

ALTERED HYDROLOGY – EFFECTS ON POOL 7

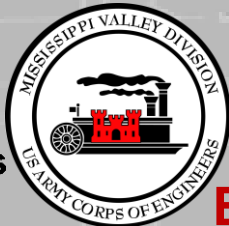
Jon Hendrickson and Kim Warshaw, St. Paul
District Corps of Engineers

Presented to the Lake Onalaska Rehabilitation
District

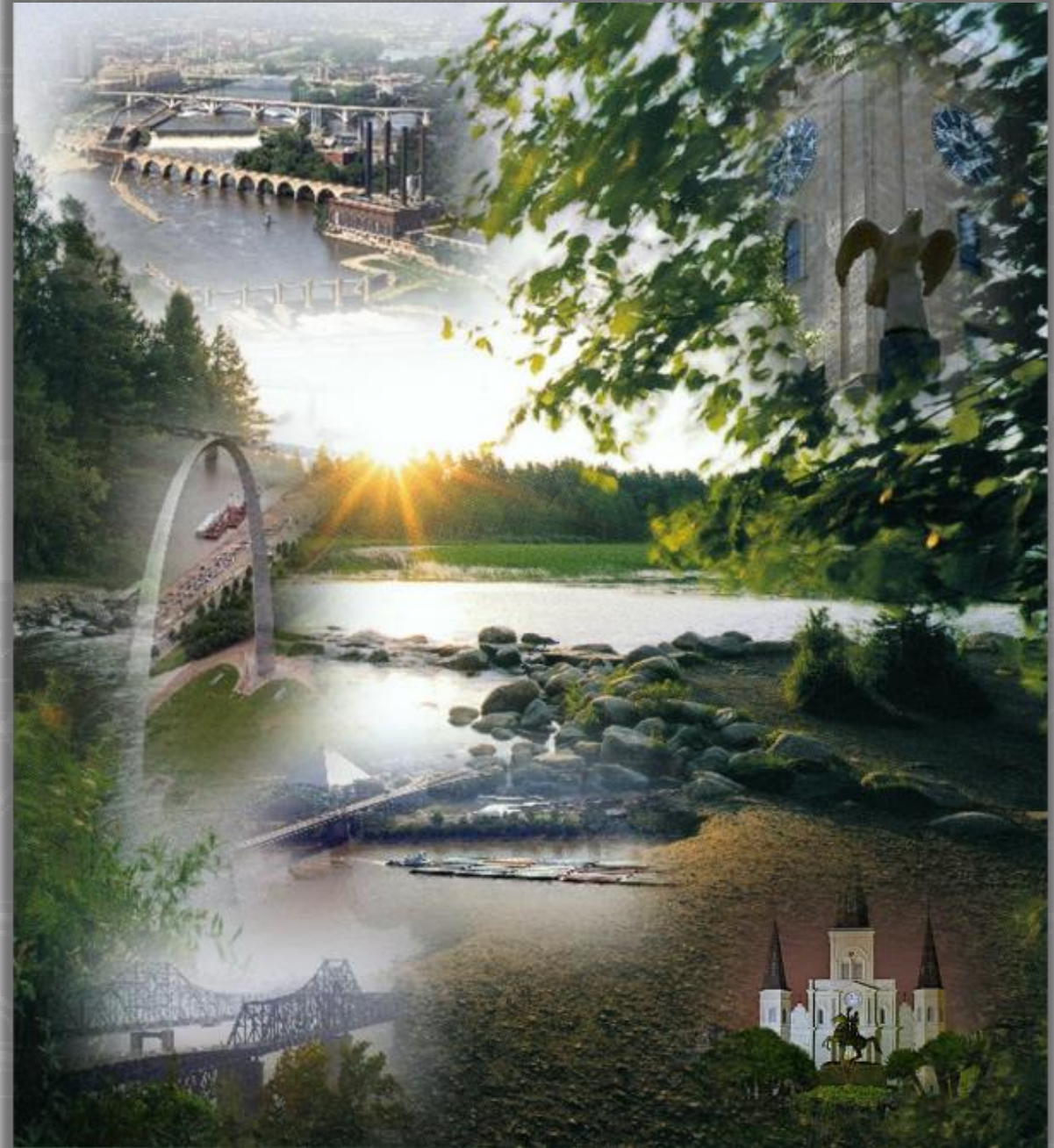
Nov 19, 2020



US Army Corps
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AGENDA



Hydrologic Trends
Water Exchange Rates
Water Surface Elevations
Future Challenges

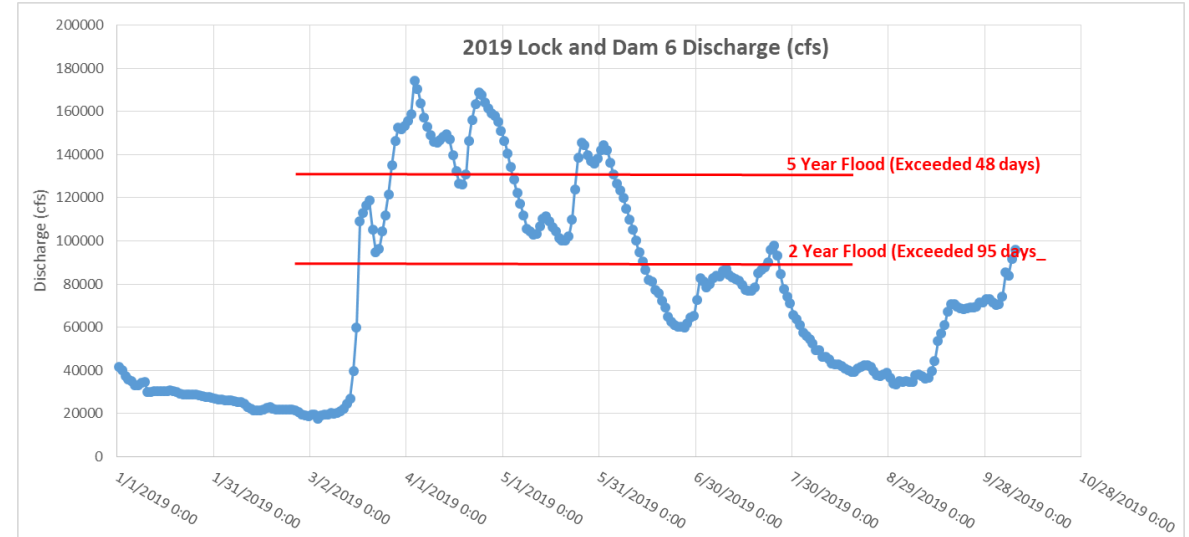


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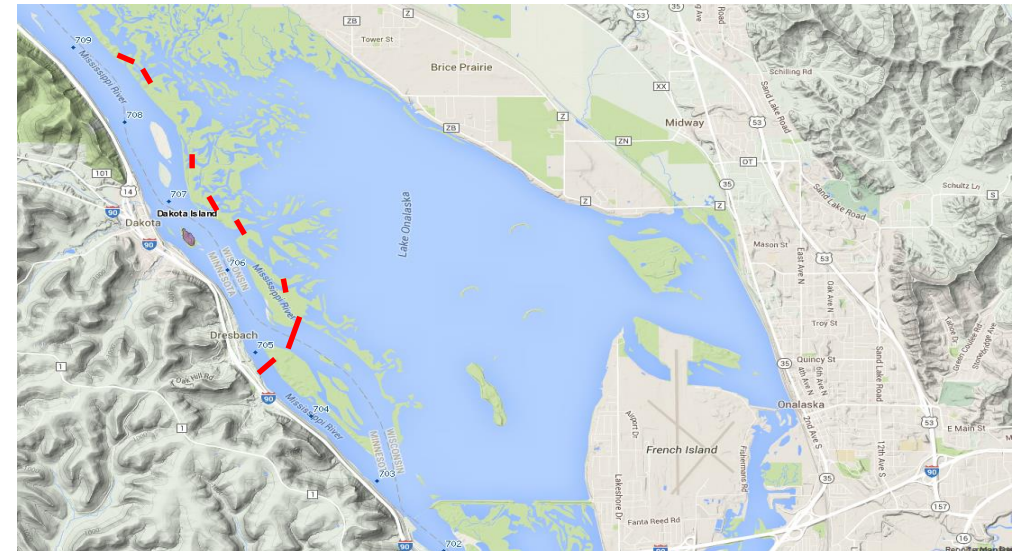


WATER EXCHANGE (2 CONSIDERATIONS)

1. Volume of Water Entering River Valley.



2. Distribution of Water within the River Valley



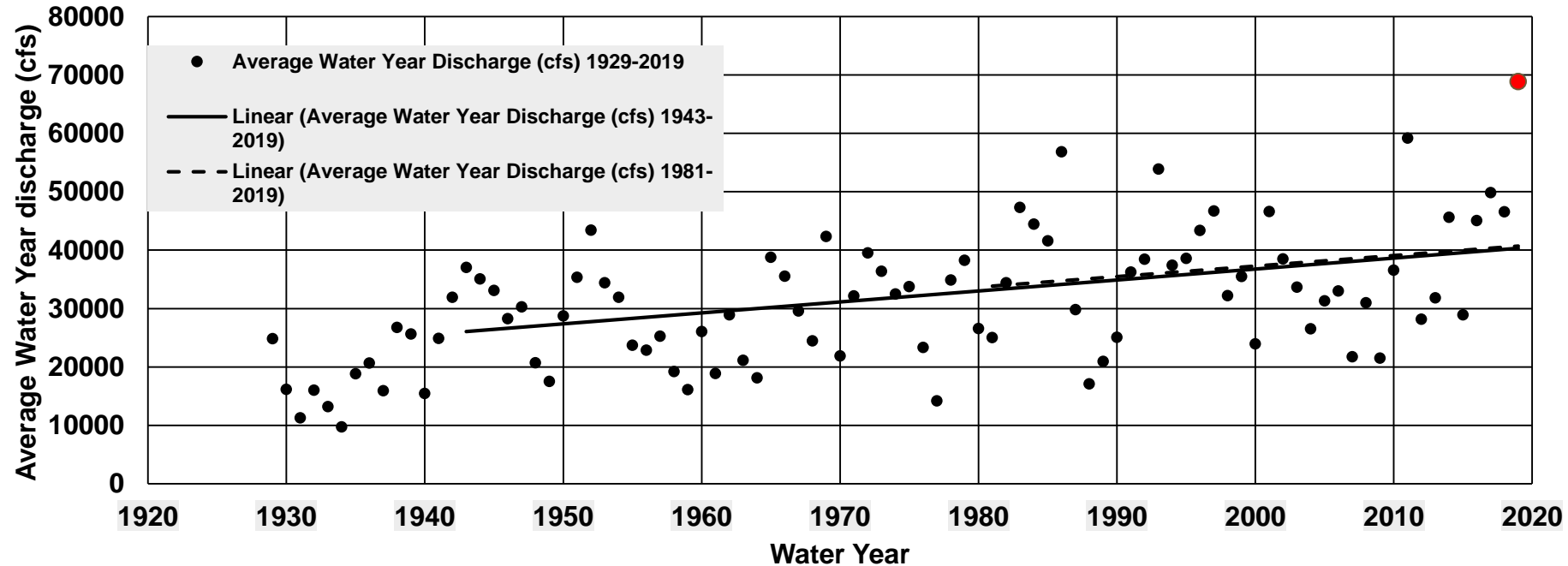
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ANNUAL FLOW VOLUMES



Mississippi River at Winona, Minnesota (USGS Gage 05378500)



Average Water Year Discharge at Winona
1943 to 1980 = 29,000 cfs
1981 to 2019 = 37,300 cfs (28.6 % increase)

2016, 2017, 2018, 2019 = 45,000, 48,000, 51,000 and 69,000 cfs
2010 to 2019 is wettest decade on record



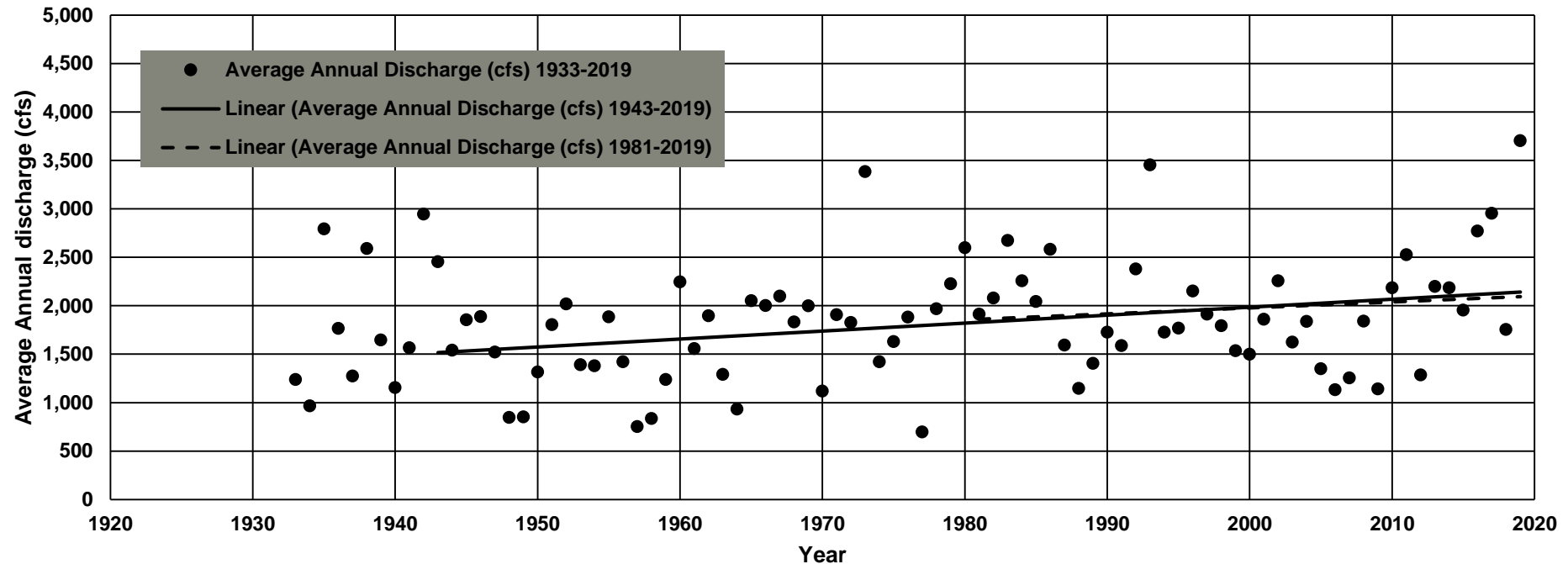


ANNUAL FLOW VOLUMES

5



Black River Near Galesville, Wisconsin (USGS Gage 05382000)



Average Water Year Discharge at Galesville

1943 to 1980 = 1,675 cfs

1981 to 2019 = 1,978 cfs (18.1 % increase)

2016, 2017, 2018, 2019 = 2773, 2957, 1758, 3705 cfs

2010 to 2019 is wettest decade on record

5



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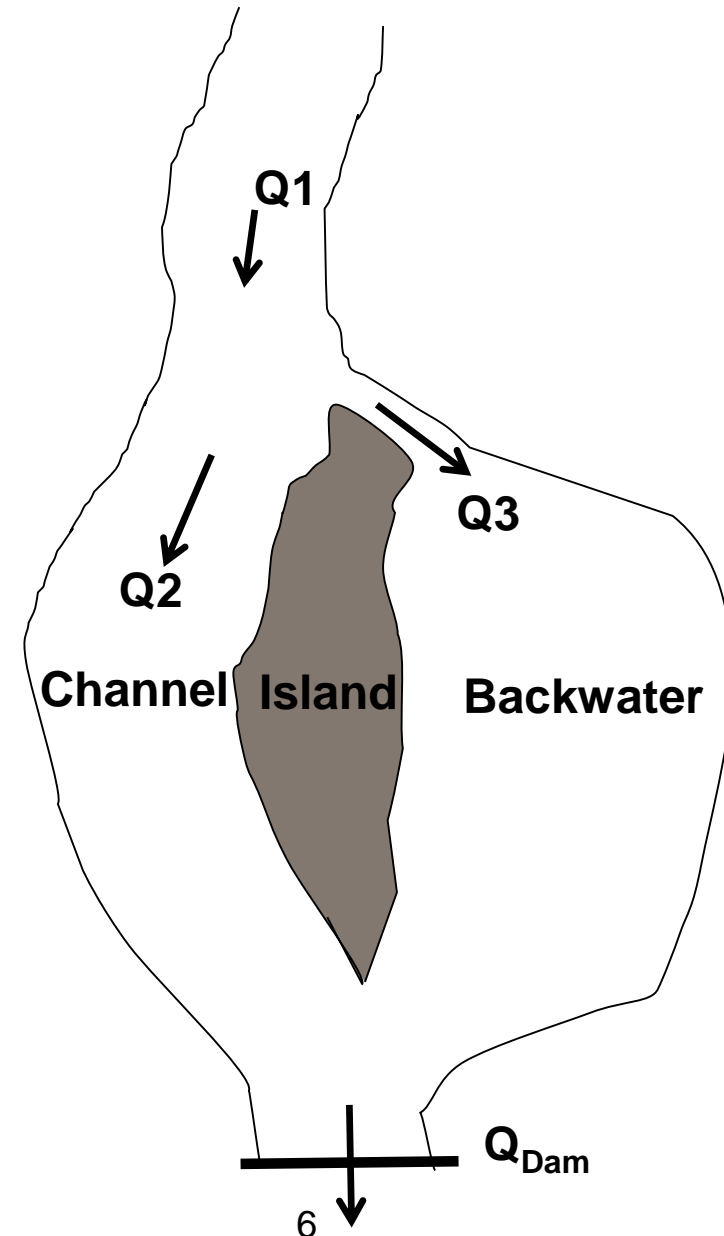


WATER EXCHANGE

In this example, the water exchange ratio between the channel and the backwater is

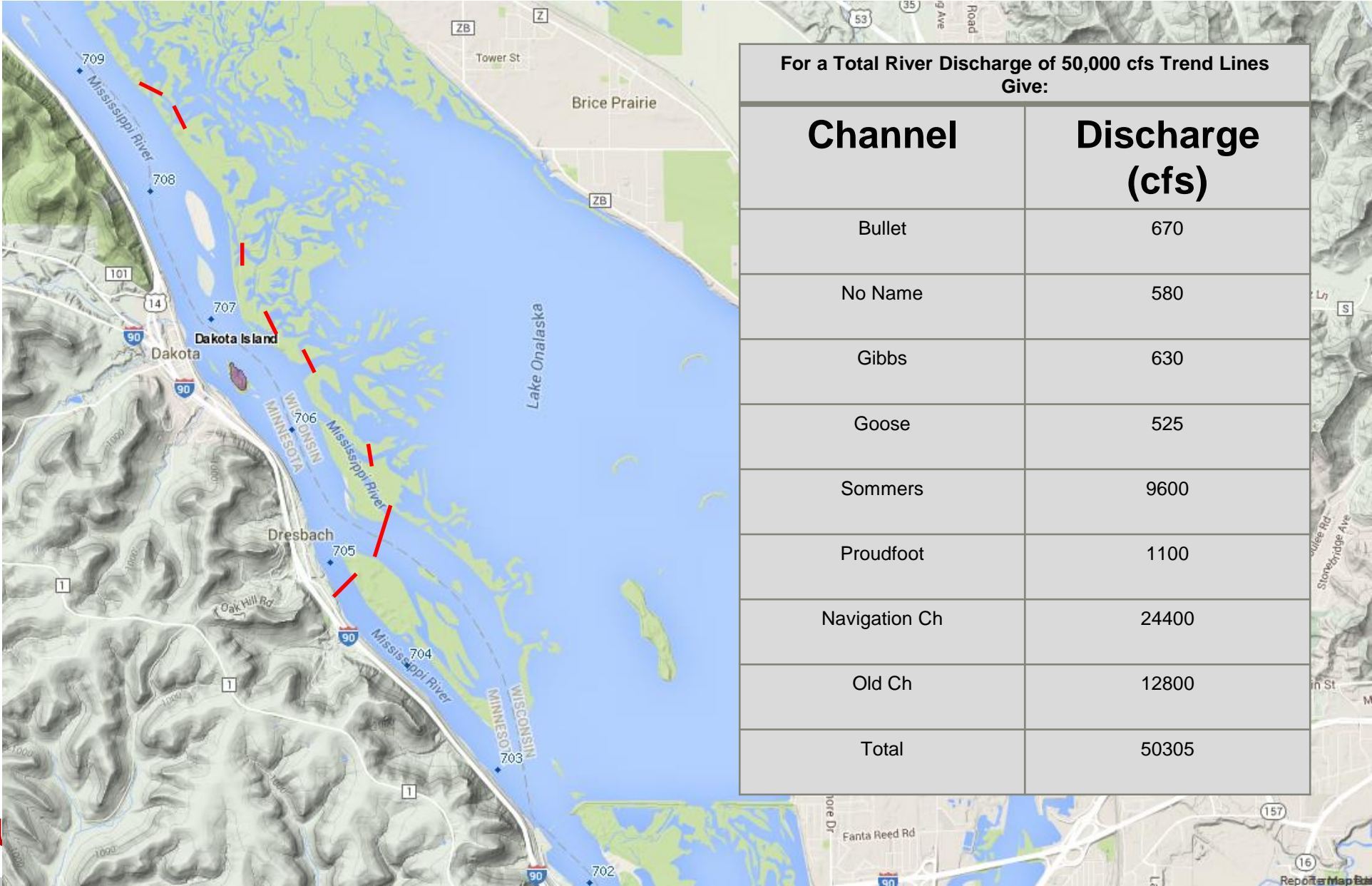
Q_3/Q_{dam} where Q = river flow

Expressed as a ratio or percentage





HYDRAULIC CONTINUITY, POOL 7



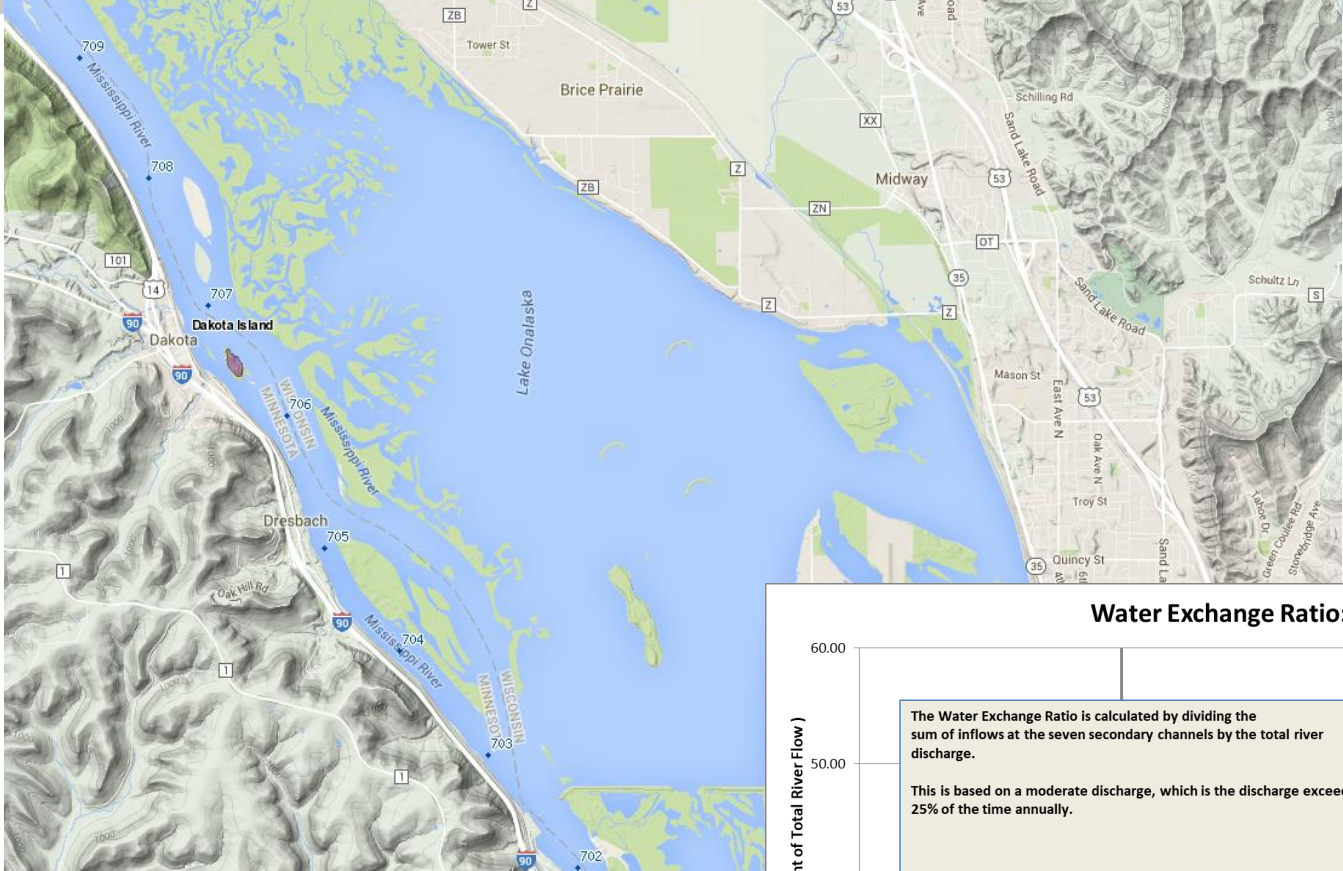
For a Total River Discharge of 50,000 cfs Trend Lines Give:	
Channel	Discharge (cfs)
Bullet	670
No Name	580
Gibbs	630
Goose	525
Sommers	9600
Proudfoot	1100
Navigation Ch	24400
Old Ch	12800
Total	50305



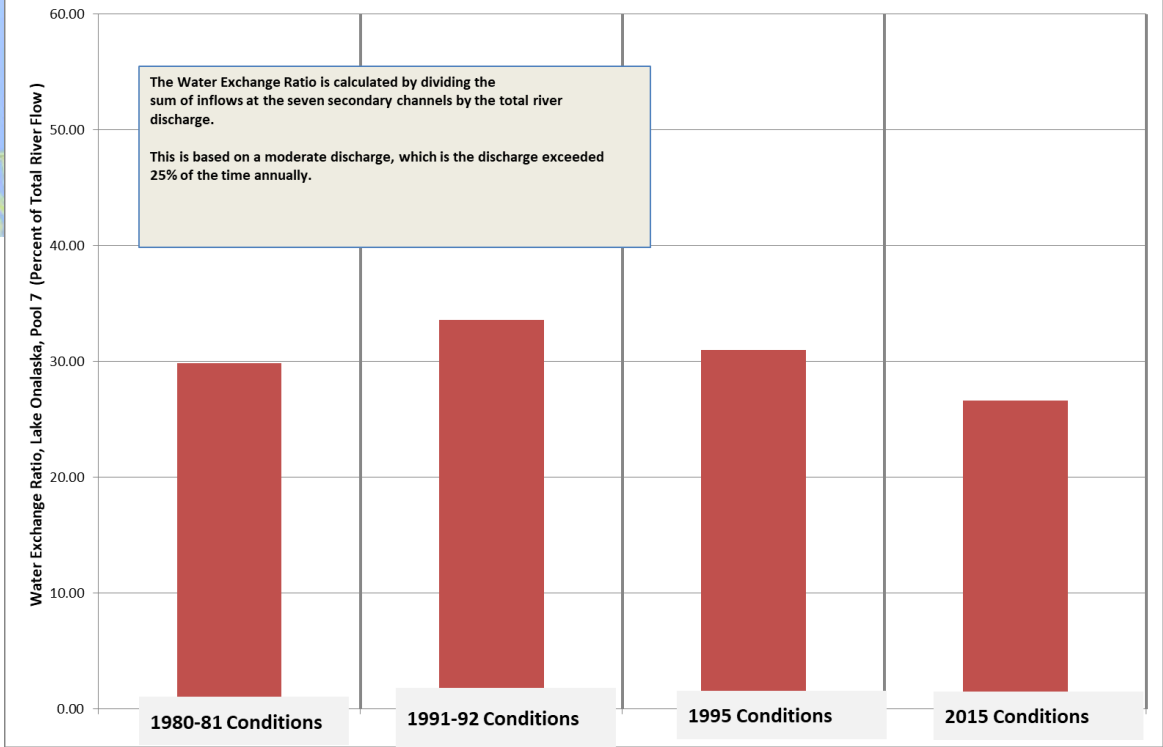
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The Dakota Navigation project was constructed in 1994



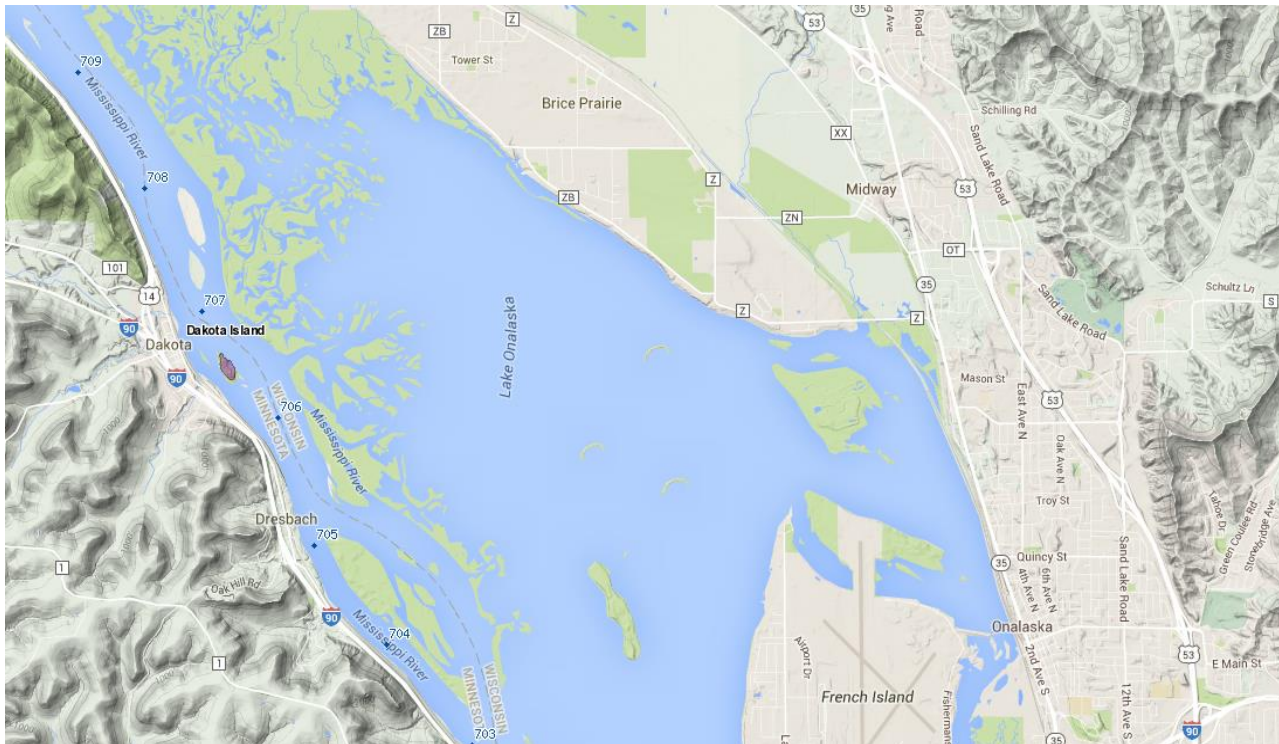
Water Exchange Ratio: Lake Onalaska, Pool 7



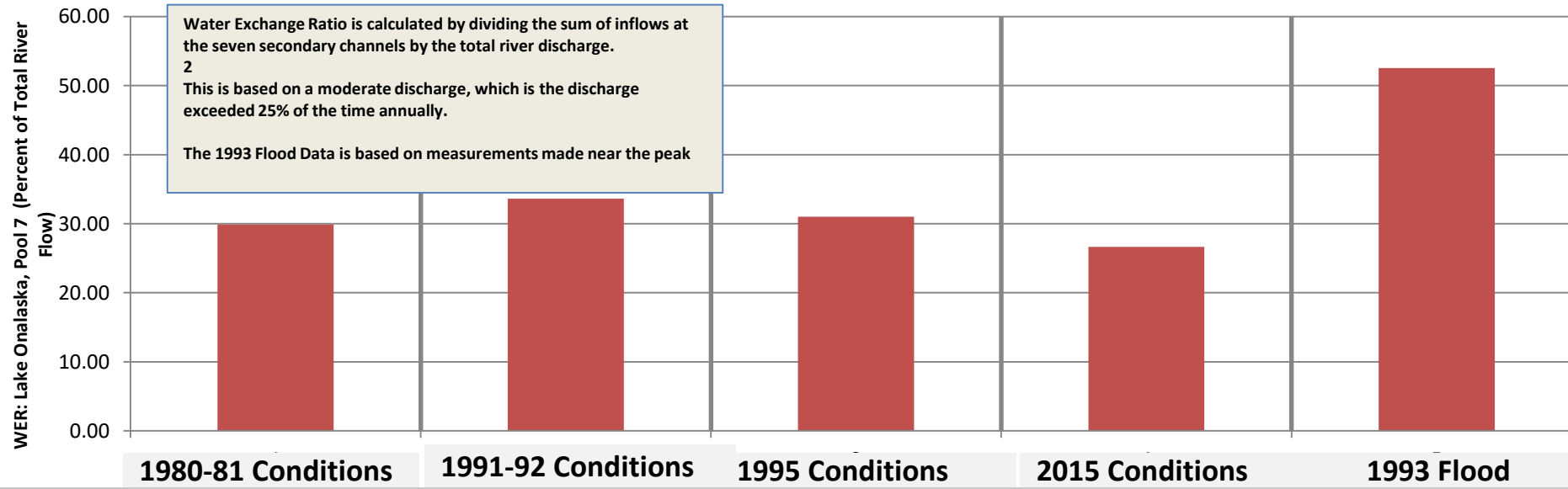
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Flood Effects



Water Exchange Ratio: Lake Onalaska, Pool 7

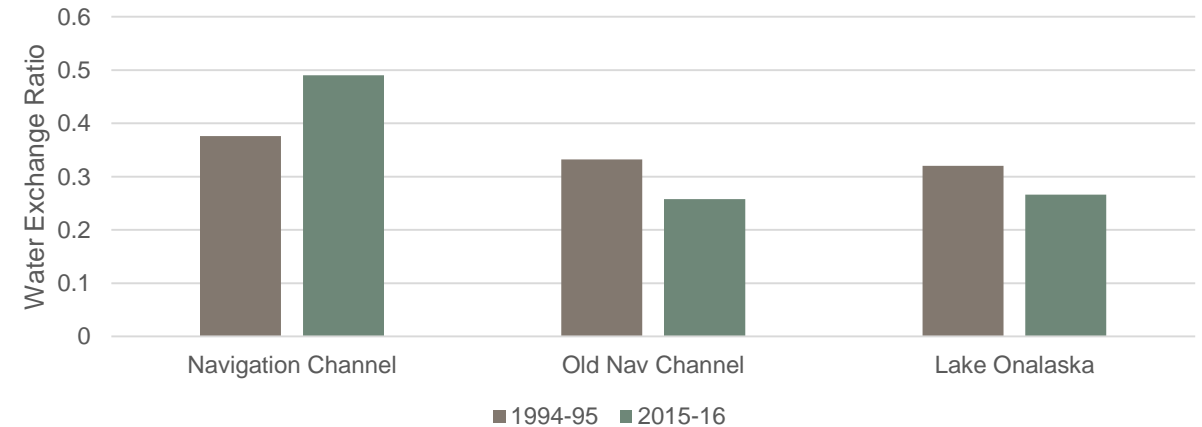
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WATER EXCHANGE - A SURROGATE FOR GEOMORPHIC CHANGE



Change in Water Exchange Ratio
Lower Pool 7

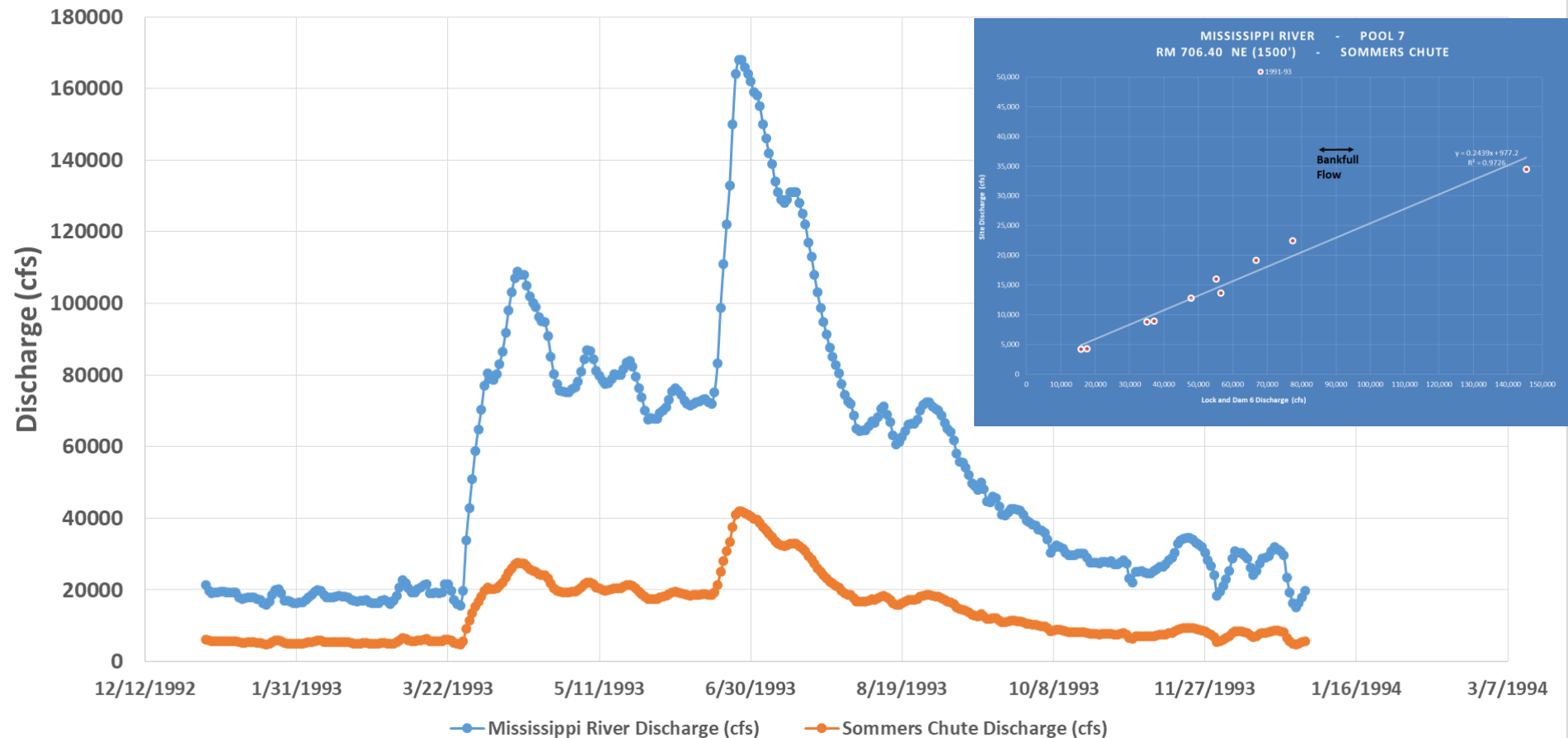


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ESTIMATES OF DAILY WATER EXCHANGE

Discharge (cfs), Mississippi River and Sommers Chute, 1993



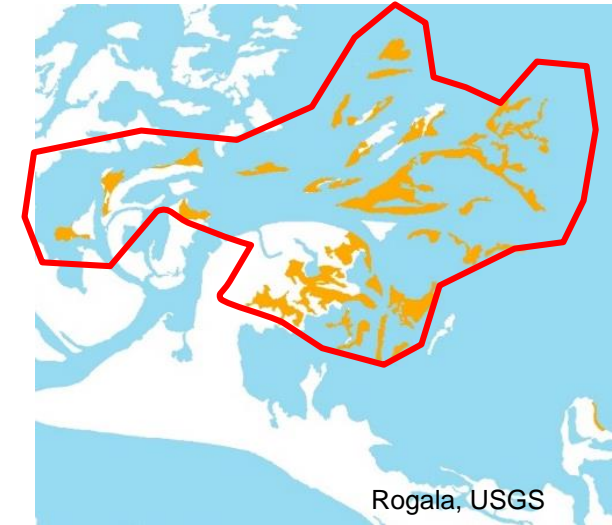


HYDROLOGY, GEOMORPHIC CHANGE, AND DREDGING

12



- Higher flow rates are accelerating geomorphic change:
 - Tributary sand loads????
 - Increased bank and shoreline erosion
 - Sediment Sinks are decreasing
 - Side Channel – Delta Change
- Pool 7 is Probably Most Significant Example to Date
 - Sediment Deposition
 - Altered flow patterns
 - Floodplain Forest Effects



Hydrogeomorphic units

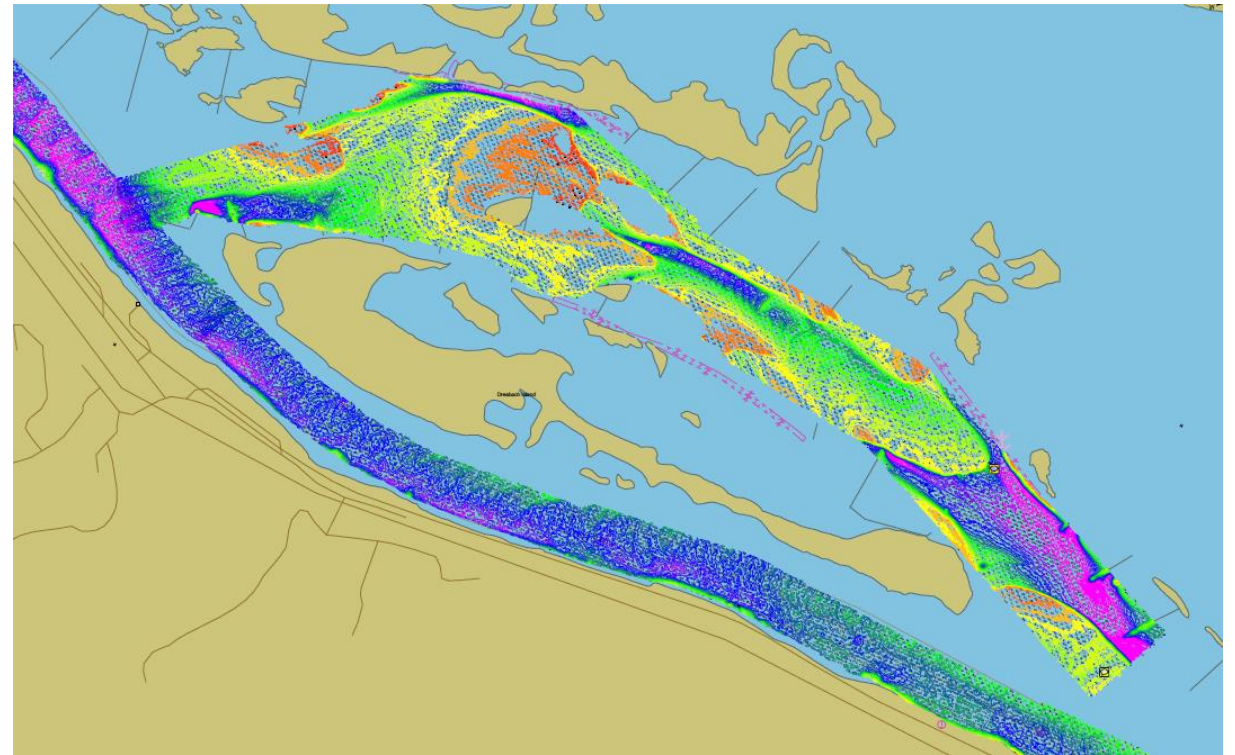


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GEOMORPHIC CHANGE

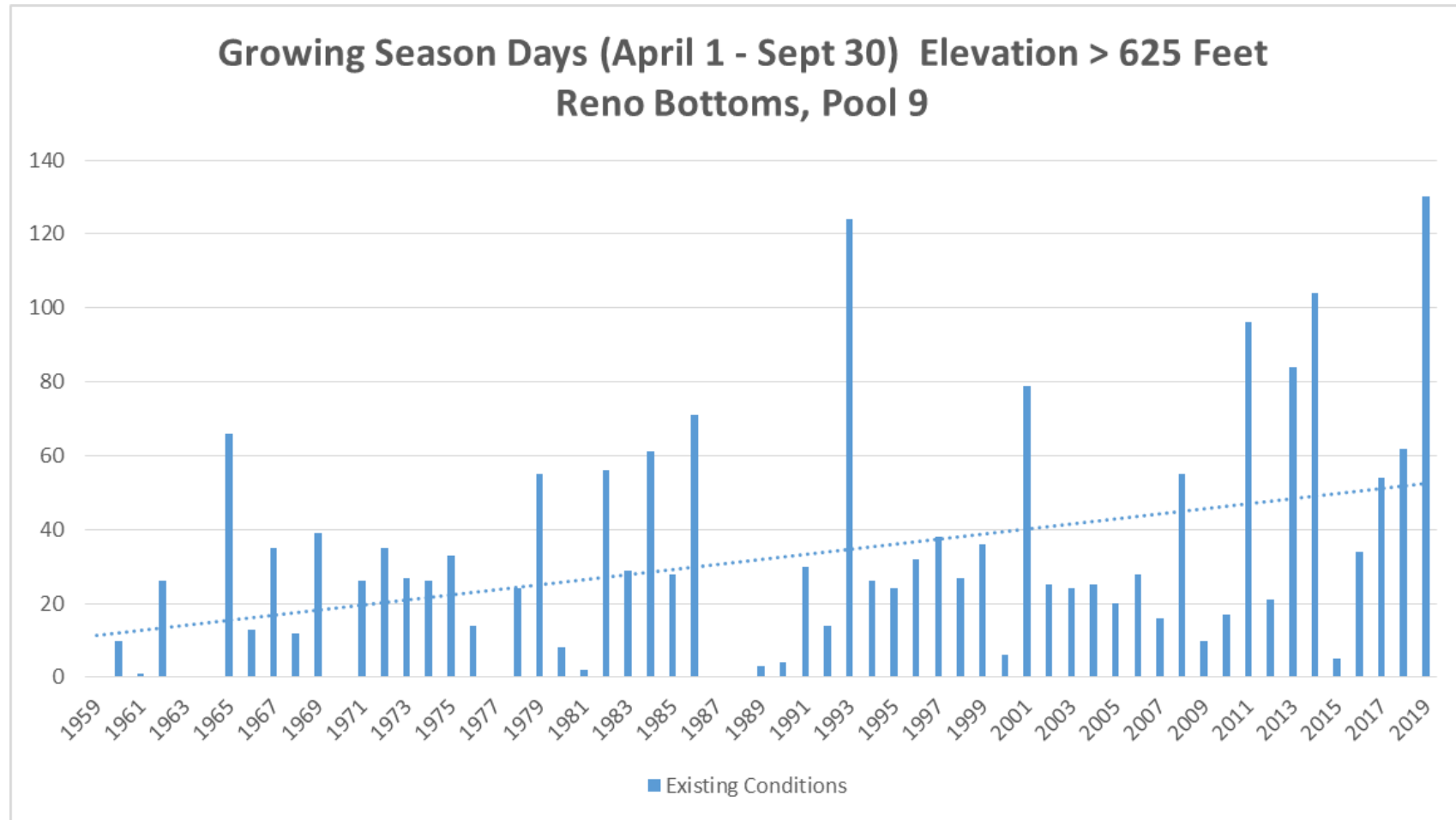
13



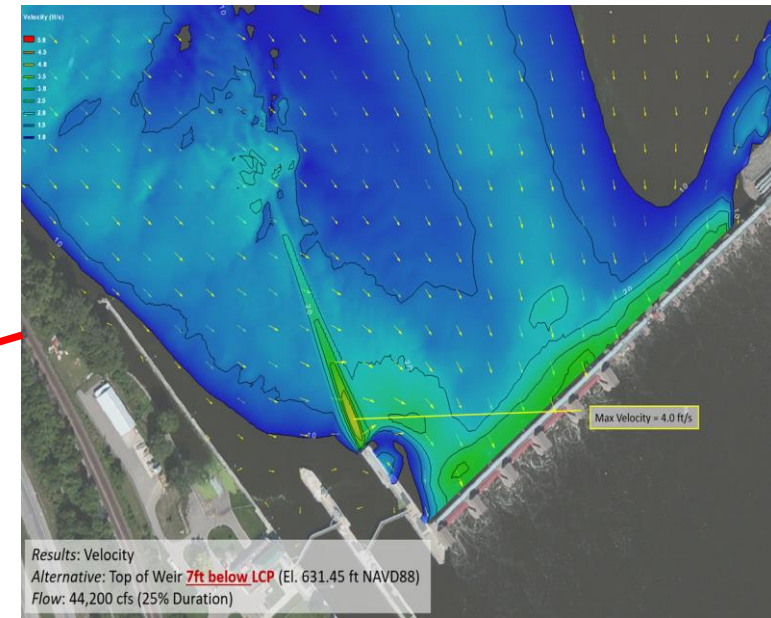
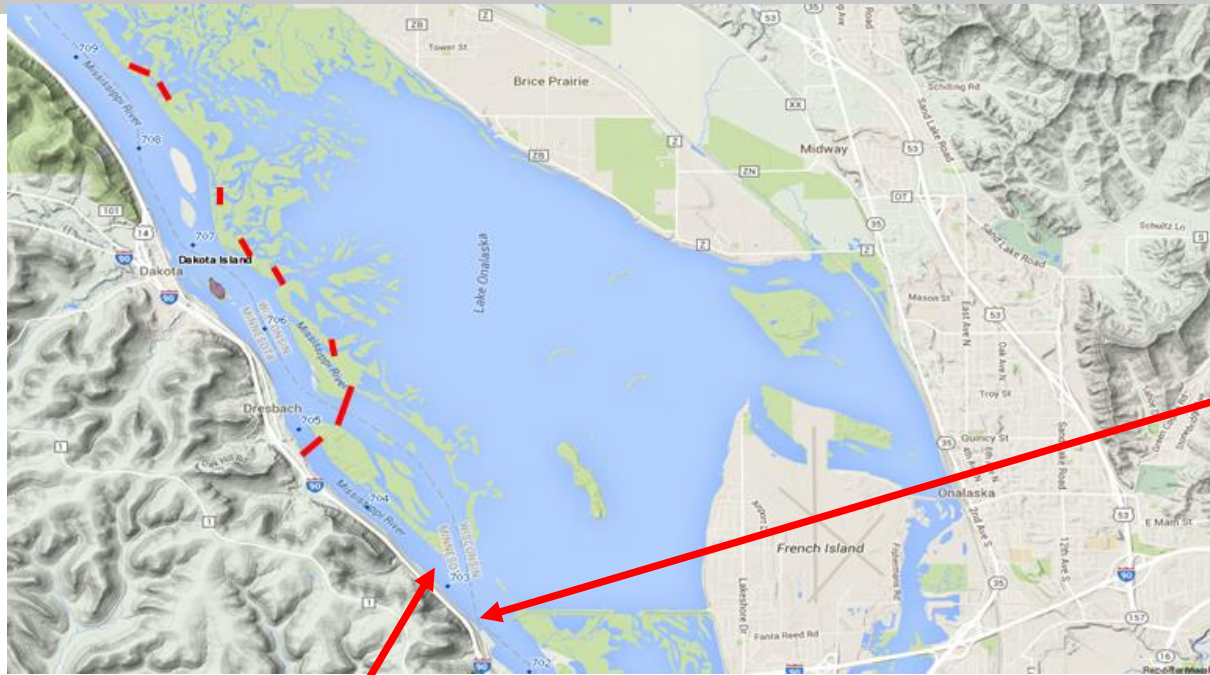
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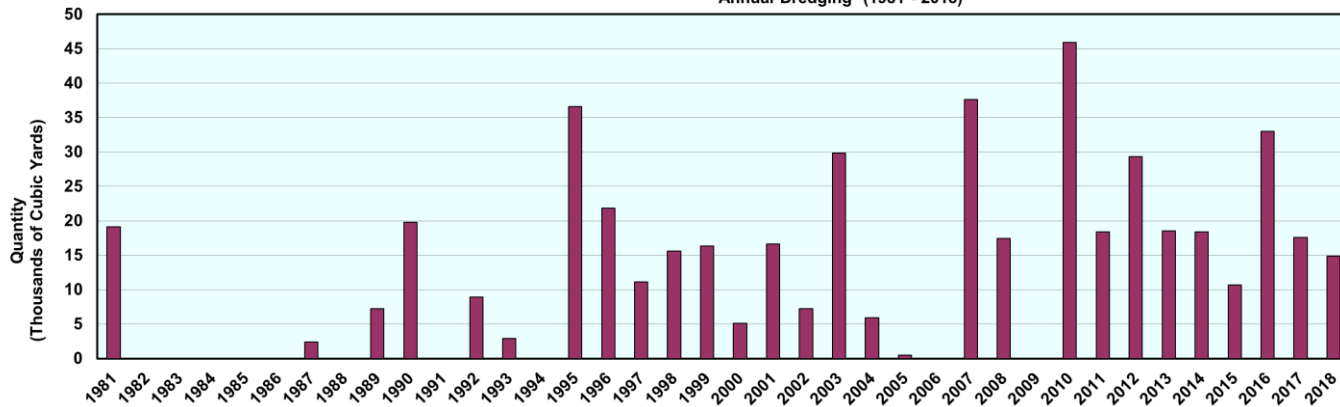
WATER SURFACE ELEVATION



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Mississippi River - Pool 7 - Lower Dresbach Island (RM. 703.0 - 703.7)
Annual Dredging (1981 - 2018)



Change in Water Exchange Ratio:

- Shifted dredging downstream
- Increased outdraft at LD 7



