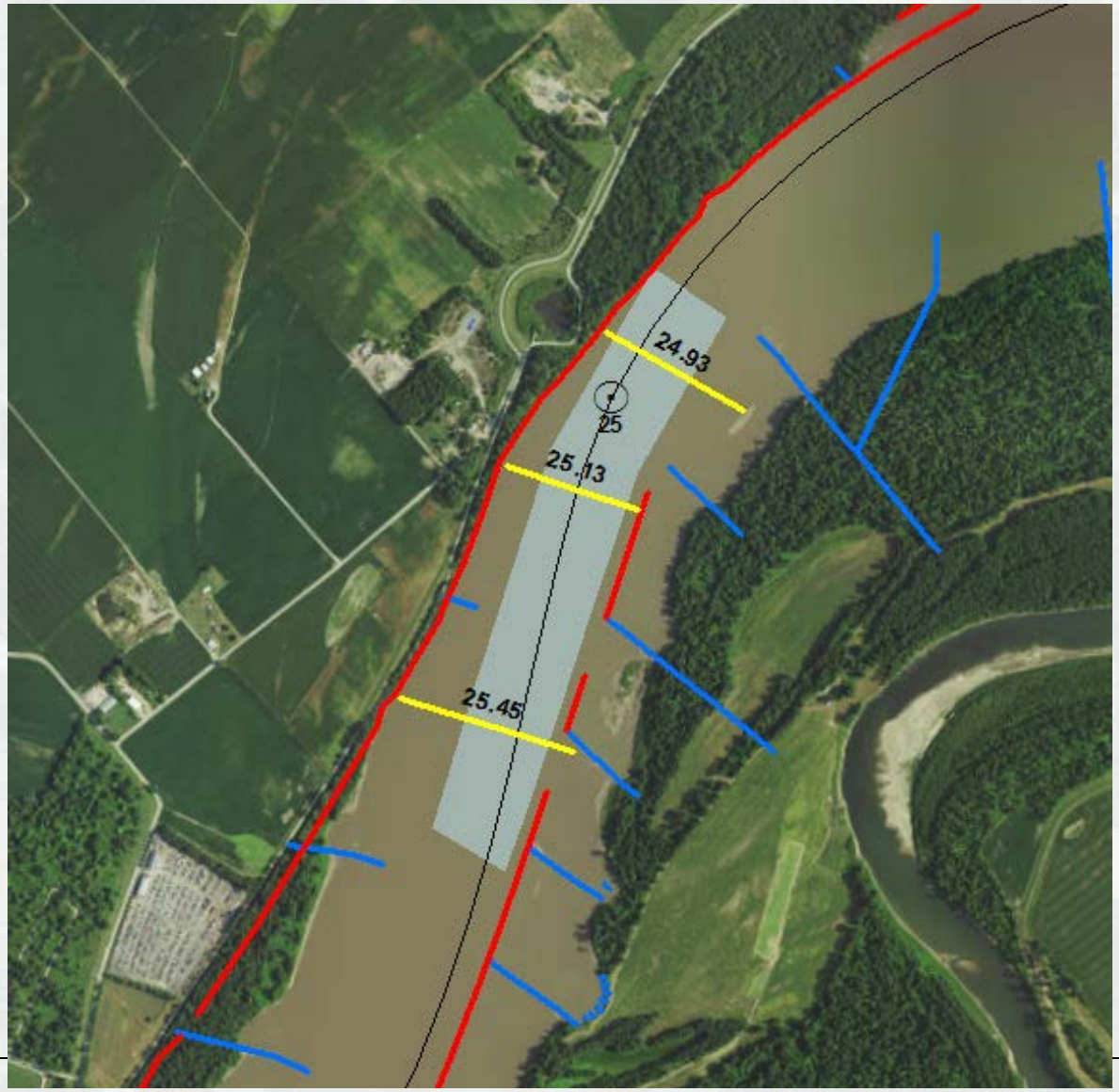
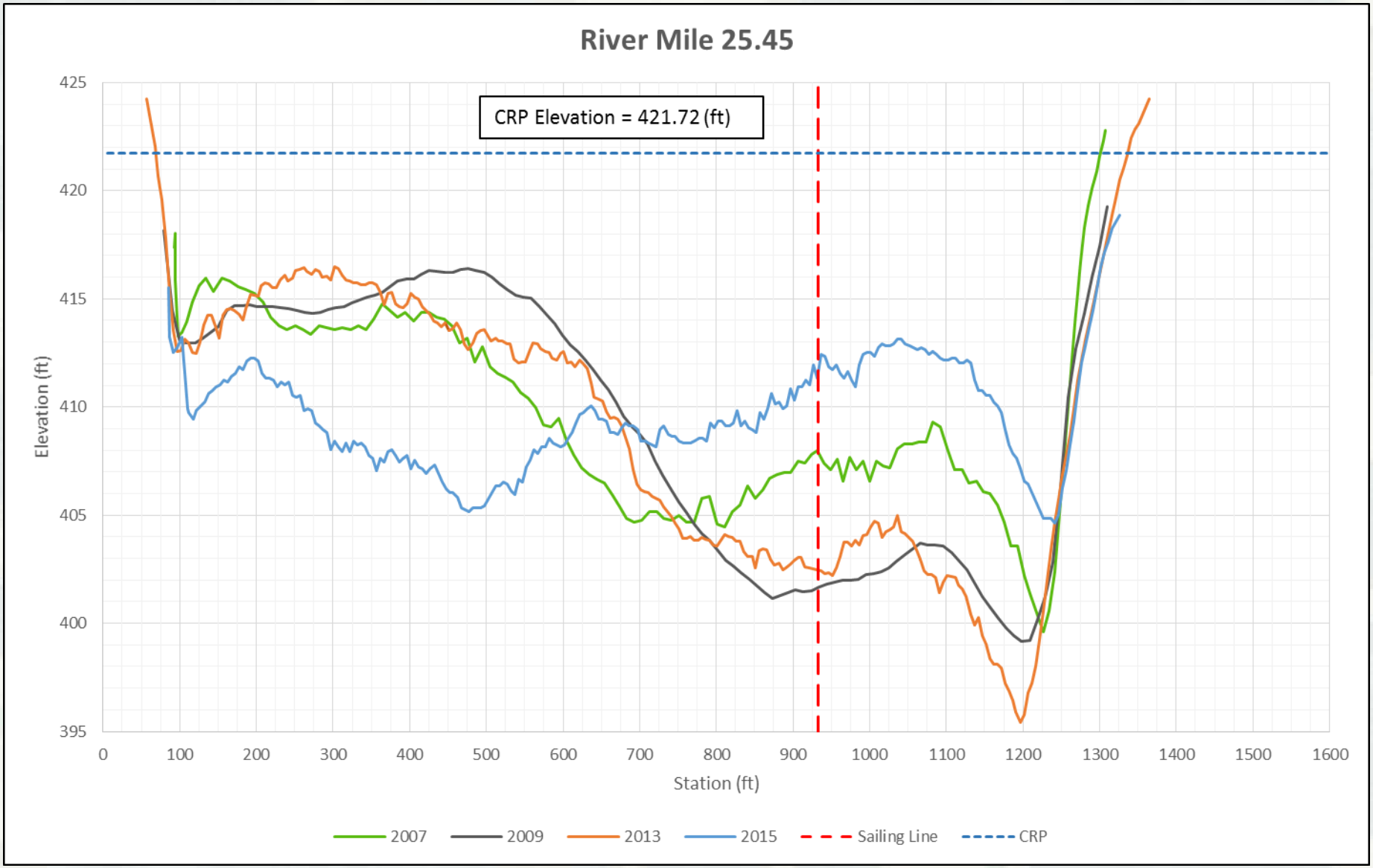
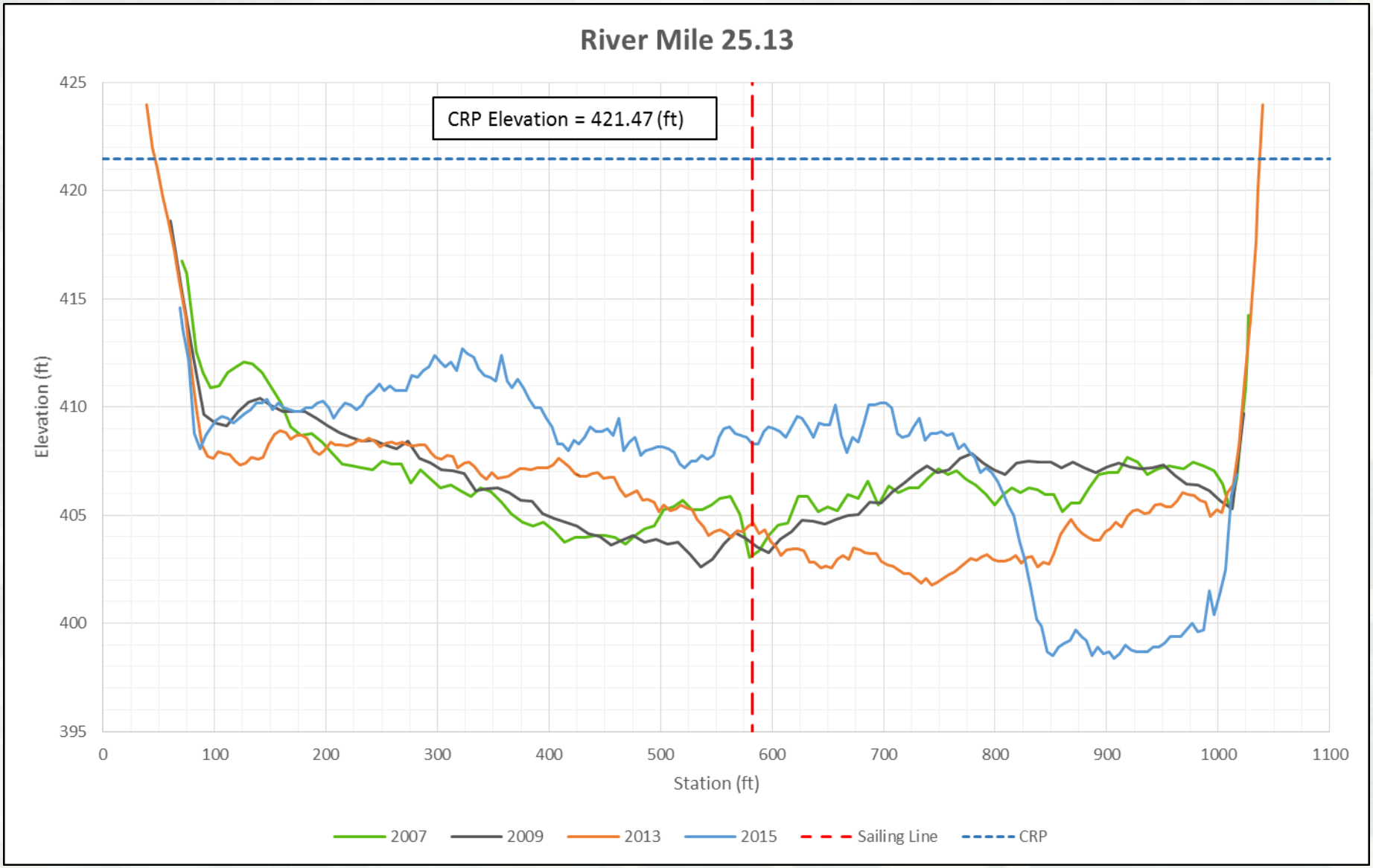
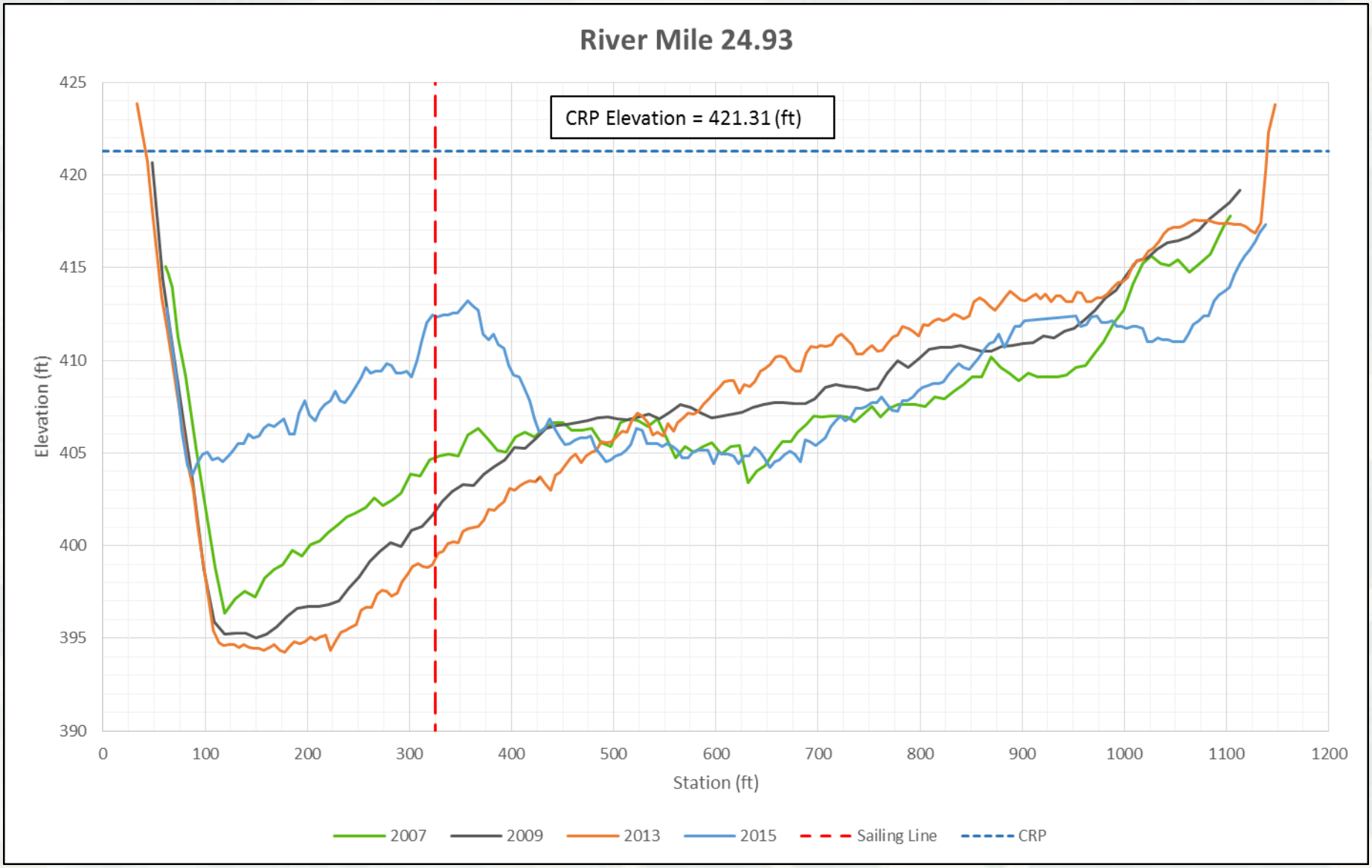
Area of Concern RM 25.5



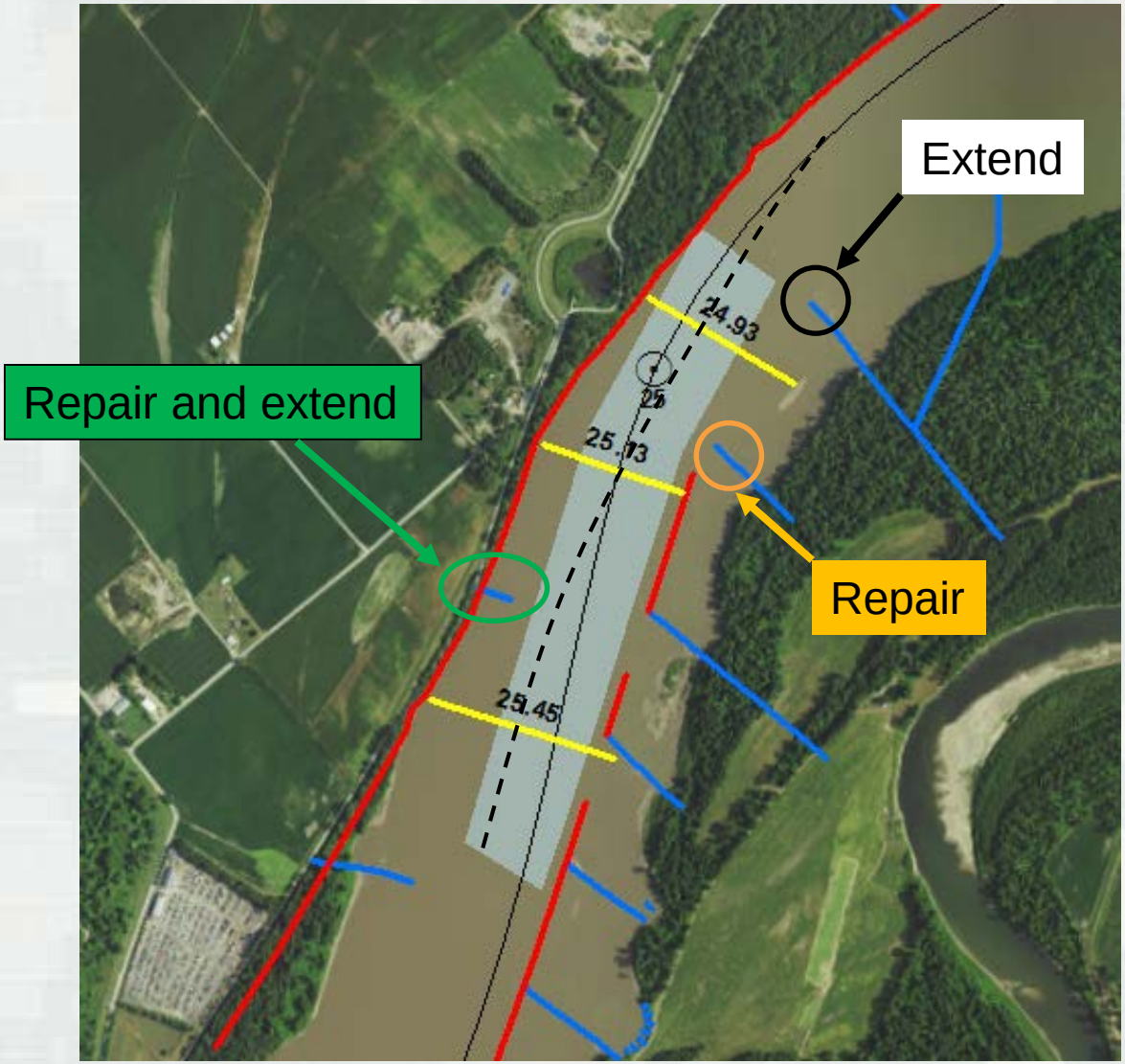
"Brian Island. Crossing is the main Problem"


River Mile 25.45
CRP Elevation = 421.72 (ft)
425
420
415
410
405
400
395
Elevation (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

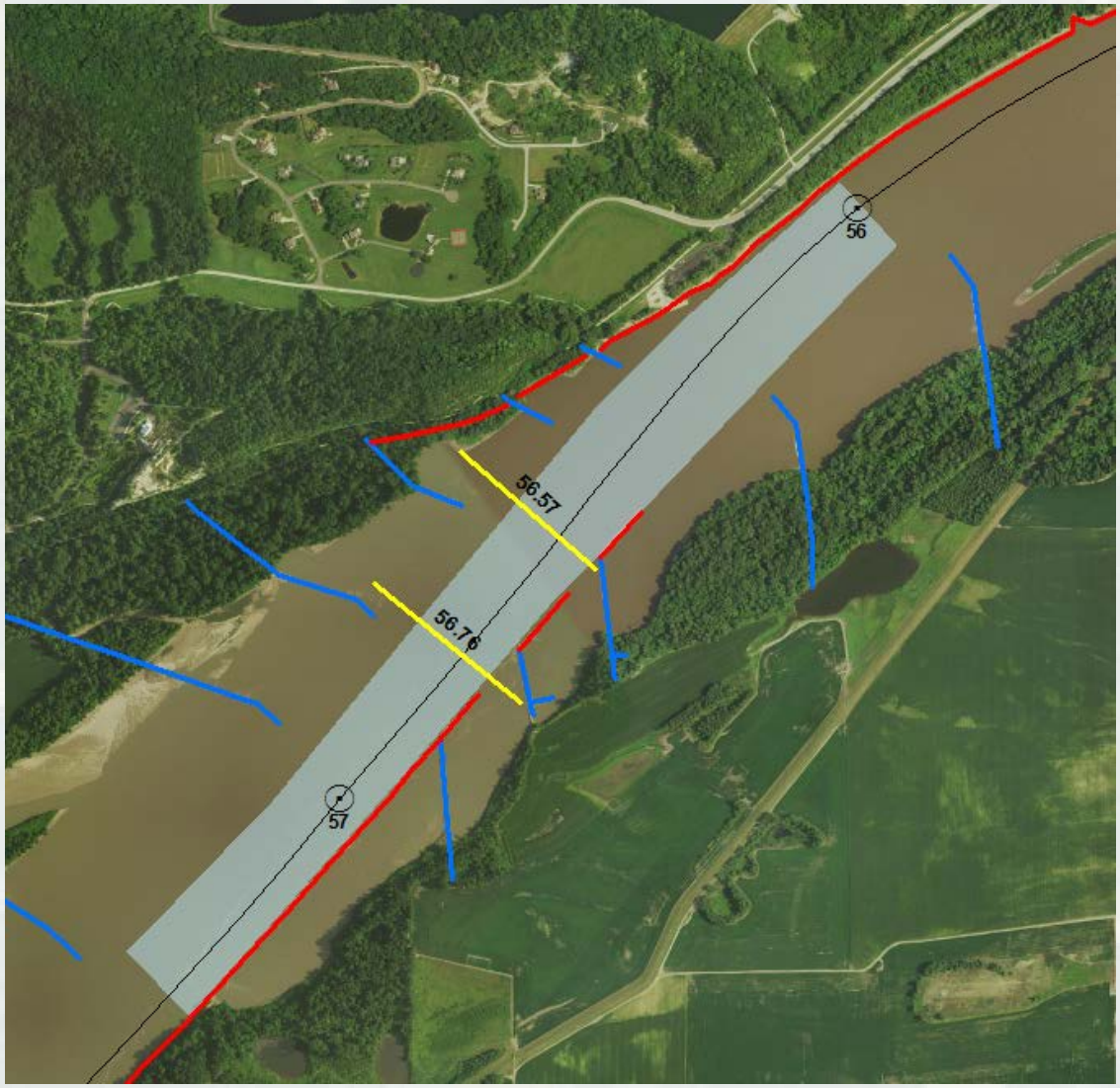

River Mile 25.13
CRP Elevation = 421.47 (ft)
425
420
415
410
405
400
395
Elevation (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP


River Mile 24.93
CRP Elevation = 421.31 (ft)
Elevation (ft)
425
420
415
410
405
400
395
390
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

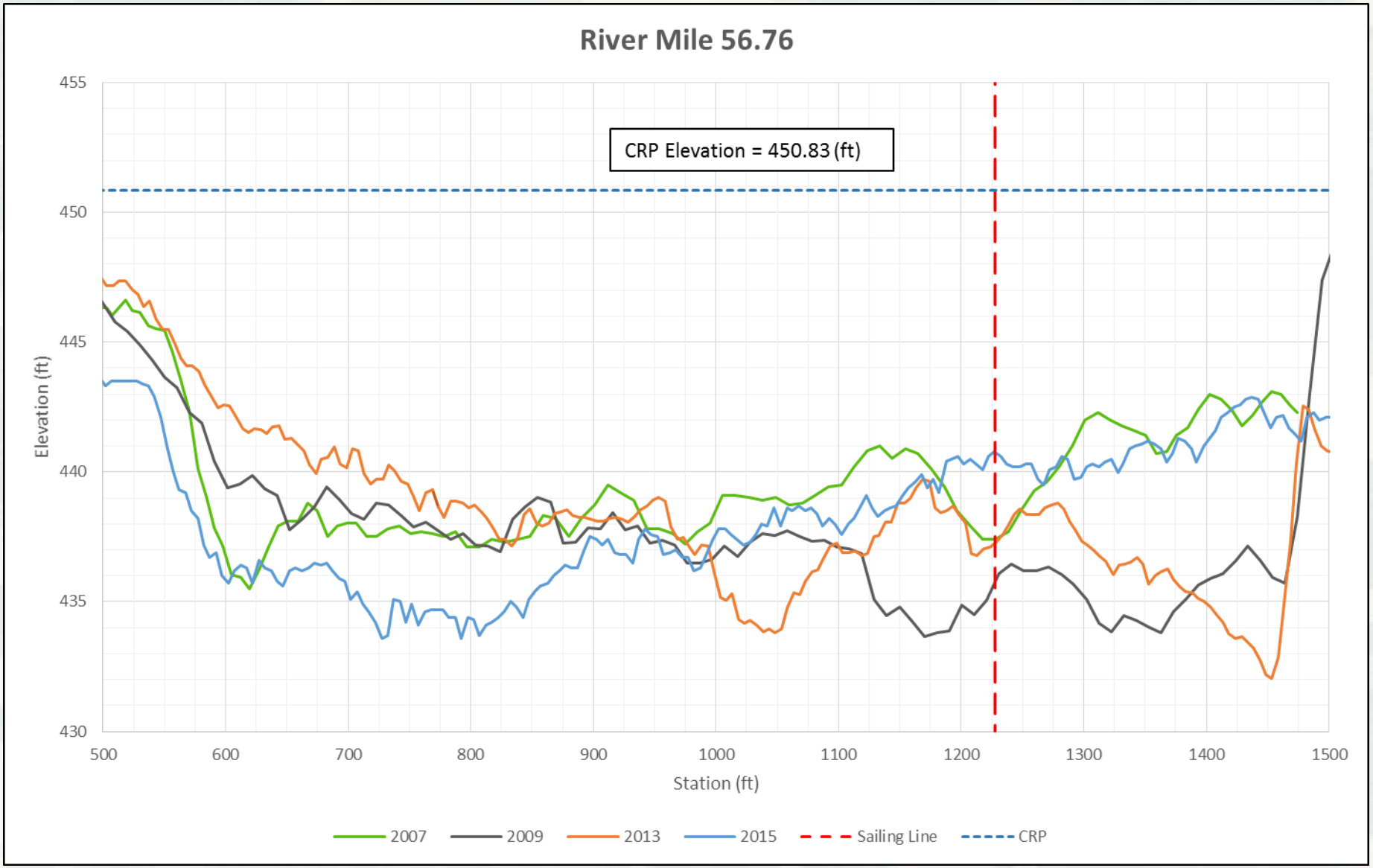
Area of Concern RM 25.5

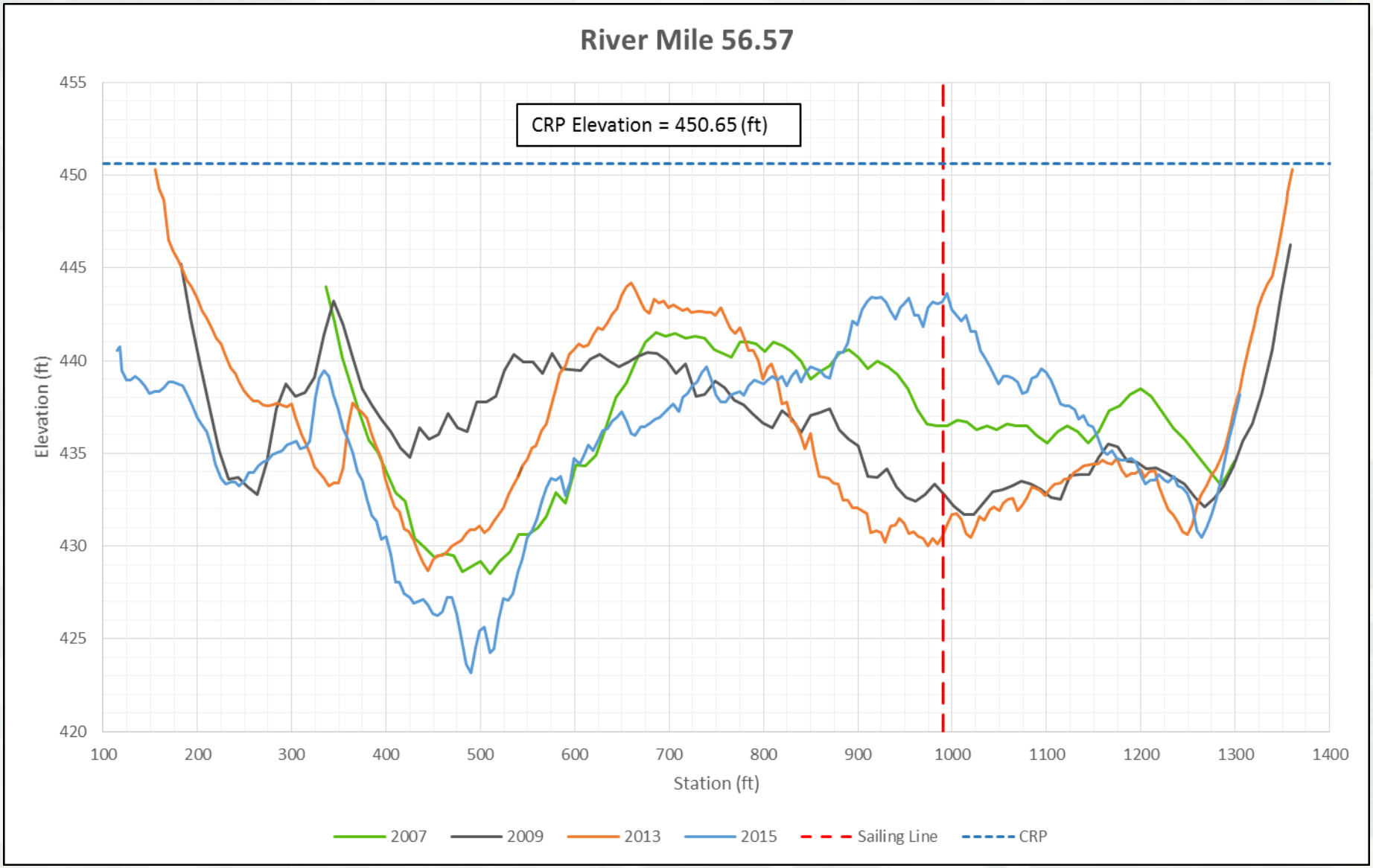


Area of Concern RM 57

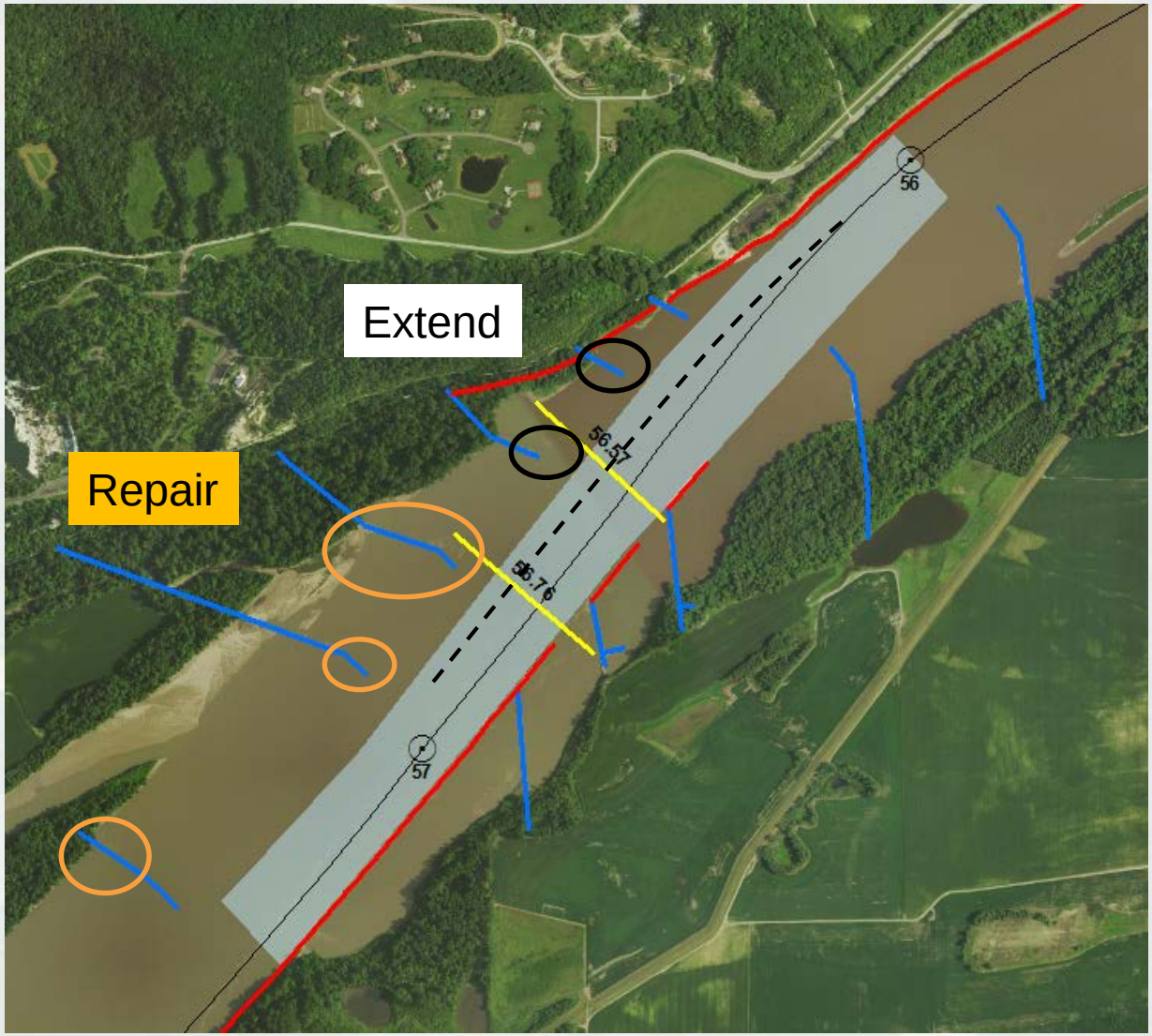


"Crossing is unstable"

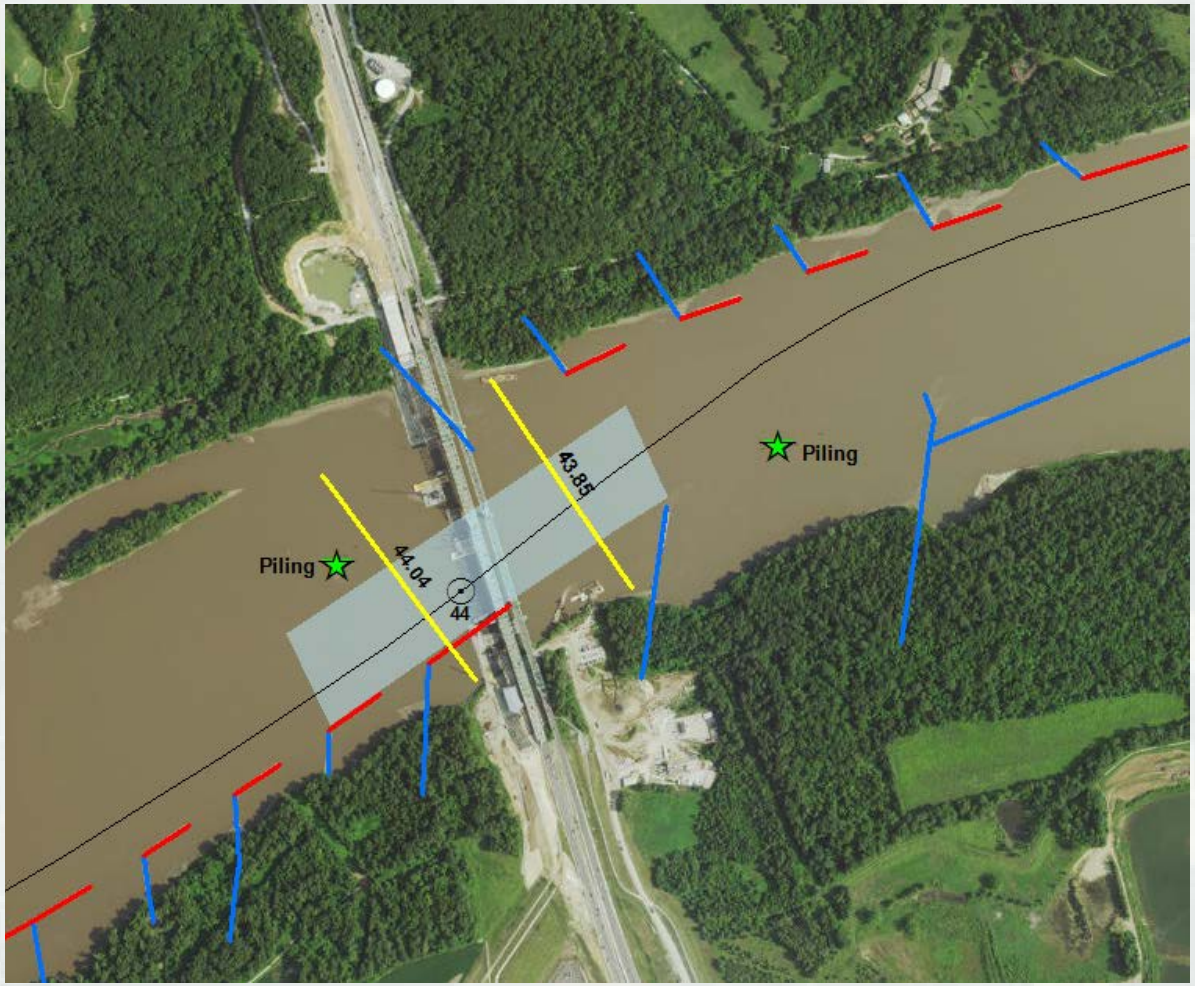

River Mile 56.76
CRP Elevation = 450.83 (ft)
455
450
445
440
435
430
Elevation (ft)
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP


River Mile 56.57
CRP Elevation = 450.65 (ft)
455
450
445
440
435
430
425
420
Elevation (ft)
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

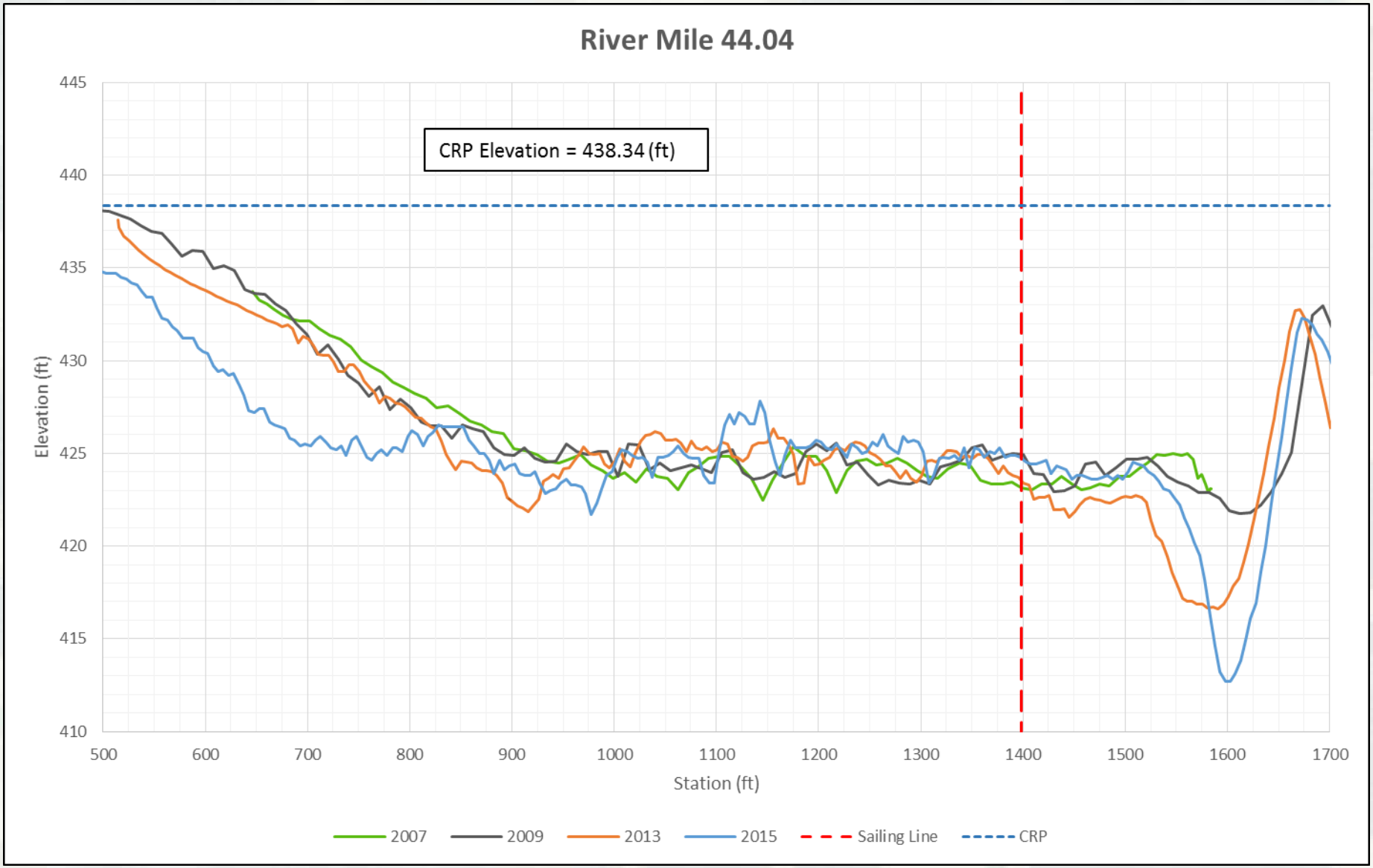
Area of Concern RM 57



Area of Concern RM 44



"Piling in river near Bridge. Right Side is Marked as Channel. Right descending bank shoals. 10' St. Charles gage will be problem. Wing dike notched DS of bridge"



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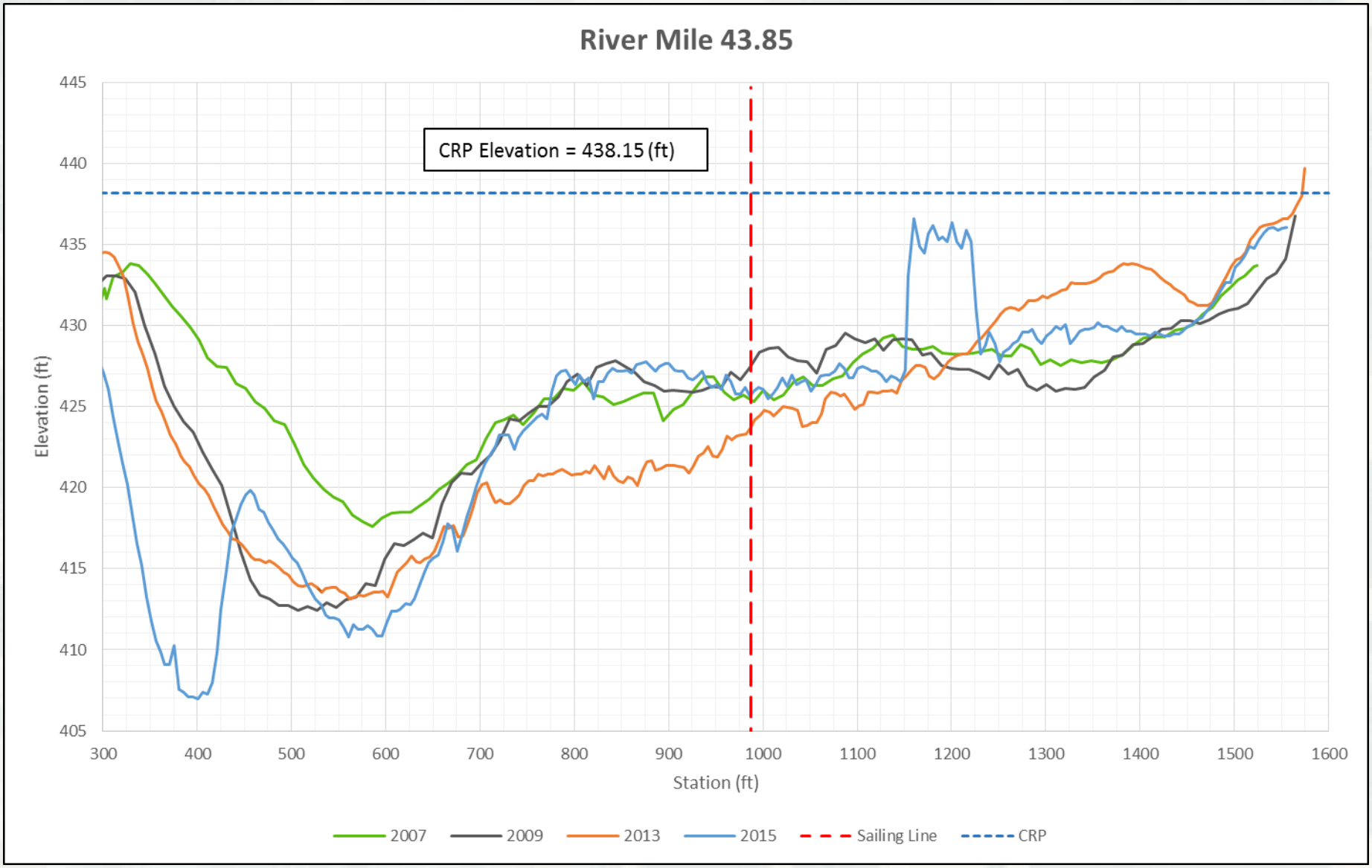
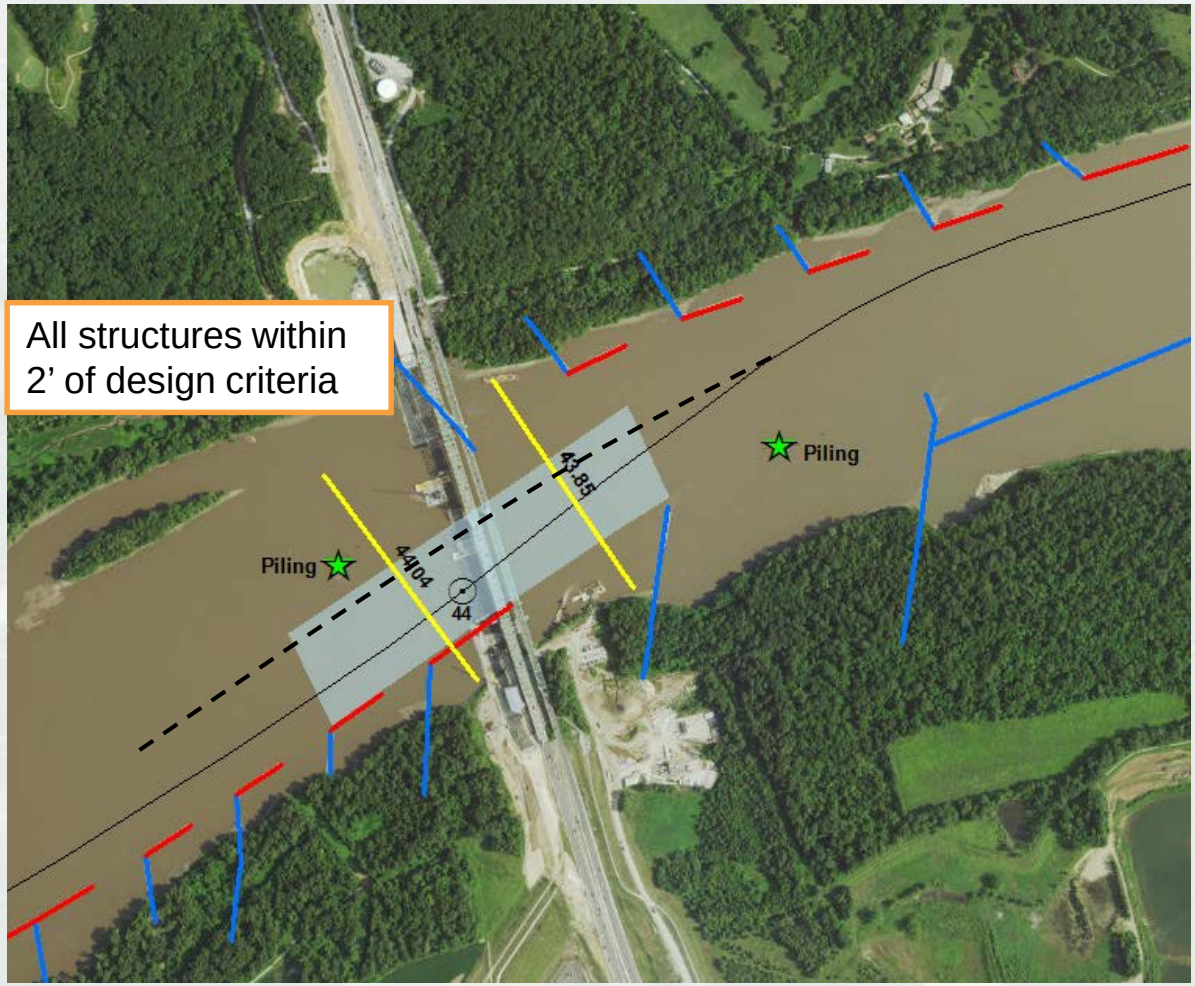
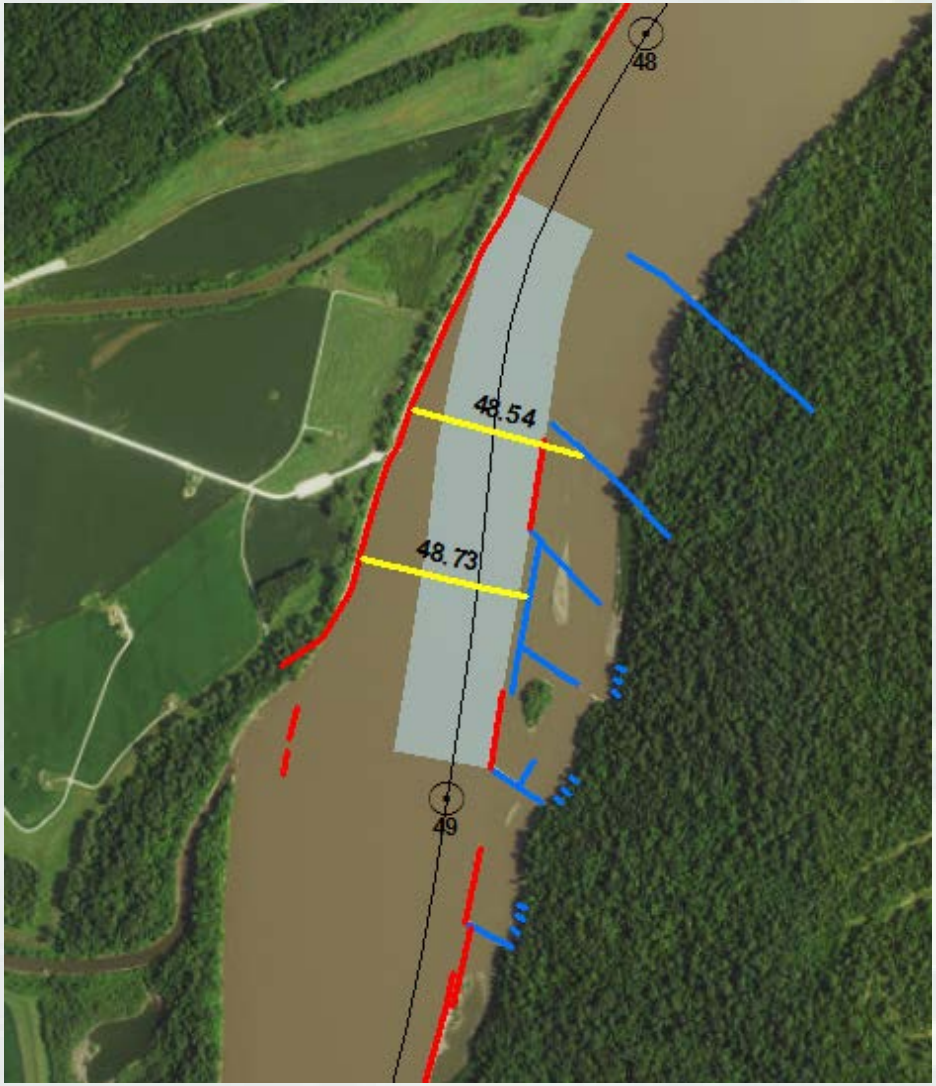

River Mile 43.85
CRP Elevation = 438.15 (ft)
445
440
435
430
425
420
415
410
405
Elevation (ft)
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

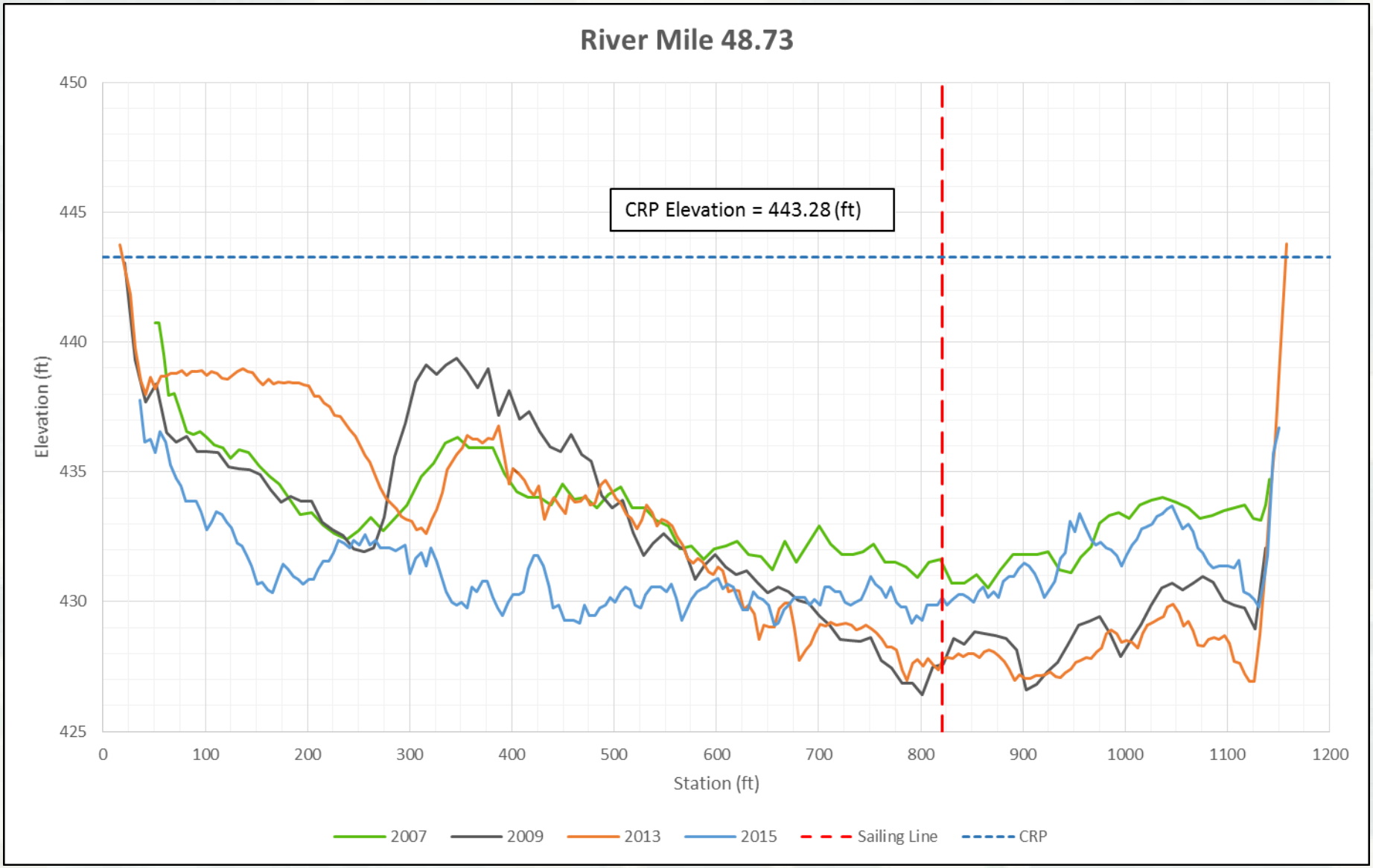
Area of Concern RM 44

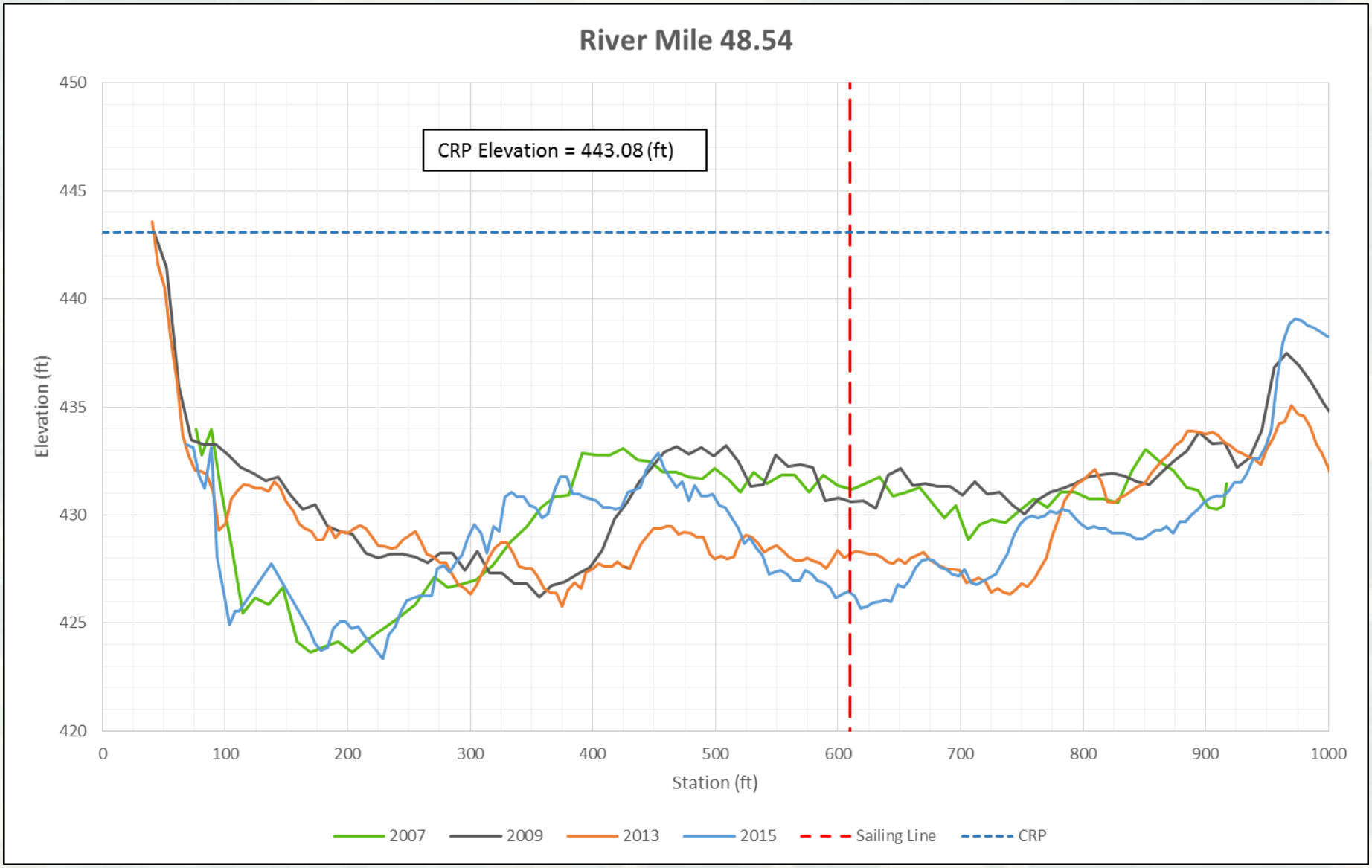


Area of Concern RM 48.5



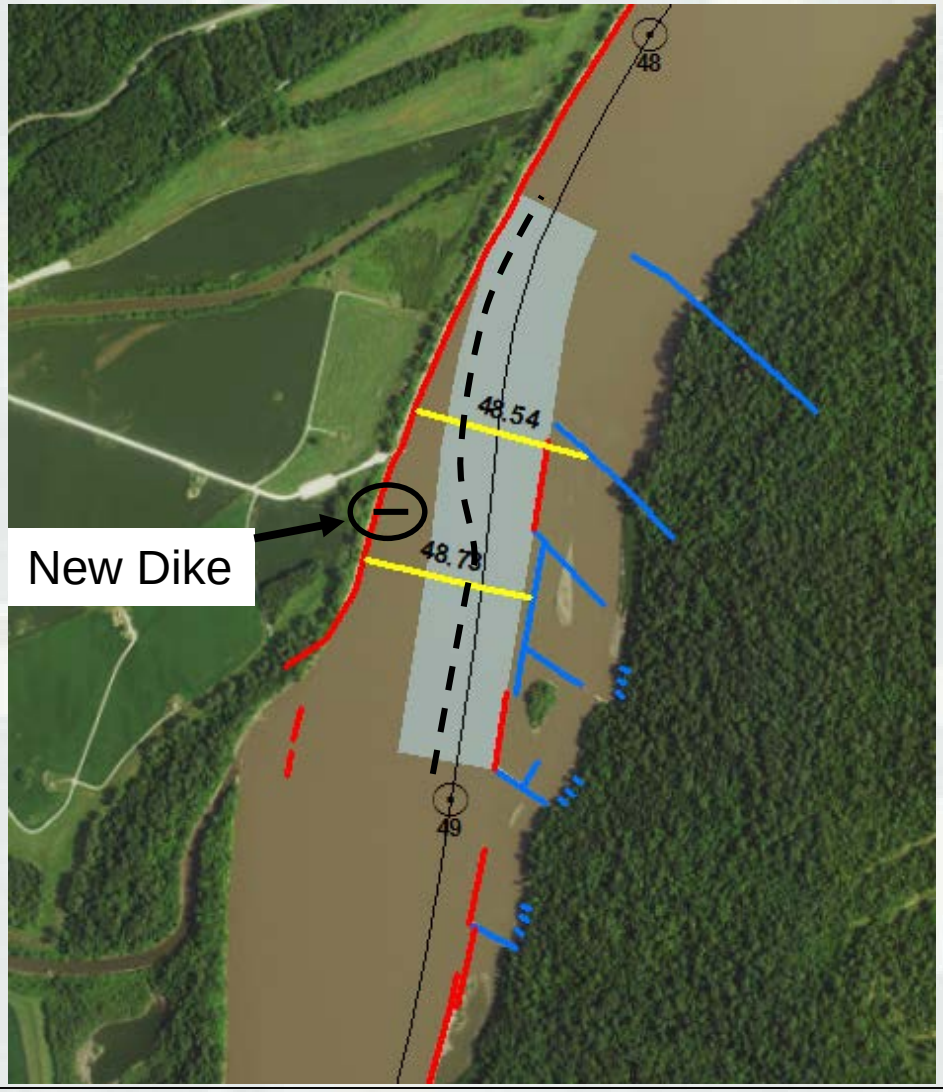
"Shallower than in past. Flushed out currently. When the river drops from high to low, the crossing fills in"


River Mile 48.73
CRP Elevation = 443.28 (ft)
Elevation (ft)
Station (ft)
450
445
440
435
430
425
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
2007
2009
2013
2015
Sailing Line
CRP

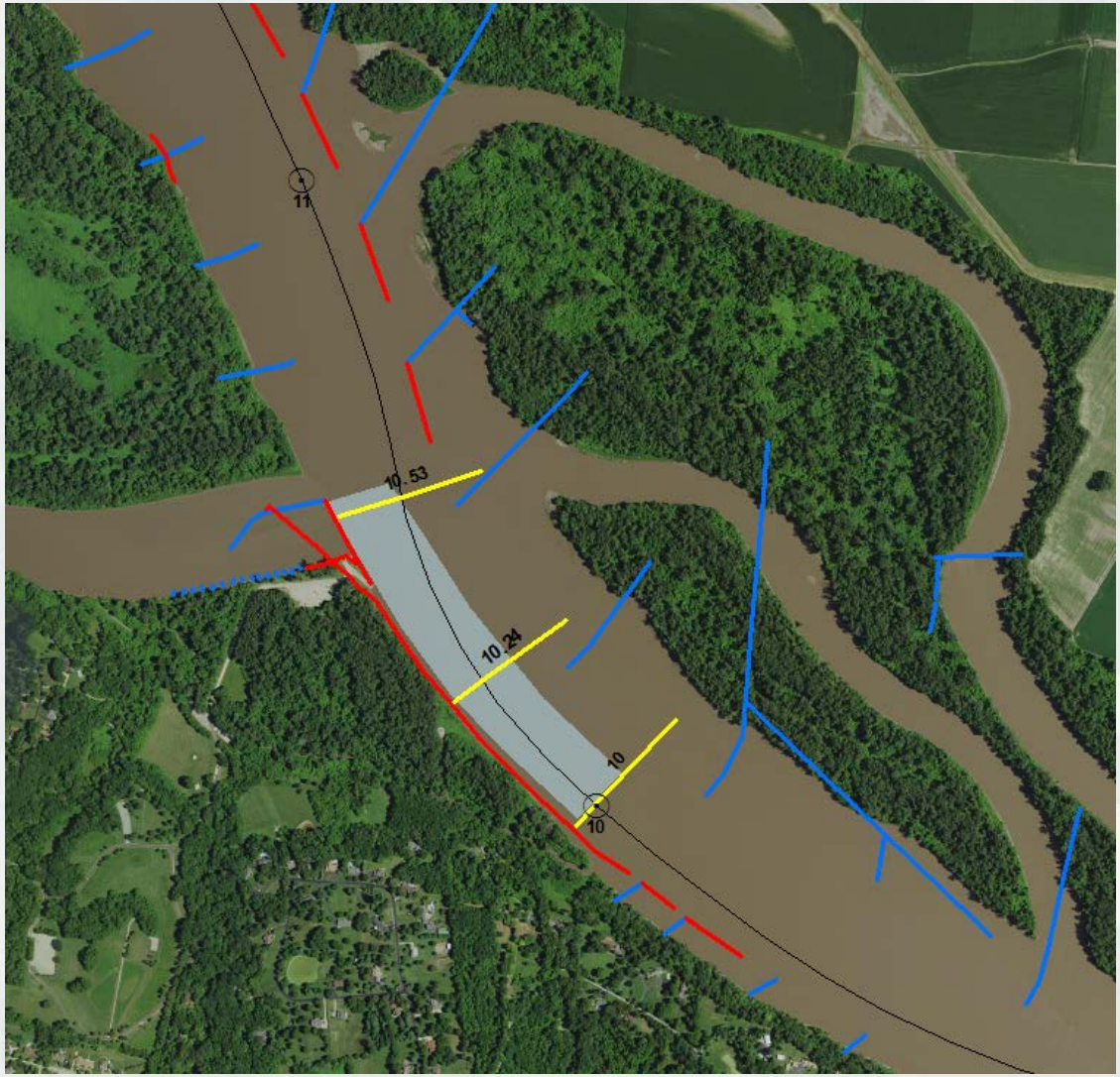

River Mile 48.54
CRP Elevation = 443.08 (ft)
450
445
440
435
430
425
420
Elevation (ft)
0
100
200
300
400
500
600
700
800
900
1000
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

Area of Concern RM 48.5

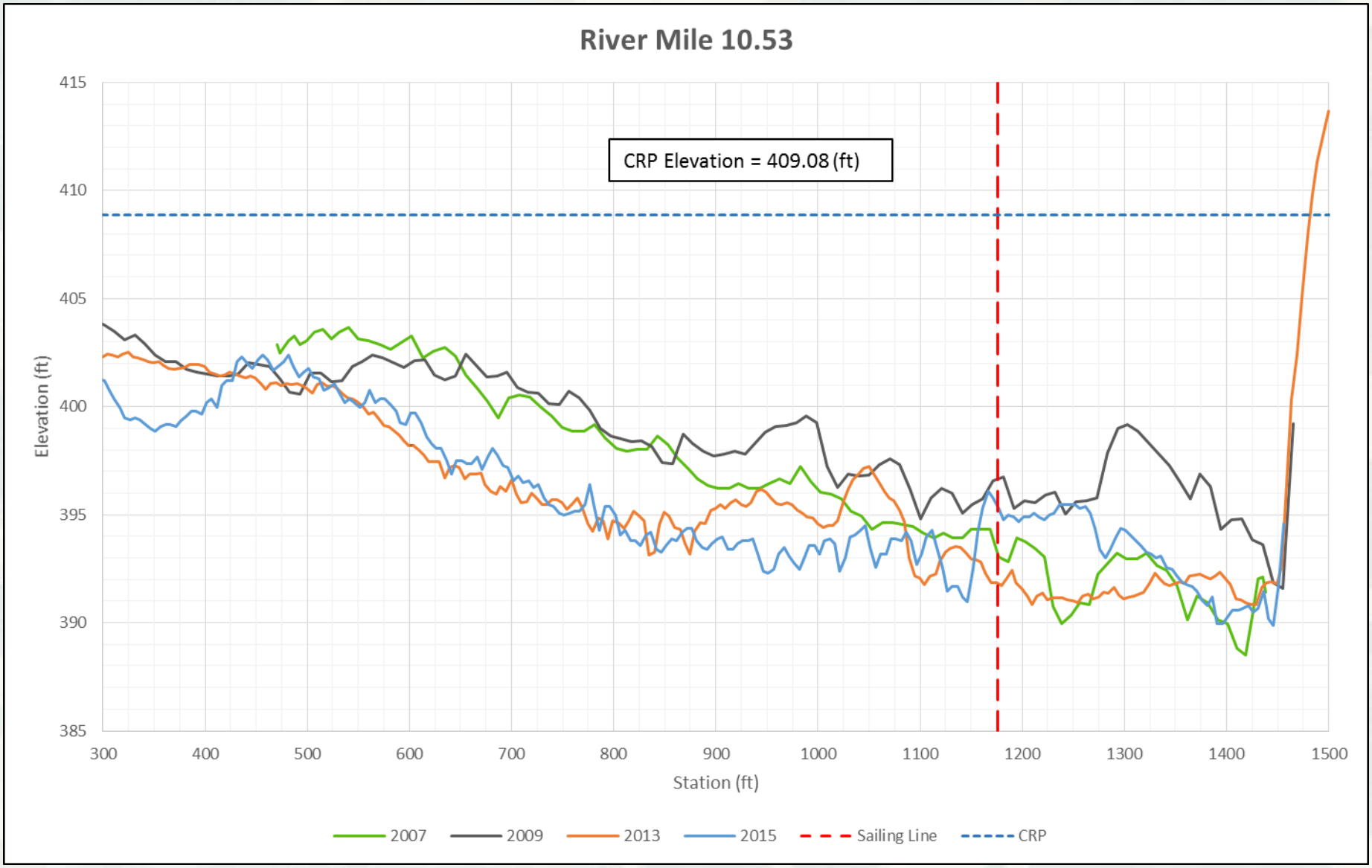
All structures within 2’ of design criteria.

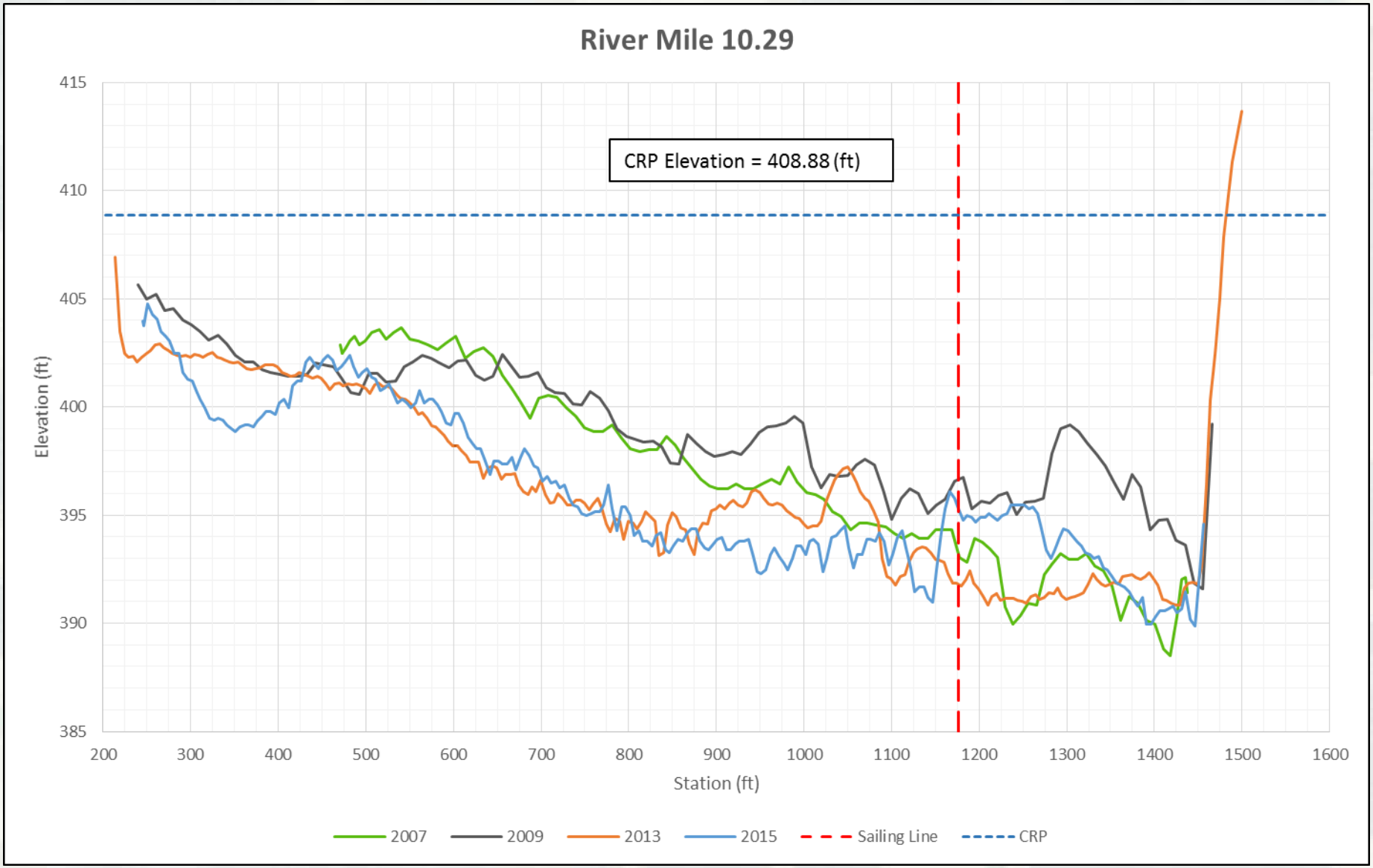


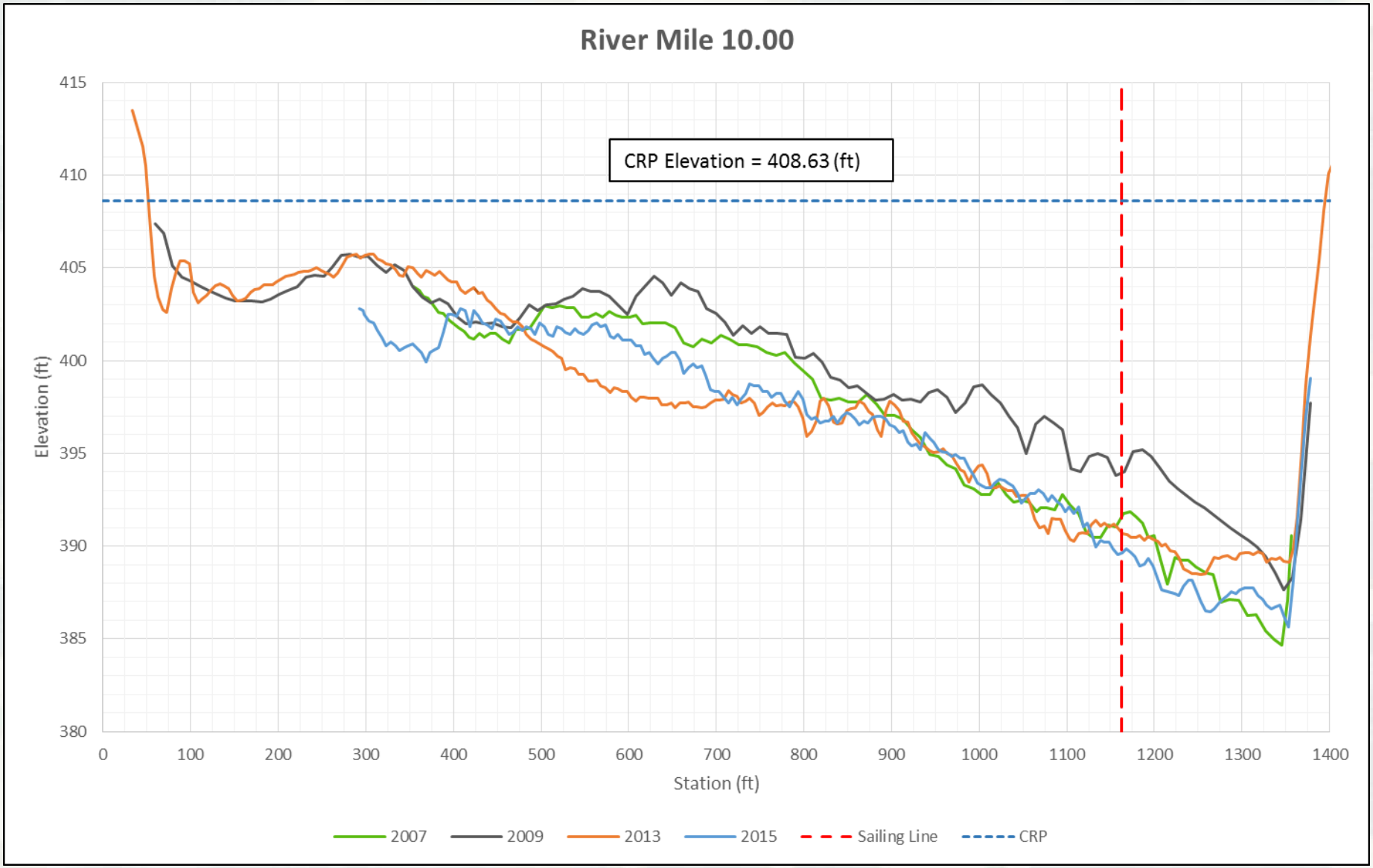
Area of Concern RM 10-10.5



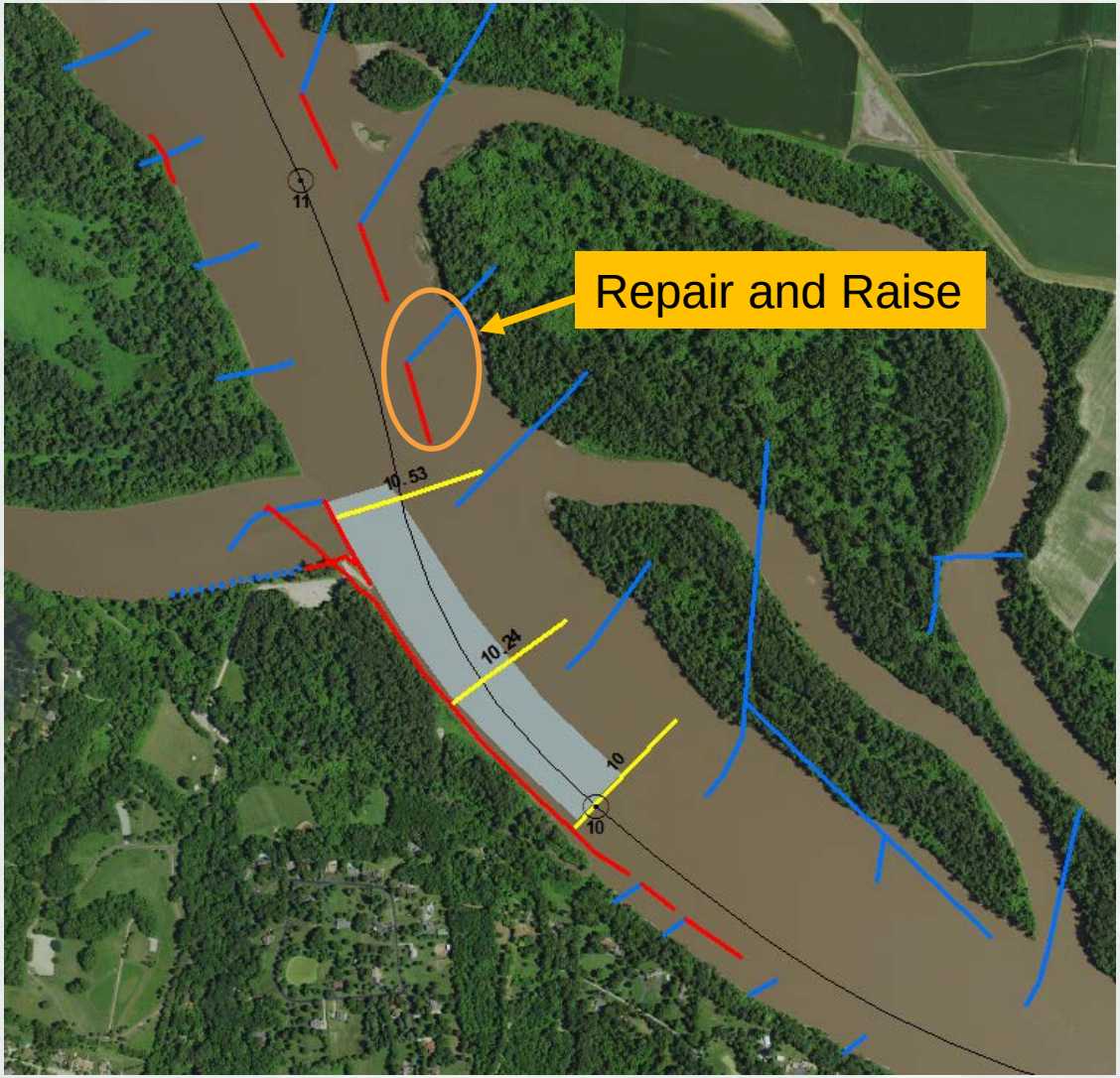
"Historic problem area, close to chute exit. Check new dike at bridge and sills in area"


River Mile 10.53
CRP Elevation = 409.08 (ft)
Elevation (ft)
415
410
405
400
395
390
385
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

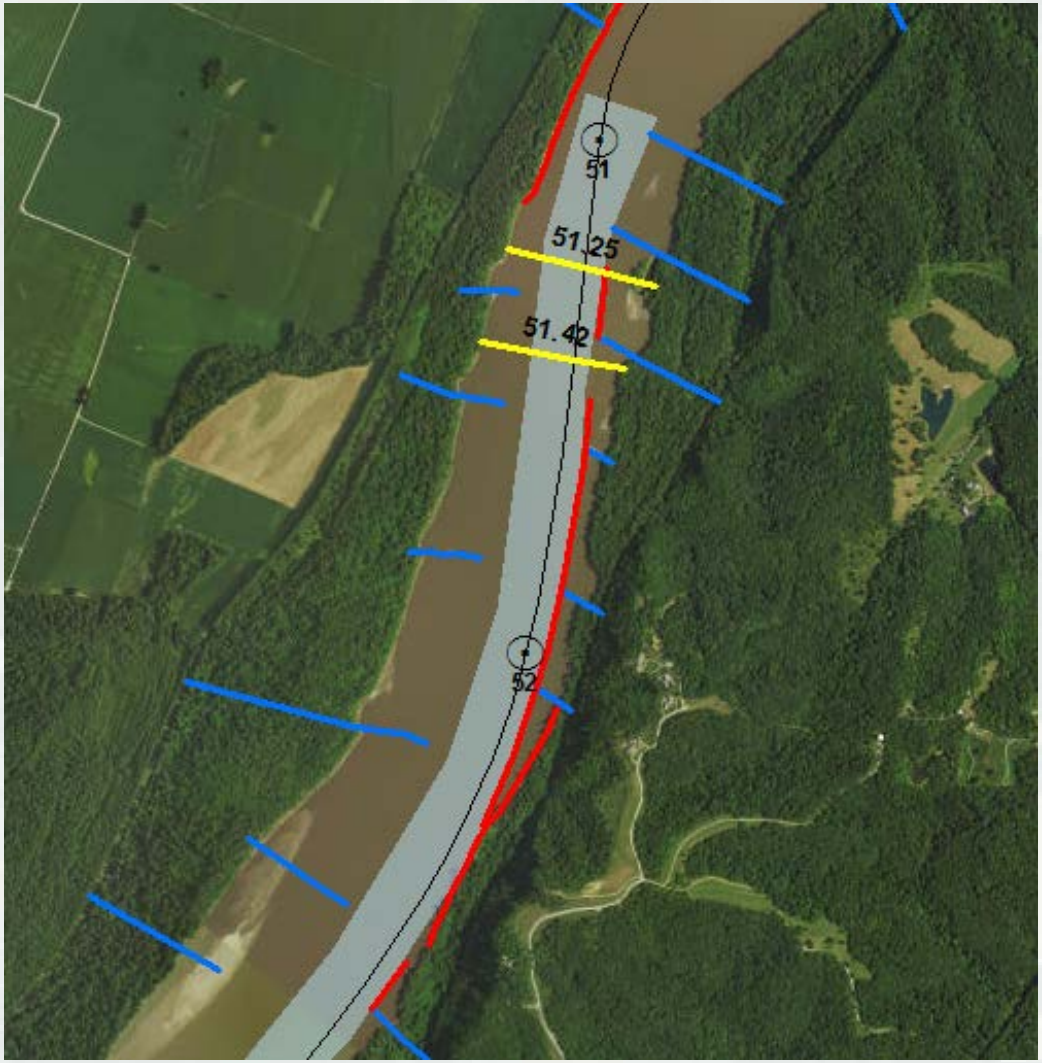

River Mile 10.29
CRP Elevation = 408.88 (ft)
Elevation (ft)
415
410
405
400
395
390
385
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP


River Mile 10.00
CRP Elevation = 408.63 (ft)
Elevation (ft)
415
410
405
400
395
390
385
380
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

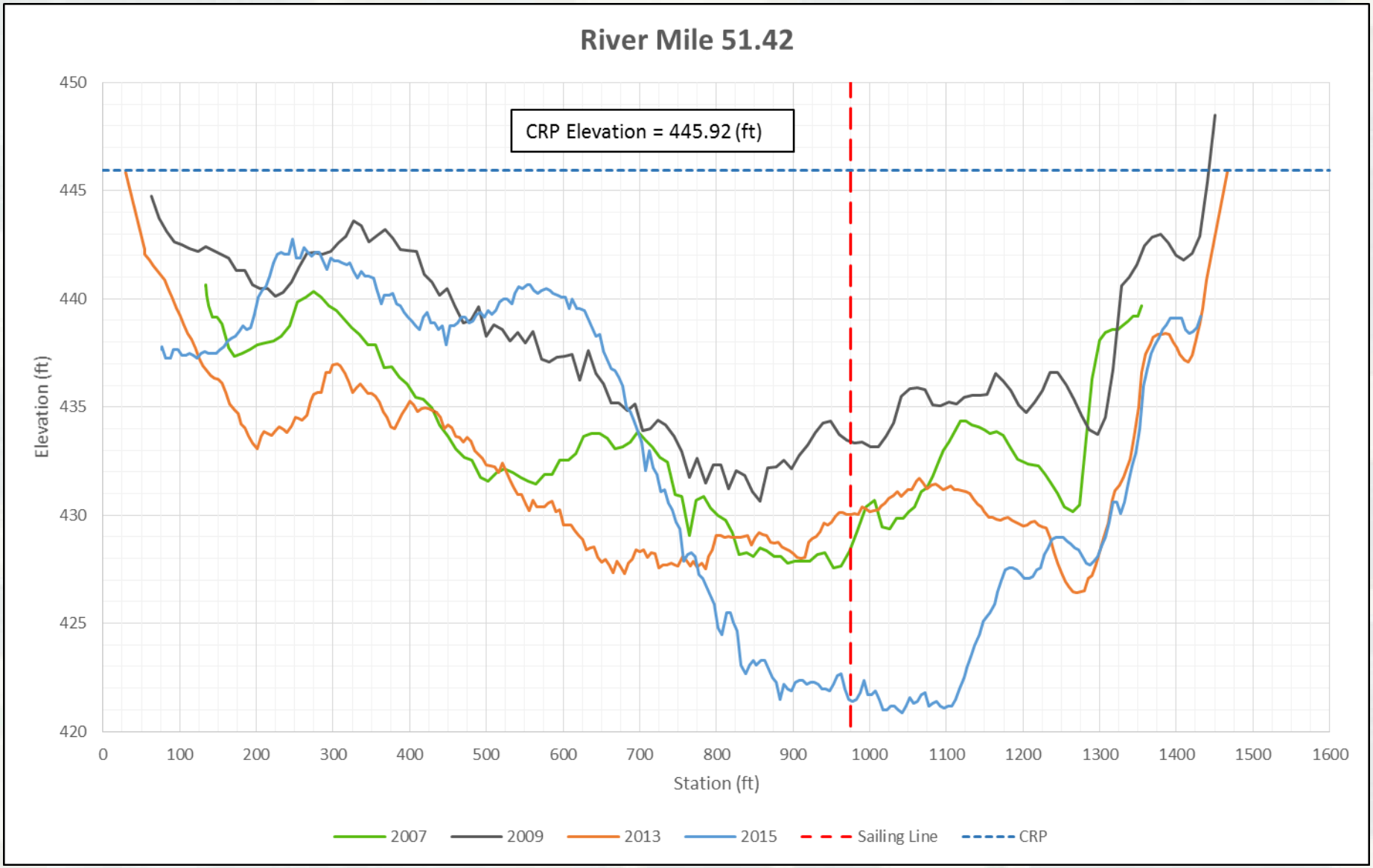
Area of Concern RM 10-10.5

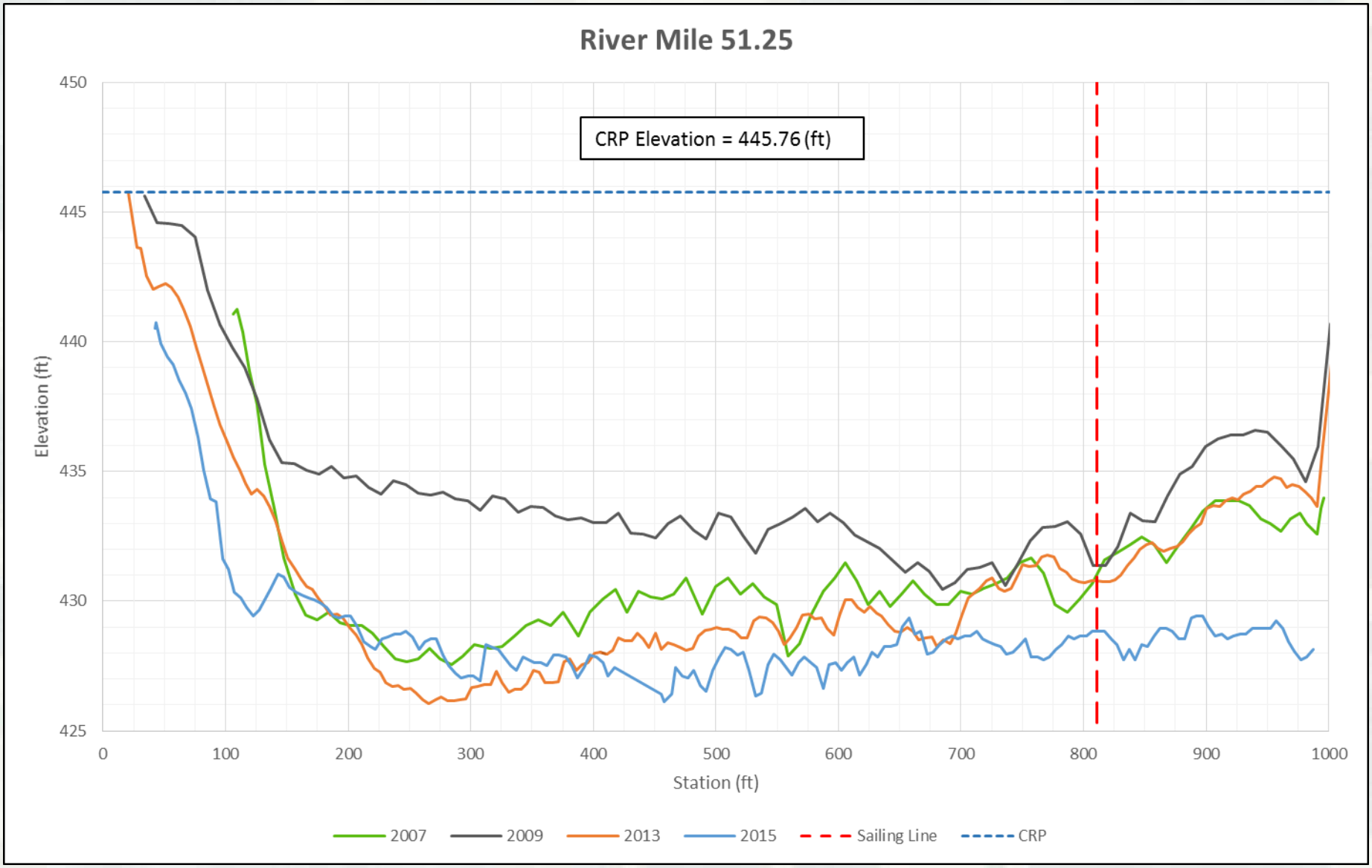


Area of Concern RM 51 - 53

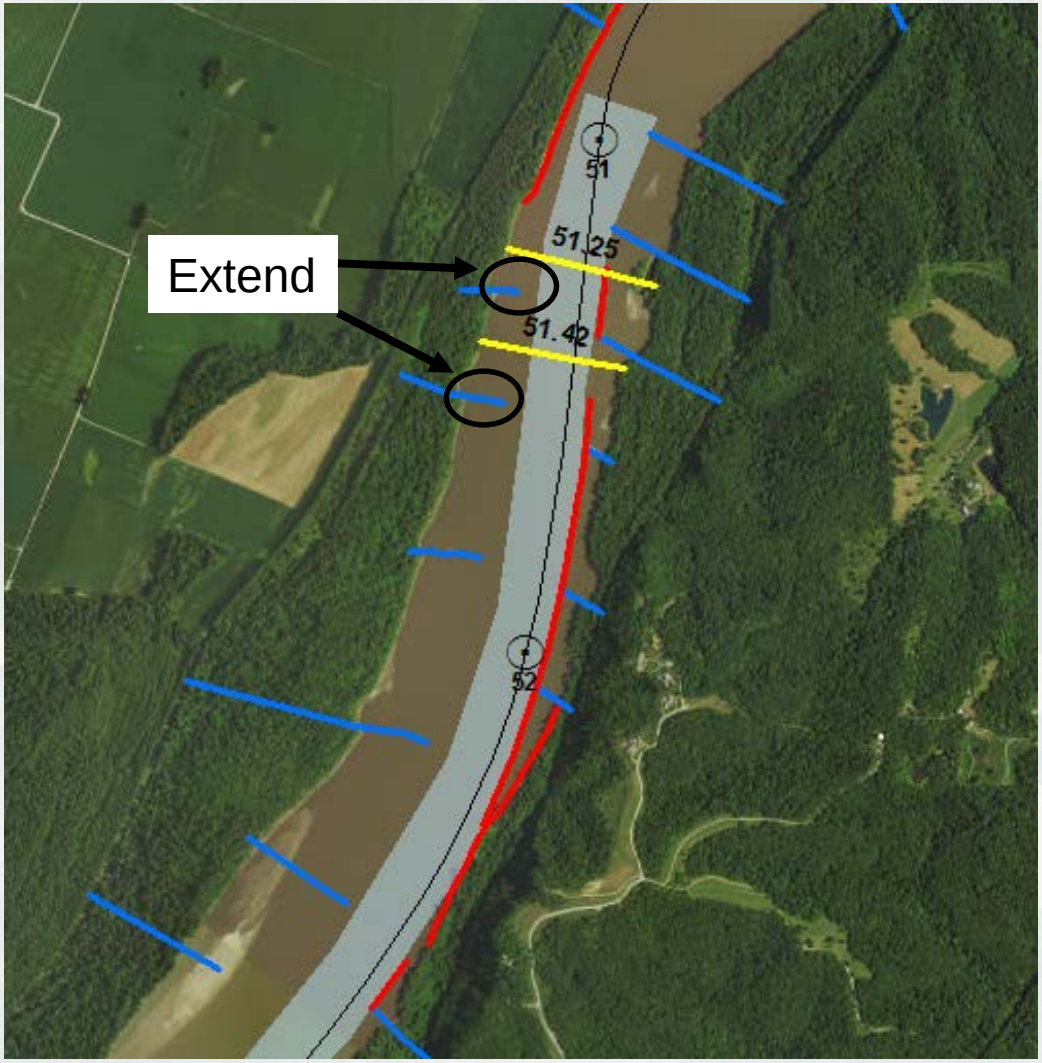


"Crossing unstable."


River Mile 51.42
CRP Elevation = 445.92 (ft)
Elevation (ft)
Station (ft)
450
445
440
435
430
425
420
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
2007
2009
2013
2015
Sailing Line
CRP


River Mile 51.25
CRP Elevation = 445.76 (ft)
450
445
440
435
430
425
Elevation (ft)
0
100
200
300
400
500
600
700
800
900
1000
Station (ft)
2007
2009
2013
2015
Sailing Line
CRP

Area of Concern RM 51 - 53



All structures within 2’ of design criteria.

Results

Current verse Recalculated Structure Height				
	% Exceedance	Current	Recalculated	Height Difference
Hermann	Crossing Control	6	10	4
	Outside dike, Revetment	5	7	2
	Inside dike, L-head	2	2	0
	Sill	-1	-3	-2
Boonville	Crossing Control	5	7	2
	Outside dike, Revetment	4	5	1
	Inside dike, L-head	2	2	0
	Sill	-2	-2	0
Waverly	Crossing Control	4	6	2
	Outside dike, Revetment	3	4	1
	Inside dike, L-head	1	2	1
	Sill	-2	-2	0
St. Joe	Crossing Control	4	4	0
	Outside dike, Revetment	3	3	0
	Inside dike, L-head	1	1	0
	Sill	-2	-3	-1