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Shaping the Region for 50 Years.

North Dakota Legislative Management
Water-Related Topics Overview Committee
April 19, 2012

Consulting Engineering • Land Surveying

West Fargo, ND • Fergus Falls, MN

North Dakota Wild Rice River Watershed Study

Joint Effort!

Richland County Water Resource District
Southeast Cass Water Resource District

Formation of Joint Board – WRD's Working Together!

Acknowledgements: Houston Engineering & Barr Engineering

North Dakota Wild Rice River Watershed Study

- CONCLUSIONS
- BACKGROUND
- HISTORIC EVENTS
- RETENTION
- MODELING
- CONCLUSIONS

CONCLUSIONS

- The historic record of Wild Rice floods shows a repeating pattern of similarity. This includes 2009, 2010, and 2011. There is 1 exception.

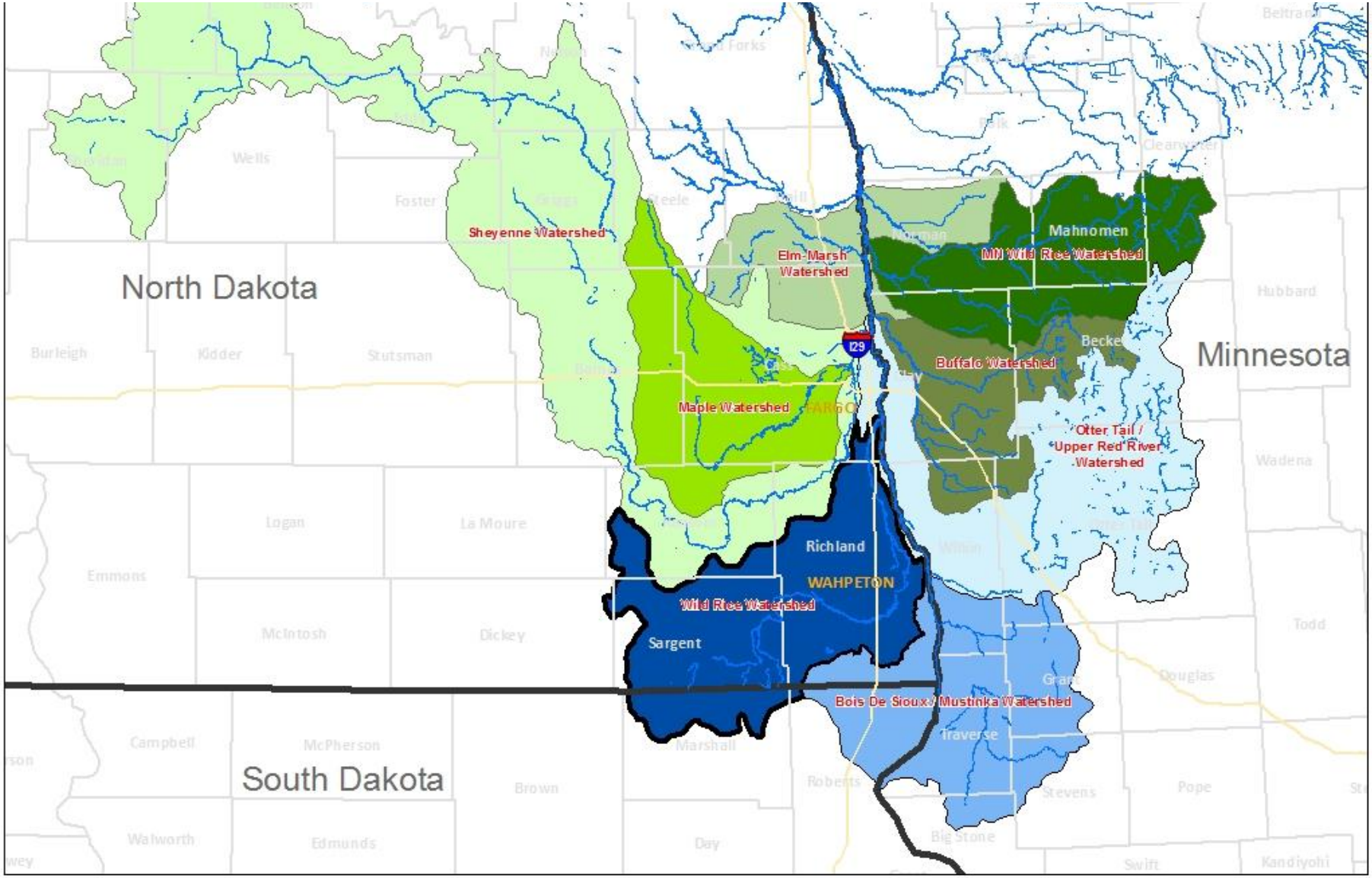
- 1997 flood is significantly different; it is **not** typical.

- Modeling shows the **Upper** Wild Rice Watershed does **not** contribute to the Red River crest at Fargo. Timing!

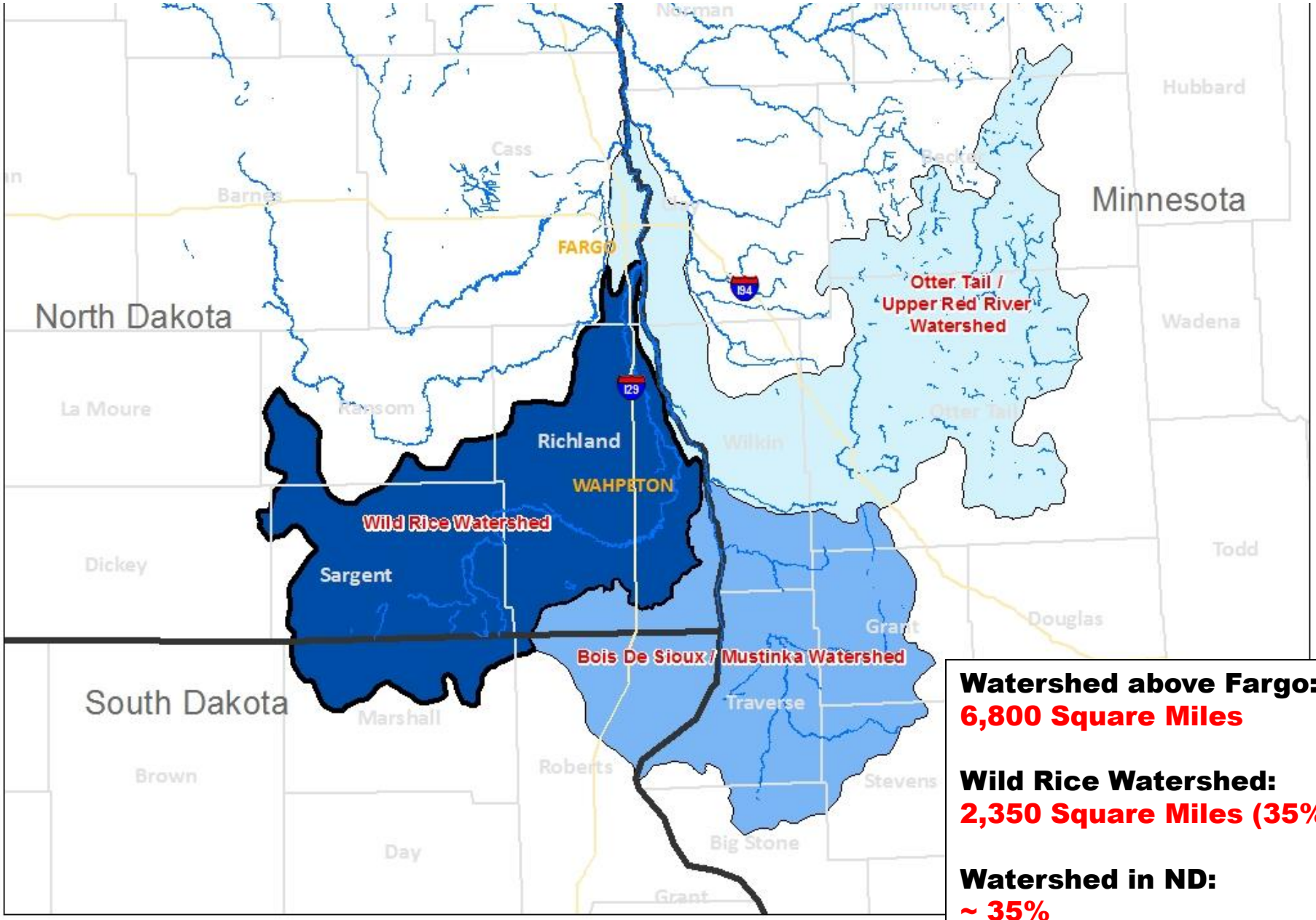
- Wild Rice Retention modeling shows strong potential for local benefits within Richland County.

- Wild Rice Retention modeling shows minimal benefit to the Red River at Fargo.

UPPER RED RIVER WATERSHED HEC-HMS MODEL
LiDAR based Hydrologic Model



Watershed Upstream of Fargo

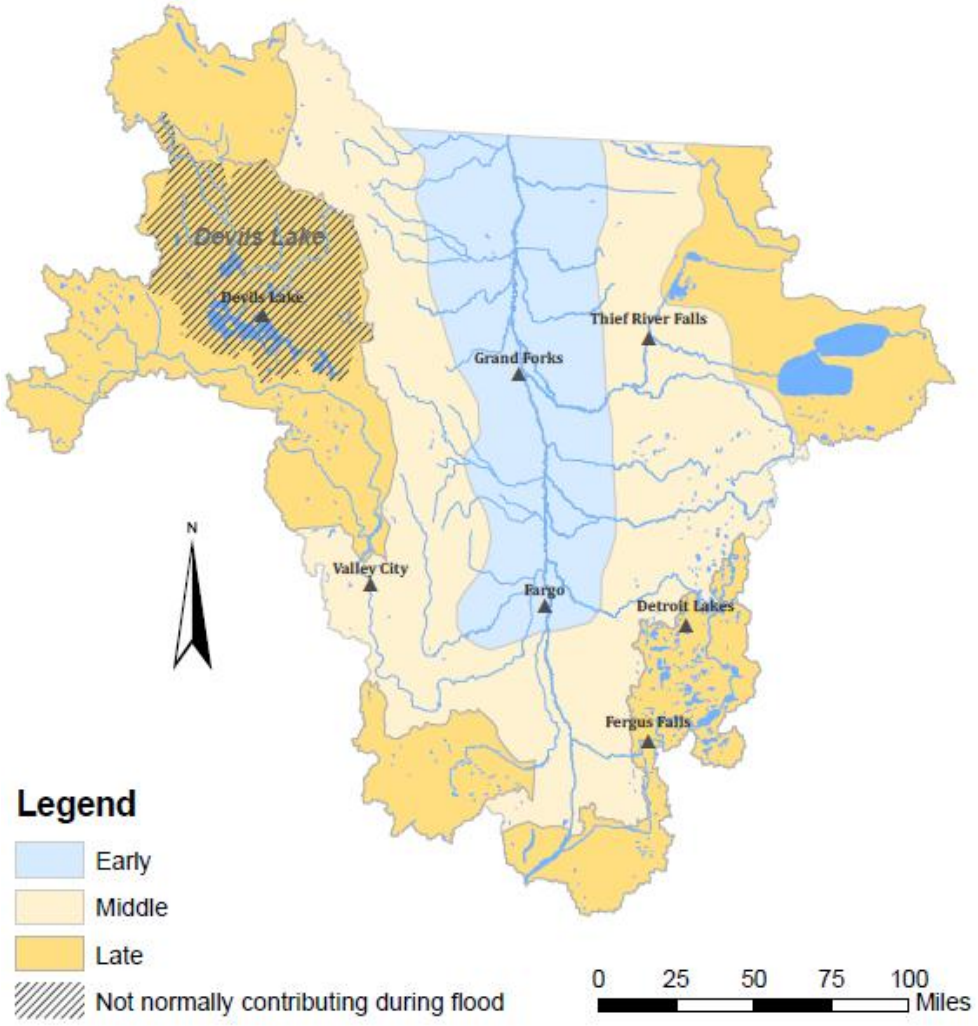


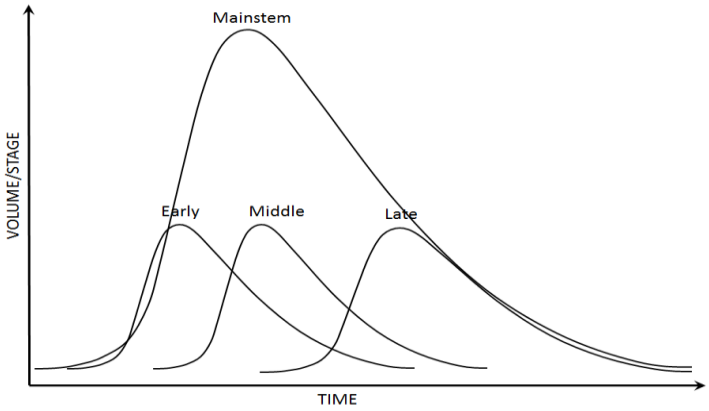
Watershed above Fargo:
6,800 Square Miles

Wild Rice Watershed:
2,350 Square Miles (35%)

Watershed in ND:
~ 35%

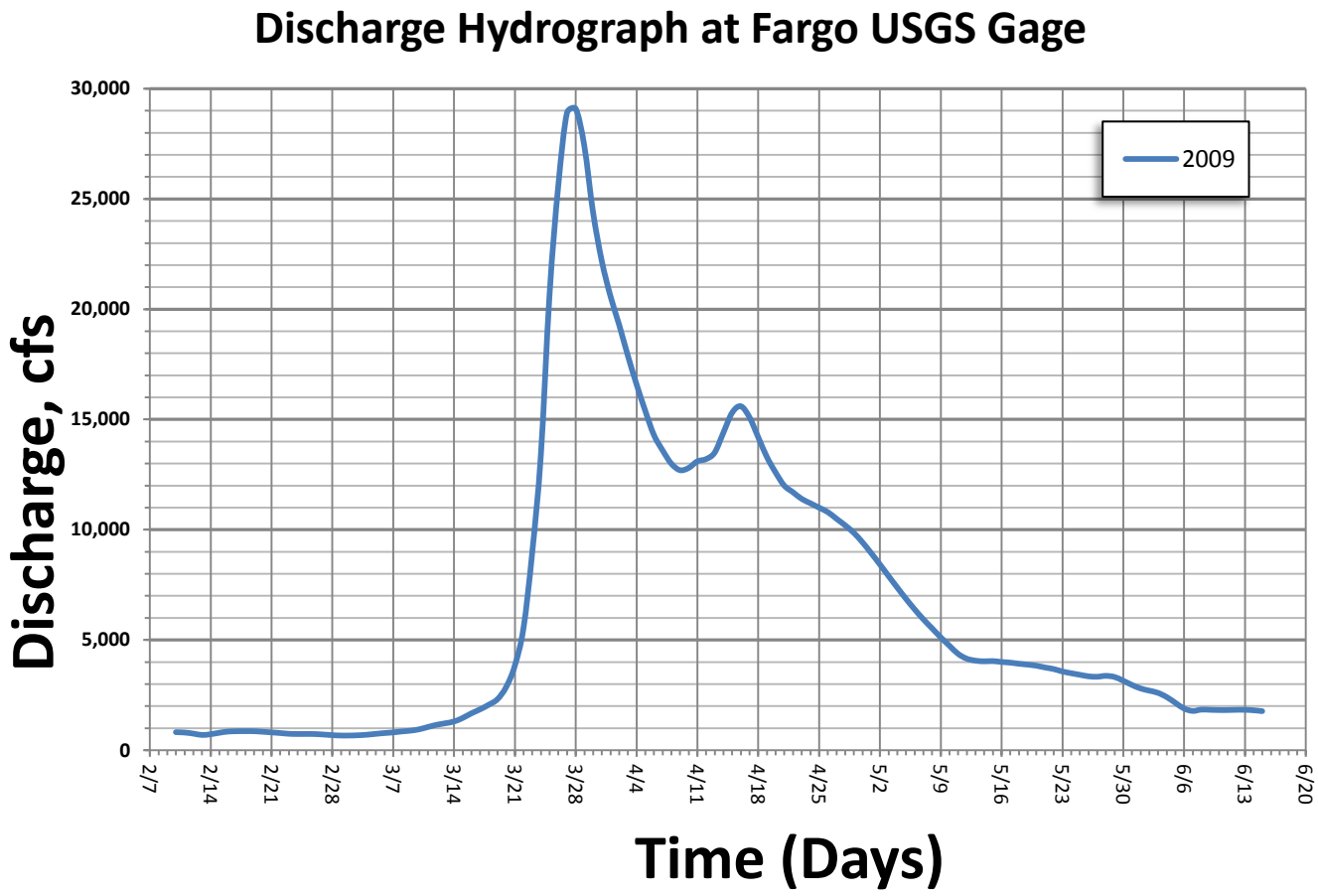
Early, Middle, and Late Water Concept



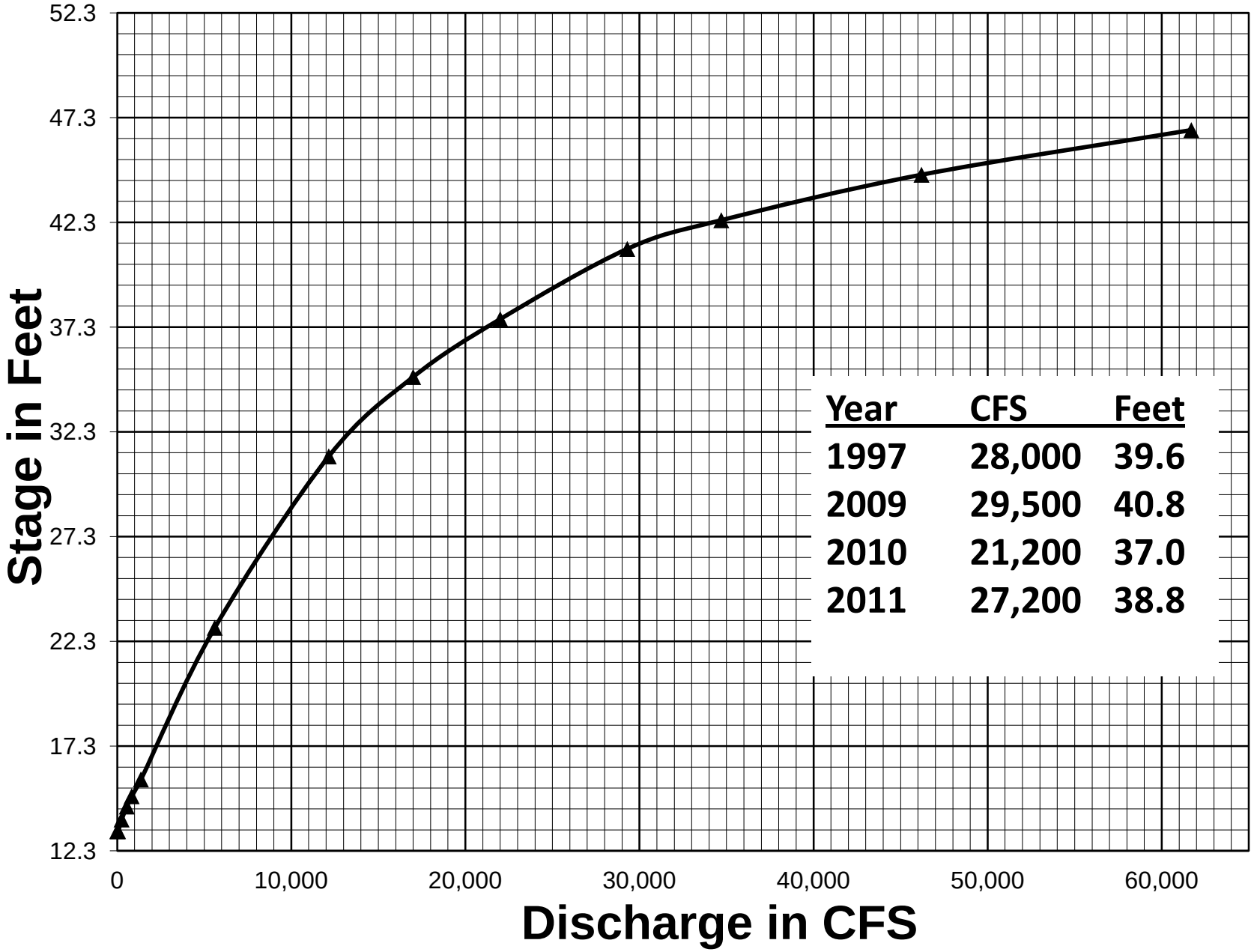


TIMING

What is a Hydrograph?



FARGO GAGE – RATING CURVE



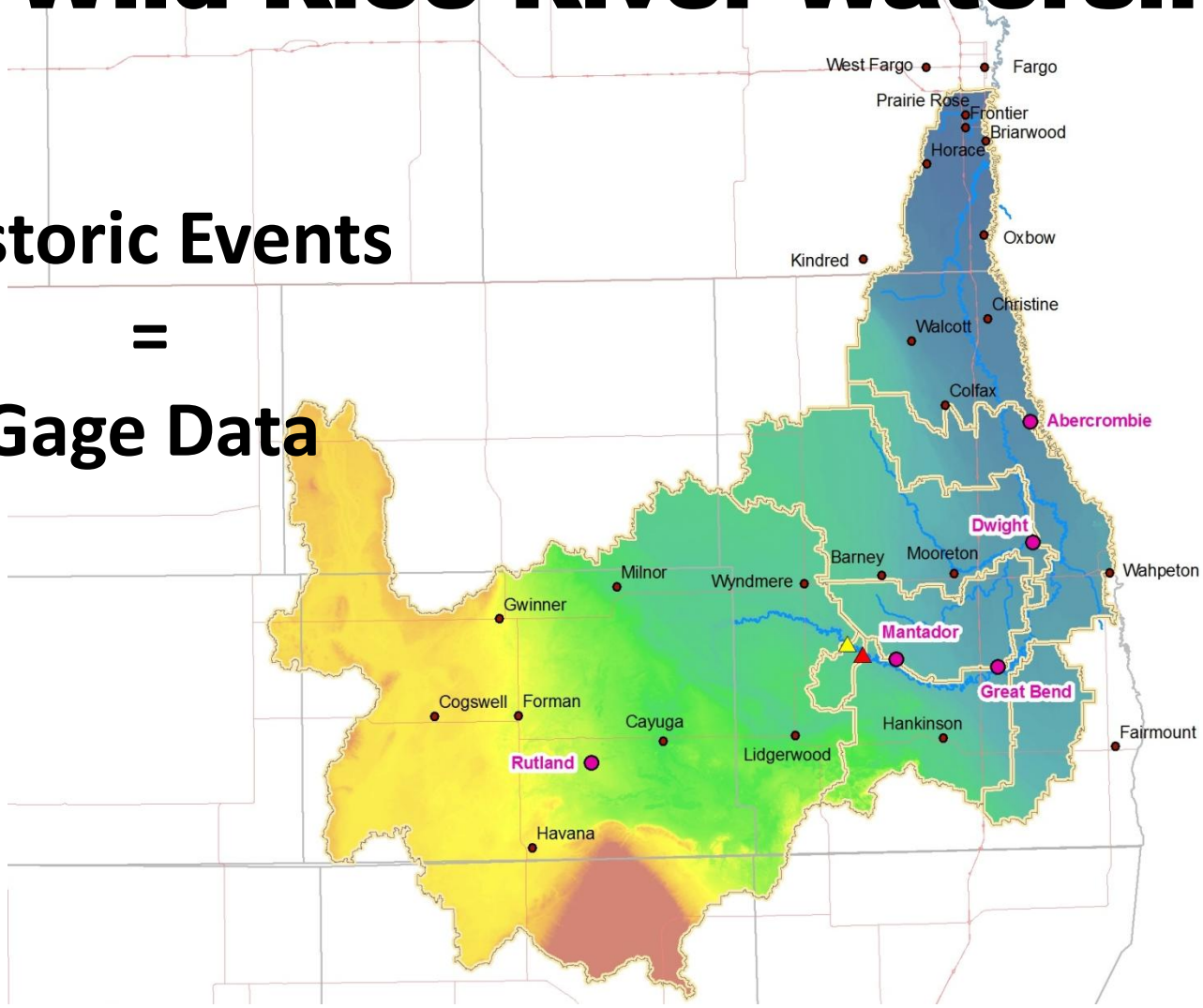
Year	CFS	Feet
1997	28,000	39.6
2009	29,500	40.8
2010	21,200	37.0
2011	27,200	38.8

Wild Rice River Watershed

Historic Events

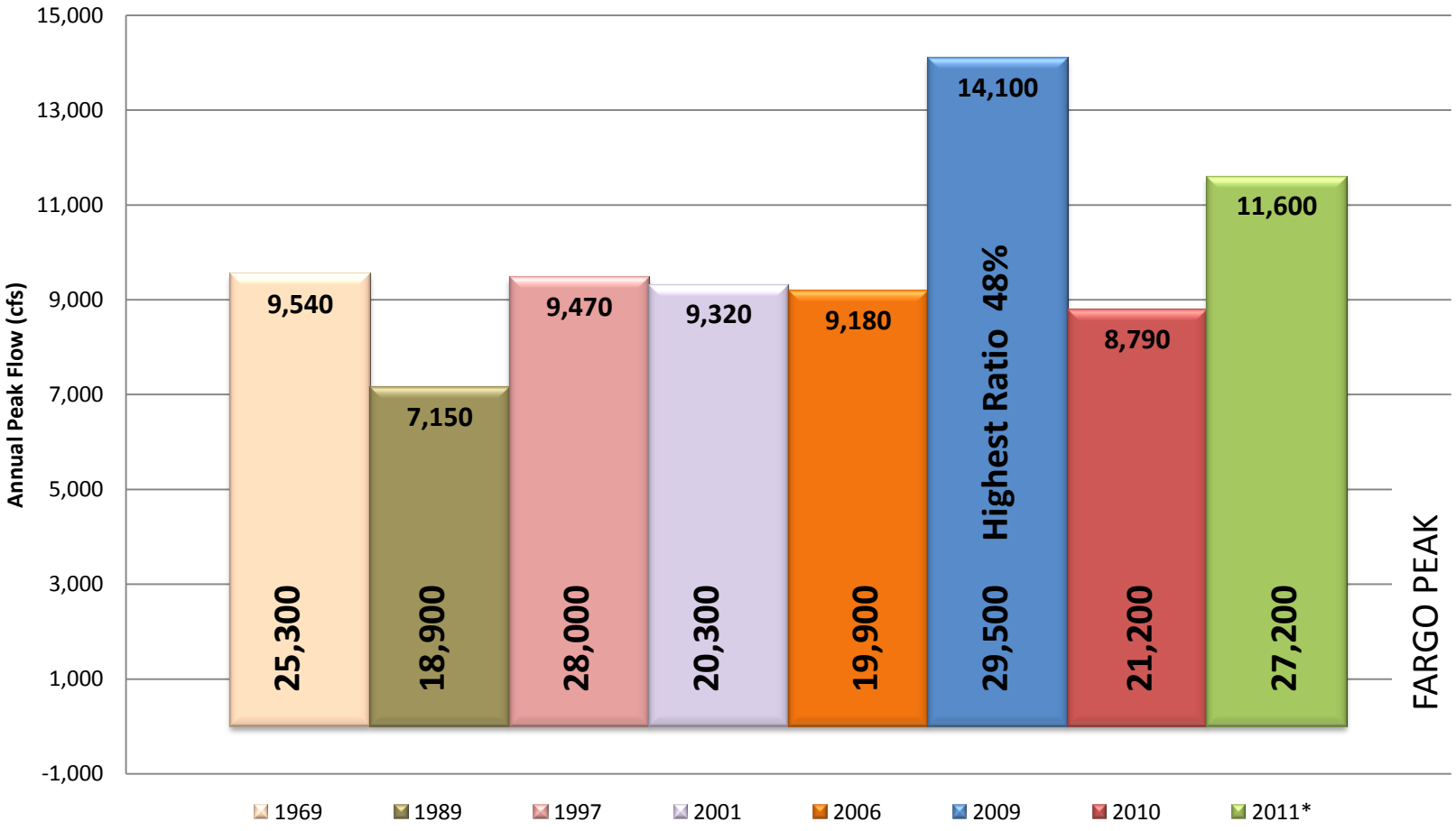
=

Gage Data



Wild Rice River at Abercrombie

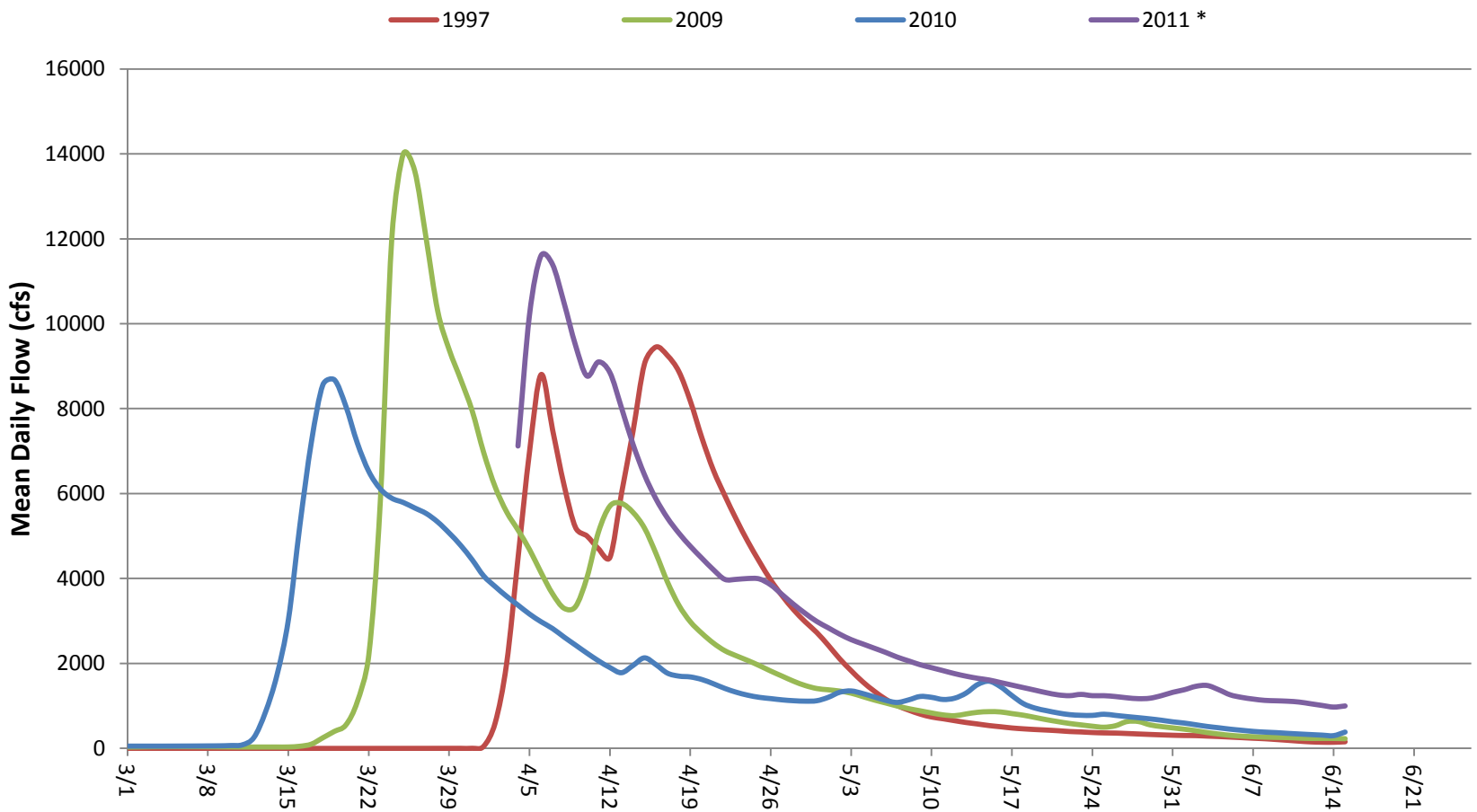
USGS: 05053000



USGS Data collected from their website: www.usgs.gov

Abercrombie Hydrograph Comparison

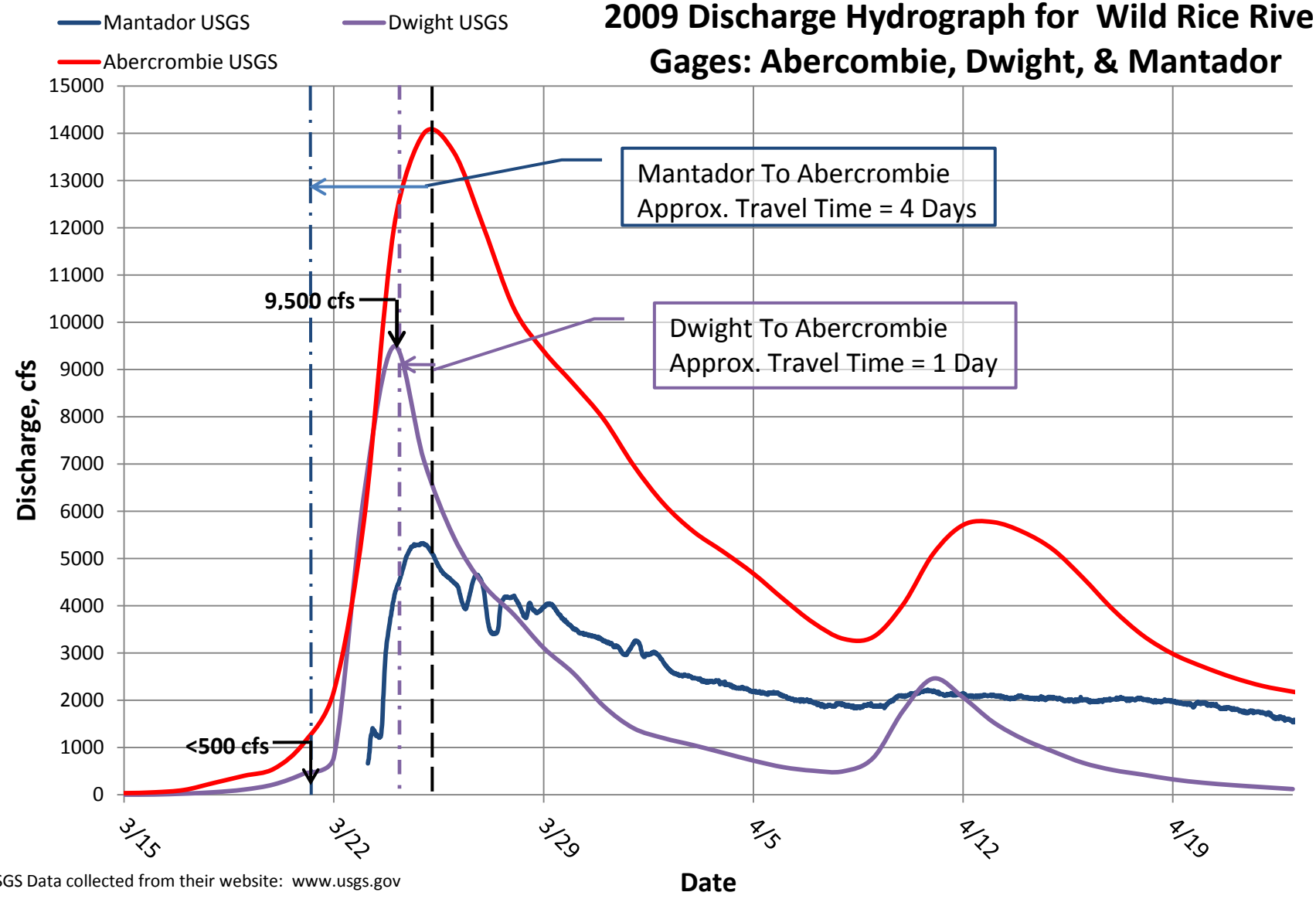
USGS Gage: 05053000



* - 2011 data is provisional

USGS Data collected from their website: www.usgs.gov

2009 Discharge Hydrograph for Wild Rice River Gages: Abercombie, Dwight, & Mantador



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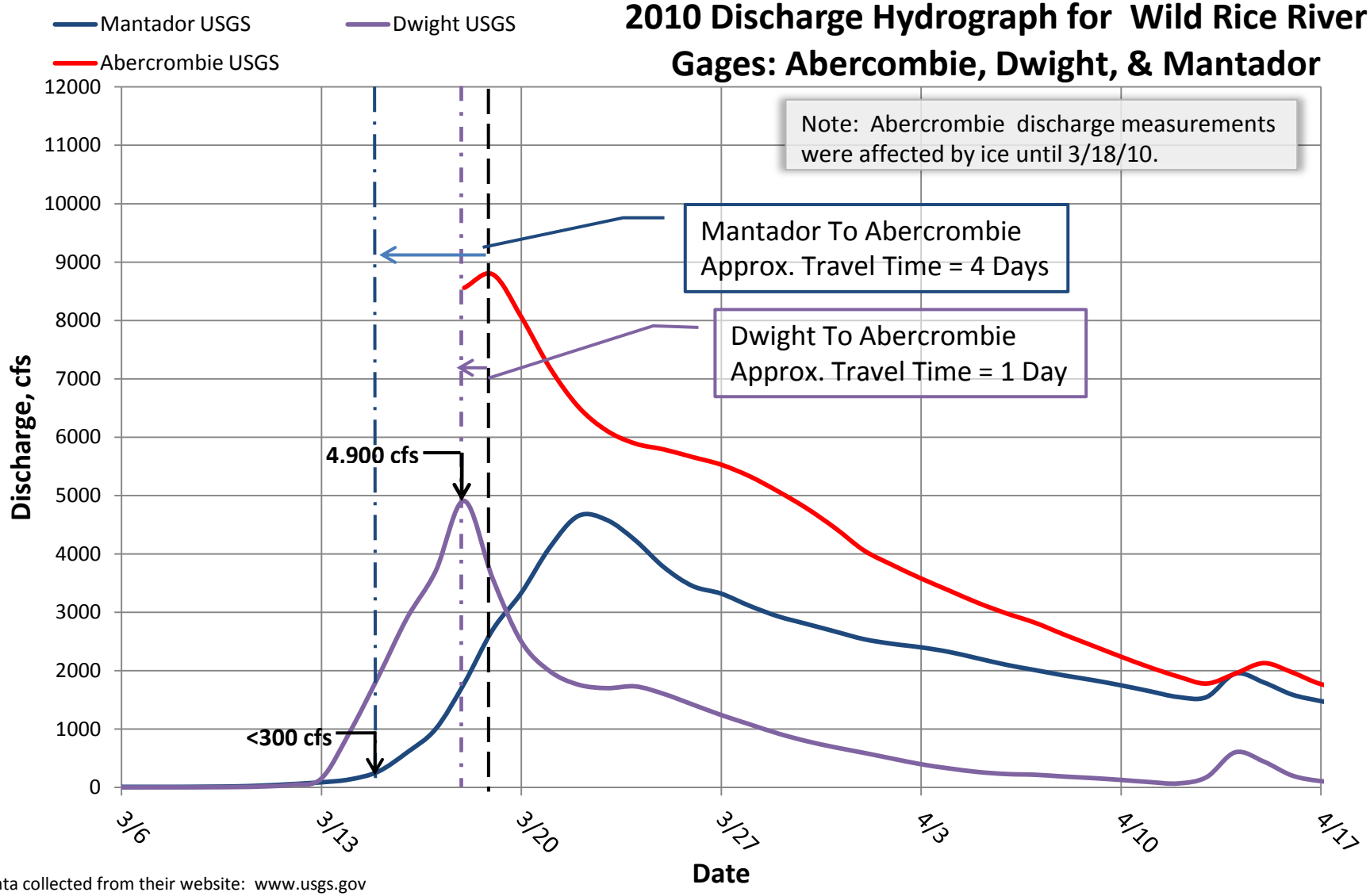
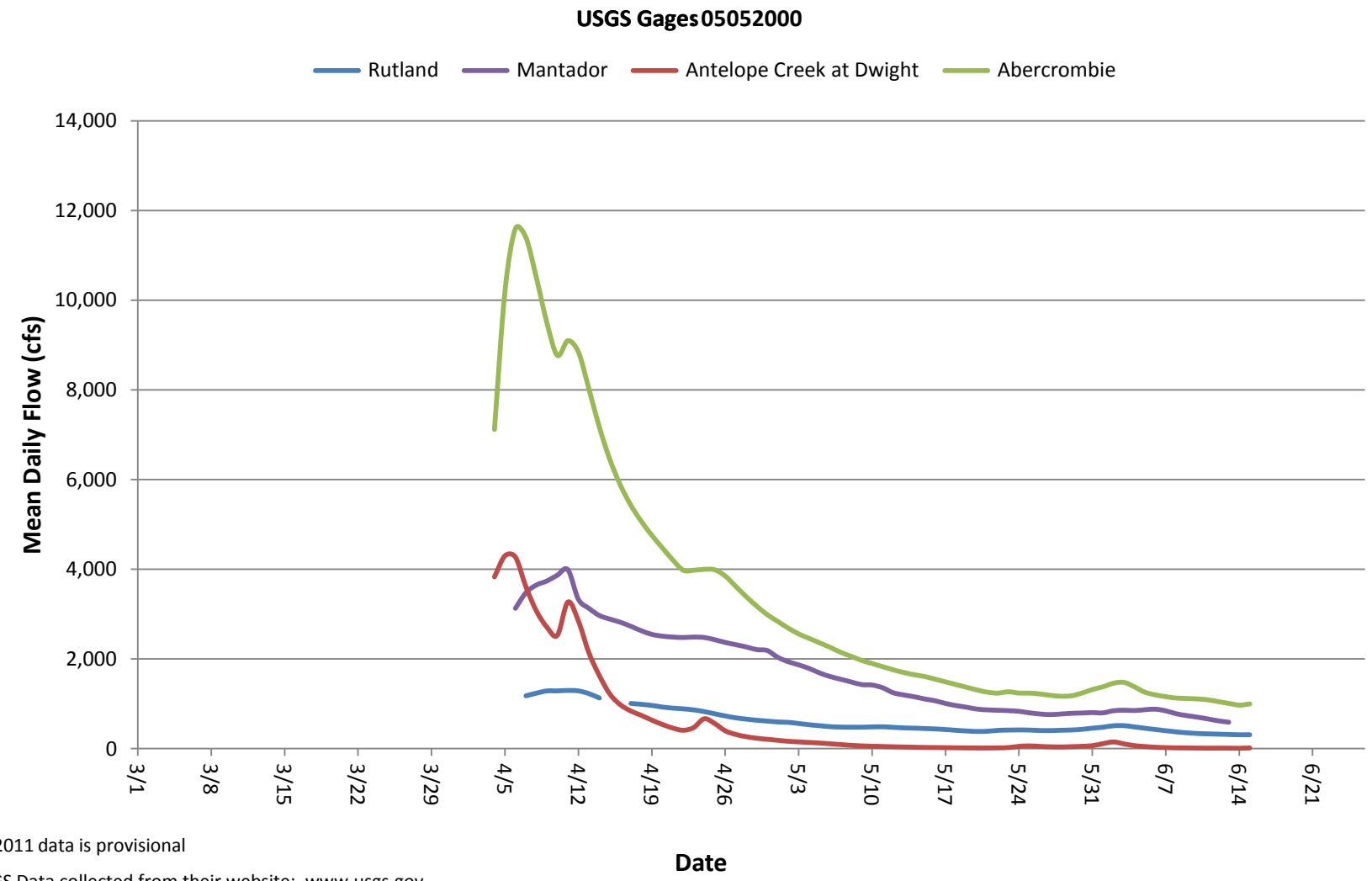
2010 Discharge Hydrograph for Wild Rice River Gages: Abercombie, Dwight, & Mantador



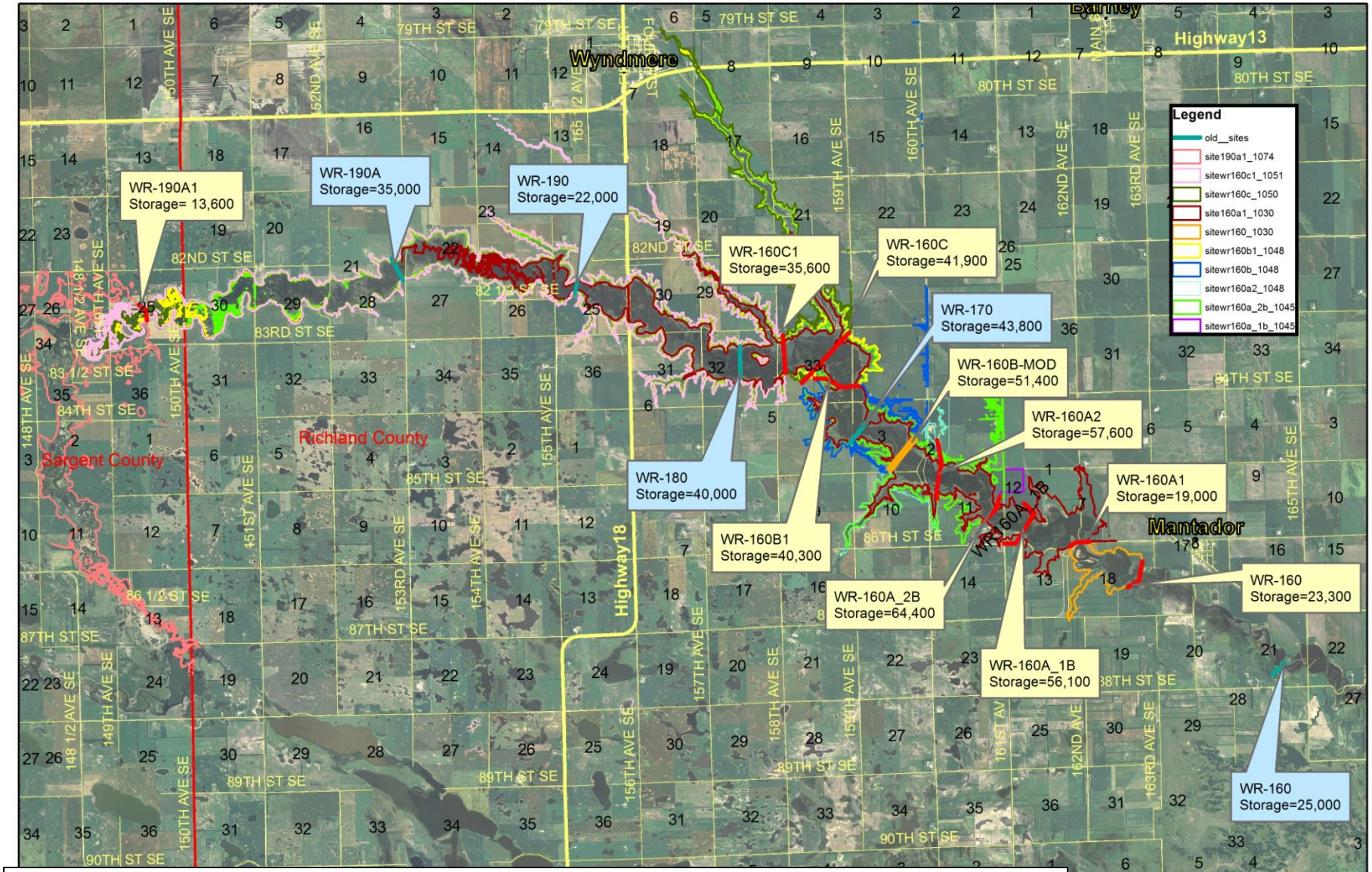
USGS Data collected from their website: www.usgs.gov

Antelope Creek and Wild Rice River - Spring 2011*



* - 2011 data is provisional

USGS Data collected from their website: www.usgs.gov



RETENTION SITE STUDY

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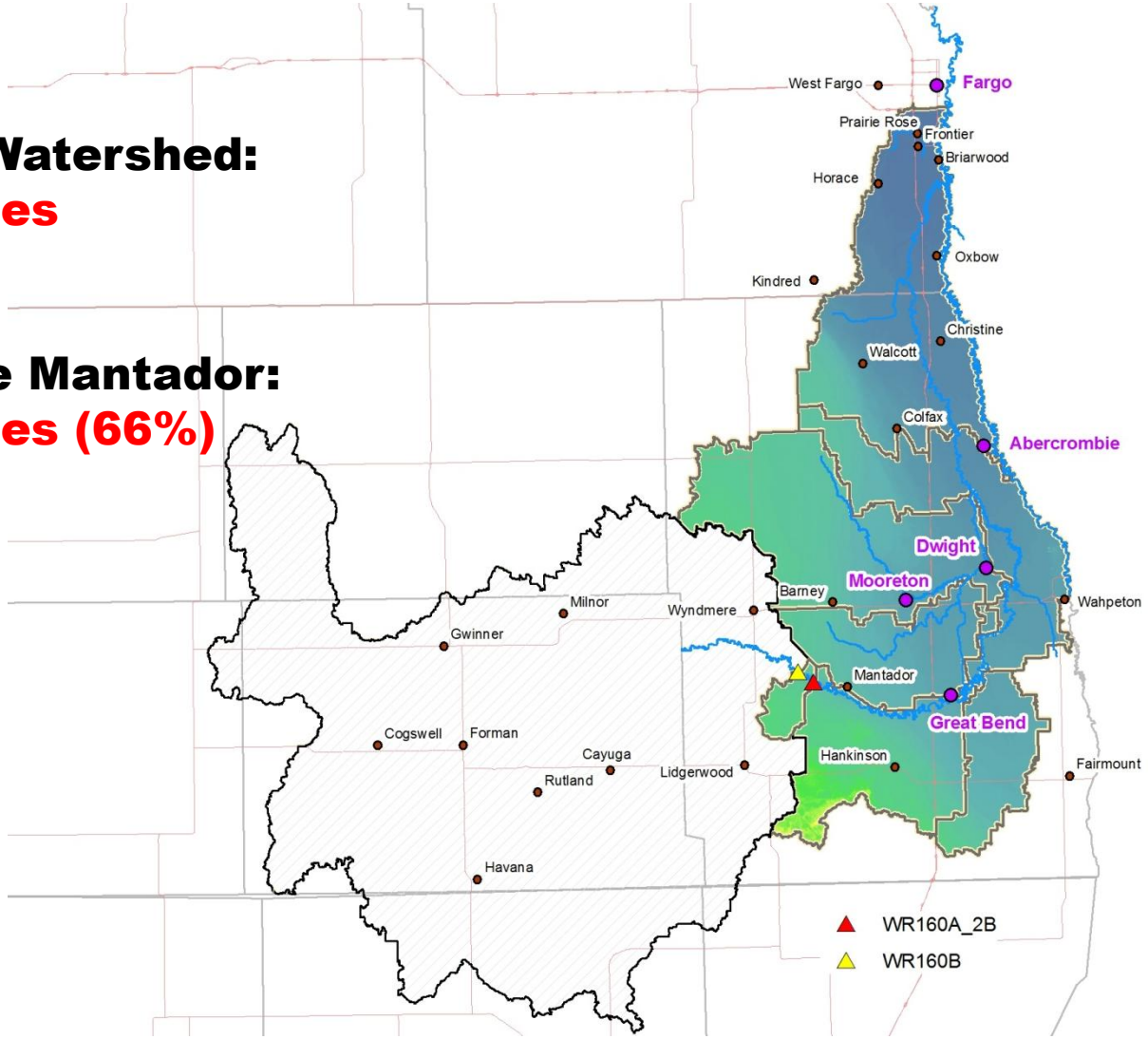
RETENTION LOCATION SELECTED
MANTADOR, ND

Wild Rice River Watershed:
2,350 Square Miles

Watershed above Mantador:
1,540 Square Miles (66%)



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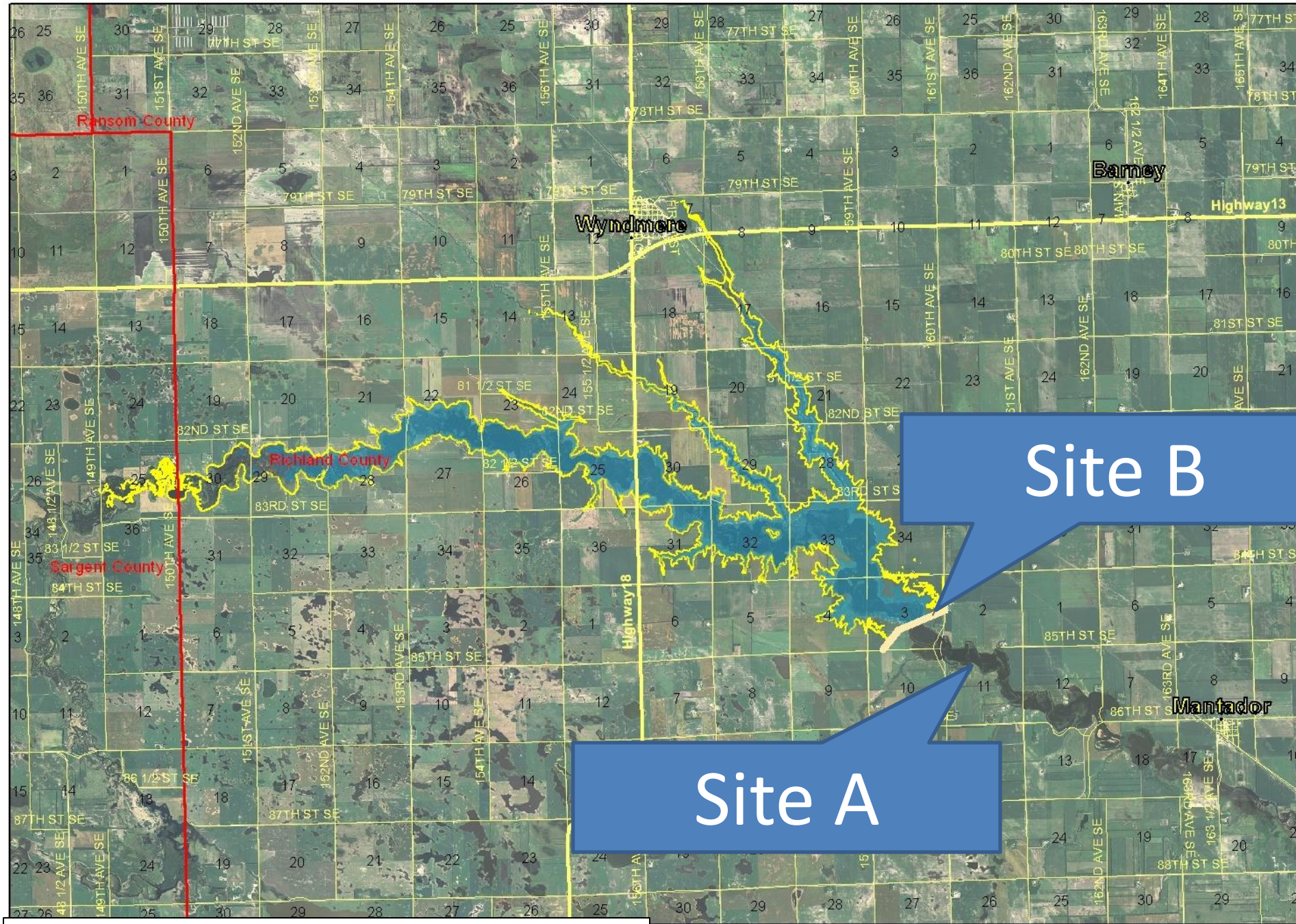
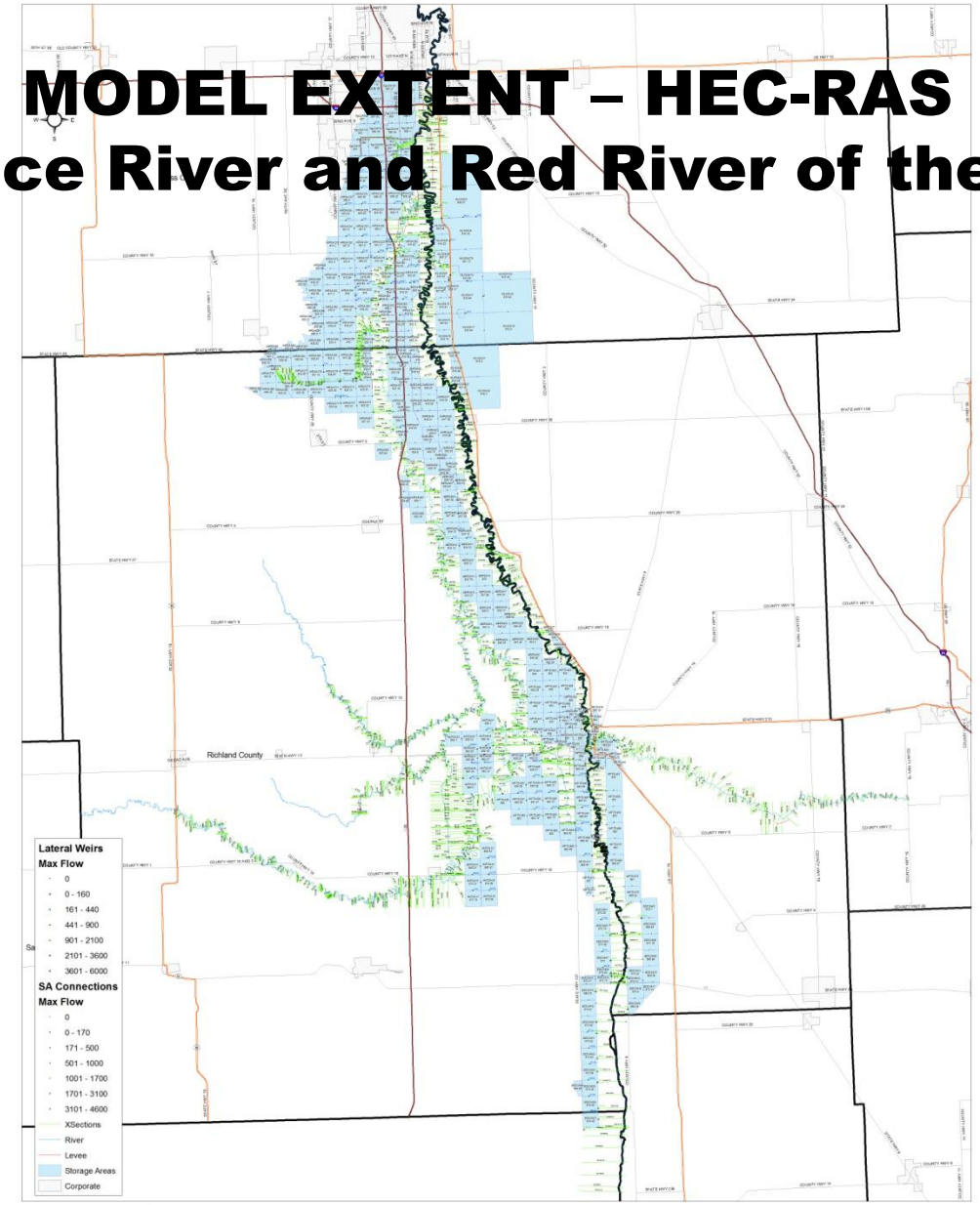


2 Sites Selected for Modeling

	Site B	Site A
Location	Section 3 Liberty Grove Twp. Richland Co. ND	Section 11 Liberty Grove Twp. Richland Co. ND
Invert Elevation	1010 ± (NAVD 88)	1009 ± (NAVD 88)
Top Dam Elevation	1048 (NAVD 88)	1048 (NAVD 88)
Dam Height	**38' ±**	39' ±
Easement Area	4,400± Acre	5,500 ± Acre
Secondary Spillway Elevation	1036.0 (NAVD 88)	1036.5 (NAVD 88)
Secondary Spillway Height	26 ±	27.5' ±
Secondary Spillway Volume	**29,800 Ac-ft (0.48 inches)**	40,000 Ac-ft (0.65 inches)
Water Surface Area	**2,600± Acres (4 Square Miles)**	3,100 ± Acres
Emergency Spillway Elevation	1043 (NAVD 88)	1043 (NAVD 88)
Emergency Spillway Height	33' ±	34.5' ±
Emergency Spillway Volume	**51,400 Ac-ft (0.83 inches)**	64,400 Ac-ft (1.04 inches)
Water Surface Area		
Primary Spillway Dimensions	15'x10' RCB	15'x10' RCB
Secondary Spillway Dimensions	210' Concrete	195' Concrete
Emergency Spillway Dimensions	1,650' Earth	1,750' Earth

MODEL EXTENT – HEC-RAS
Wild Rice River and Red River of the North



HISTORICAL 1997 FLOOD EVENT
WILD RICE DAM STUDY
Lateral Weirs & SA Connections Max Flow
Storage Area & Cross Section Max Elevation

0 5 10 20 Miles

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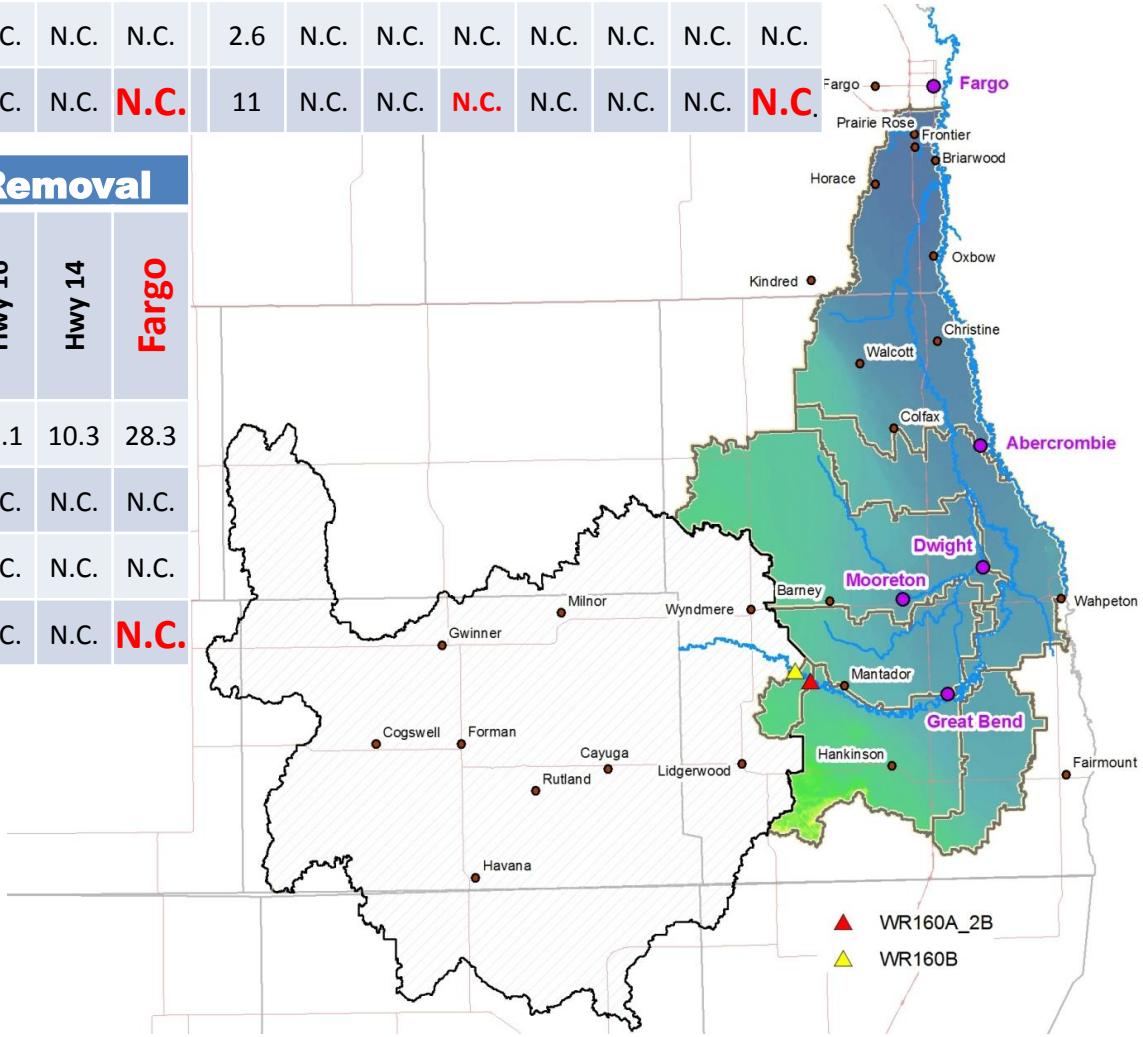
Historic 2009

	SITE B								SITE A							
	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo
Peak Q (kcfs) - Existing	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3
Peak Q (kcfs) - Project	3.2	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	3.2	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Q (kcfs) - Change	2.6	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.6	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Stage (Inches) – Diff	11	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	11	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

	Upper Watershed Removal							
	Great Bend	Mooreton	Dwight	Abercrombie	Hwy 2	Hwy 16	Hwy 14	Fargo
Peak Q (kcfs) - Existing	5.8	3.8	9.0	13.7	14.8	12.1	10.3	28.3
Peak Q (kcfs) - Project	2.5	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Q (kcfs) - Change	3.3	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.
Stage (Inches) – Diff	18	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.

N.C.= change in discharge is less than 100 cfs
or change in stage is less than 1 inch



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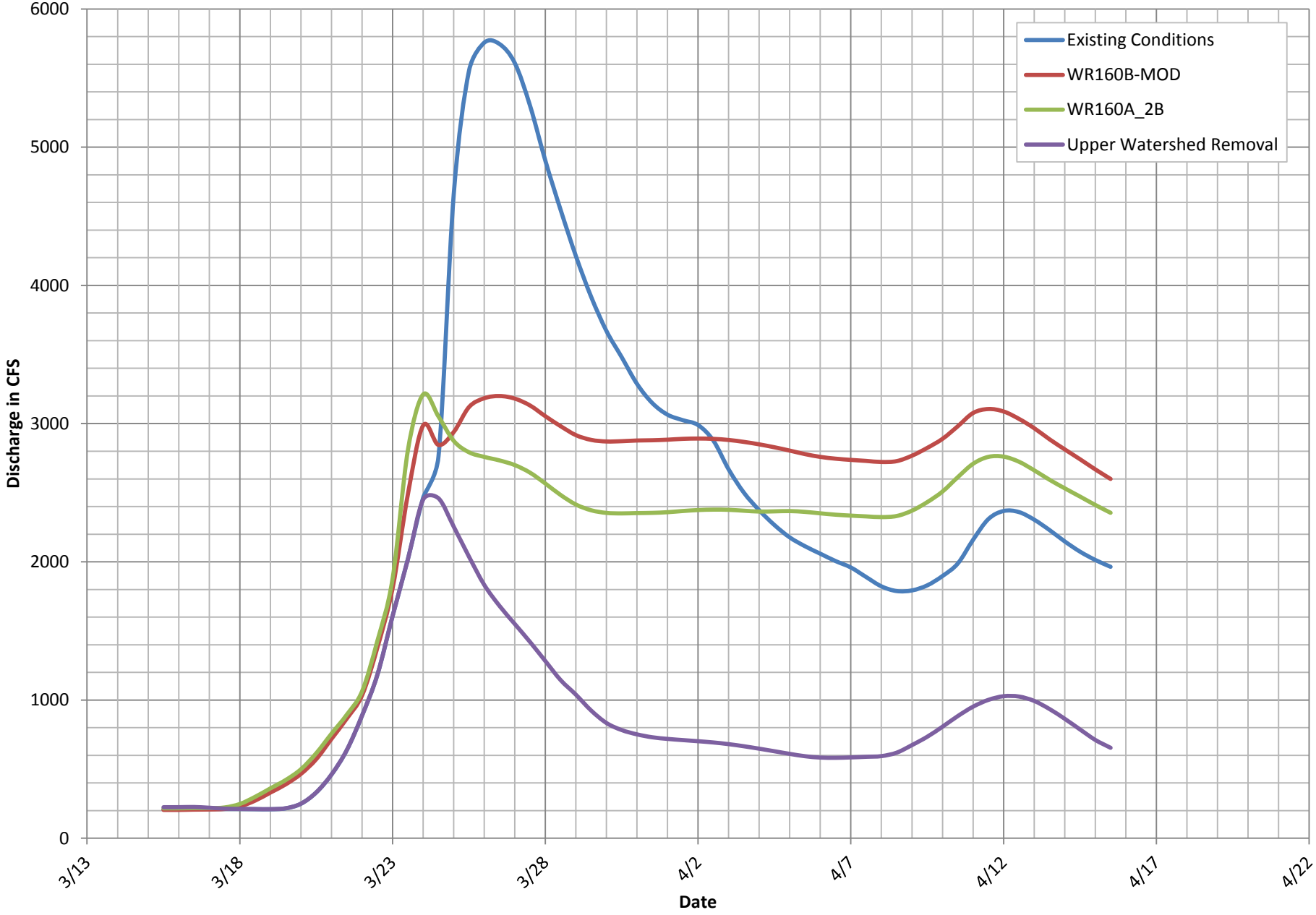
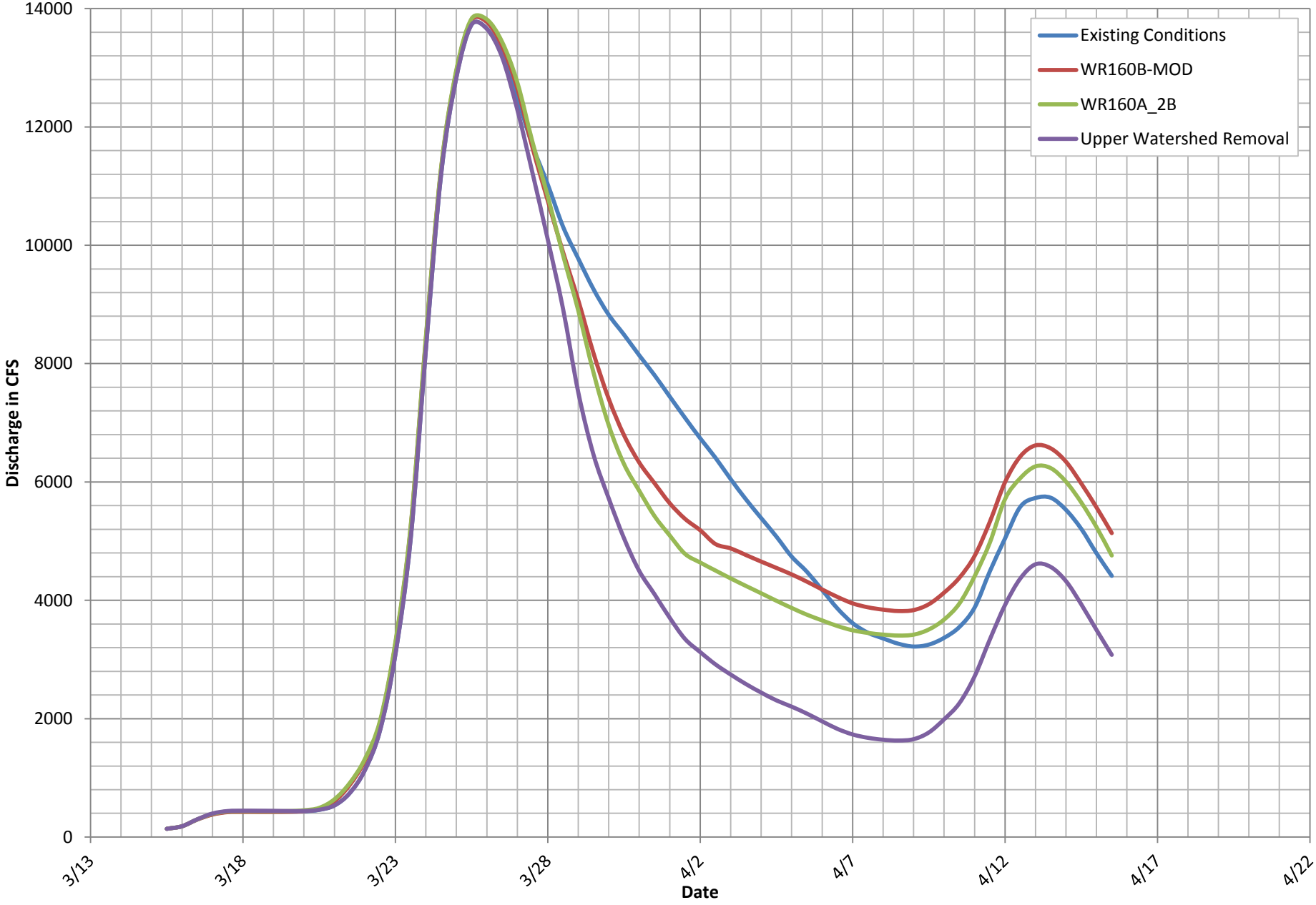
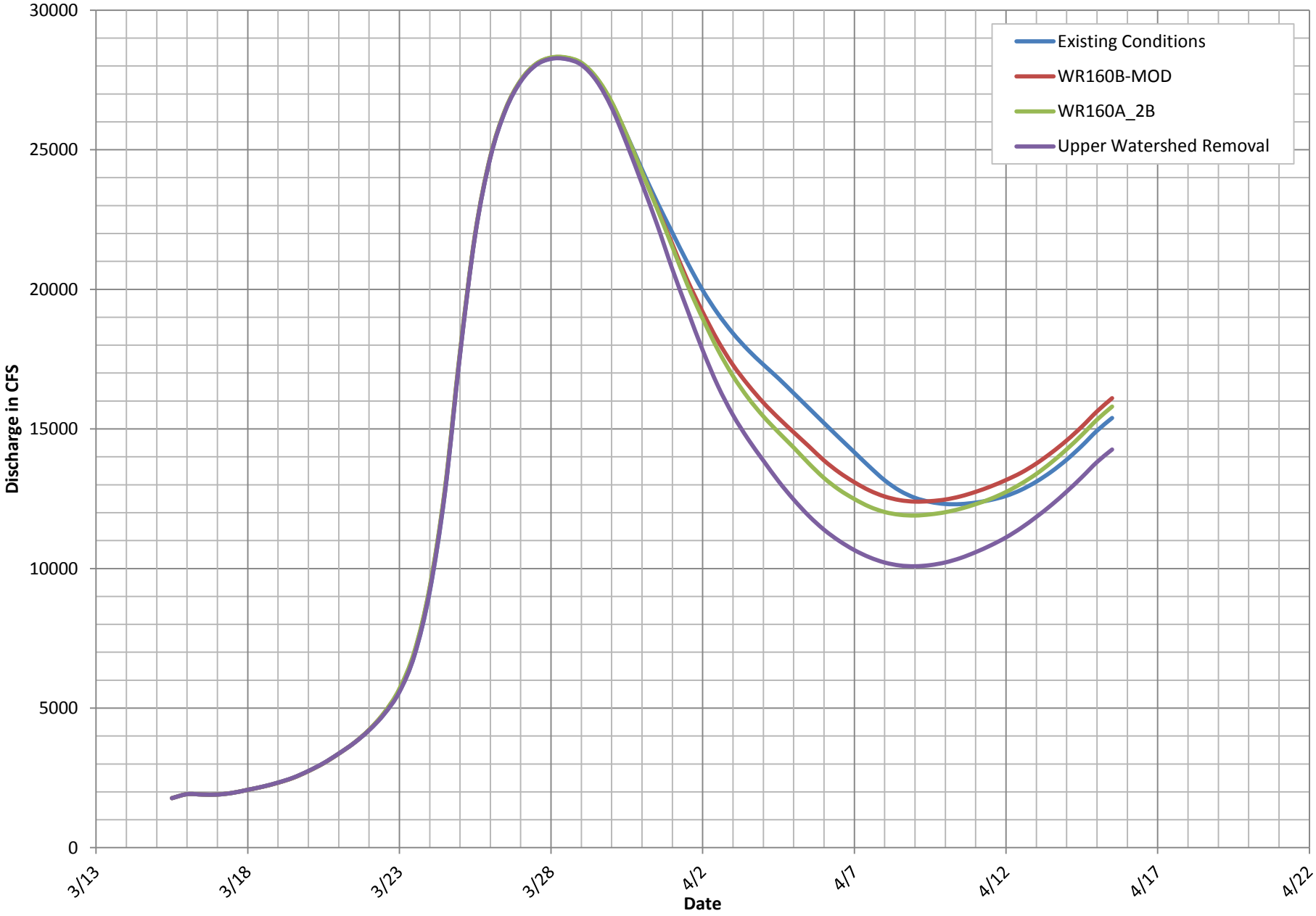

2009 Wild Rice River at Great Bend, ND Discharge Hydrograph
Discharge in CFS
6000
5000
4000
3000
2000
1000
0
3/13
3/18
3/23
3/28
4/2
4/7
4/12
4/17
4/22
Date
Existing Conditions
WR160B-MOD
WR160A_2B
Upper Watershed Removal

2009 Wild Rice River at Abercrombie, ND Discharge Hydrograph

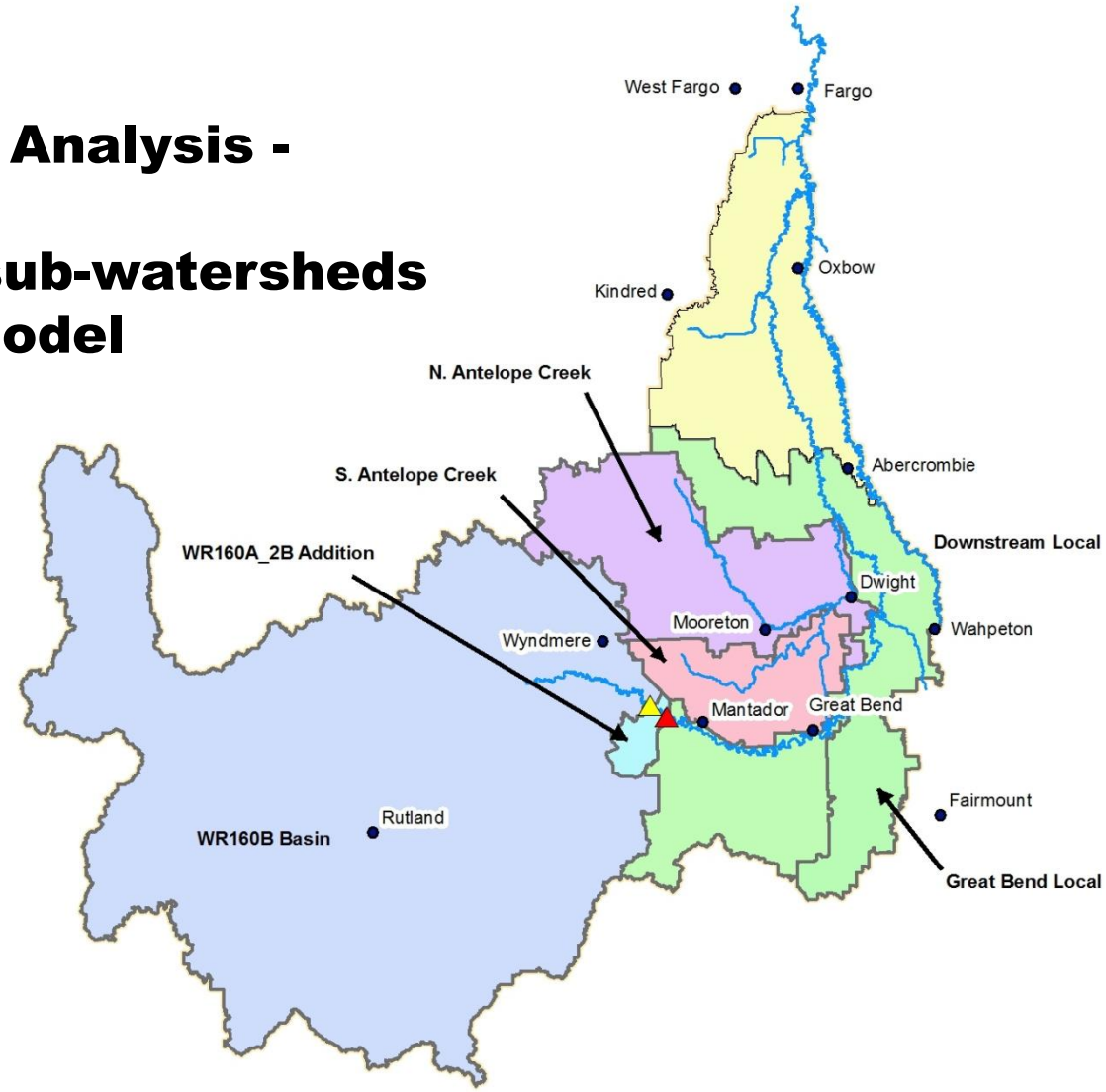



2009 Red River at Fargo, ND Discharge Hydrograph
30000
25000
20000
15000
10000
5000
0
Discharge in CFS
3/13
3/18
3/23
3/28
4/2
4/7
4/12
4/17
4/22
Date
Existing Conditions
WR160B-MOD
WR160A_2B
Upper Watershed Removal

2009 HEC-RAS MODELING

Sensitivity Analysis -

removing sub-watersheds from the model



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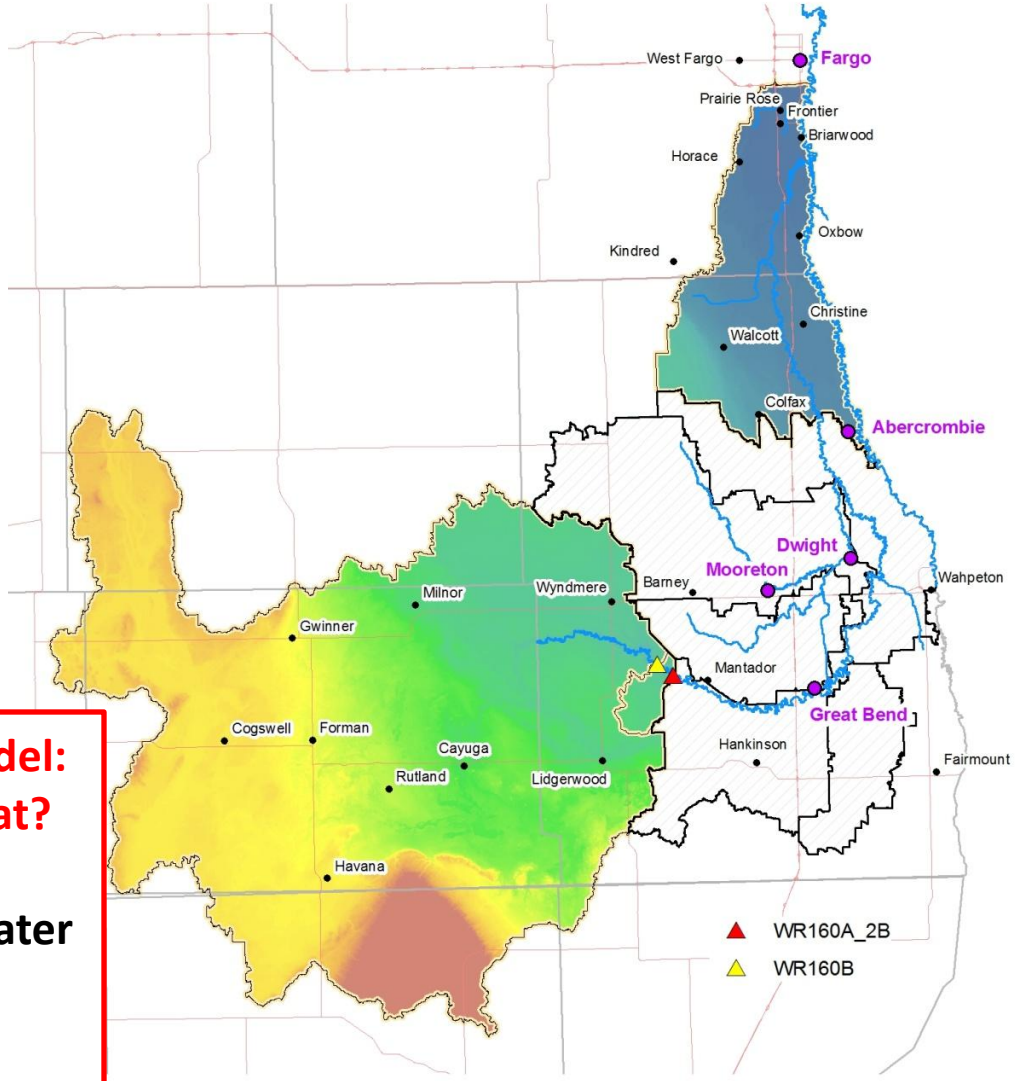
2009 FLOOD SENSITIVITY ANALYSIS

2009 FARGO ANALYSIS:

Scenario	CFS	FEET
Fargo Existing:	28,300	40.6
Upper Removal:	28,300	40.6
Mid Removal:	26,200	39.7
Lower Removal:	27,200	40.1
Entire Removal:	**22,300**	**37.8**
2010 Actual	21,200	37.0

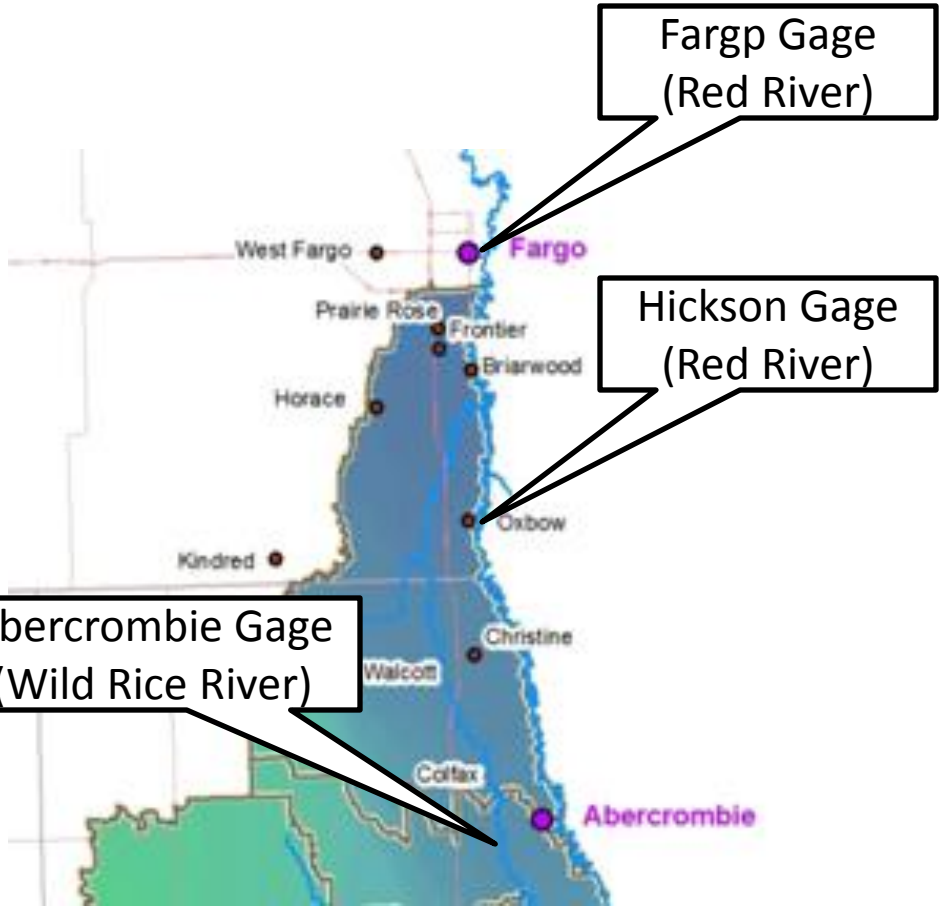
Entire Removal of Wild Rice from the Model: 300,000 AC-FT of Water…How much is that?

1 Township (36 Sections) = 13.0' of Water
2 Townships (72 Sections) = 6.5'
5 Townships (180 Sections) = 2.5'
13 Townships (468 Sections) = 1.0'



2009 Flood Flows

Wild Rice @ Abercrombie	14,100 cfs
Red River @ Hickson	23,700 cfs
Combined Flow at Fargo???	37,800 cfs No!
Actual Flow at Fargo	**29,500 cfs**



WHY?

Natural storage (ponding) south of Fargo reduced the flood peak.

CONCLUSIONS

- The historic record of Wild Rice floods shows a repeating pattern of similarity. This includes 2009, 2010, and 2011. There is 1 exception.

- 1997 flood is significantly different; it is **not** typical.

- Modeling shows the **Upper** Wild Rice Watershed does **not** contribute to the Red River crest at Fargo. Timing!

- Wild Rice Retention modeling shows strong potential for local benefits within Richland County.

- Wild Rice Retention modeling shows minimal benefit to the Red River at Fargo.