

Flow Routing Tool and Channel Width Model

Patrick Farrell

Seth M Turner, PE

PRRIP Science Plan Reporting Session

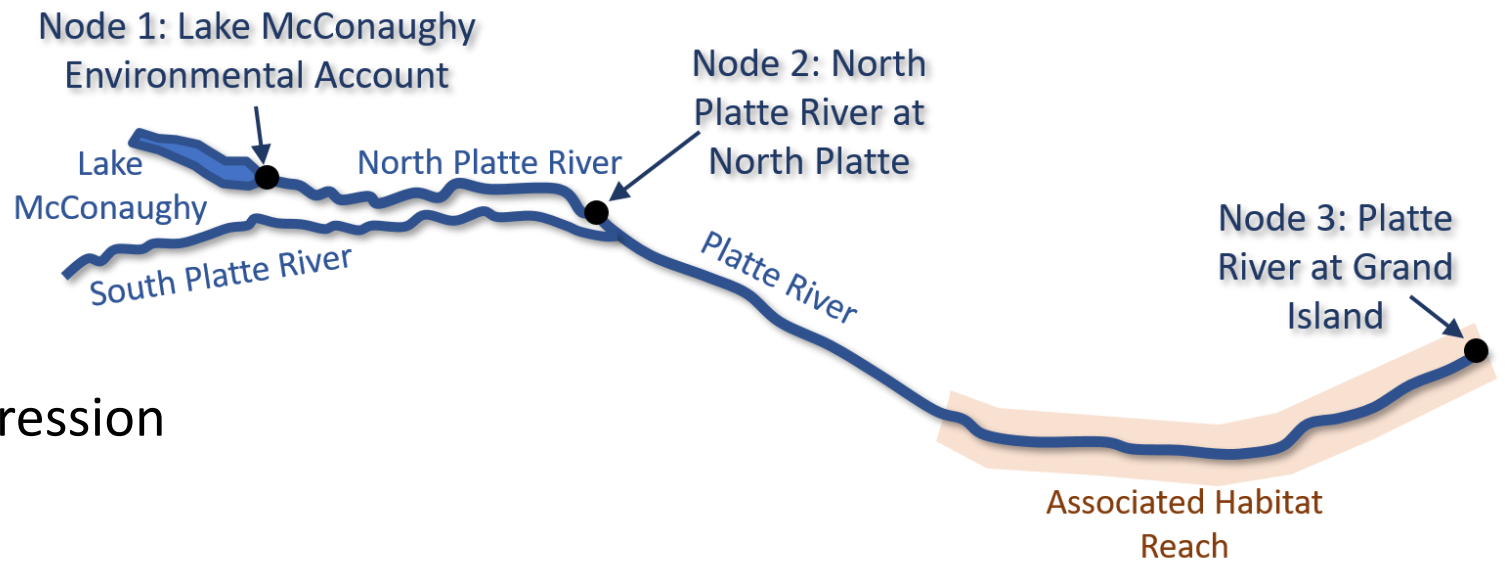
February 15, 2022

First Increment Extension

- WC Species Objective
- Extension Big Questions (EBQs)
 - EBQ #1 – How effective is it to use Program water to maintain suitable whooping crane roosting habitat?
 - EBQ #2 – How effective is Program management of Phragmites for maintaining suitable whooping crane roosting habitat?
 - 30-day minimum germination suppression releases (1,500 cfs target between June 1-July 15)
- Tools:
 - Flow routing tool
 - Channel width model

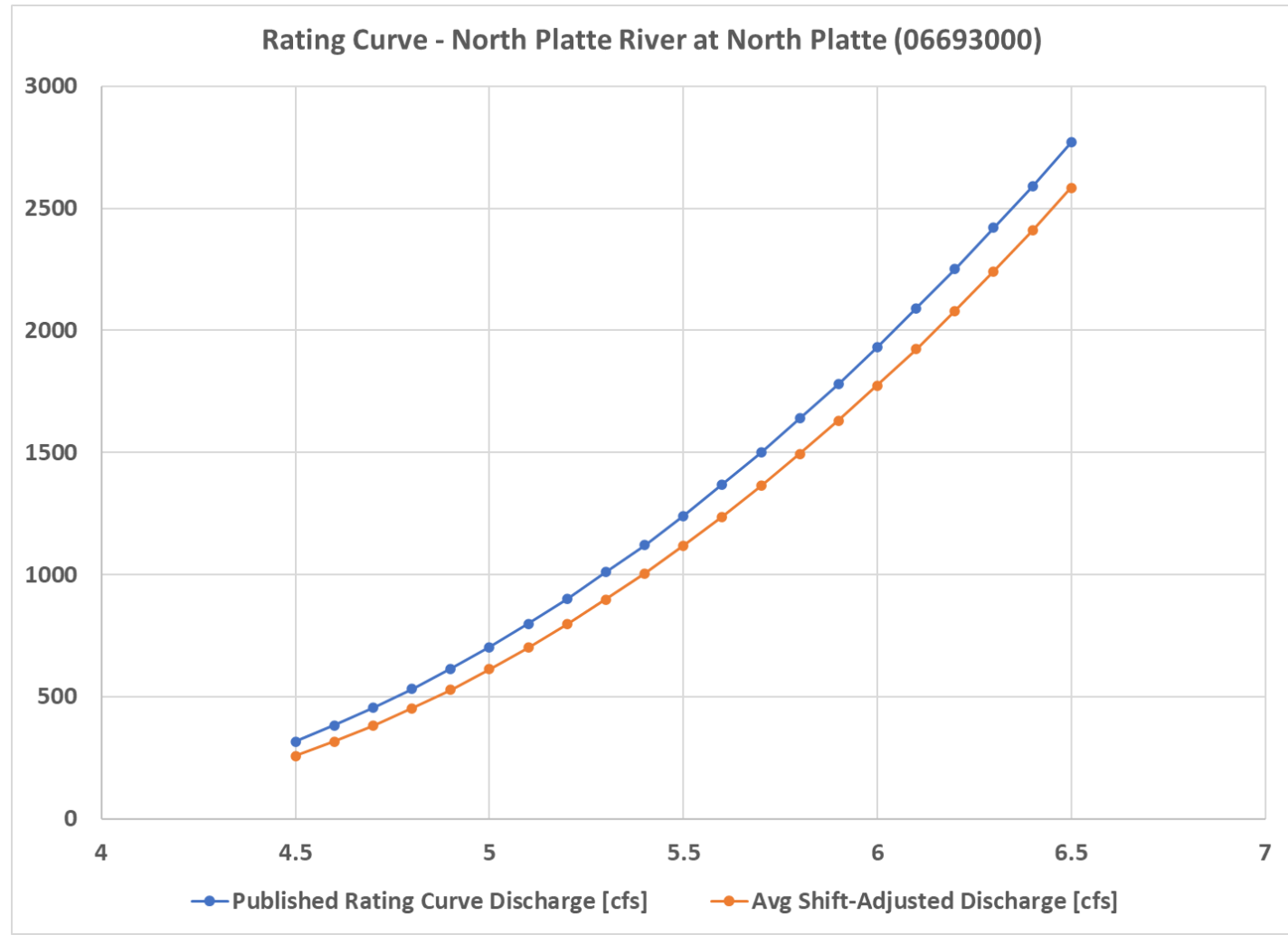
Flow Routing Tool

- Highly simplified representation of Platte River system
- Microsoft Excel
- Routing of EA releases to evaluate management scenarios
- 3 nodes
 - Lake McConaughy EA
 - North Platte
 - Grand Island
- 3 EA release options
 - Spring migration
 - June-July germination suppression
 - Fall migration

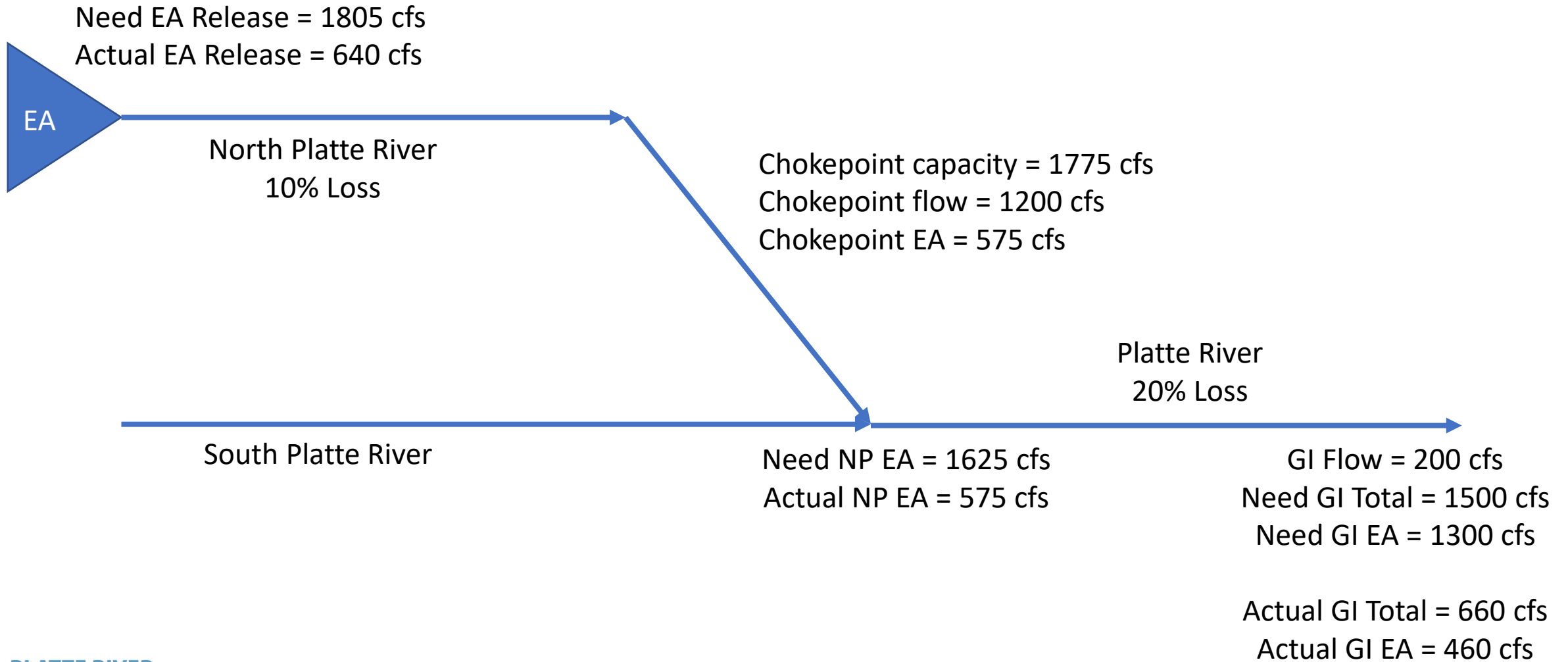


Model Inputs

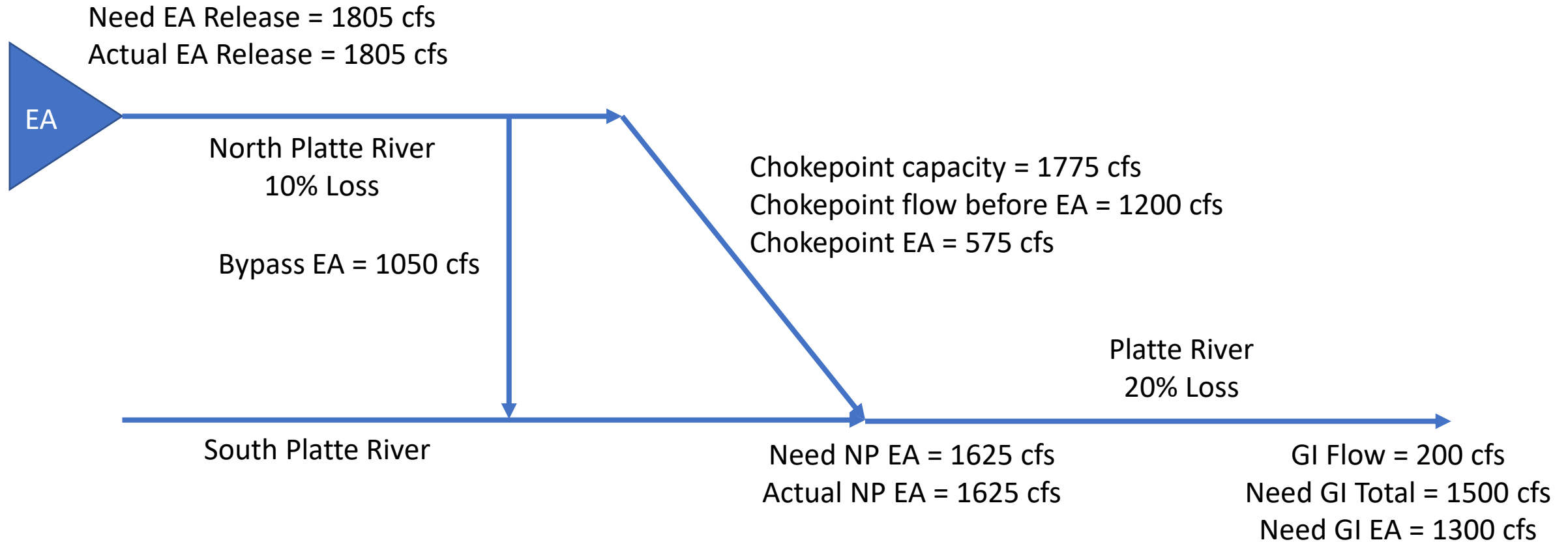
- Scenario years (12-year sequence)
- Desired flow at Grand Island
- Maximum stage at North Platte
- Bypass canal capacity
- Percentile-based parameters
 - Transit losses
 - EA accruals



Example Calculation – No Bypass Canal

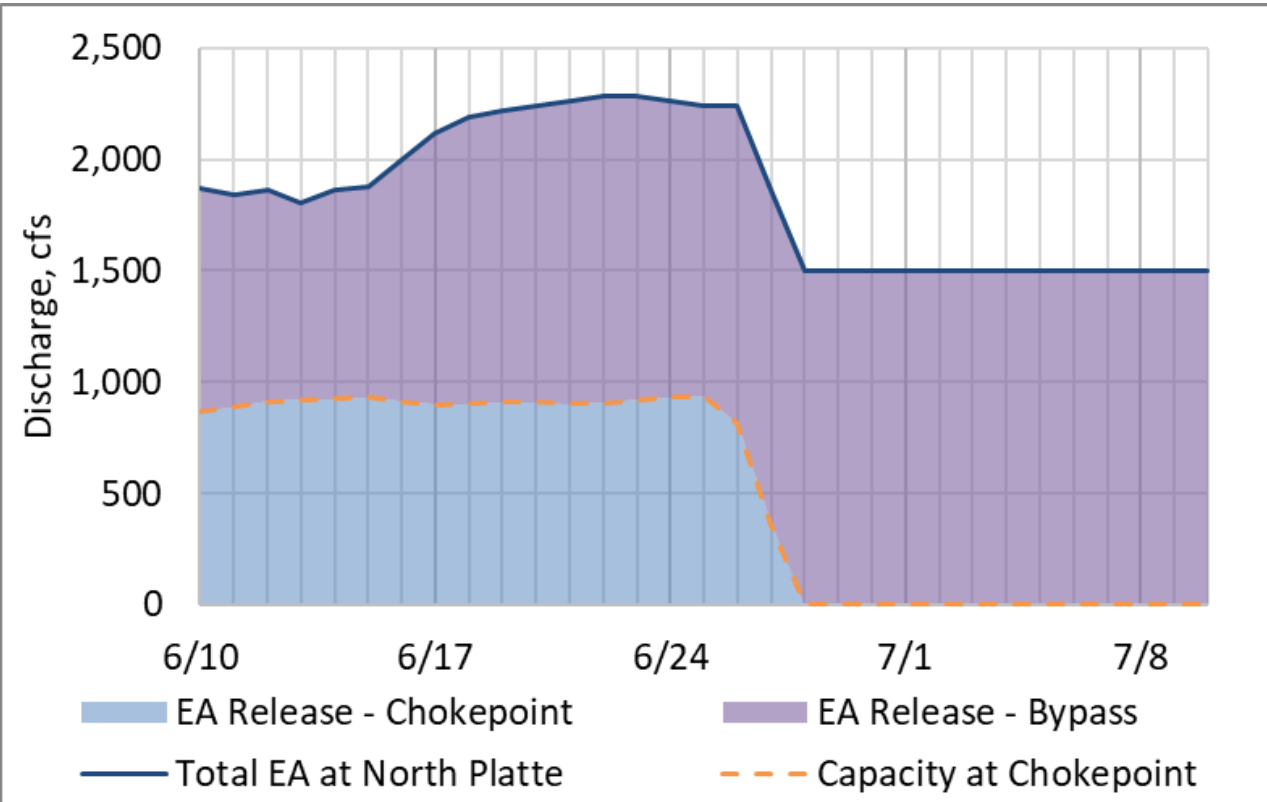


Example Calculation – With Bypass Canal

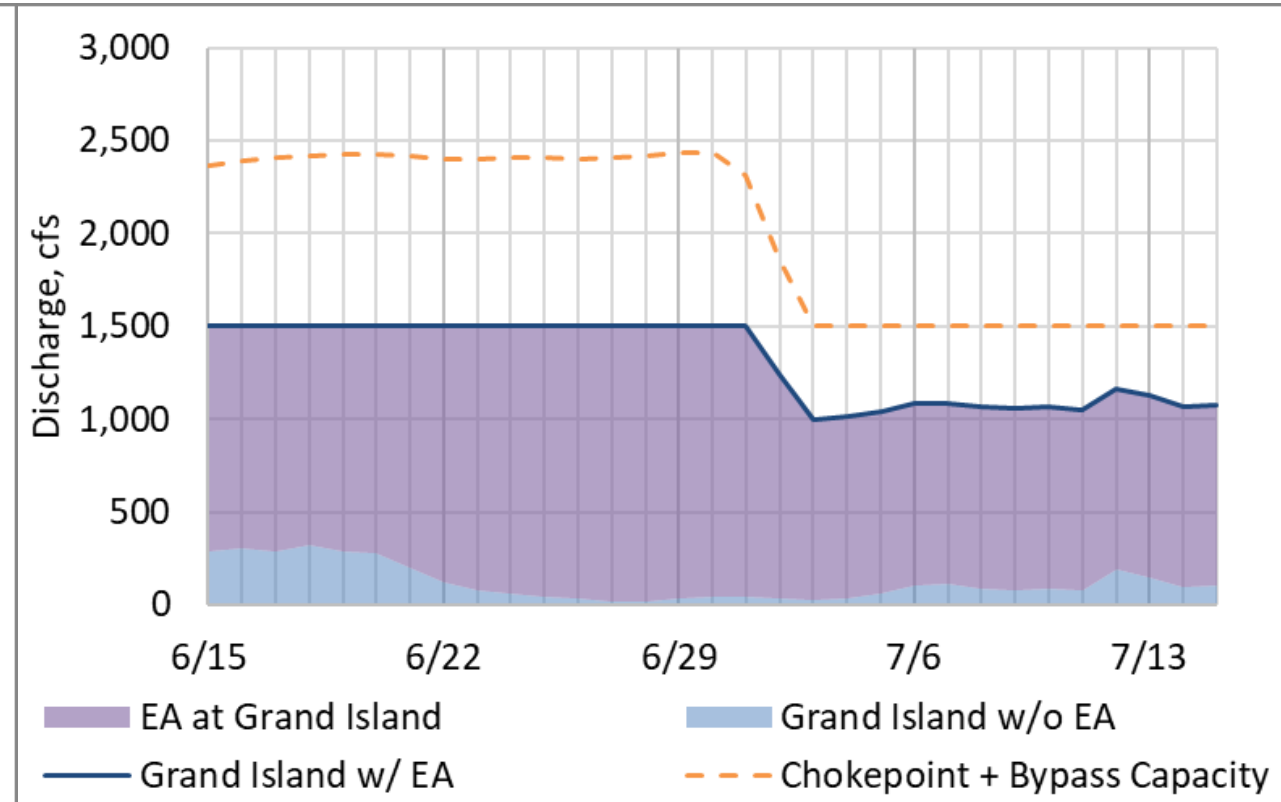


Example Model Output

EA Release at North Platte,
Chokepoint vs Bypass Canal



Flow at Grand Island



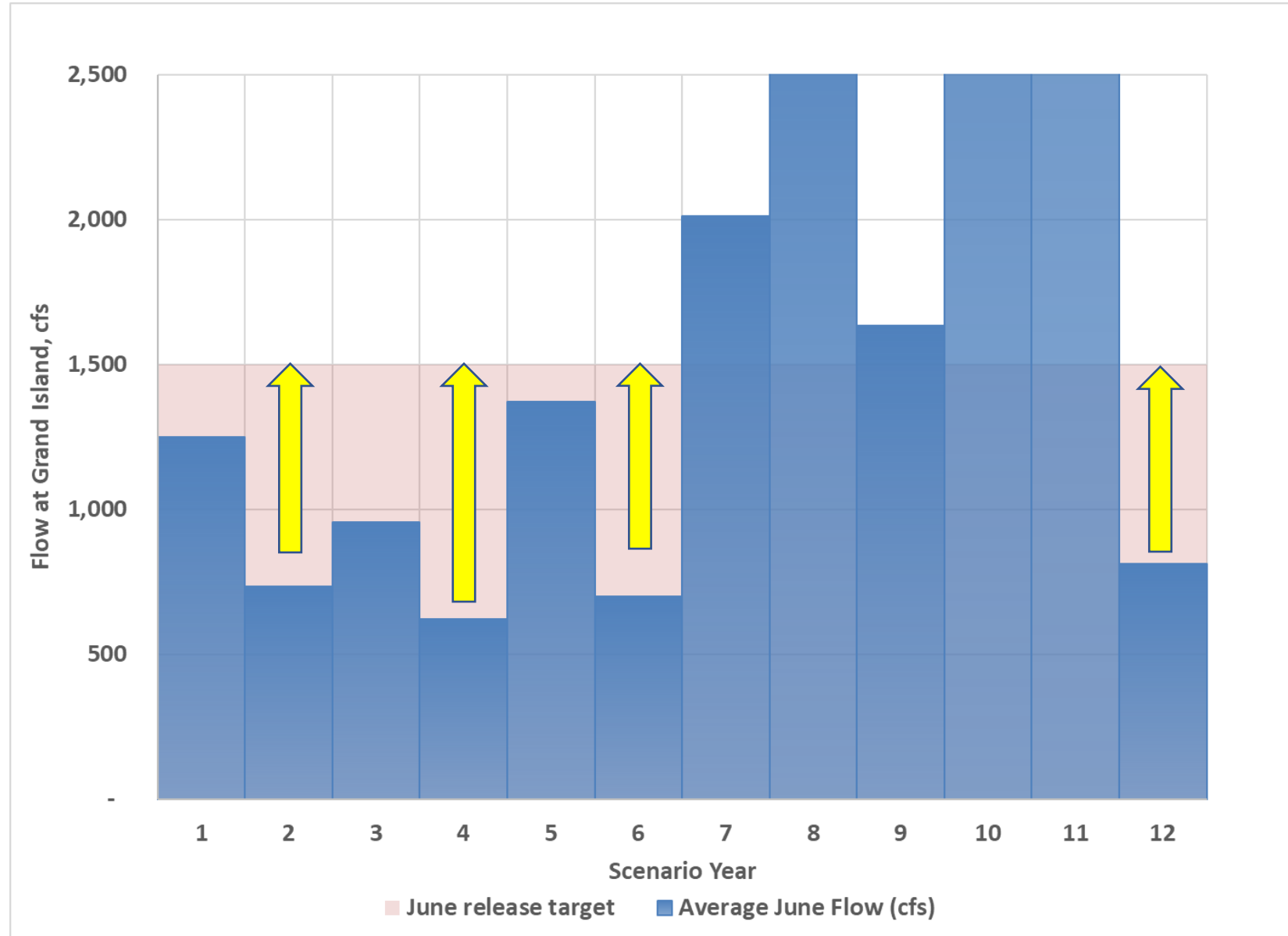
- Direct calculation of EA and total flows at North Platte and Grand Island
- Estimates of flow at Overton, Kearney, and Duncan
- Daily flows used to calculate flow variables for channel width model

Future AHR scenarios: Flows

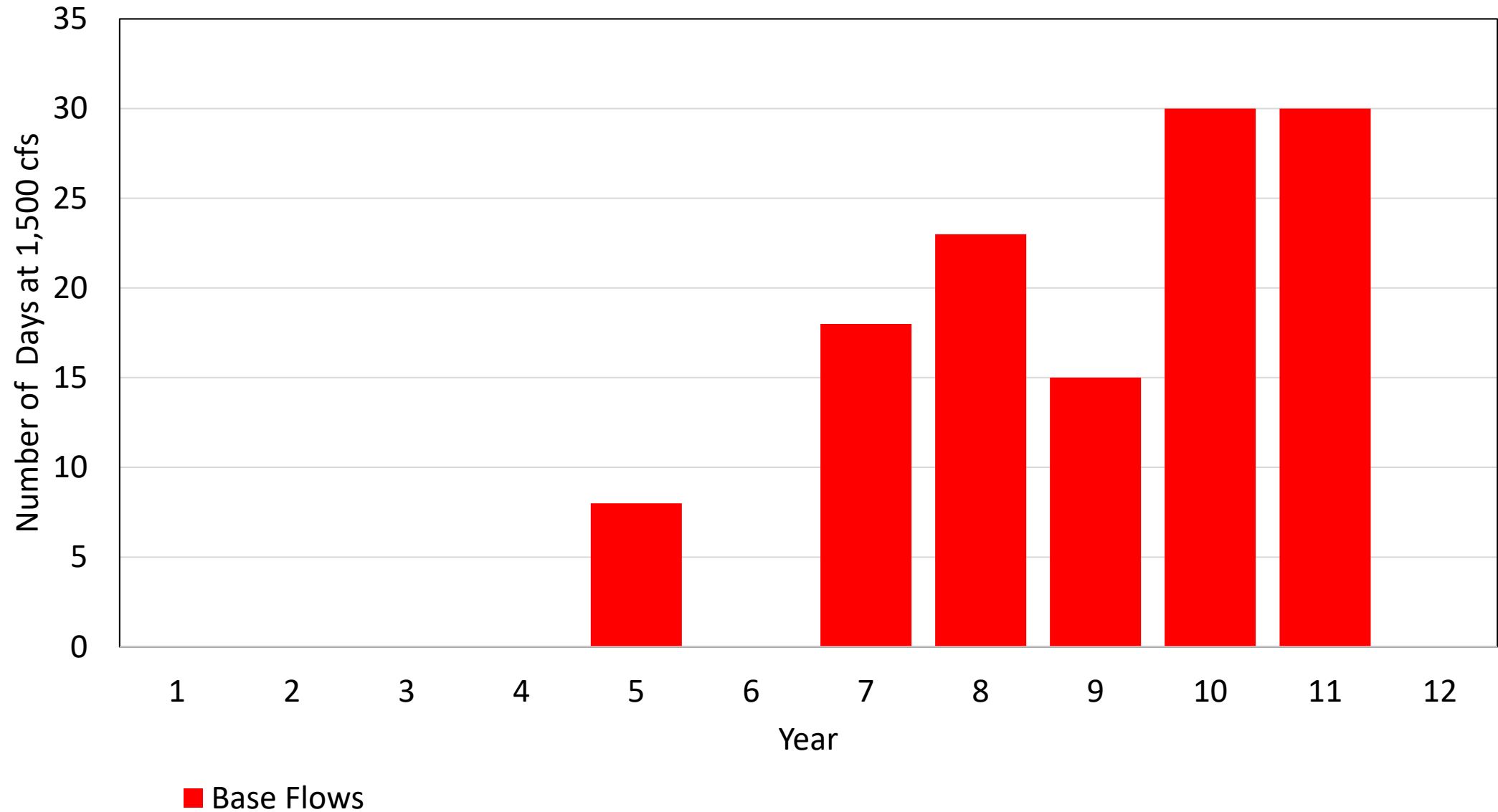
- Primary objective
 - Understand how flow releases can be used to reach 30-day minimum flow target in the First Increment Extension
- Management Scenarios
 - Base flows
 - Base flows + flow releases
 - Base flows + flow releases with bypass canal

Future AHR scenarios: flow releases

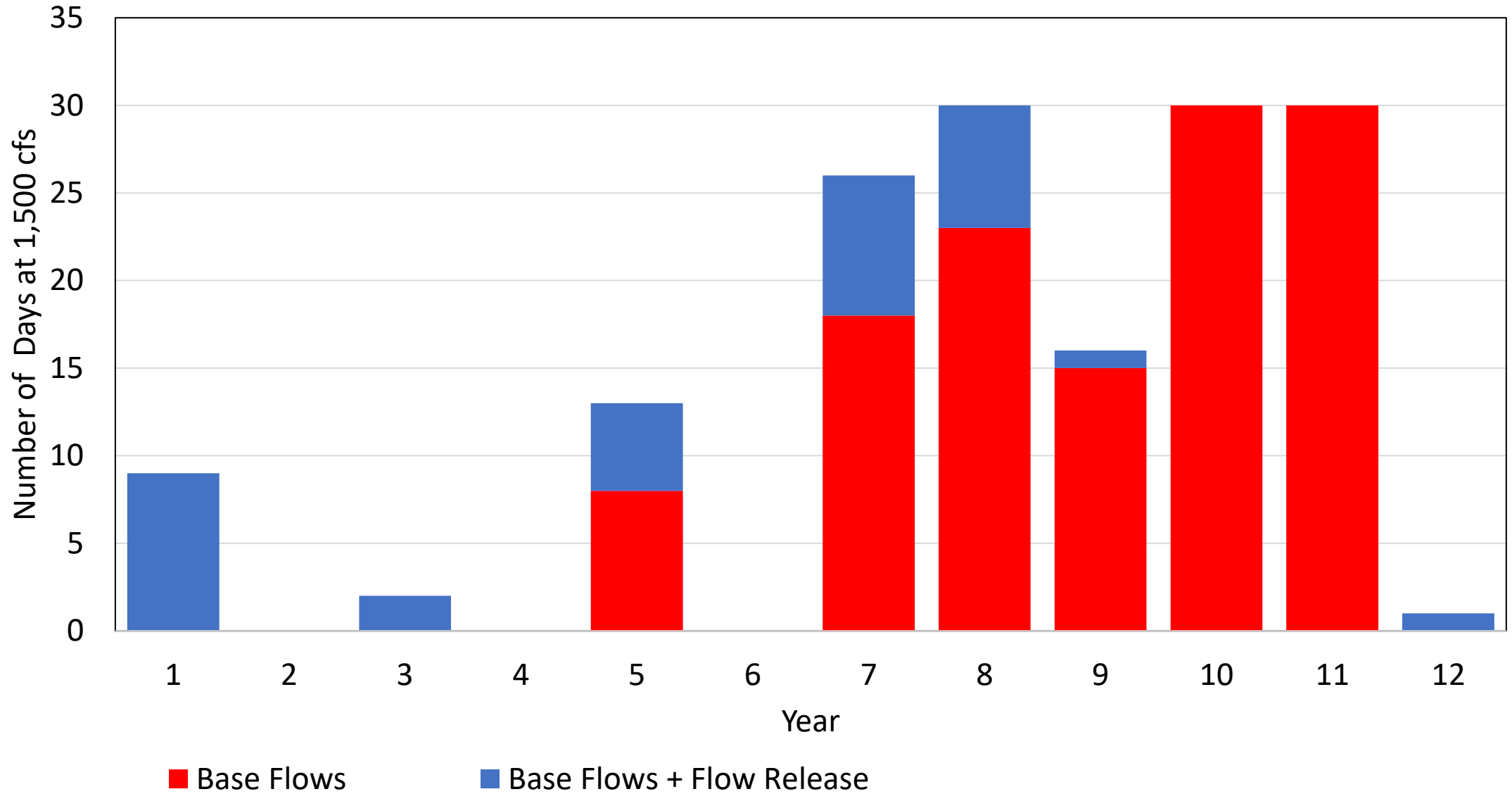
- Released water from Lake McConaughy through Grand Island
- Assumptions
 - 2001 – 2012 hydrology
 - 5.5 ft North Platte chokepoint max river stage
 - Germination suppression only
 - 1,500 cfs target flow at Grand Island
 - 1,500 cfs bypass canal capacity



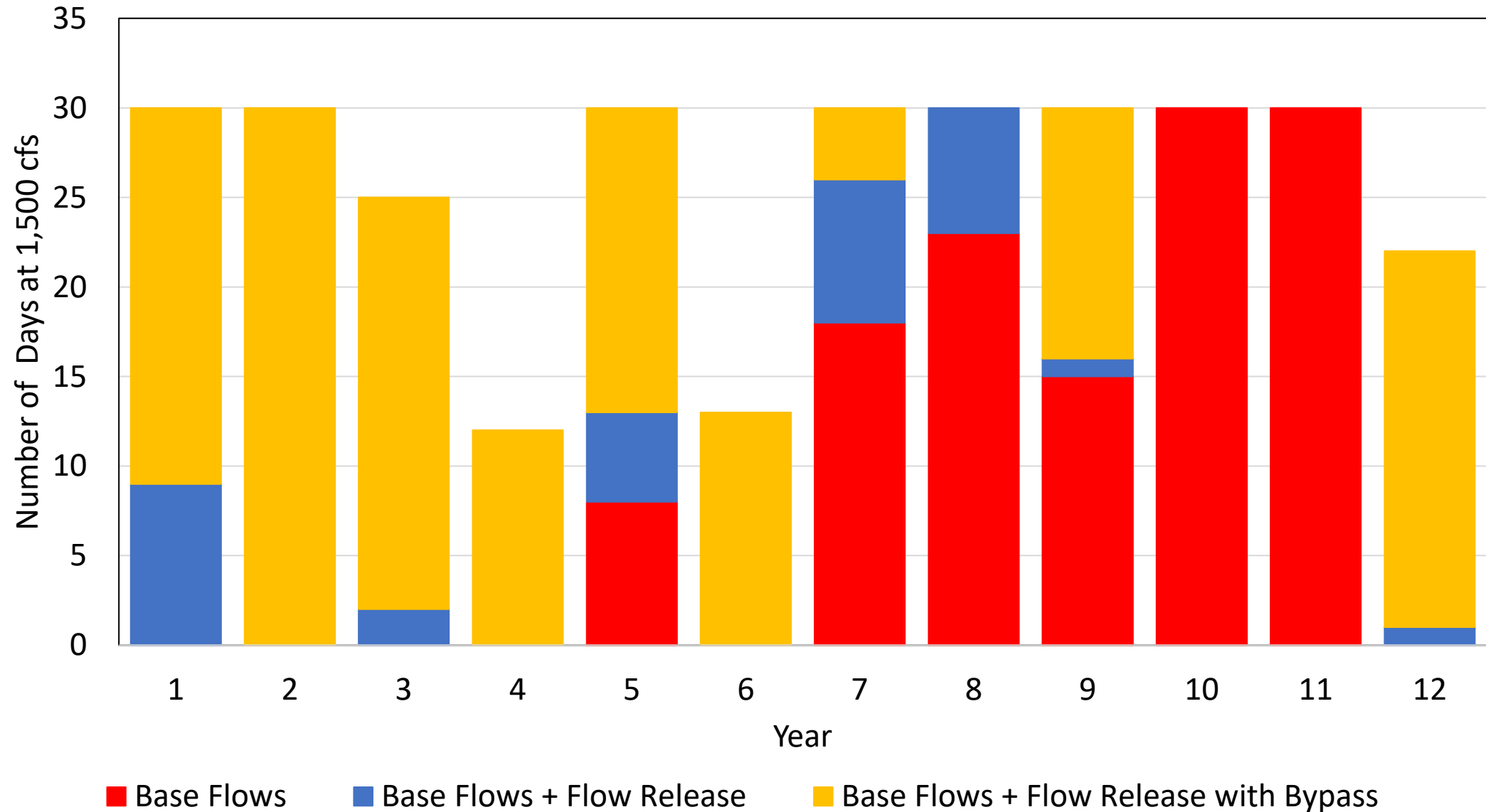
Flow scenario: Base Flows



Flow scenario: Base Flows + Flow Releases

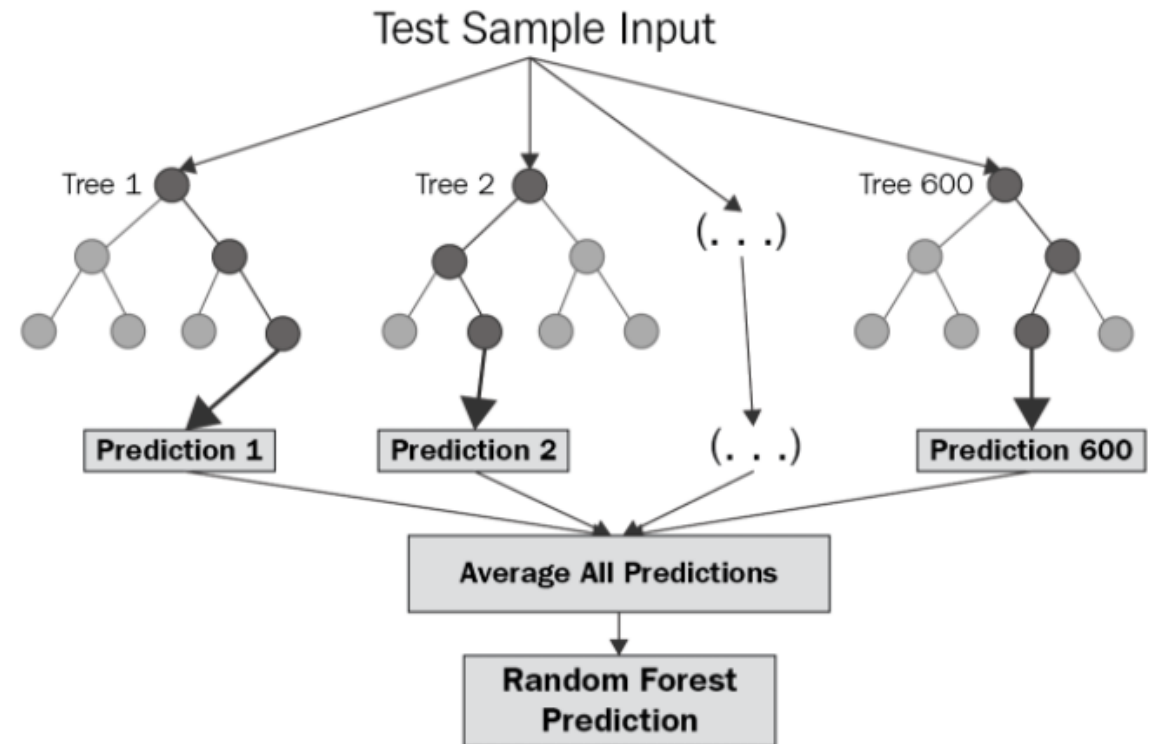


Flow scenario: Base Flows + Flow Releases with Bypass



Channel Width Model

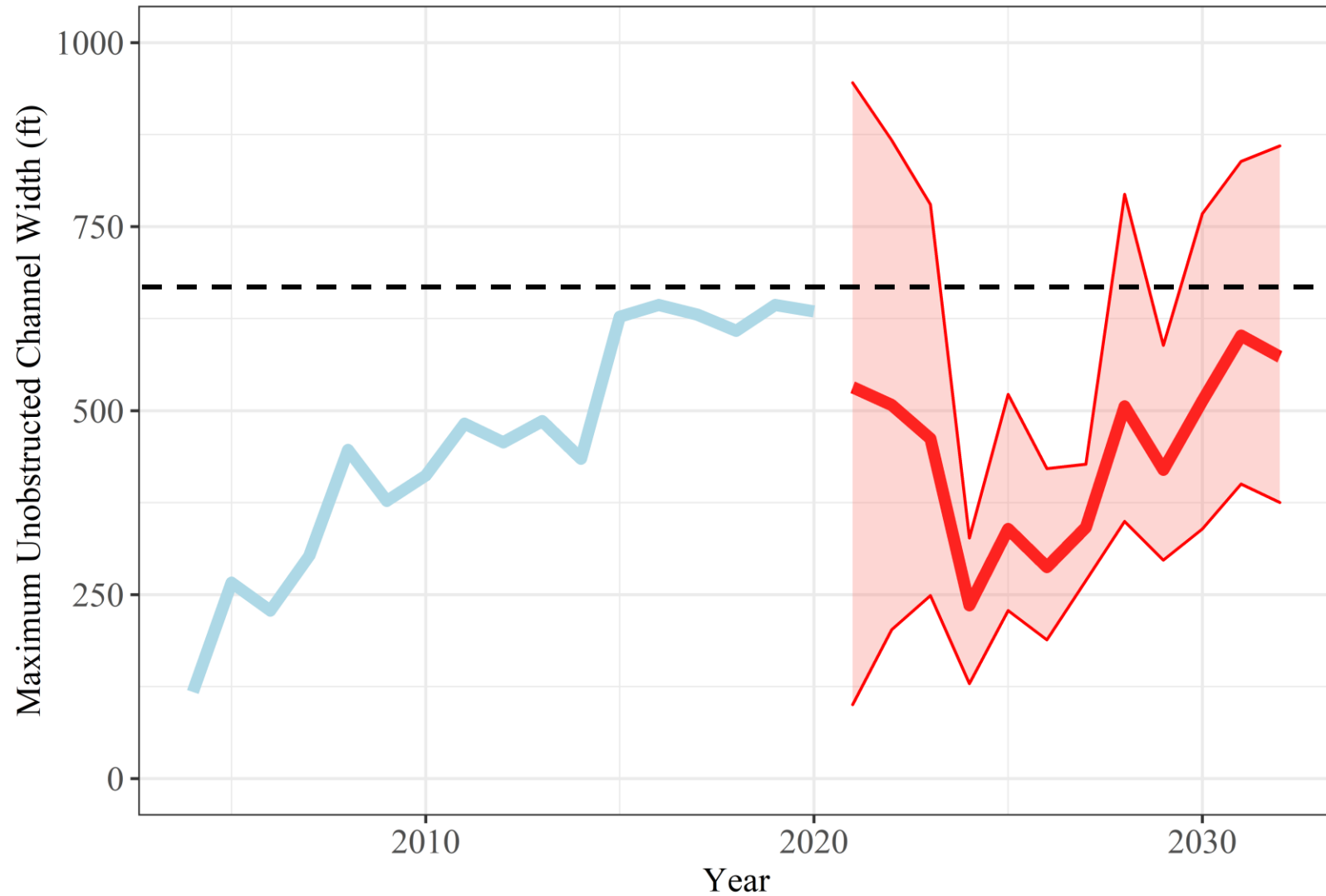
- Updates
 - Δ MUCW
- Past peak flows
- Random Forest model optimization using 10-fold cross validation.
- Bootstrapped confidence intervals



Future AHR scenarios: Flows + Management

- Primary objective
 - Understand how flow releases can maintain wide, unobstructed channel widths in the First Increment Extension
- Management Scenarios
 - Herbicide application
 - Herbicide application + base flows + flow release
 - Herbicide application + base flows + flow release with bypass canal

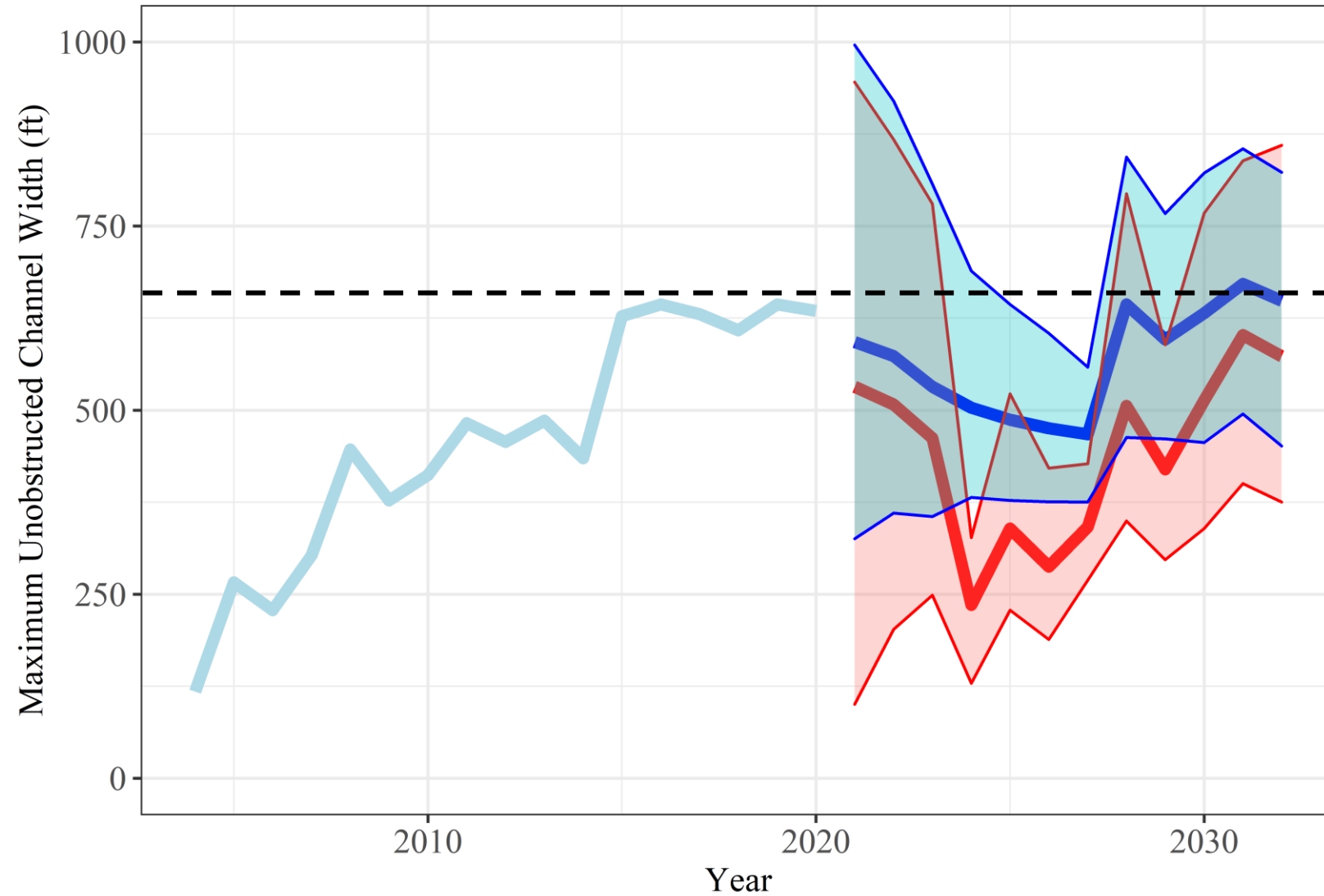
Flow scenario: Herbicide only



* Estimates and confidence intervals here represent bootstrapped averages and 90% confidence intervals not fully represented in the Channel Width Model brief version.

Scenario ■ Herbicide

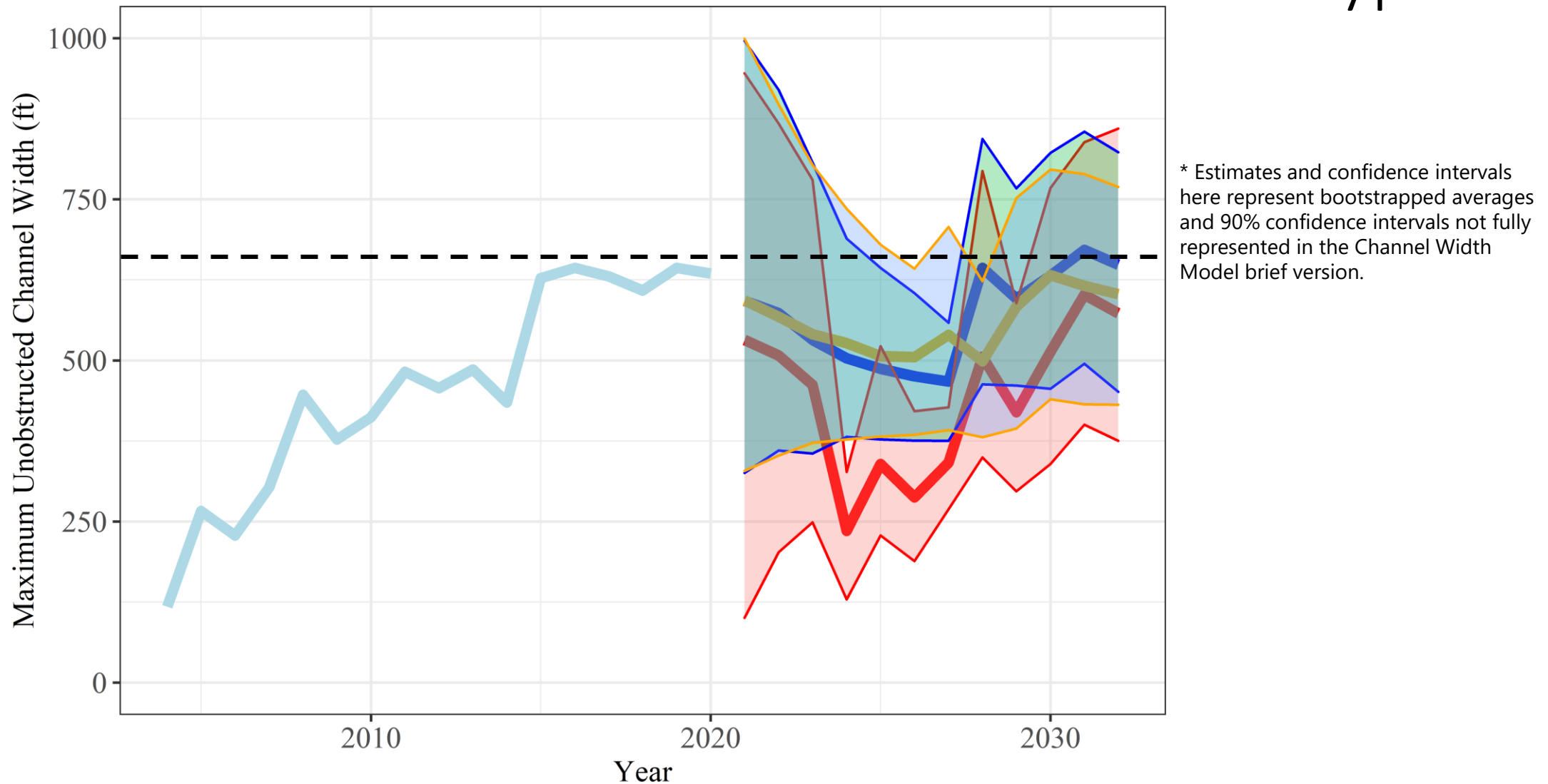
Flow scenario: Herbicide + Flow Releases



* Estimates and confidence intervals here represent bootstrapped averages and 90% confidence intervals not fully represented in the Channel Width Model brief version.

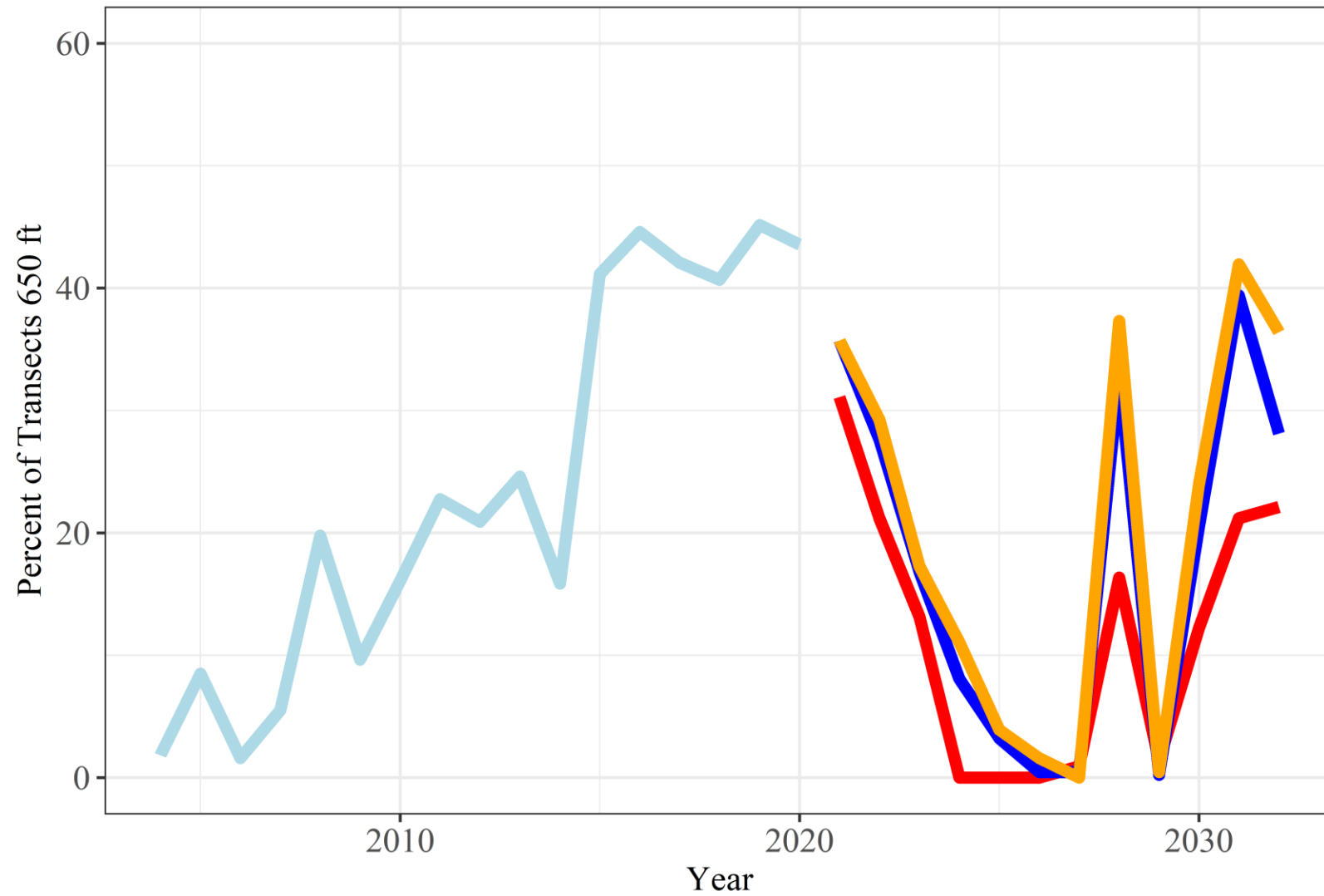
Scenario ■ Herbicide ■ Herbicide + Flow Releases

Flow scenario: Herbicide + Flow Releases with bypass



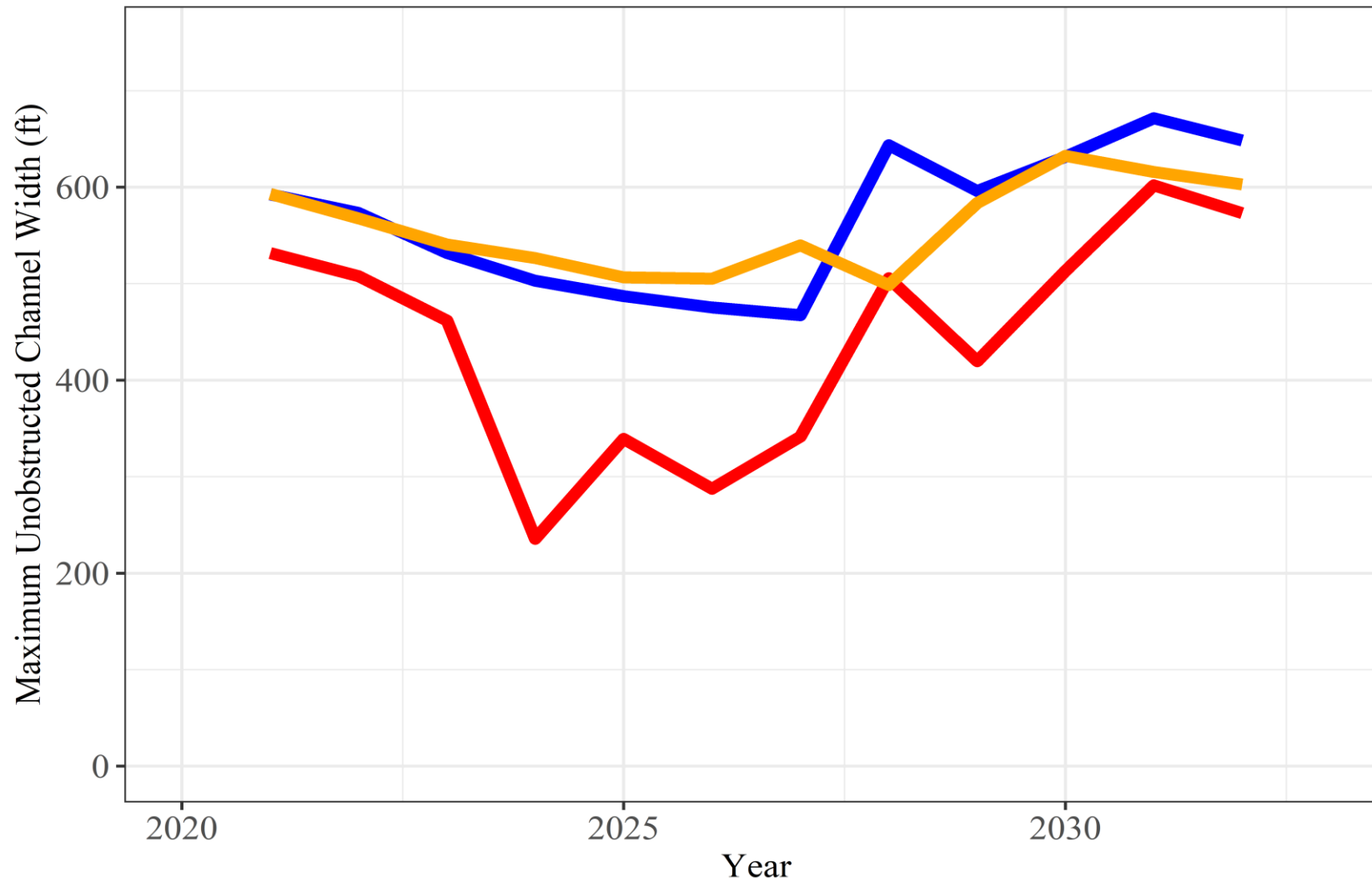
Scenario ■ Herbicide ■ Herbicide + Flow Releases ■ Herbicide + Flow Releases with Bypass

Flow scenario: Herbicide + Flow Releases with bypass



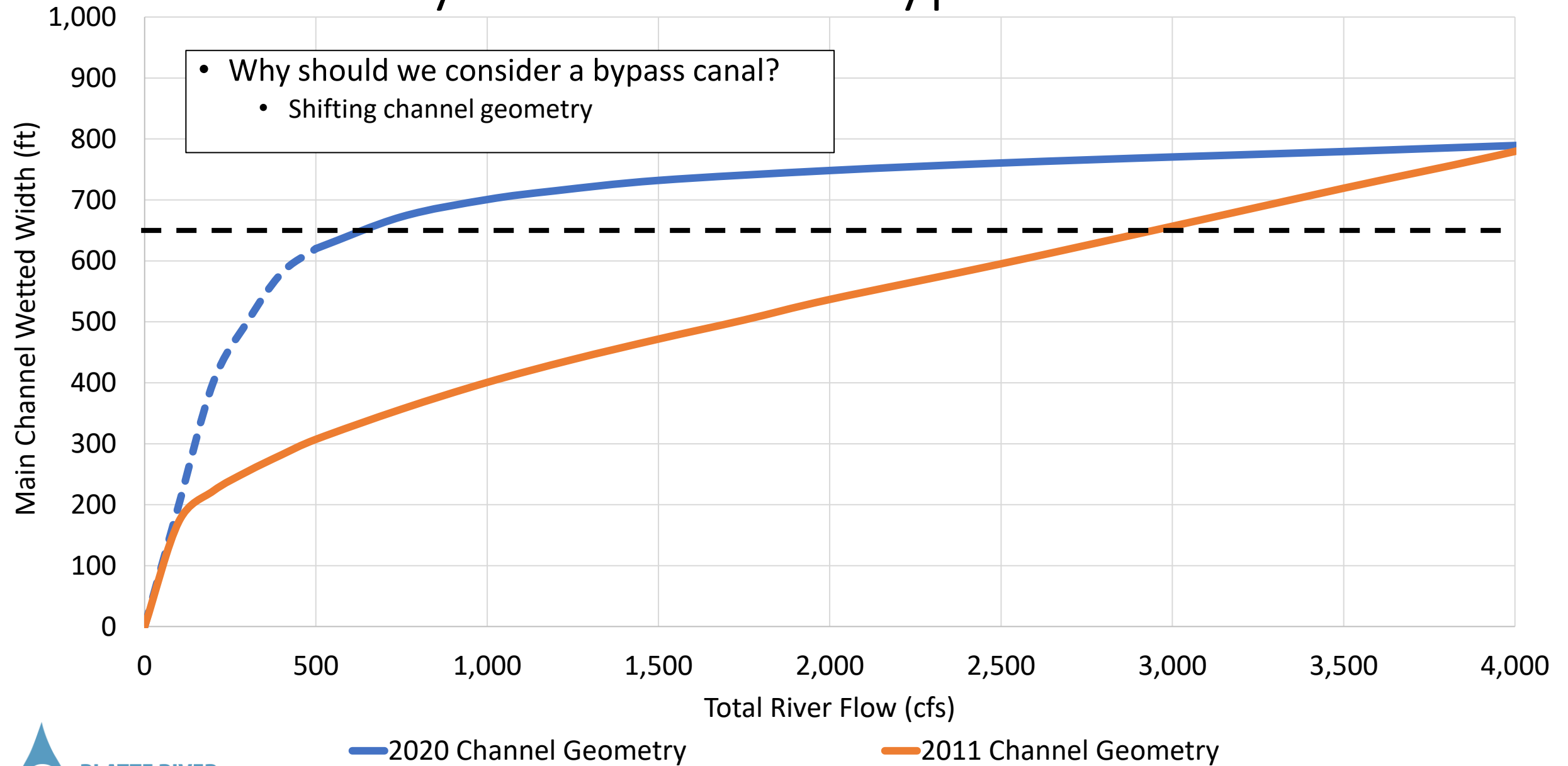
Scenario ■ Herbicide ■ Herbicide + Flow Releases ■ Herbicide + Flow Releases with Bypass

Preliminary conclusions: EA Releases



Scenario ■ Herbicide ■ Herbicide + Flow Releases ■ Herbicide + Flow Releases with Bypass

Preliminary conclusions: Bypass



Future Development

- Run EA releases for two more years
 - Determine germination suppression effectiveness
 - Similarity to natural flows
- Refine integration of bypass canal operation in flow routing tool
- Monte Carlo simulations to explore climatic variability

Discussion Questions

- 1) Did we choose an appropriate way to project channel width prediction uncertainty through the First Increment Extension (2021-2032) to communicate future channel width conditions under different scenarios? If not, what constitutes a more appropriate method to project into the future?
- 2) What performance indicators are most important to understand the effects of germination suppression flows and other management actions (e.g., river channel disking, in-channel herbicide application) on channel width conditions? What visual representations would be most effective to communicate the costs (EA water and money) and benefits of actions to a broad audience?
- 3) How do we incorporate channel width modeling to make the decision whether to continue germination suppression flow releases at periodic check points during the First Increment Extension (See Figure 5 – Extension Science Plan Attachment #3) and what other information do we need to make those decisions?