Folsom Dam Water Control Manual Update

Joint Federal Project, Folsom Dam

Public Workshop
May 25, 2016
Sacramento Library Galleria
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US Army Corps of Engineers
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WELCOME
&
INTRODUCTIONS

PURPOSE OF MANUAL UPDATE

- Revise operation rules for Folsom Dam to reduce flood risk based on the capabilities of the Folsom Joint Federal Project (JFP).
- Reflect operational capabilities created by improved weather forecasts.
- Potentially reduce the volume of flood control reservation in Folsom Reservoir at any particular time by comparison to the operations that have been in effect since ‘95

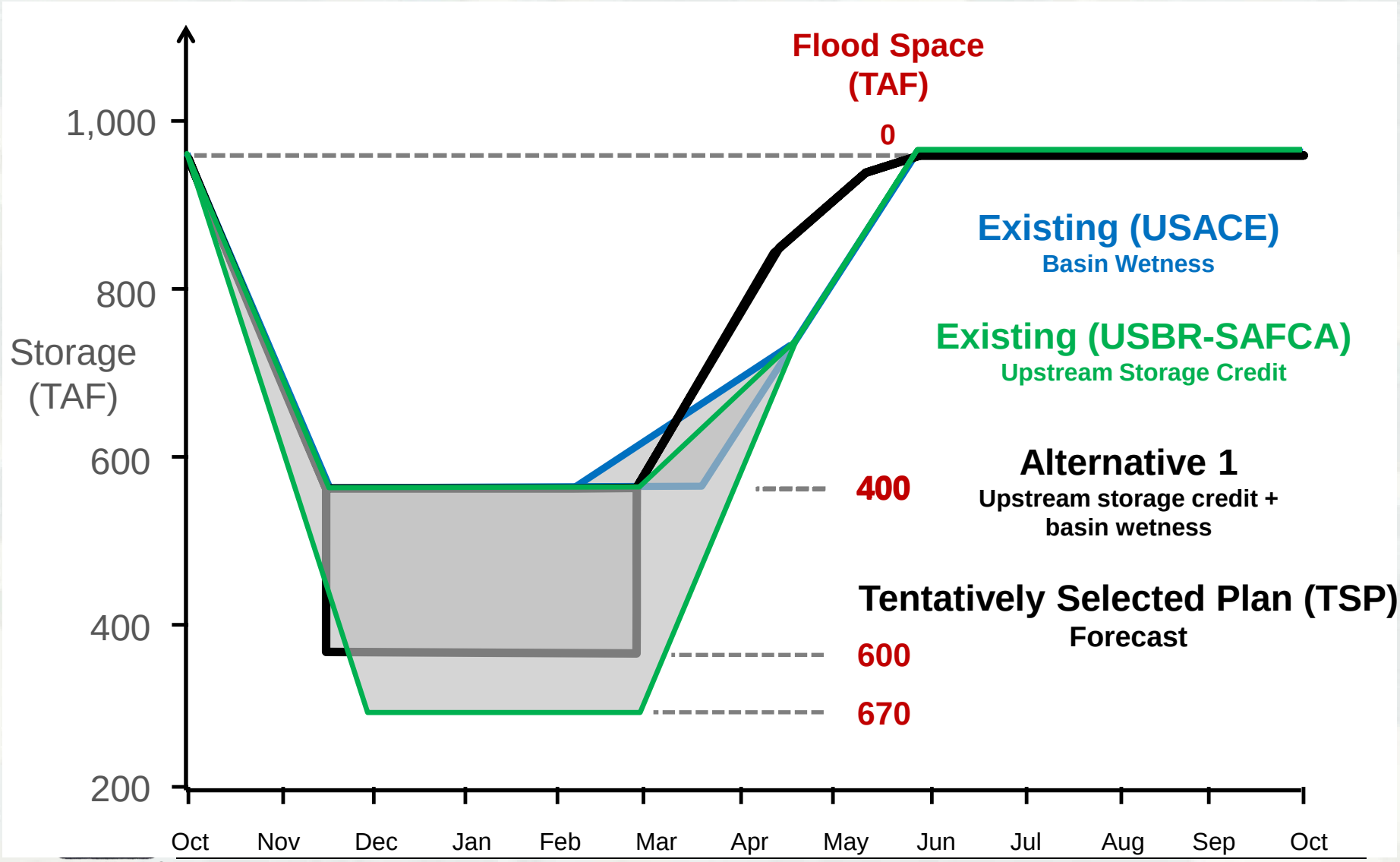
OBJECTIVES OF MANUAL UPDATE

- Pass the Probable Maximum Flood while maintaining 3 feet of freeboard below the top of dam to stay within the dam safety constraints of the U.S. Department of Interior, Bureau of Reclamation.
- Control a 1/100 annual chance flow (“100-year flood”) to a maximum release of 115,000 cubic feet per second as criteria set by the Sacramento Area Flood Control Agency to support Federal Emergency Management Agency levee accreditation along the American River.
- Control a 1/200 annual chance flow (“200-year flood”) as defined by criteria set by the State of California (State) Department of Water Resources to a maximum release of 160,000 cubic feet per second, when taking into account all the authorized modifications within the American River Watershed.

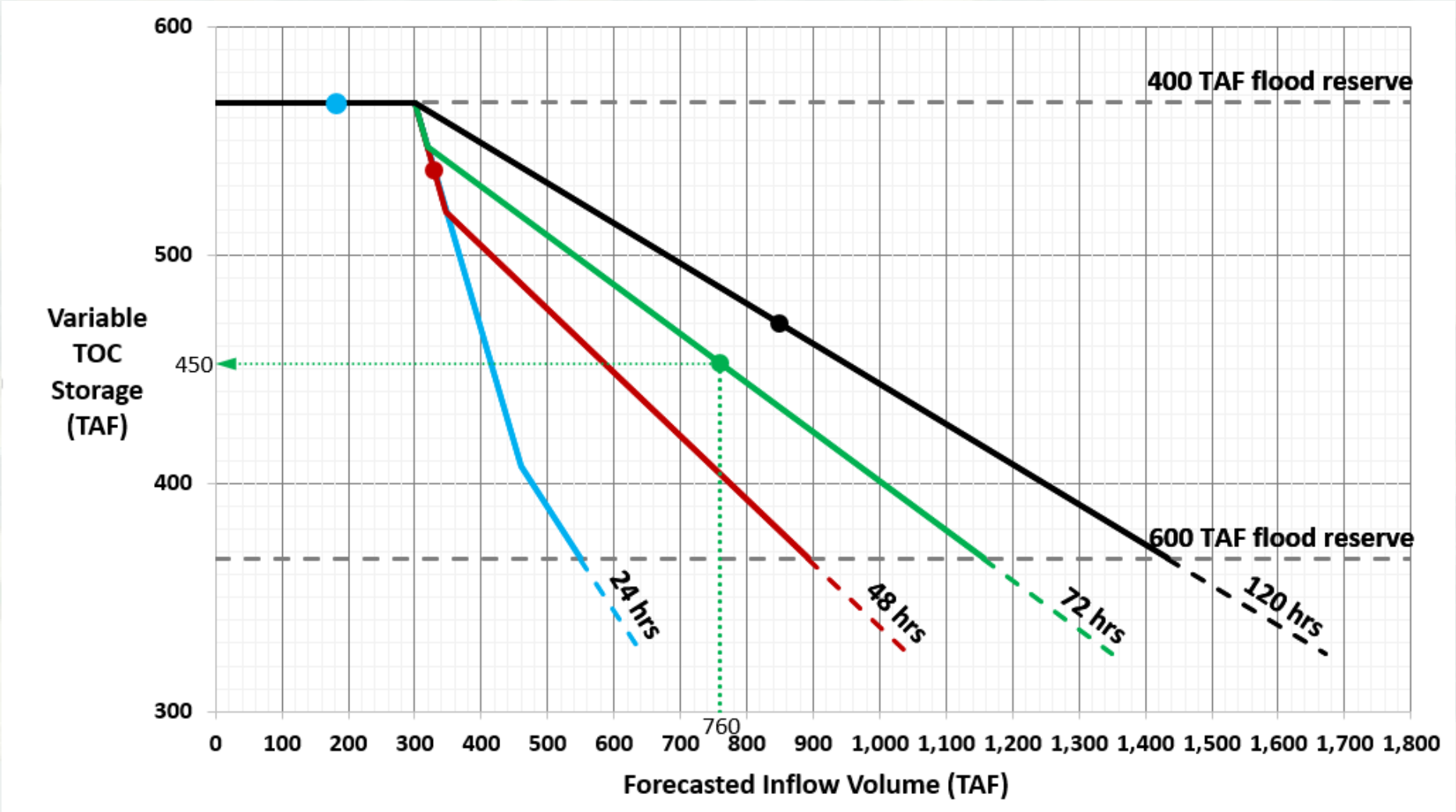
TODAY'S DISCUSSION

- Tentatively-Selected Plan
- Environmental Effects of the Tentatively-Selected Plan
- Project Milestone Schedule

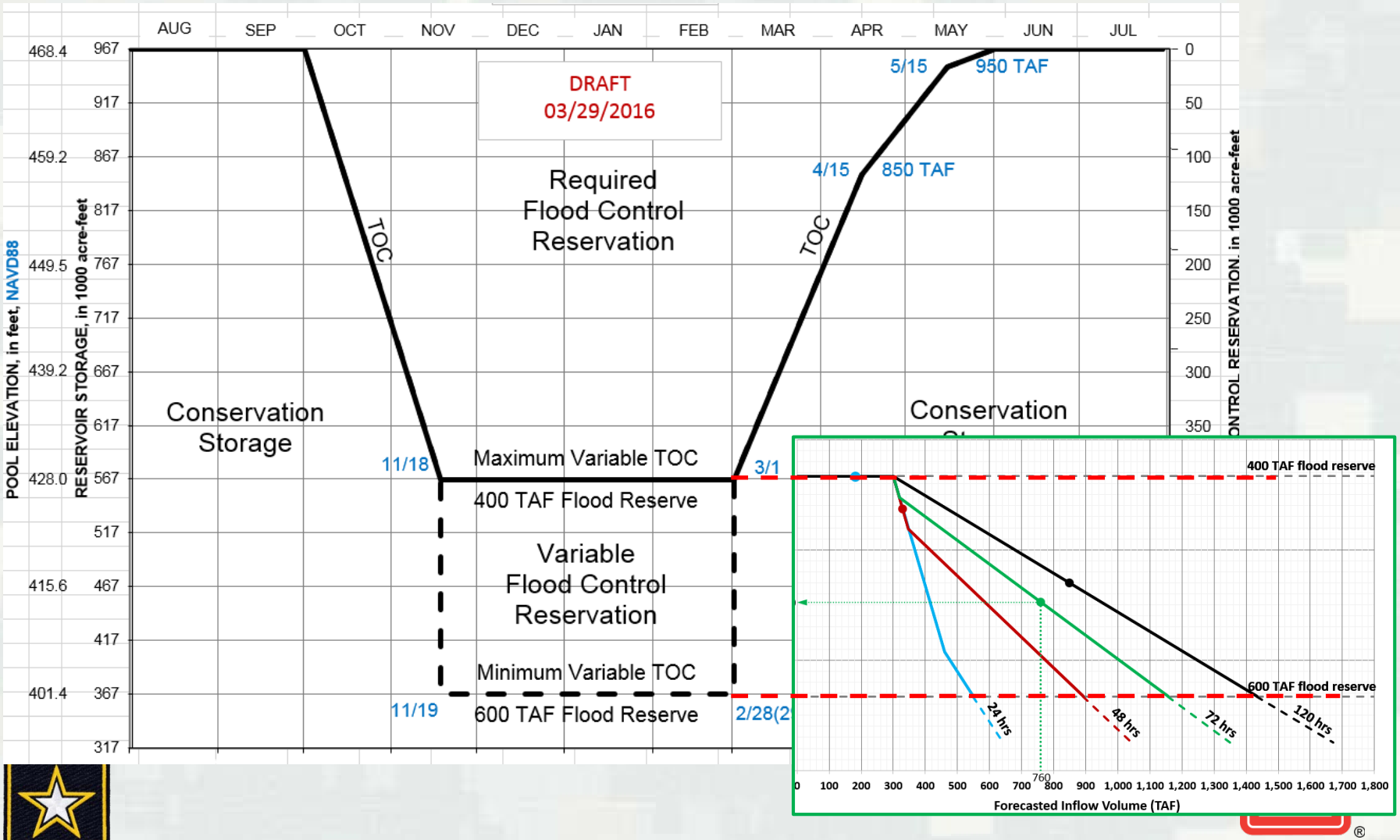
Water Control Diagrams

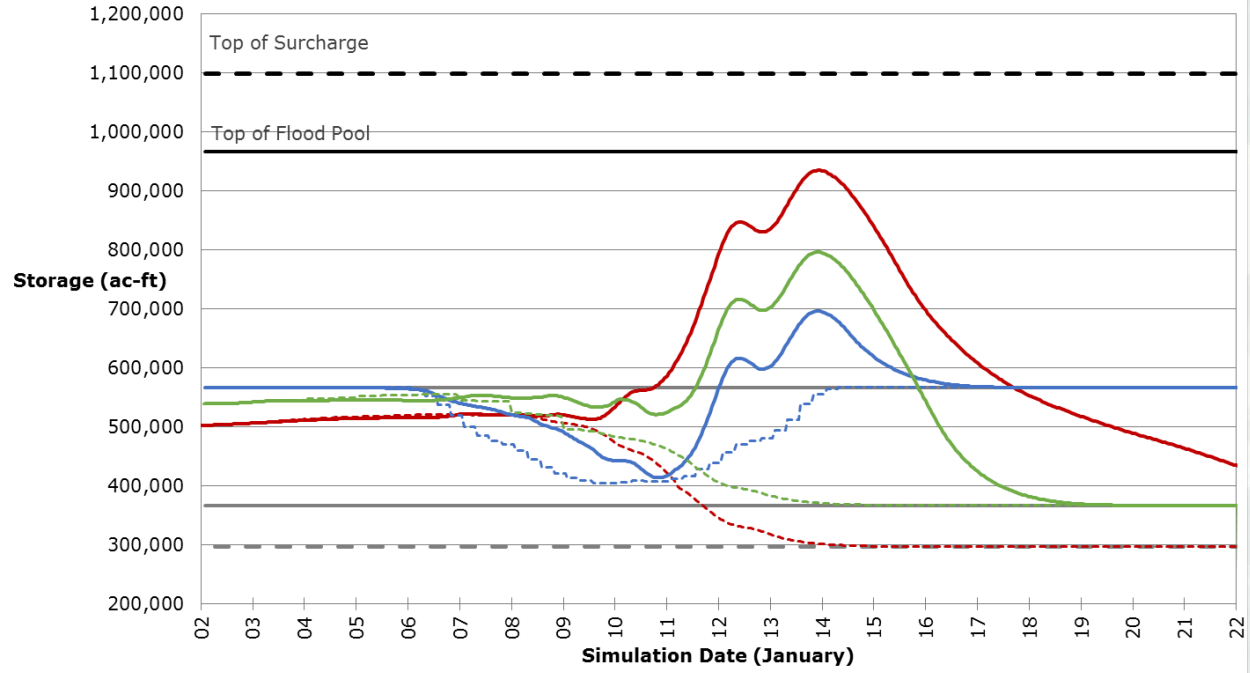


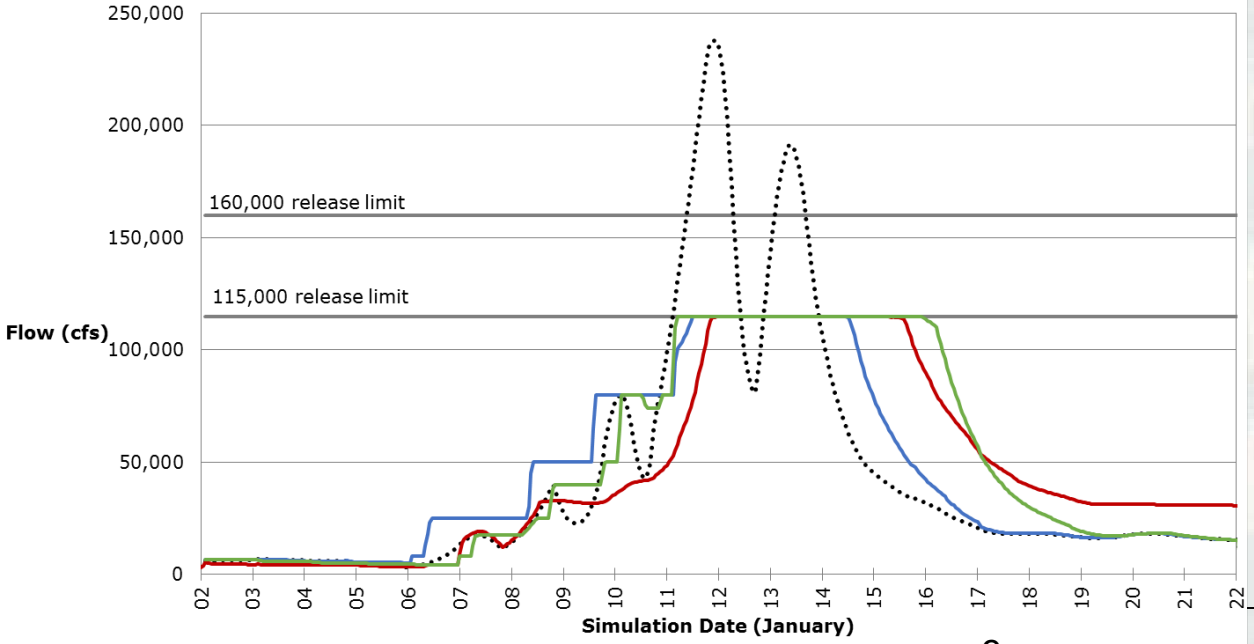
Forecast-based TOC



Water Control Diagram







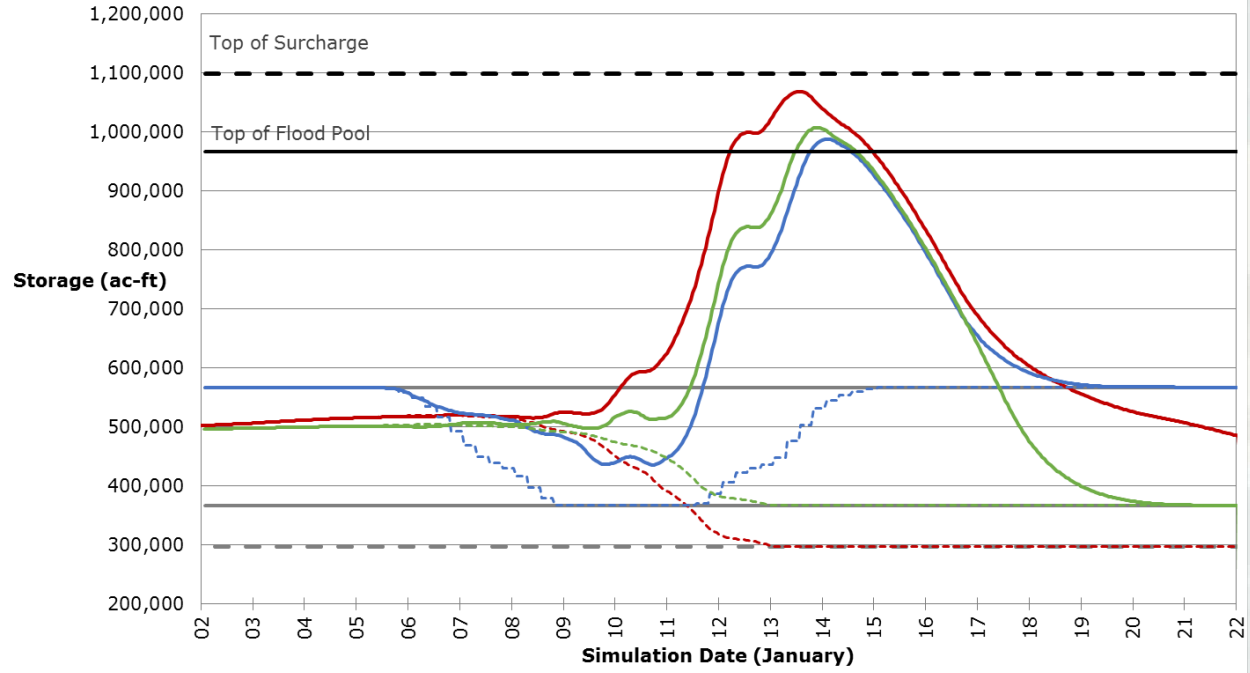
1986 event pattern scaled to 100-yr

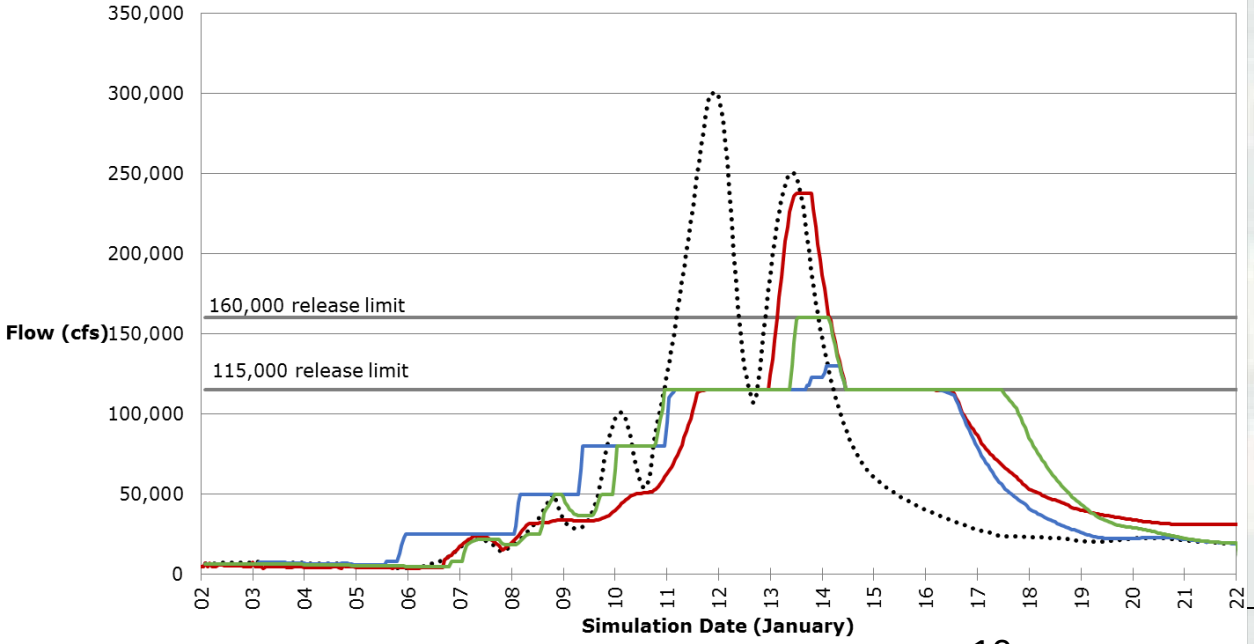
Forecast operation reflects perfect forecast

USBR/SAFCA – US storage

Alt. 1 – US storage and basin wetness

TSP – Forecast





1986 event pattern scaled to 200-yr

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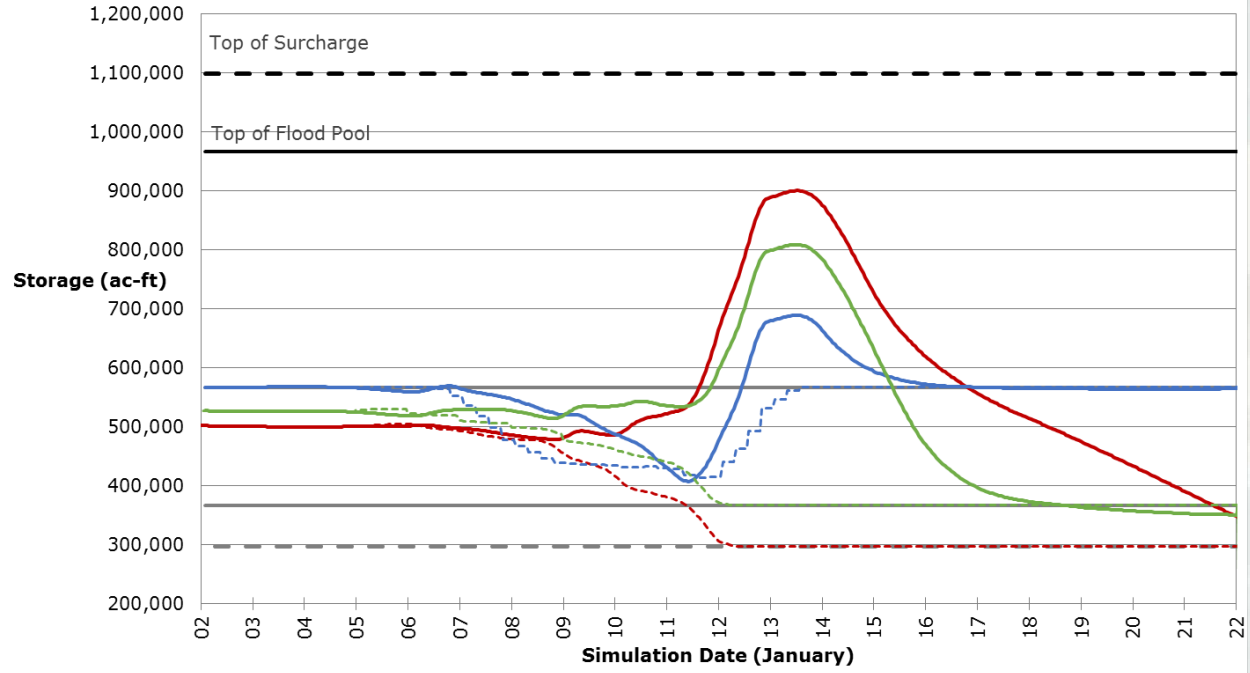

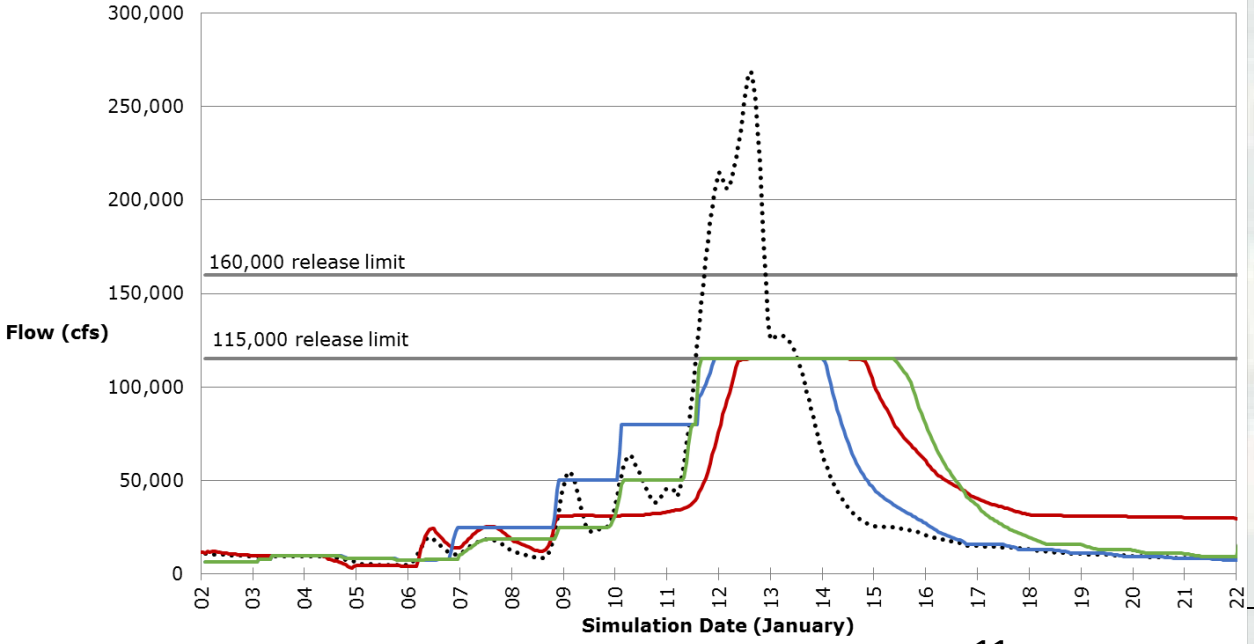

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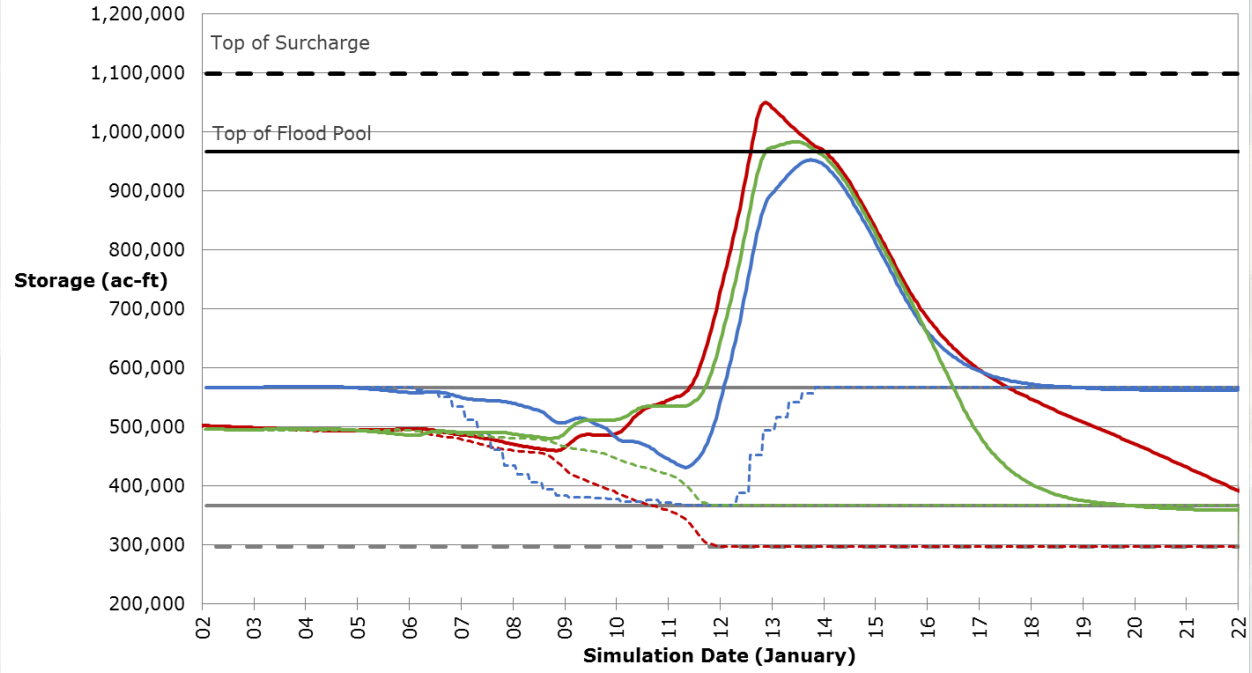

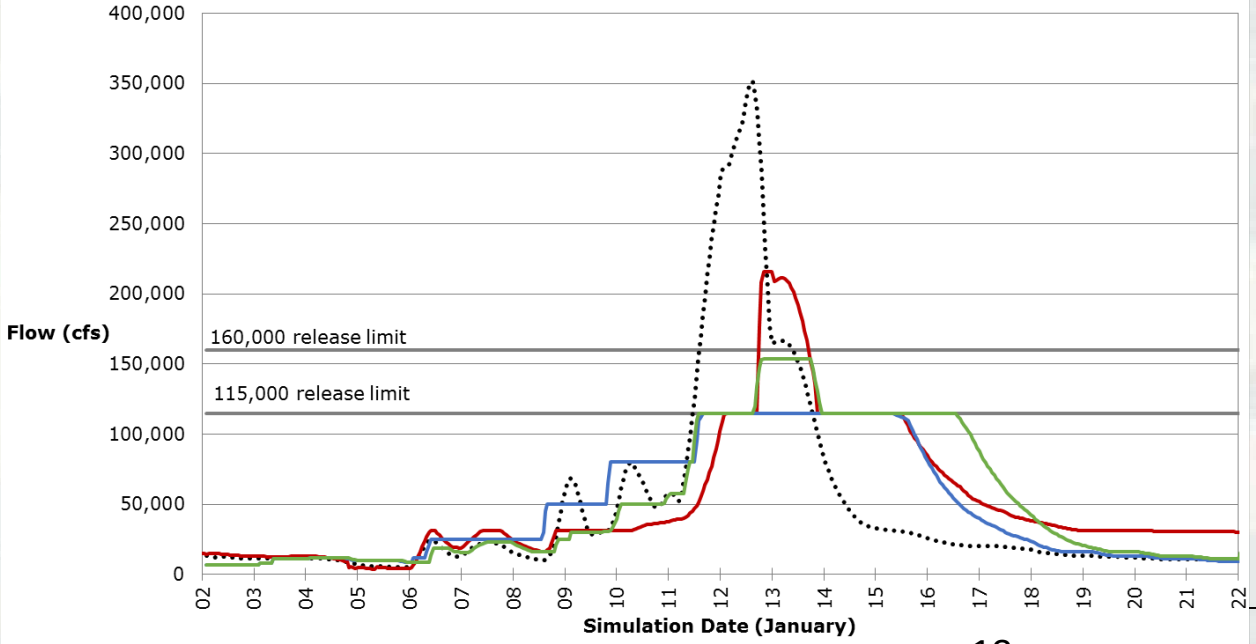

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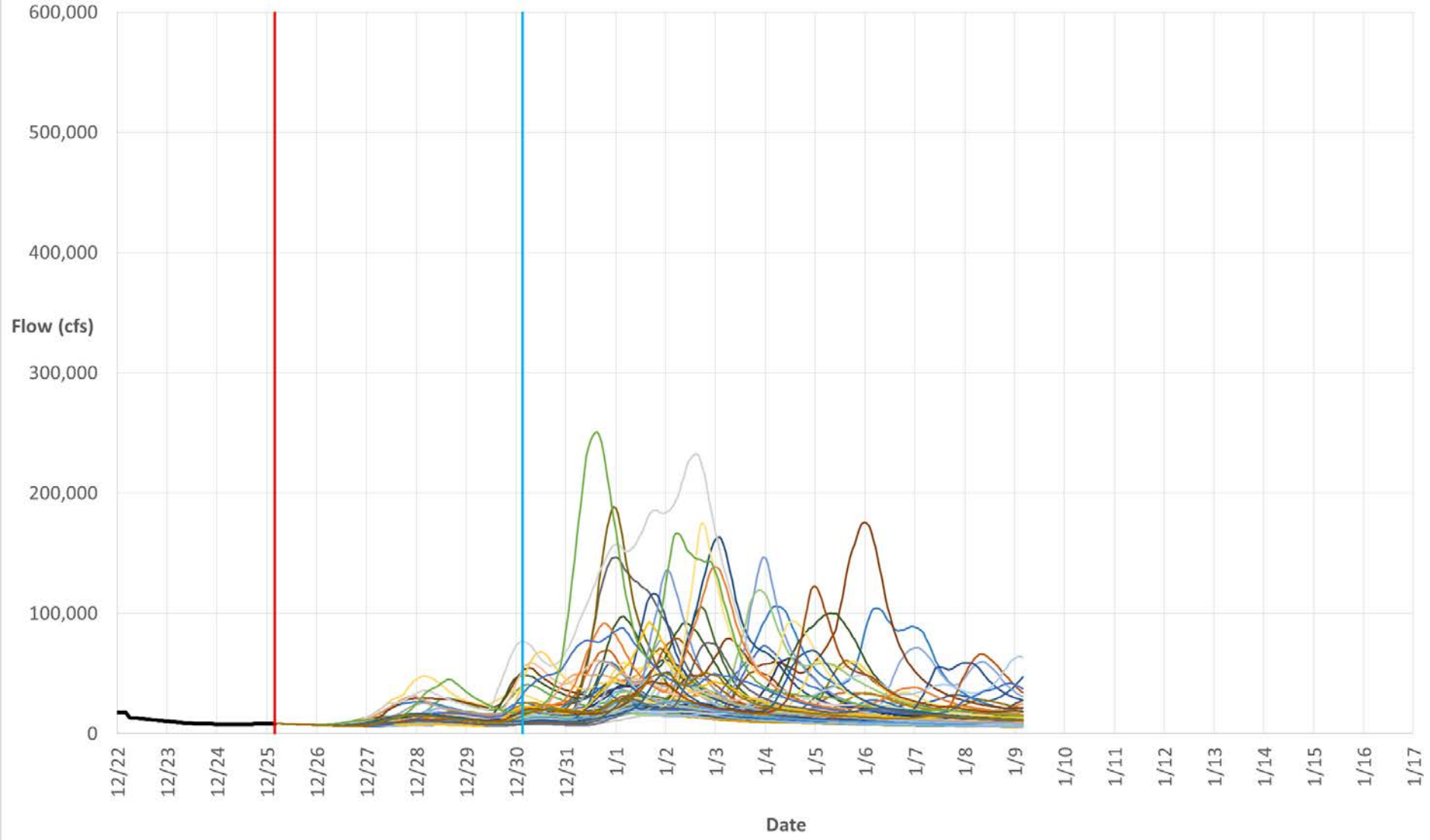
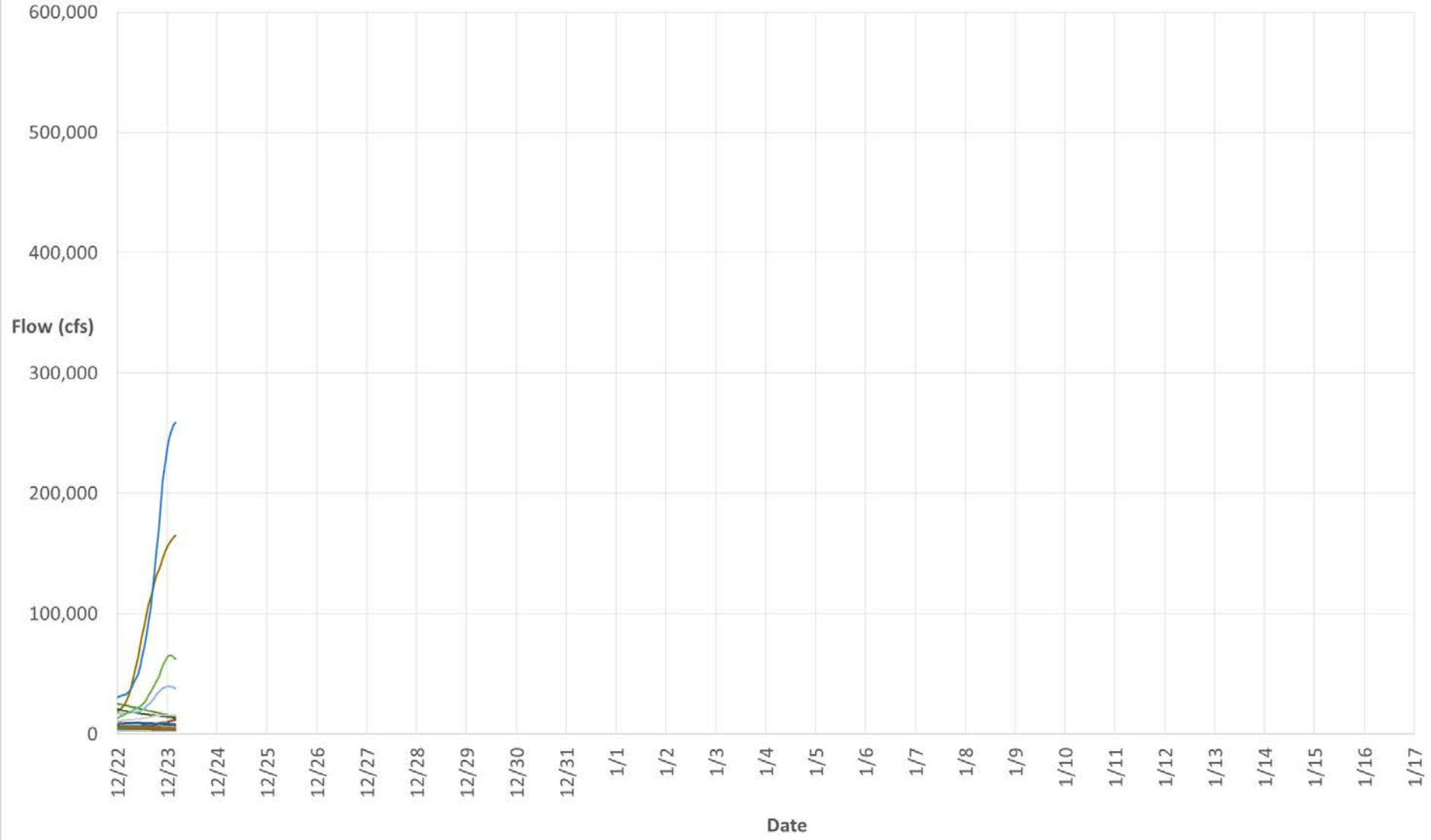
Forecast Ensemble EXAMPLE



Forecast Ensemble 12/8/1996



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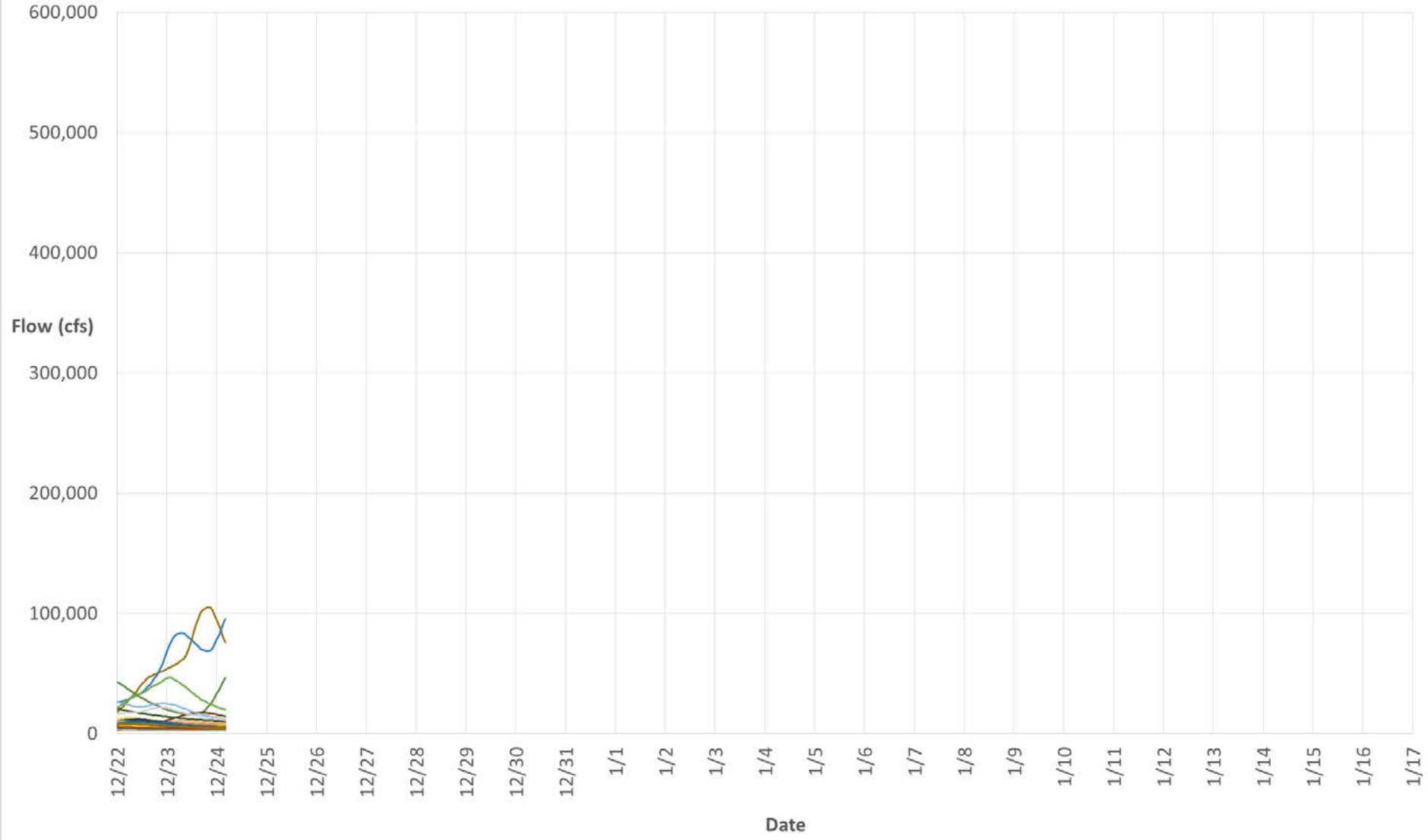

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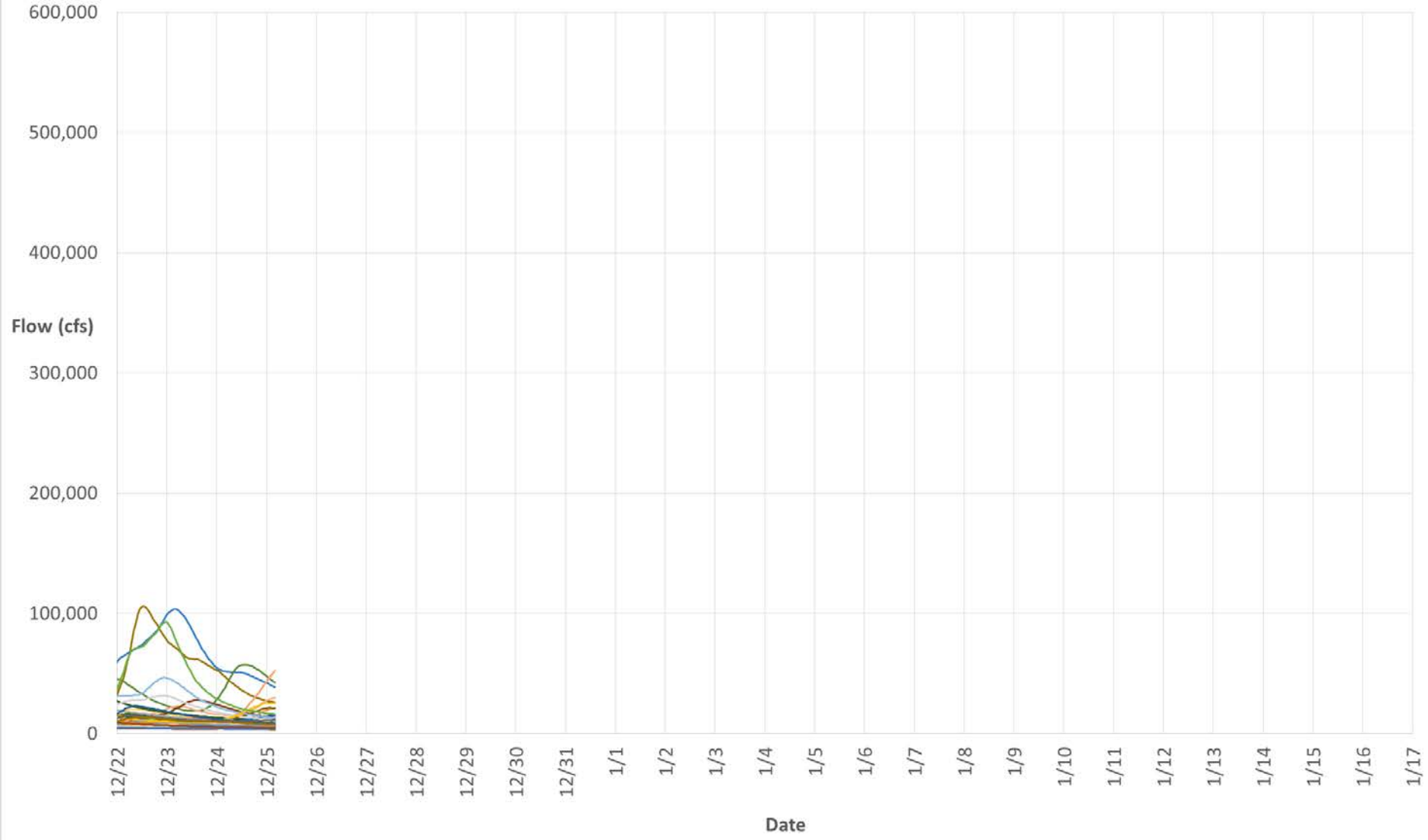

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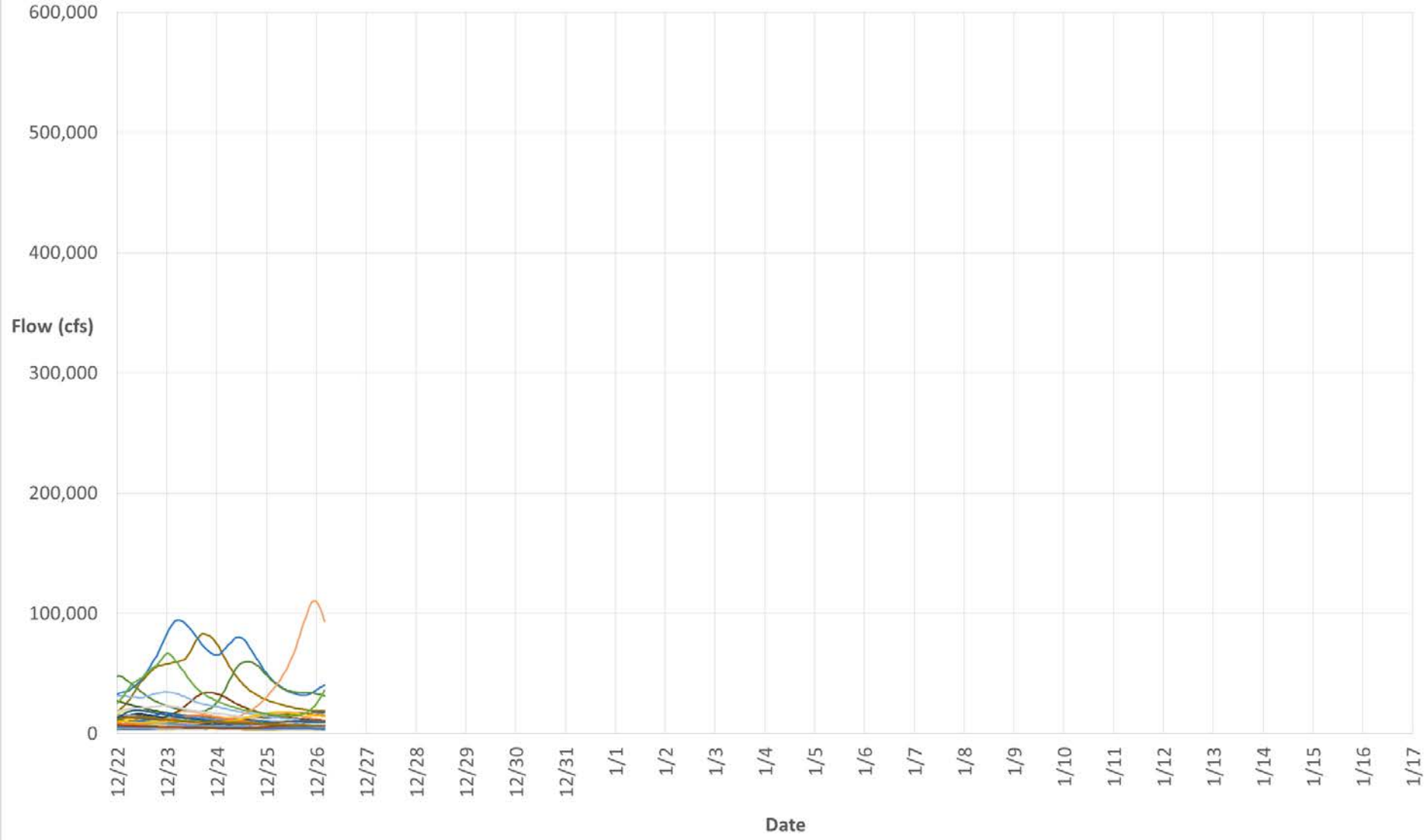

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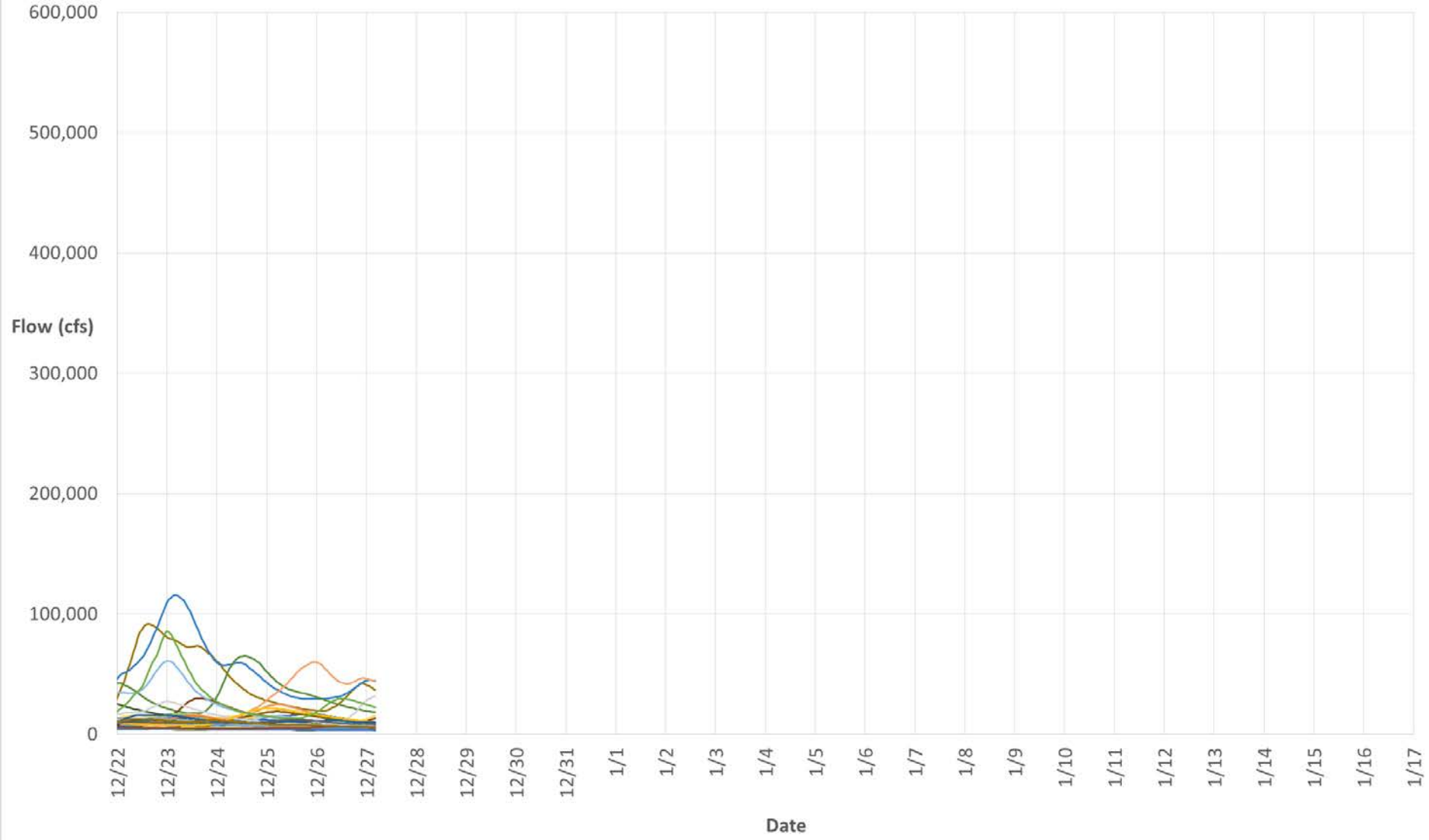

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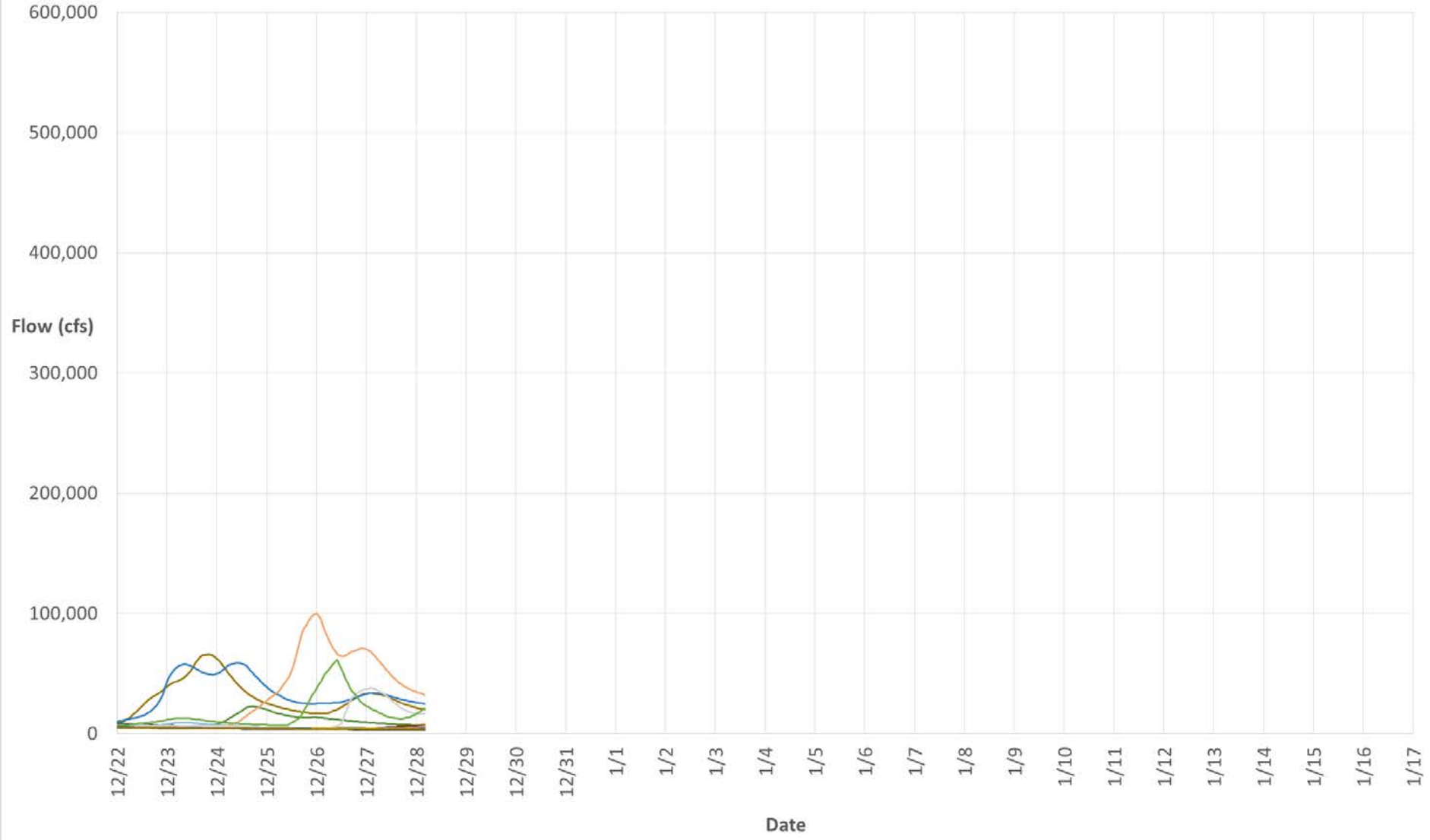

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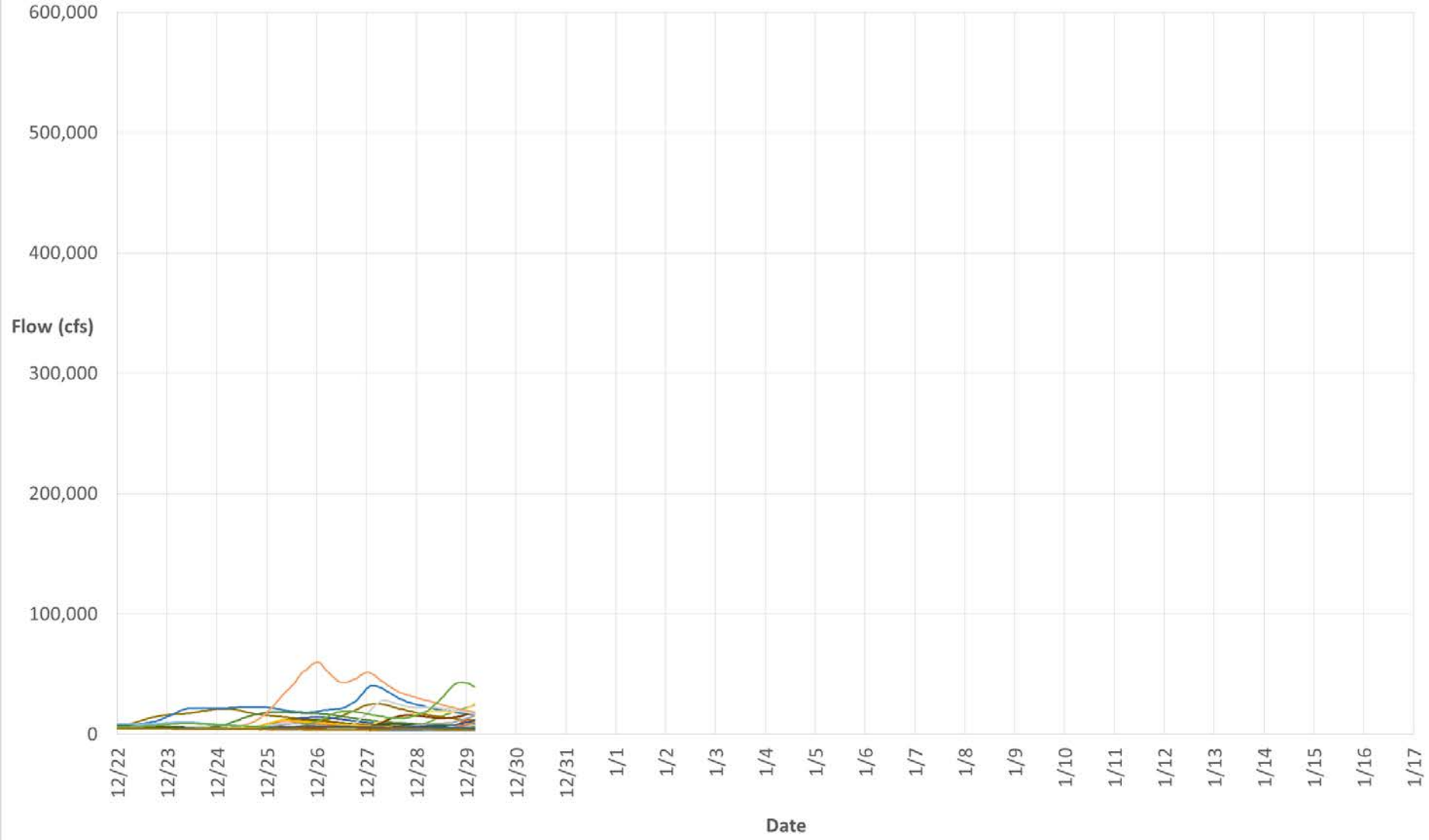

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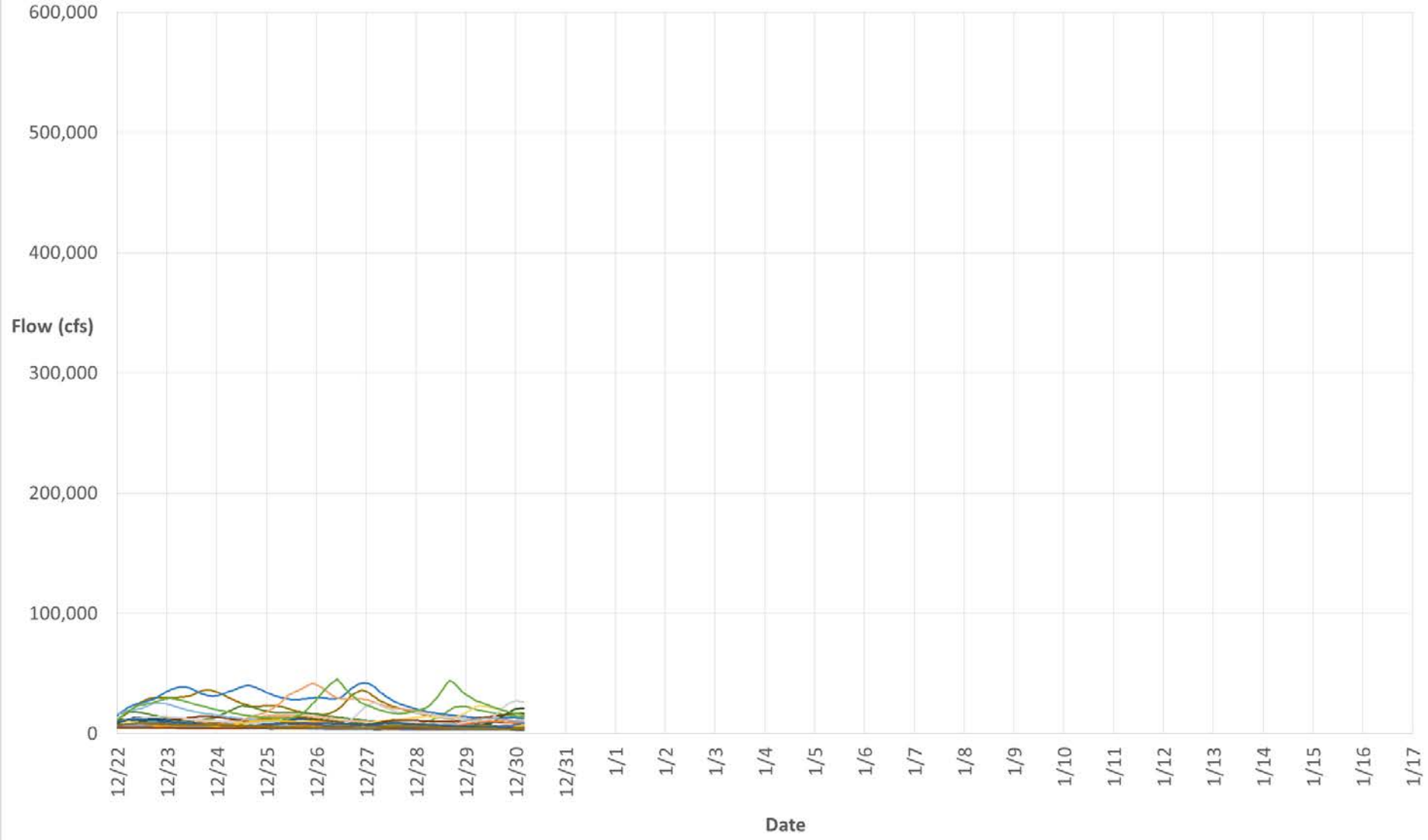

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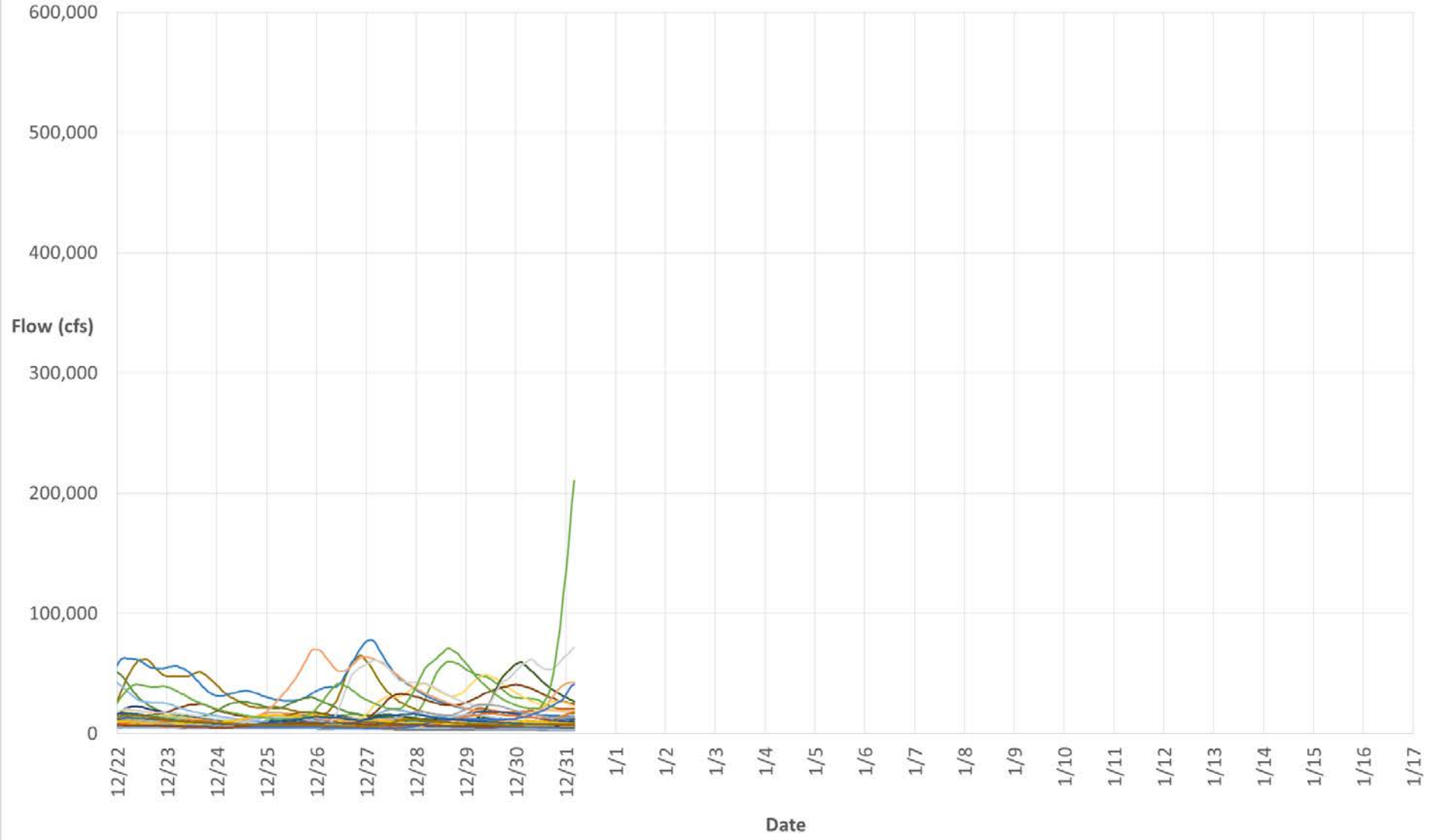

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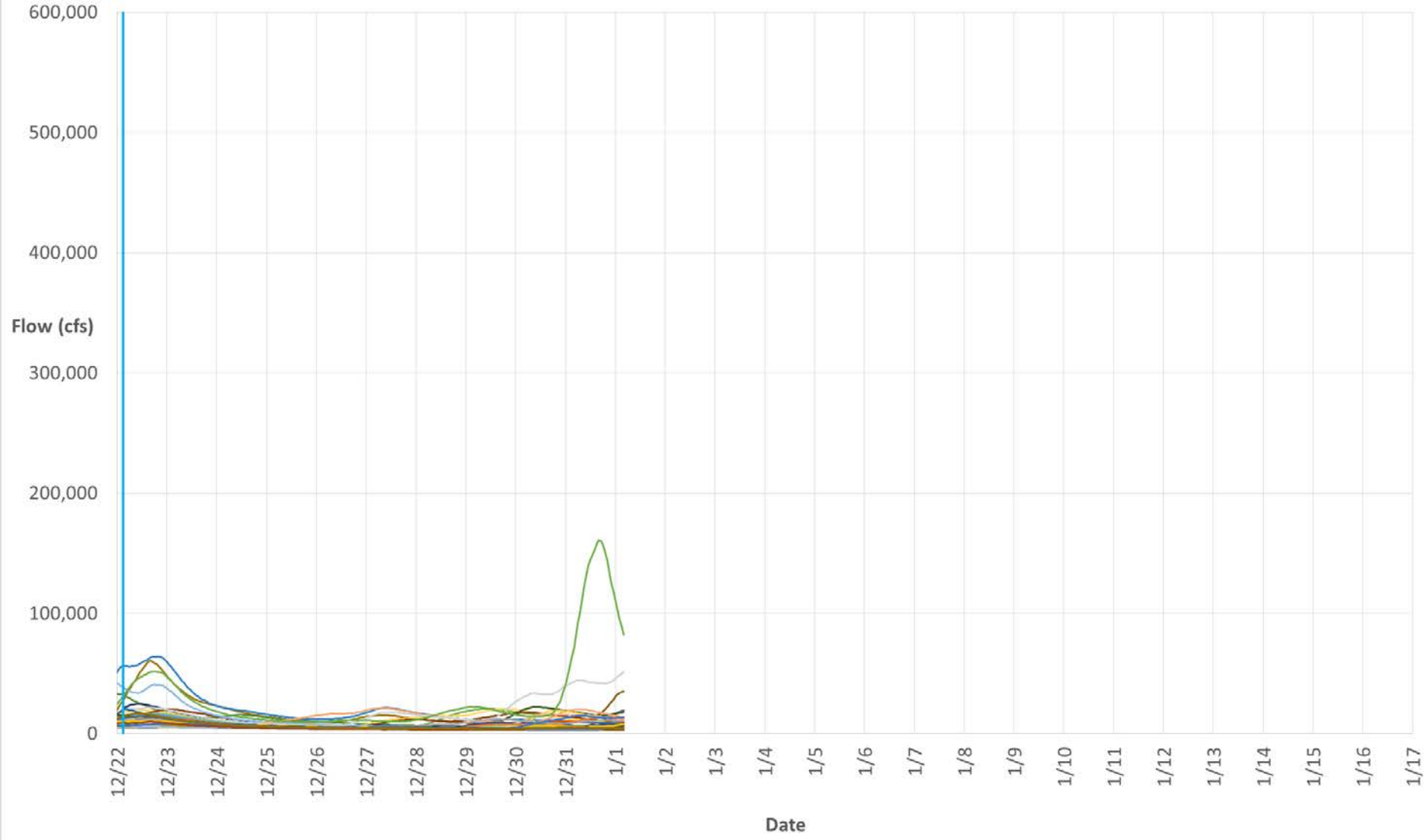

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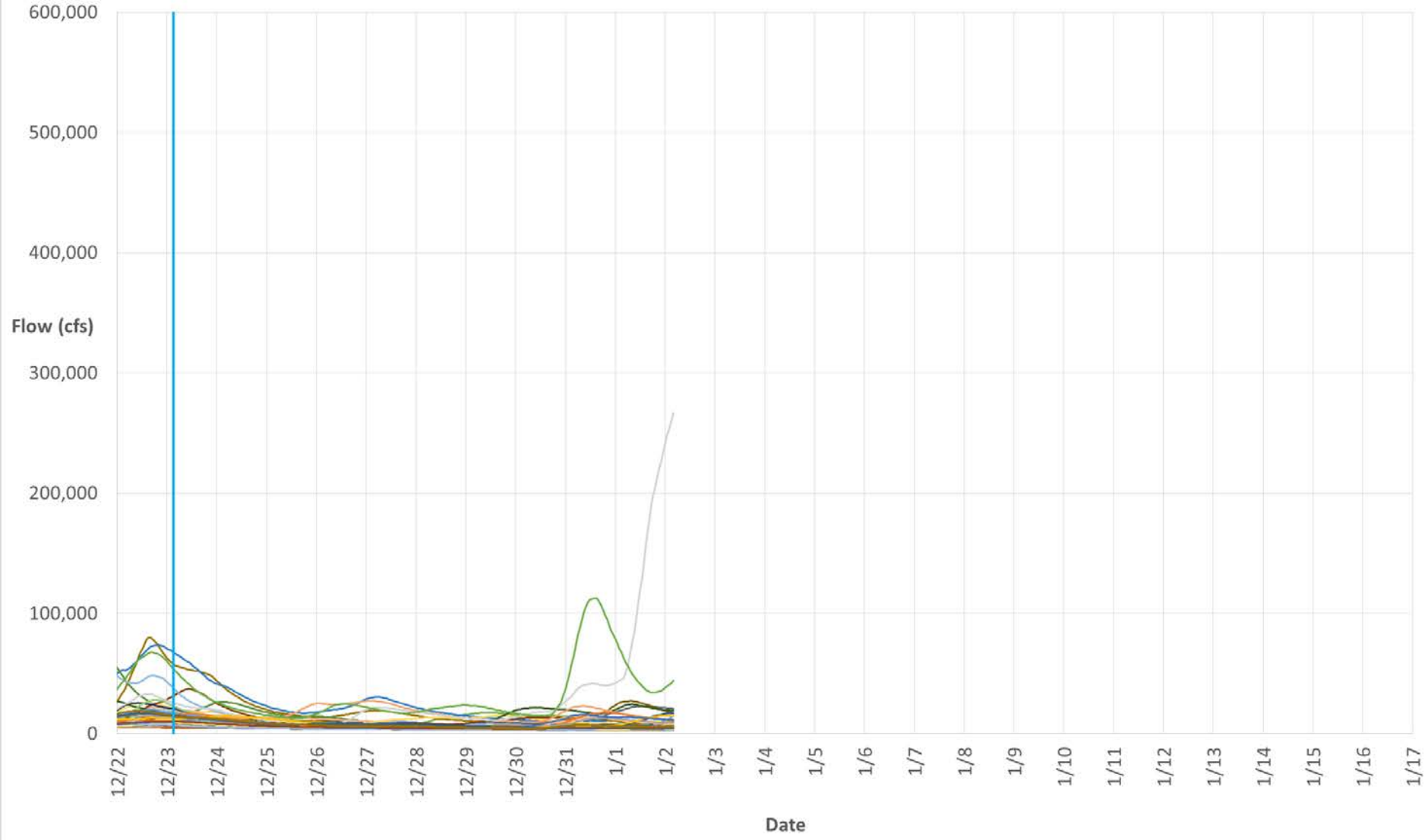

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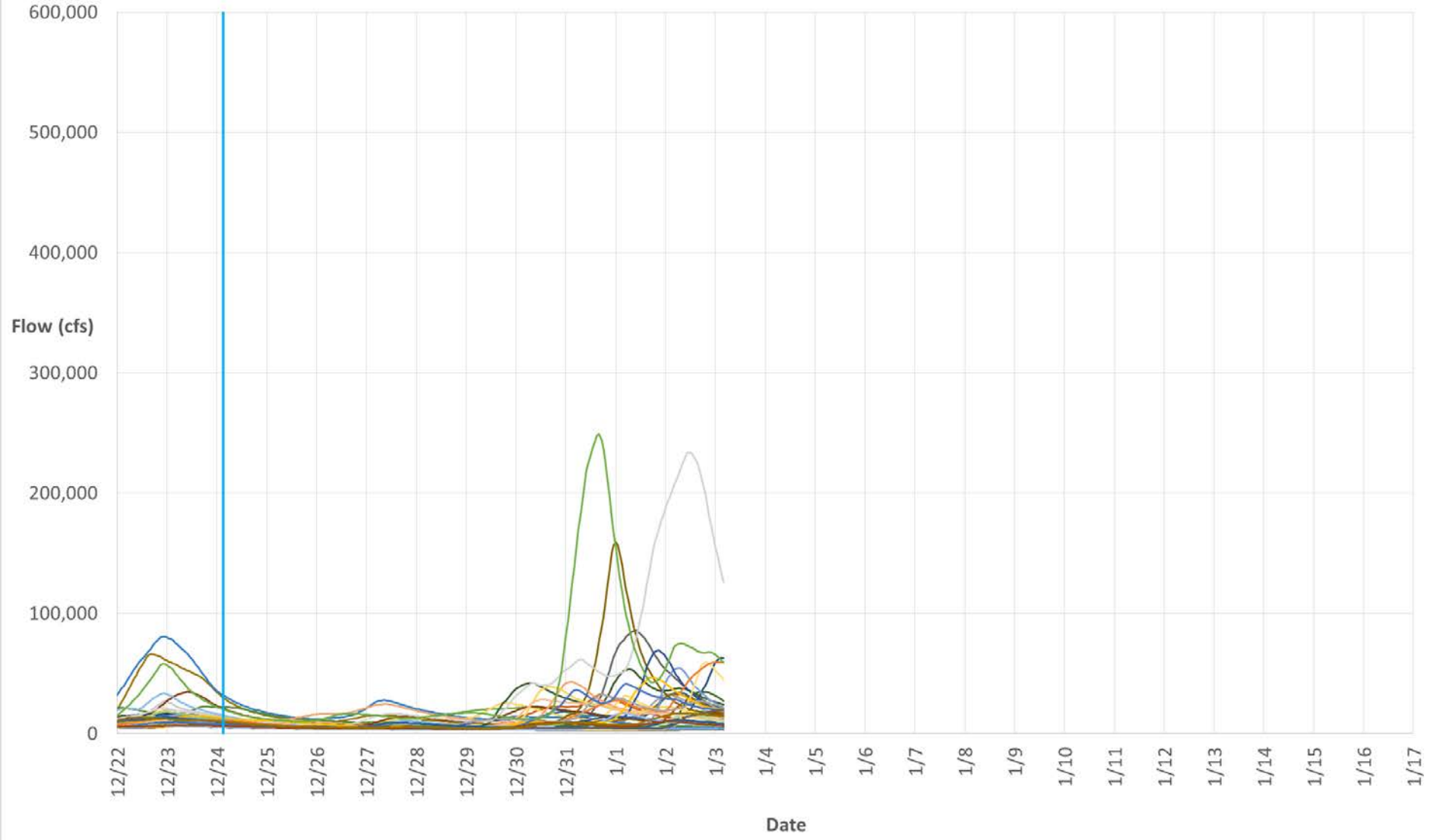

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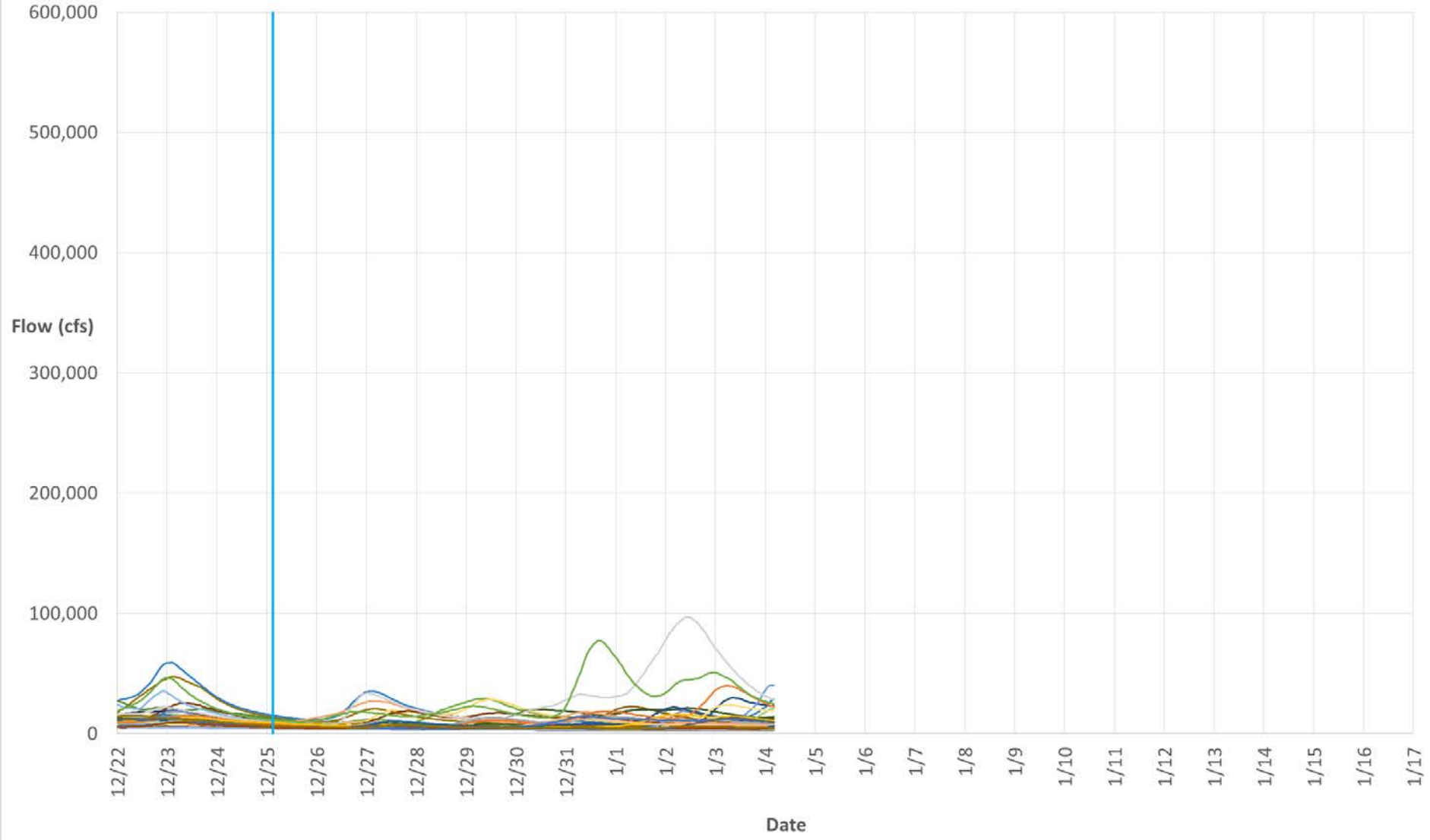

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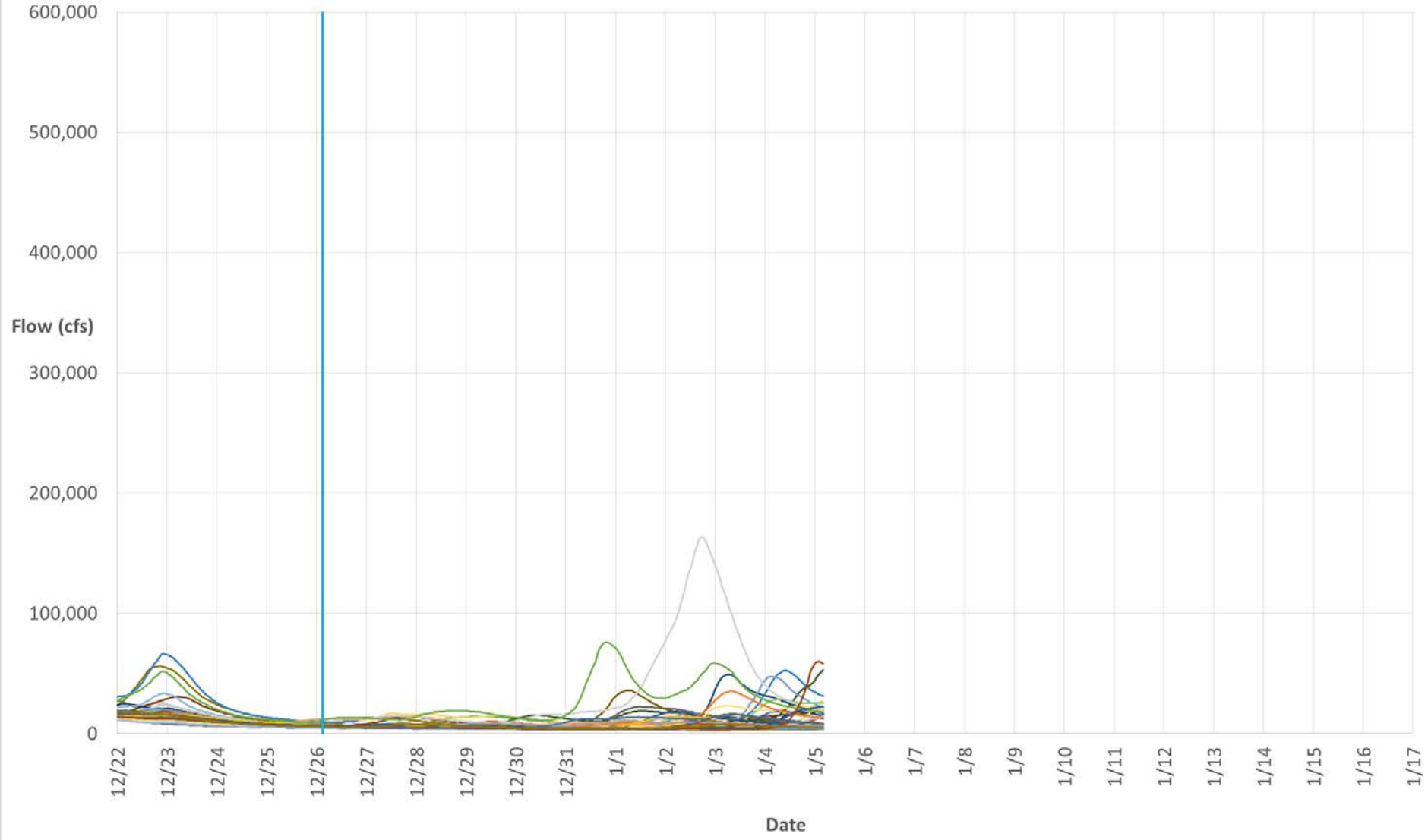

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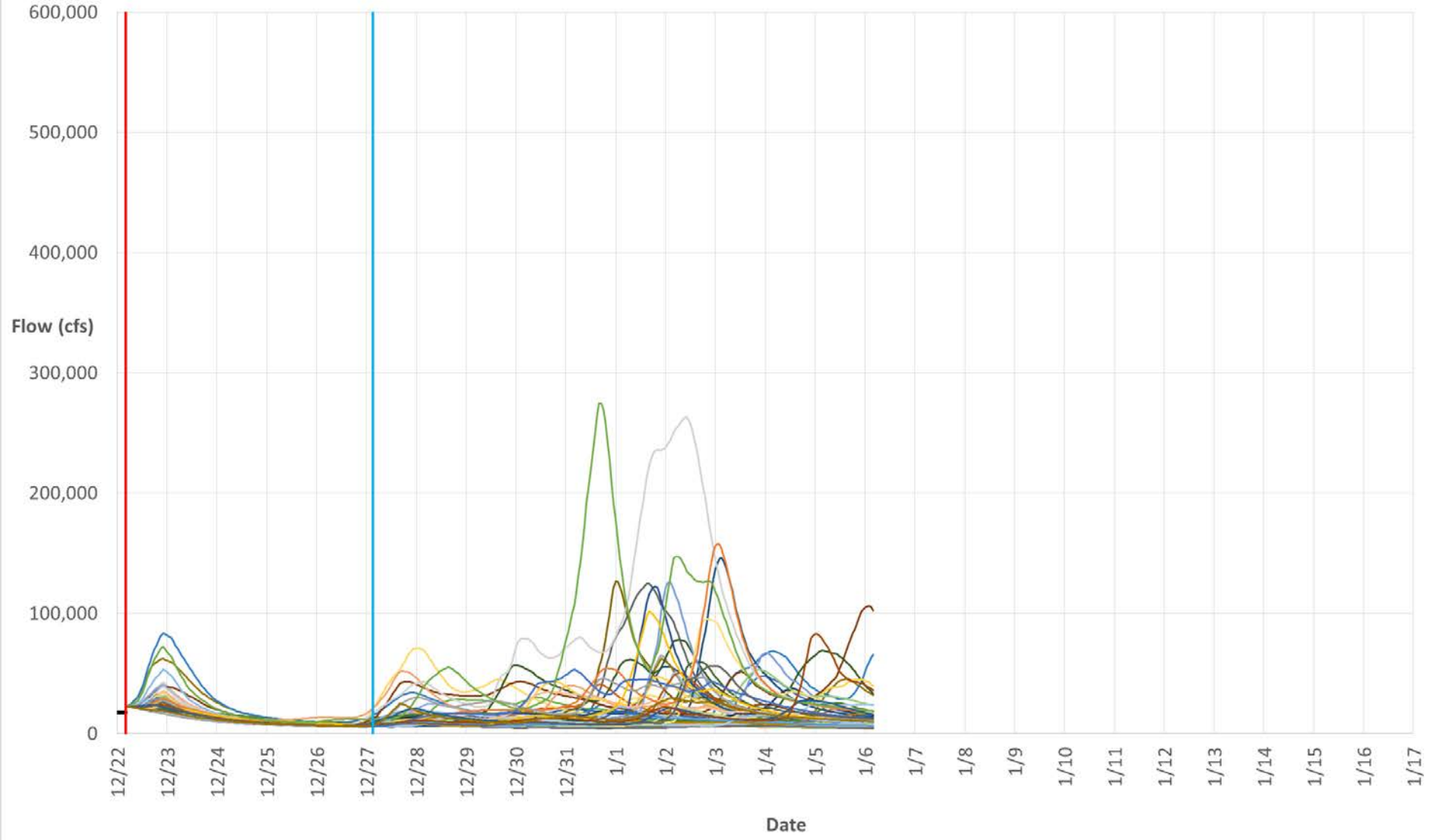

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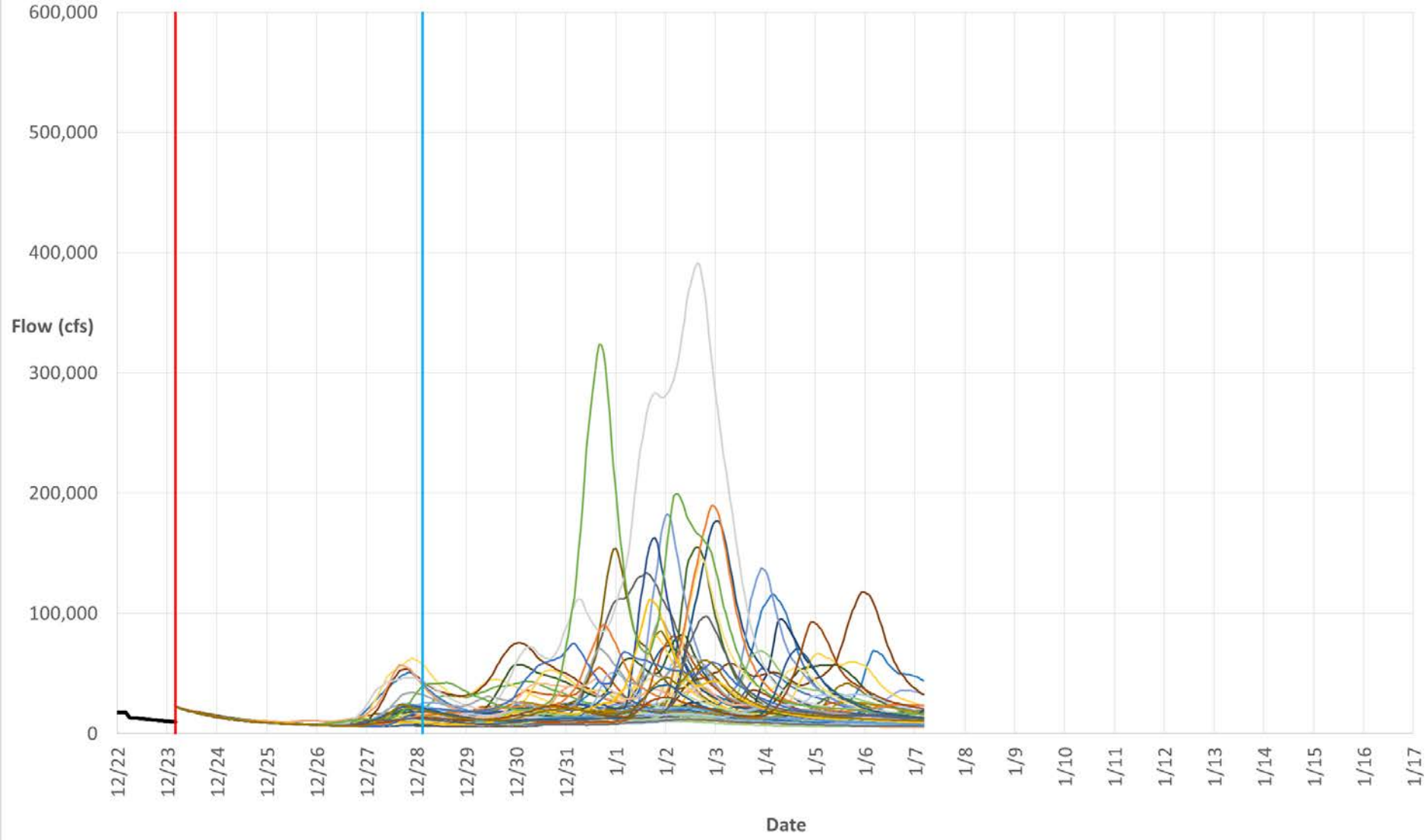

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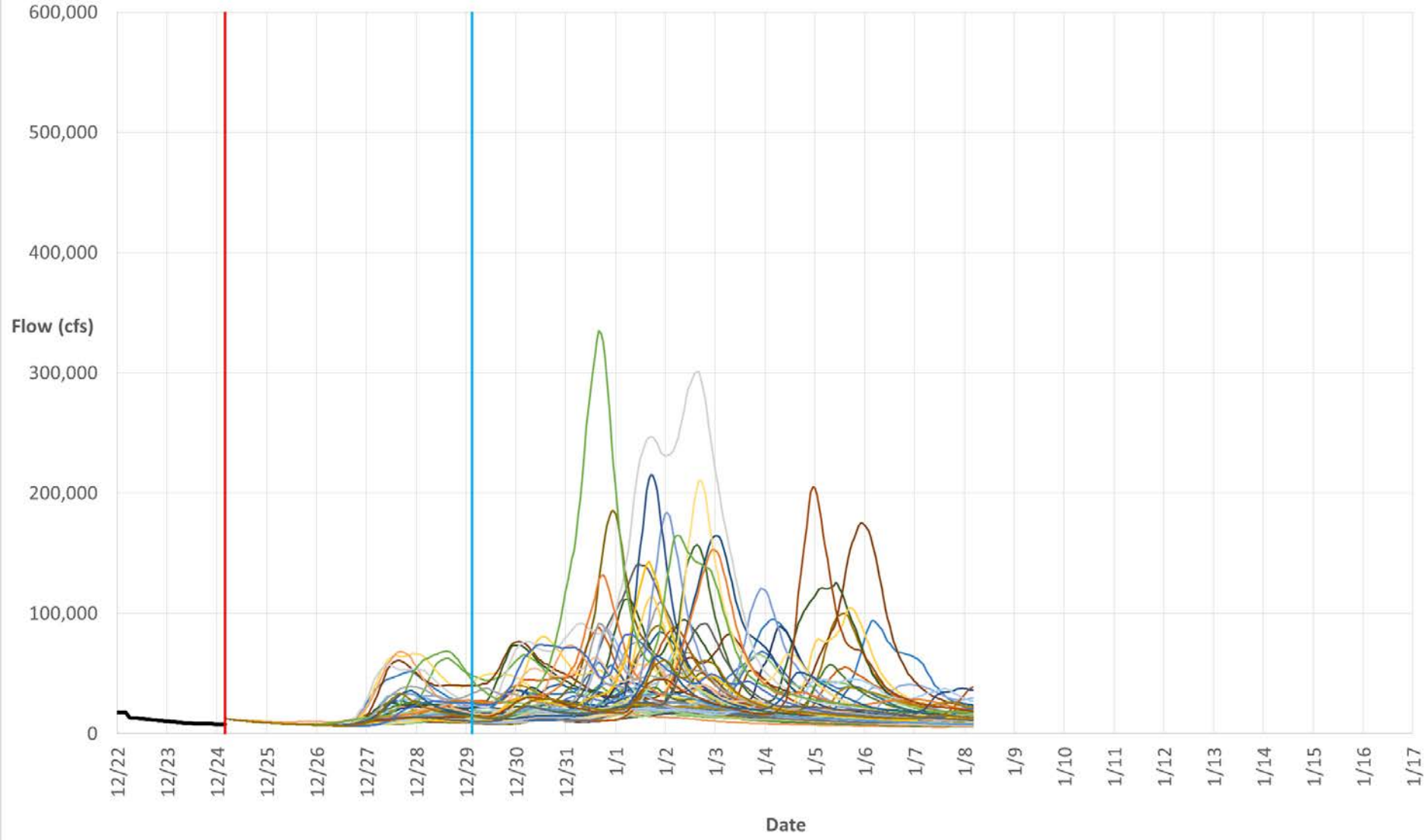

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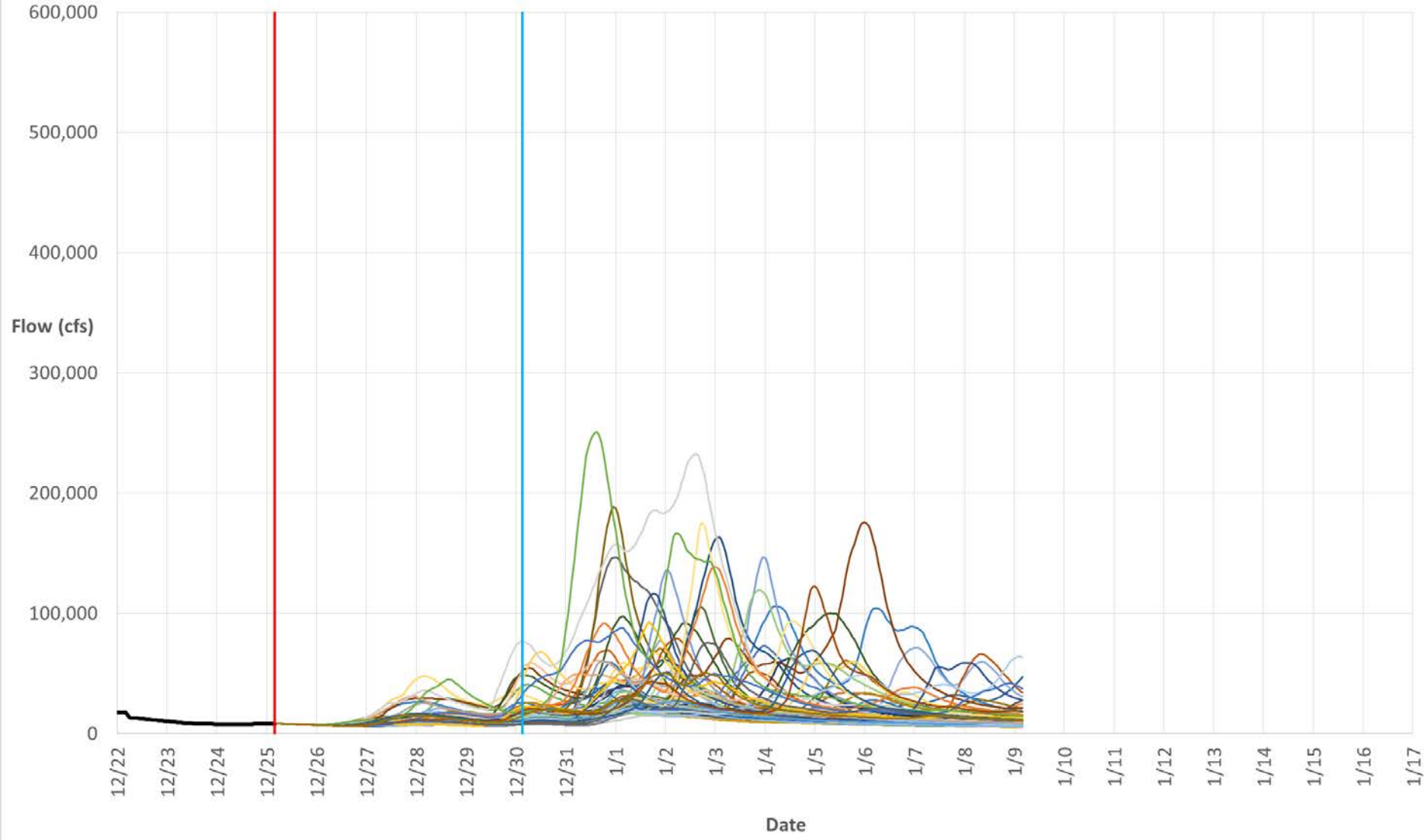

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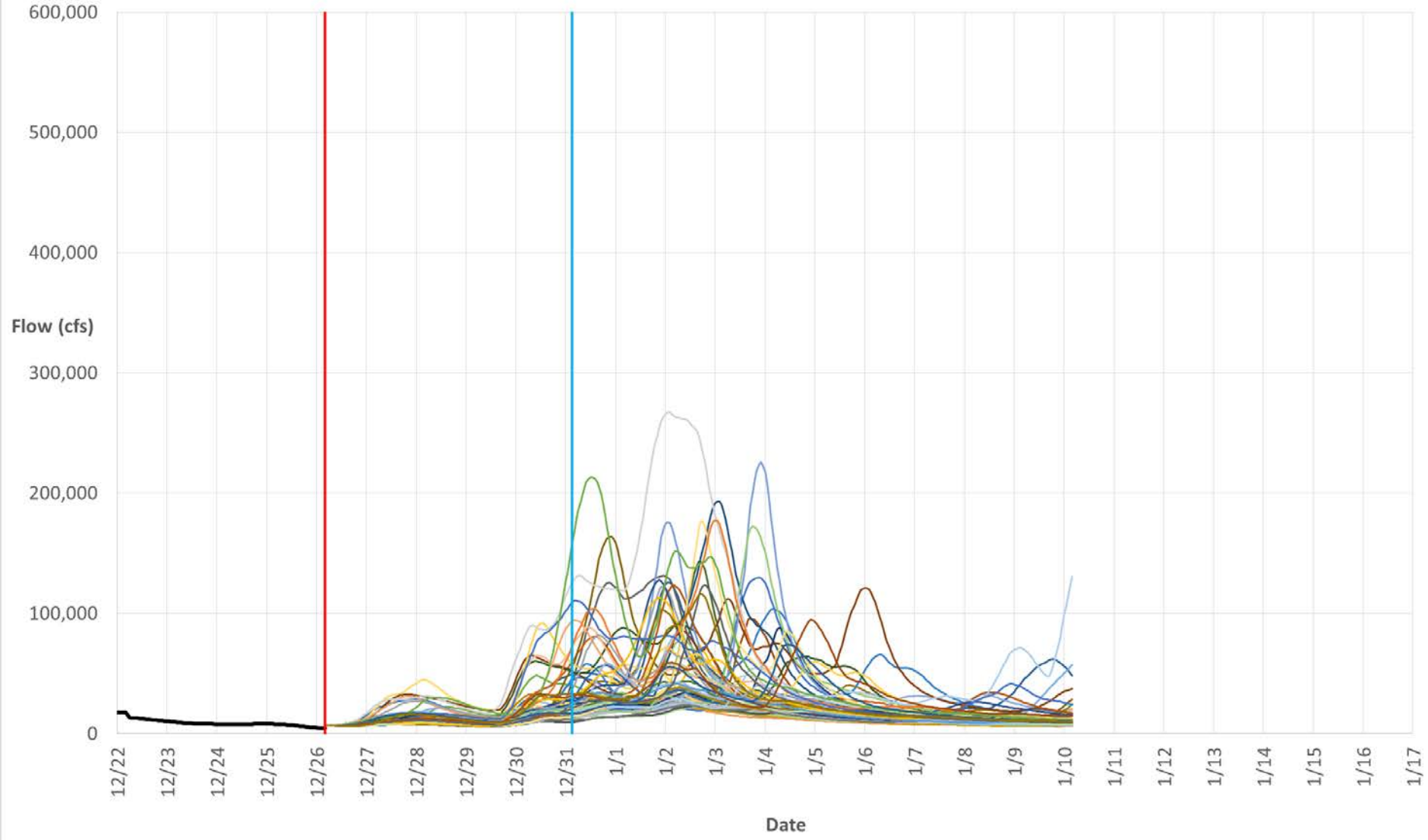

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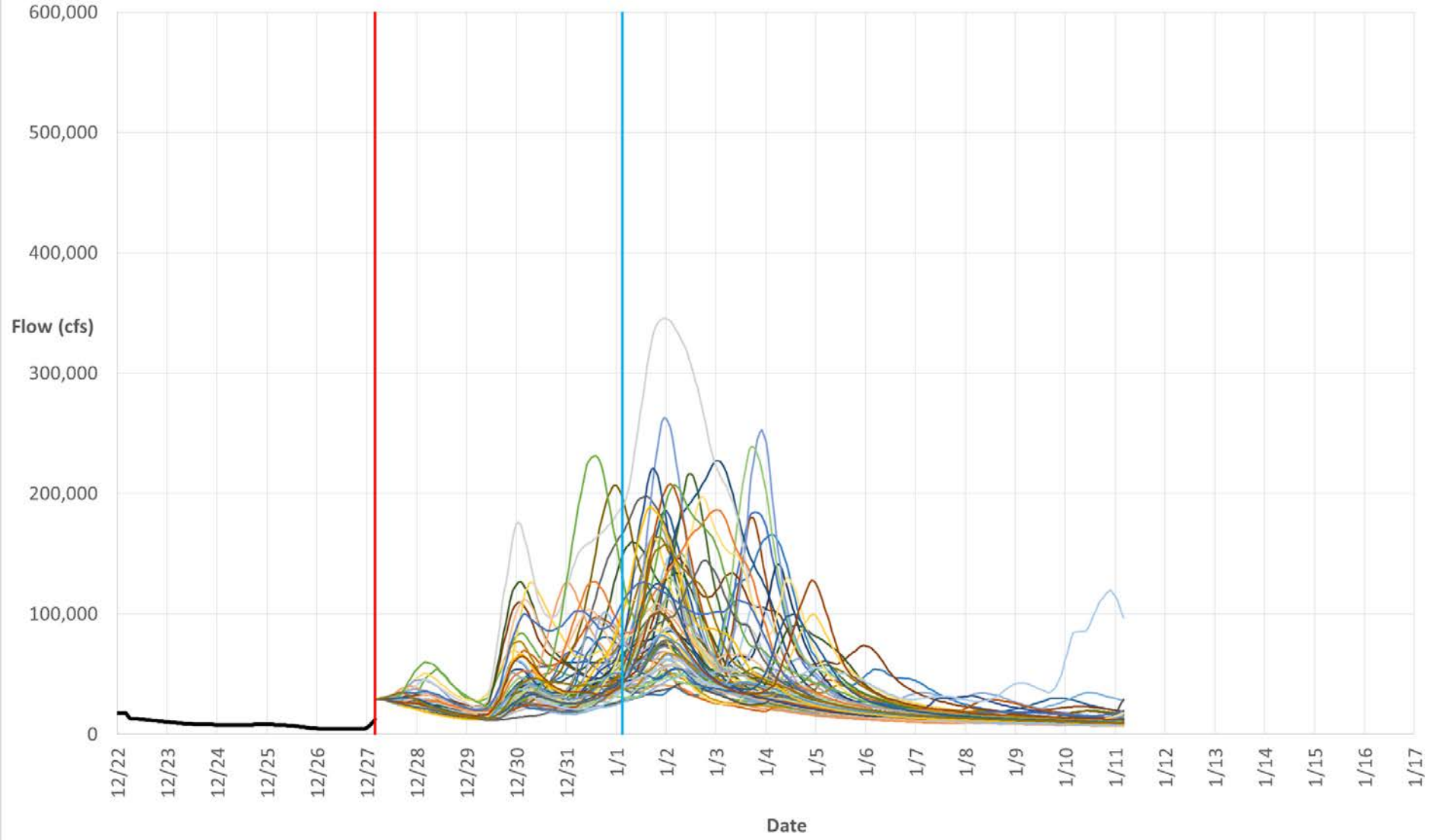

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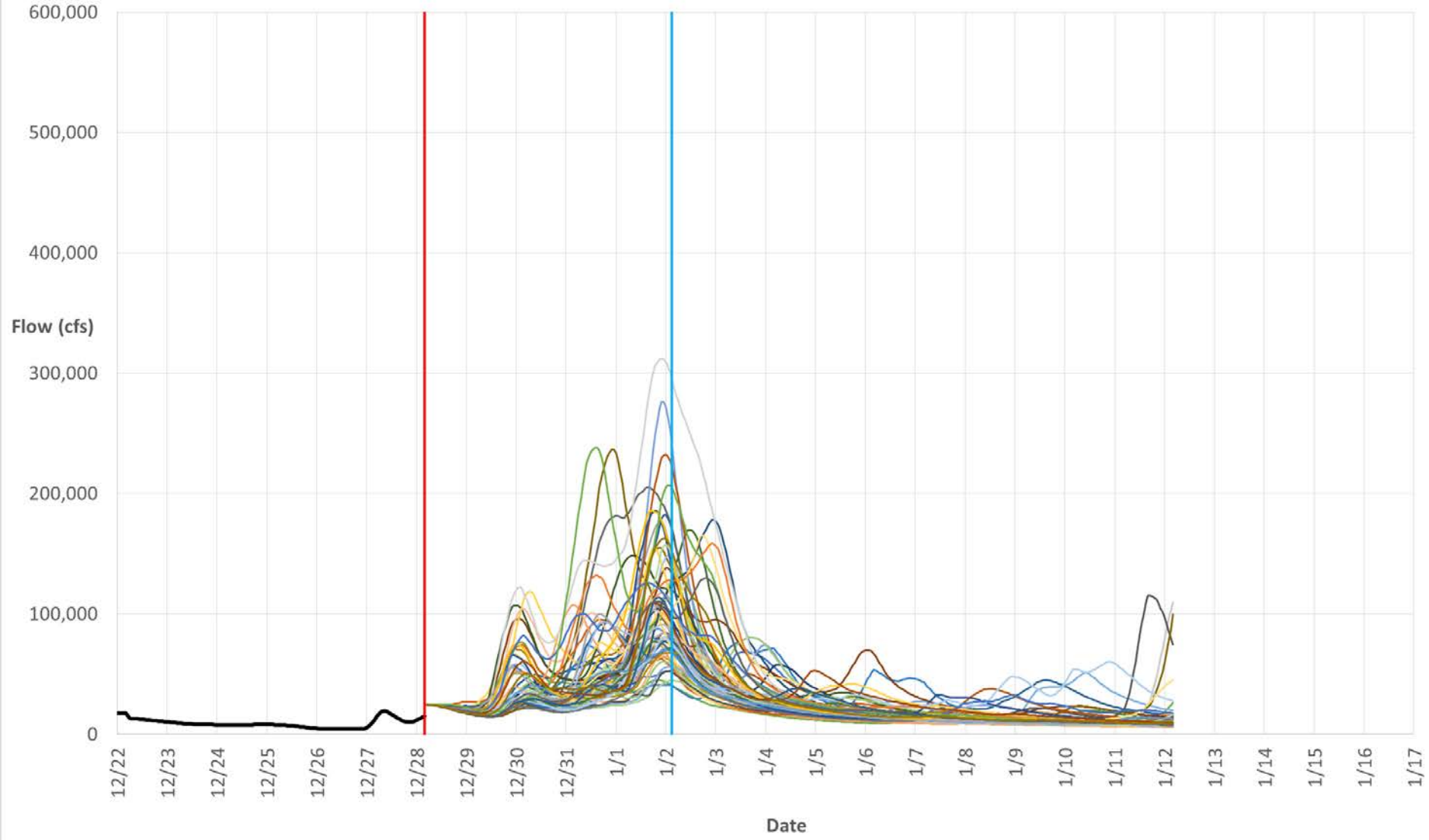

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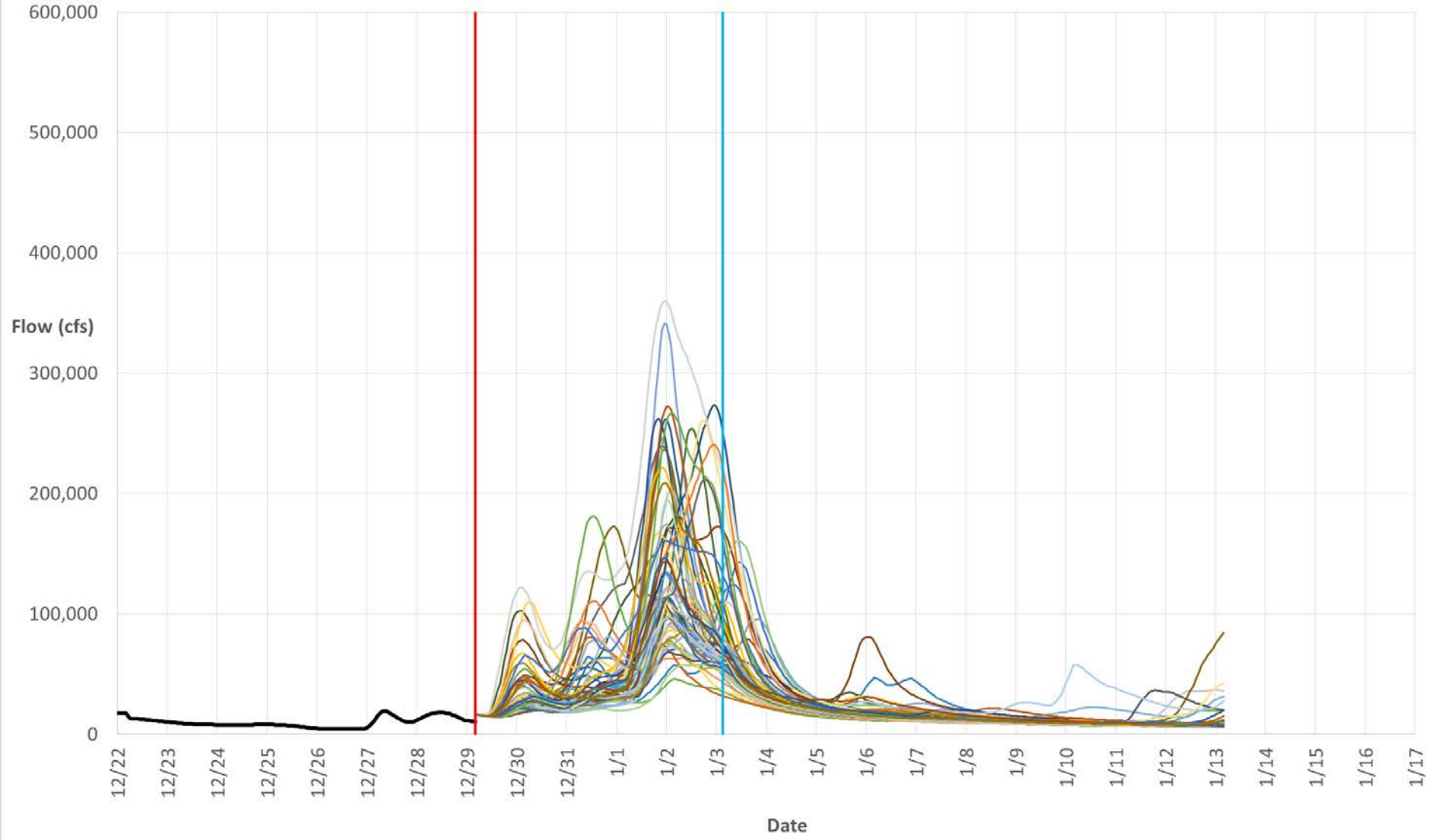

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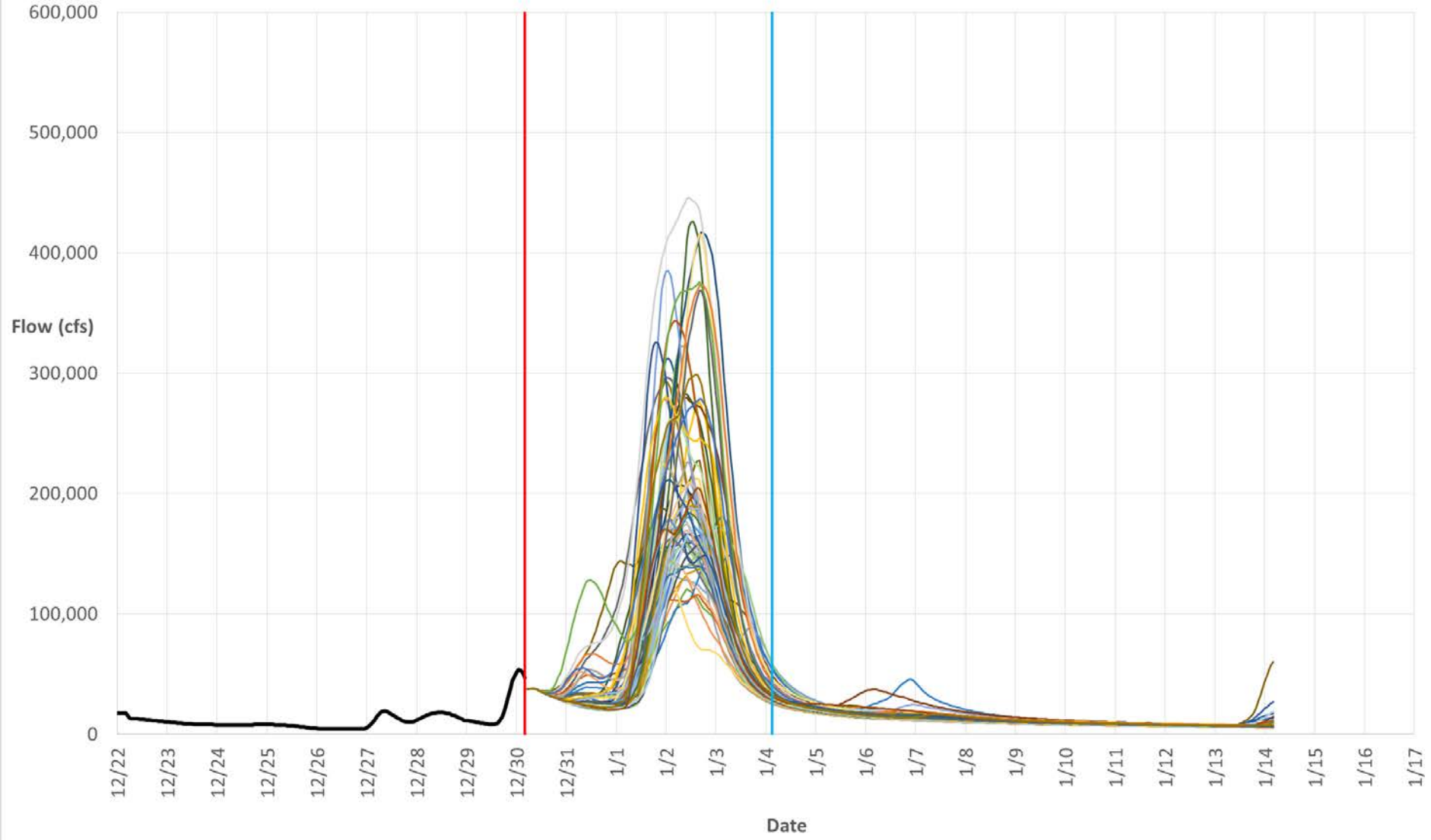

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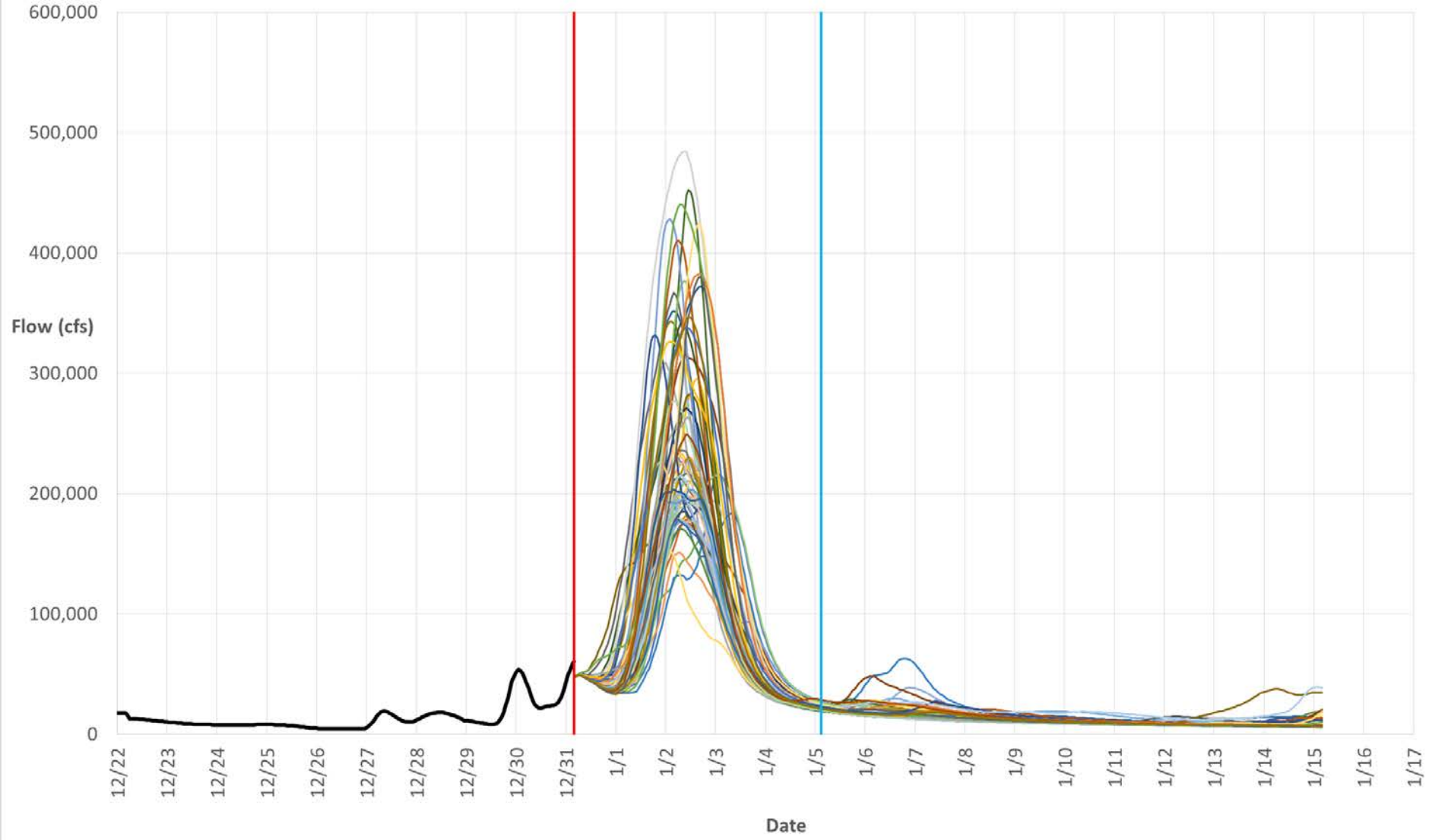
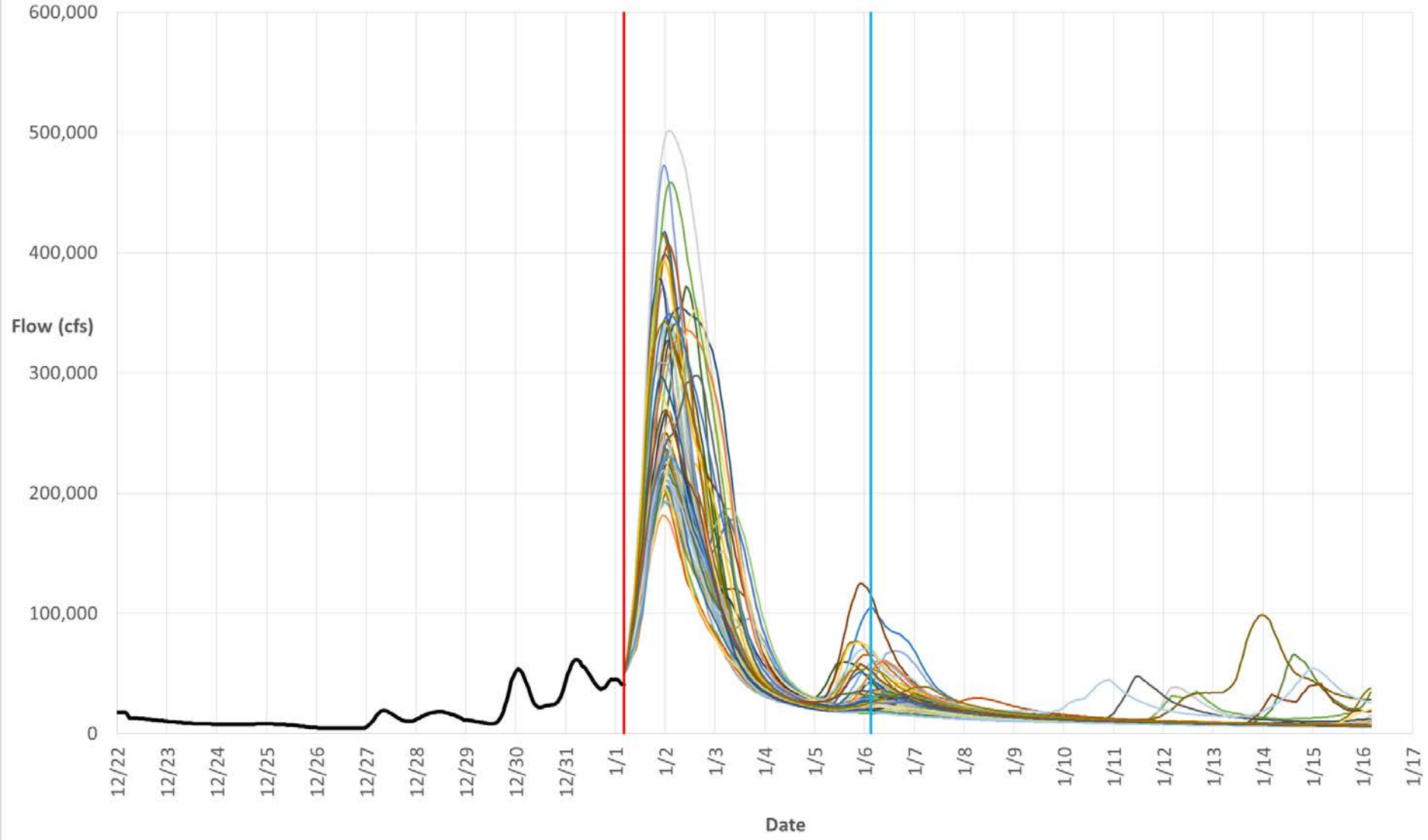


Forecast Ensemble 1/1/1997



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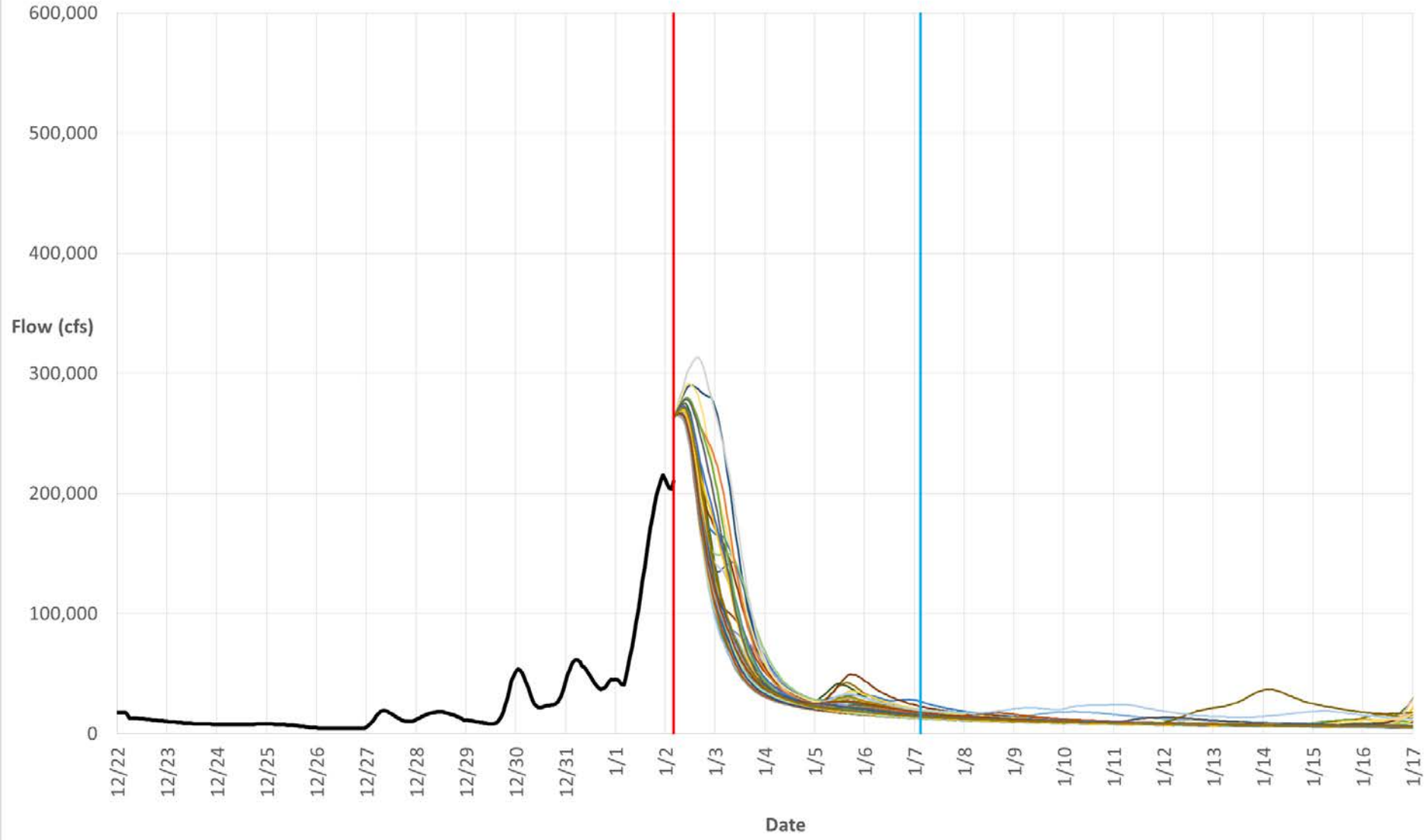
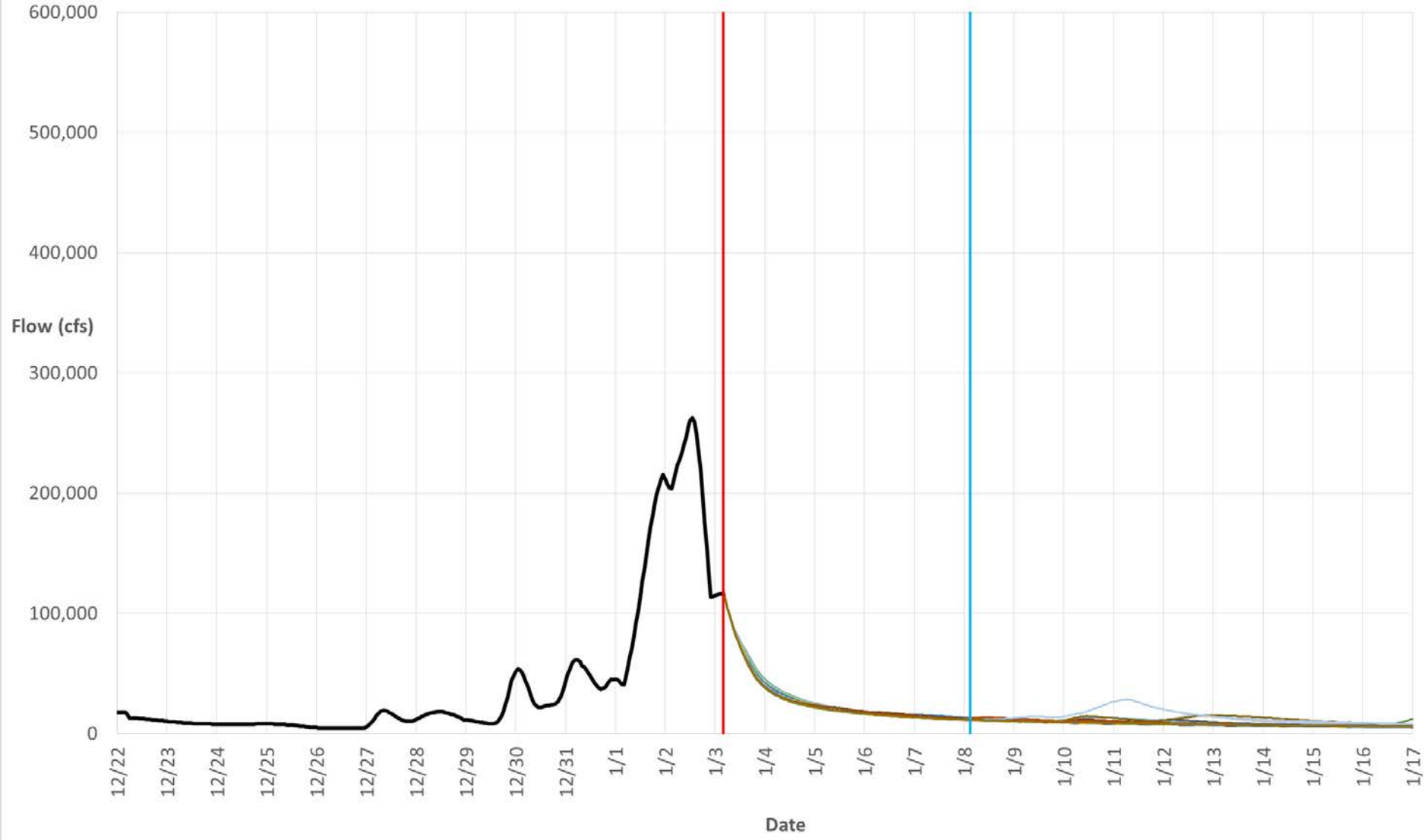
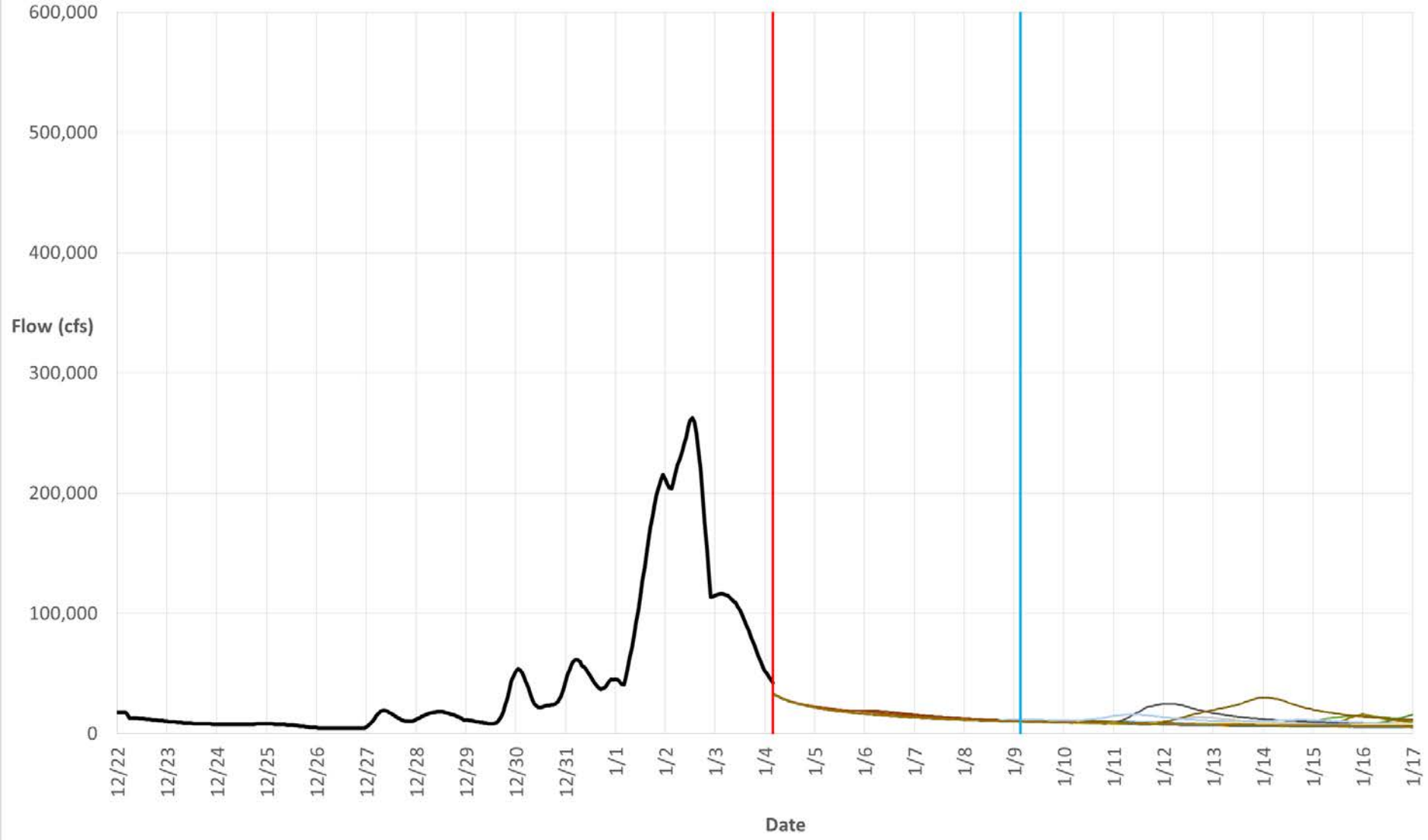


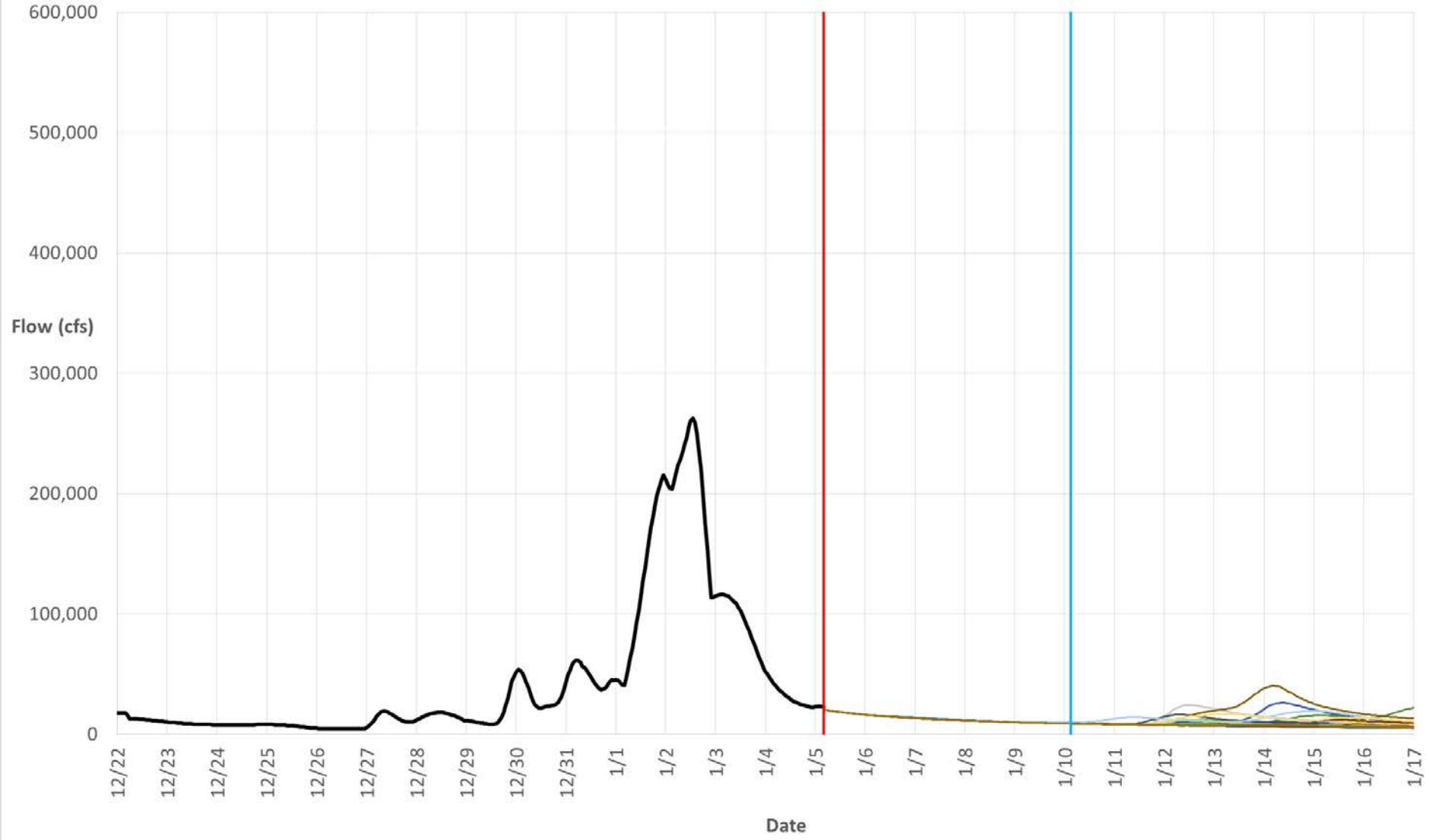
Forecast Ensemble 1/3/1997



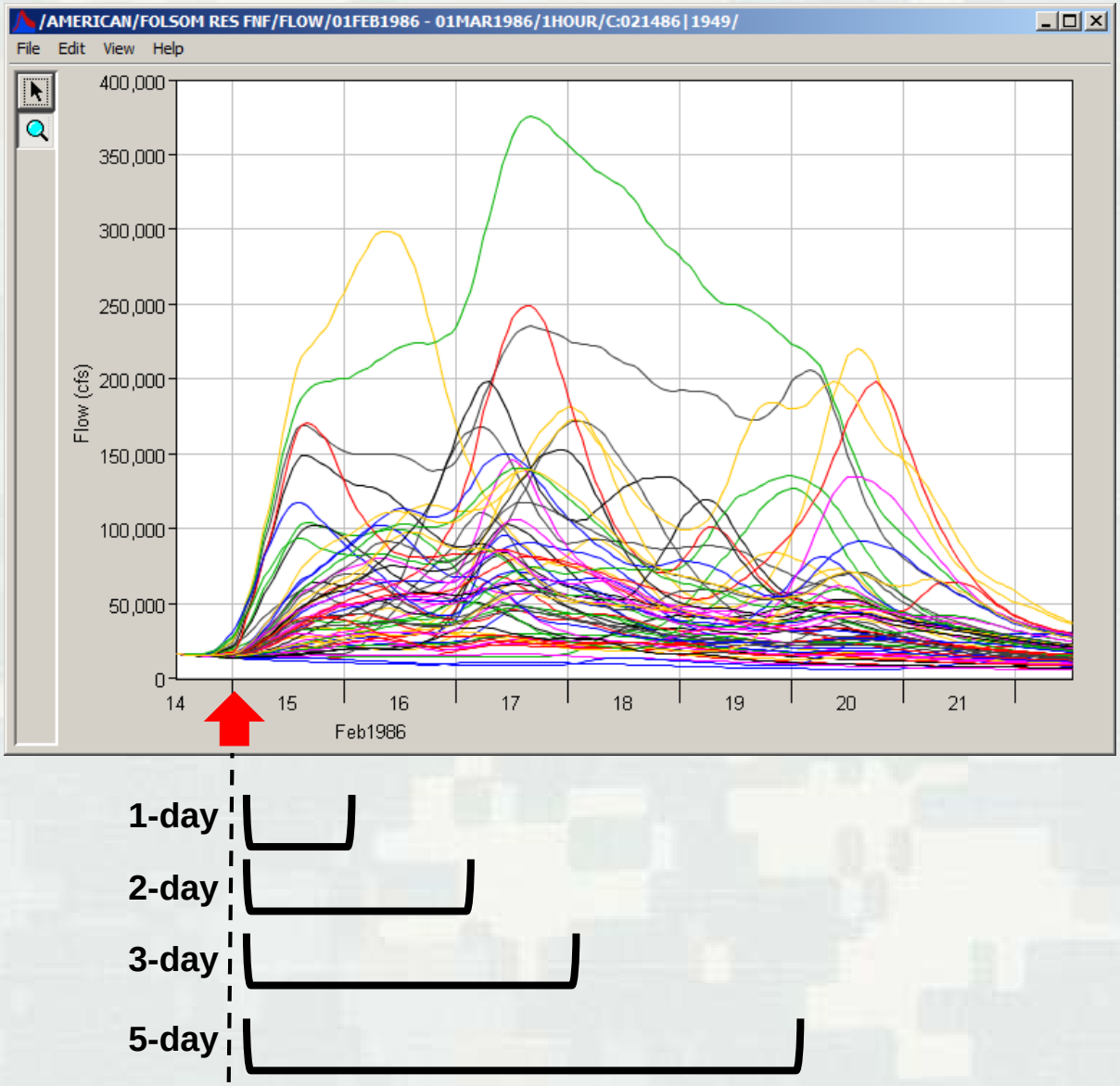
Forecast Ensemble 1/4/1997



Forecast Ensemble 1/5/1997

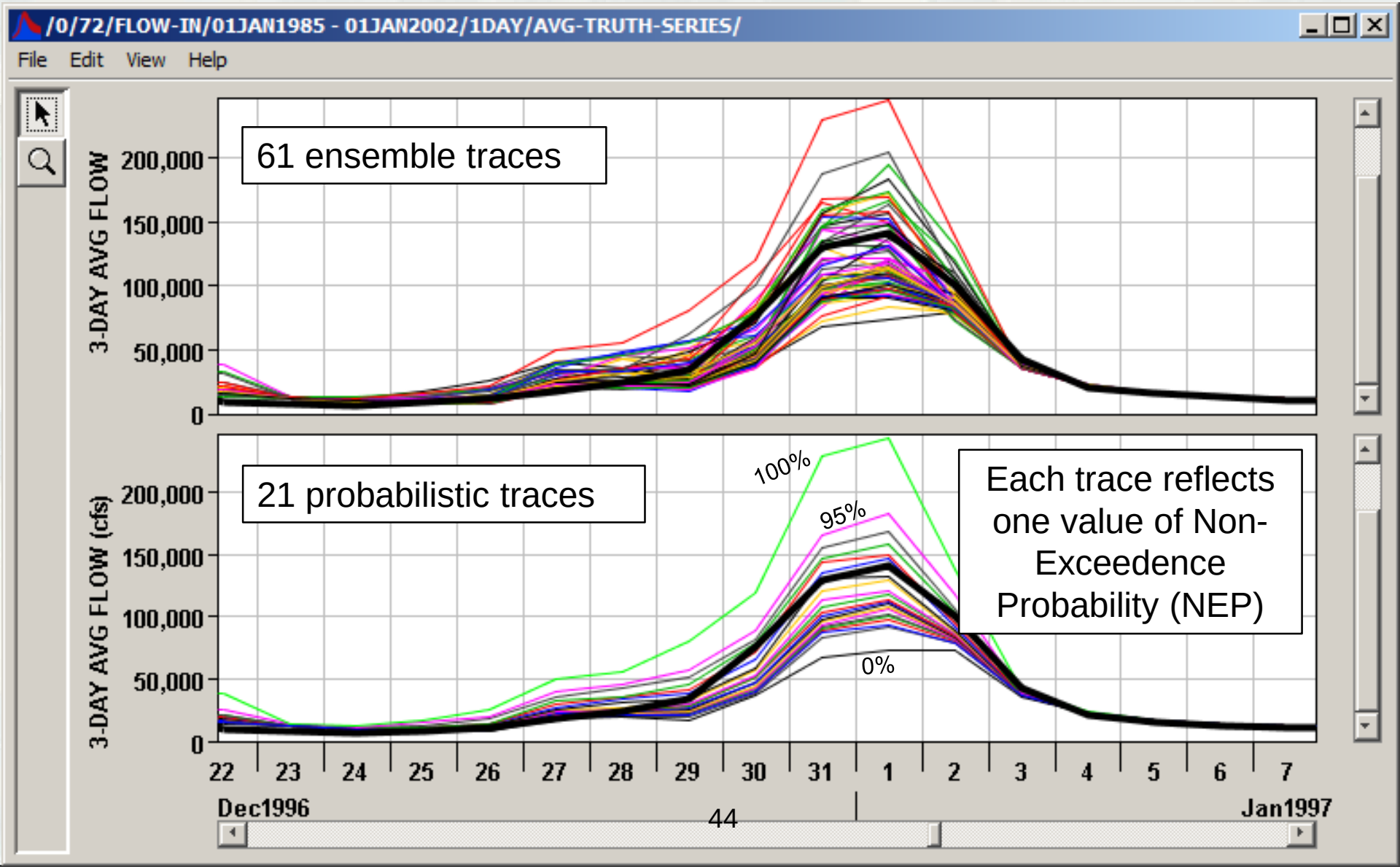


Compute Forecasted Inflow Volumes



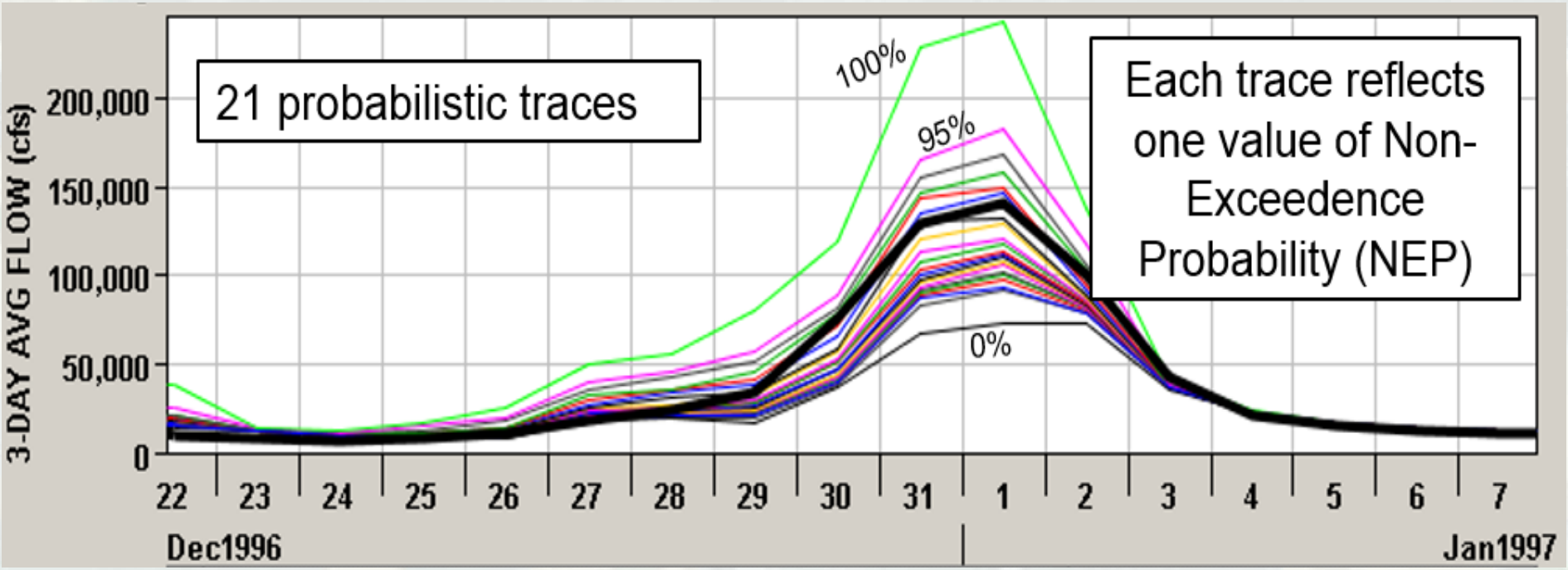
1997 Event Hindcast Series

3-day volume updated daily

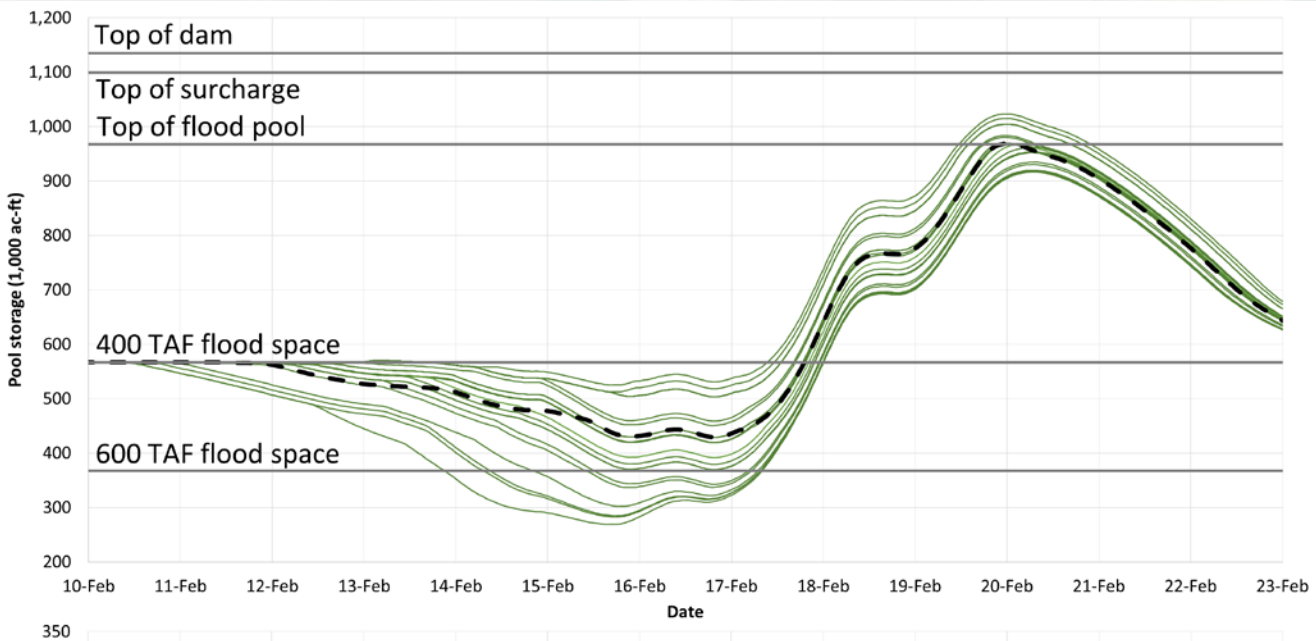


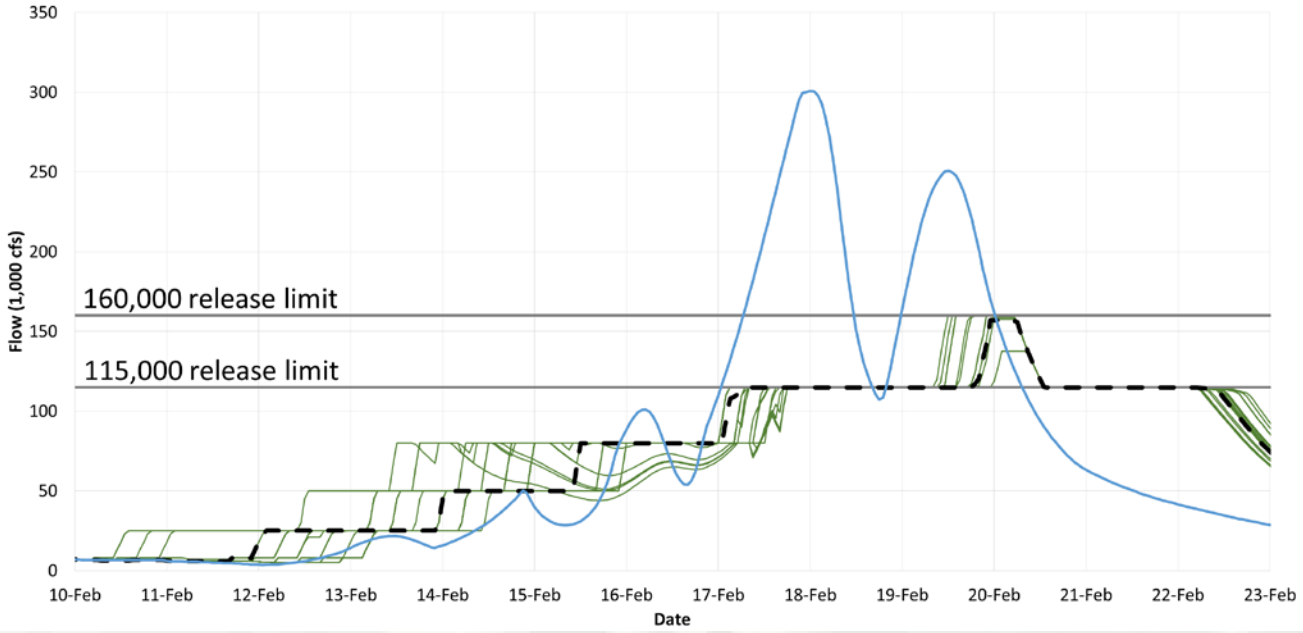
Robustness Testing

- Considers uncertainty in forecast indicated by the forecast ensemble.
- Tests operation using imperfect forecasts.
- Used to identify operational NEP value.



Robustness Test Example





1986 event pattern scaled to 200-yr

21 simulations corresponding to NEP values ranging from 0% to 100% (5% increments).

Perfect forecast shown as black dashed line for reference.

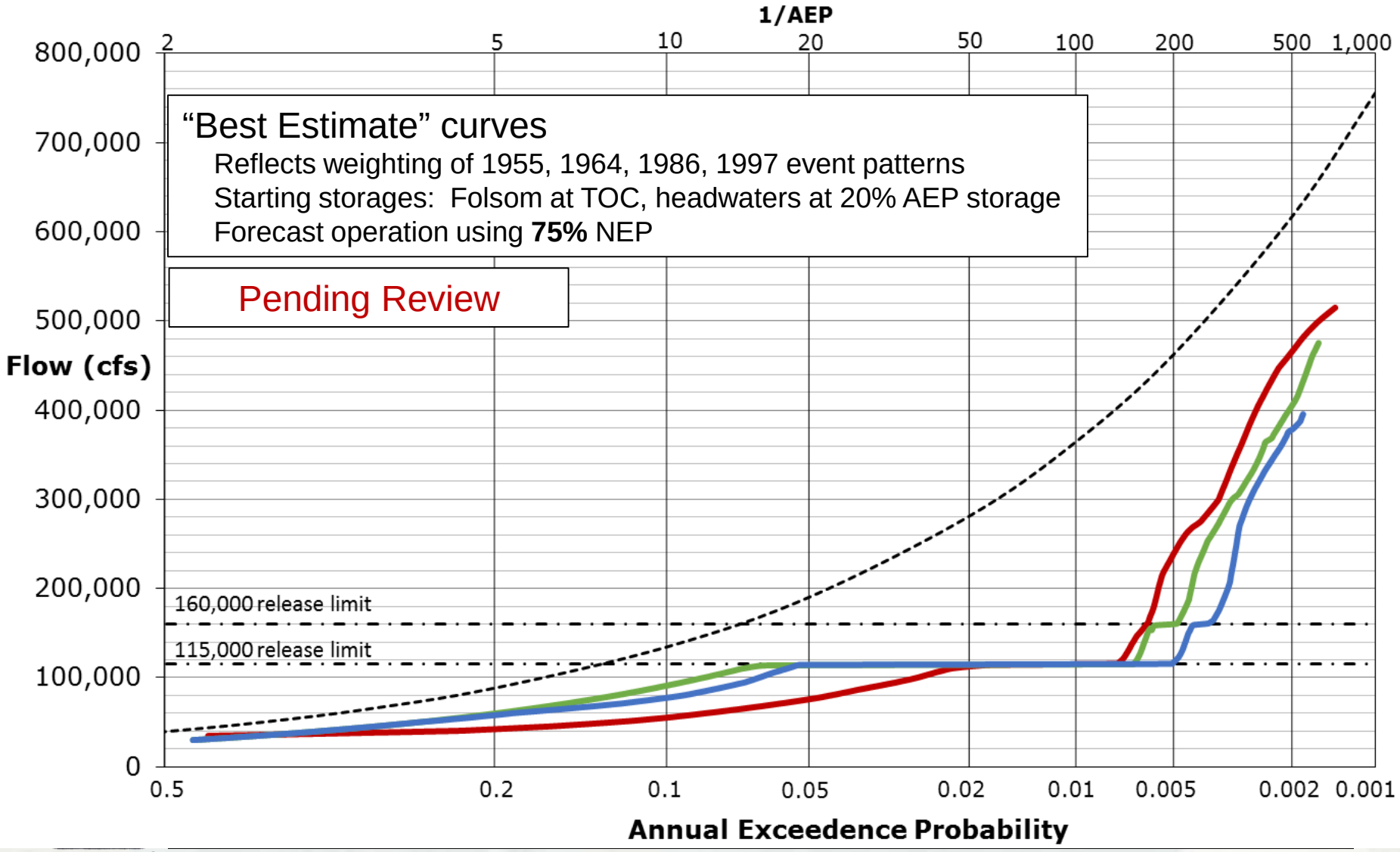
Robustness Summary

Project Goals	Minimum NEP (%) (1986 / 1997 patterns)
Pass 100-yr event at 115 kcfs	0% / 0% (ALL PASS)
Pass 200-yr event at 160 kcfs	0% / 0% (ALL PASS)

Other Metrics of Interest	Minimum NEP (%) (1986 / 1997 patterns)
Pass 200-yr event at 160 kcfs (24-hr late forecast)	55% / 60%
Pass 200-yr event at 115 kcfs	65% / 75%

Additional robustness tests and results in Engineering Report

Regulated Peak Flow-Frequency

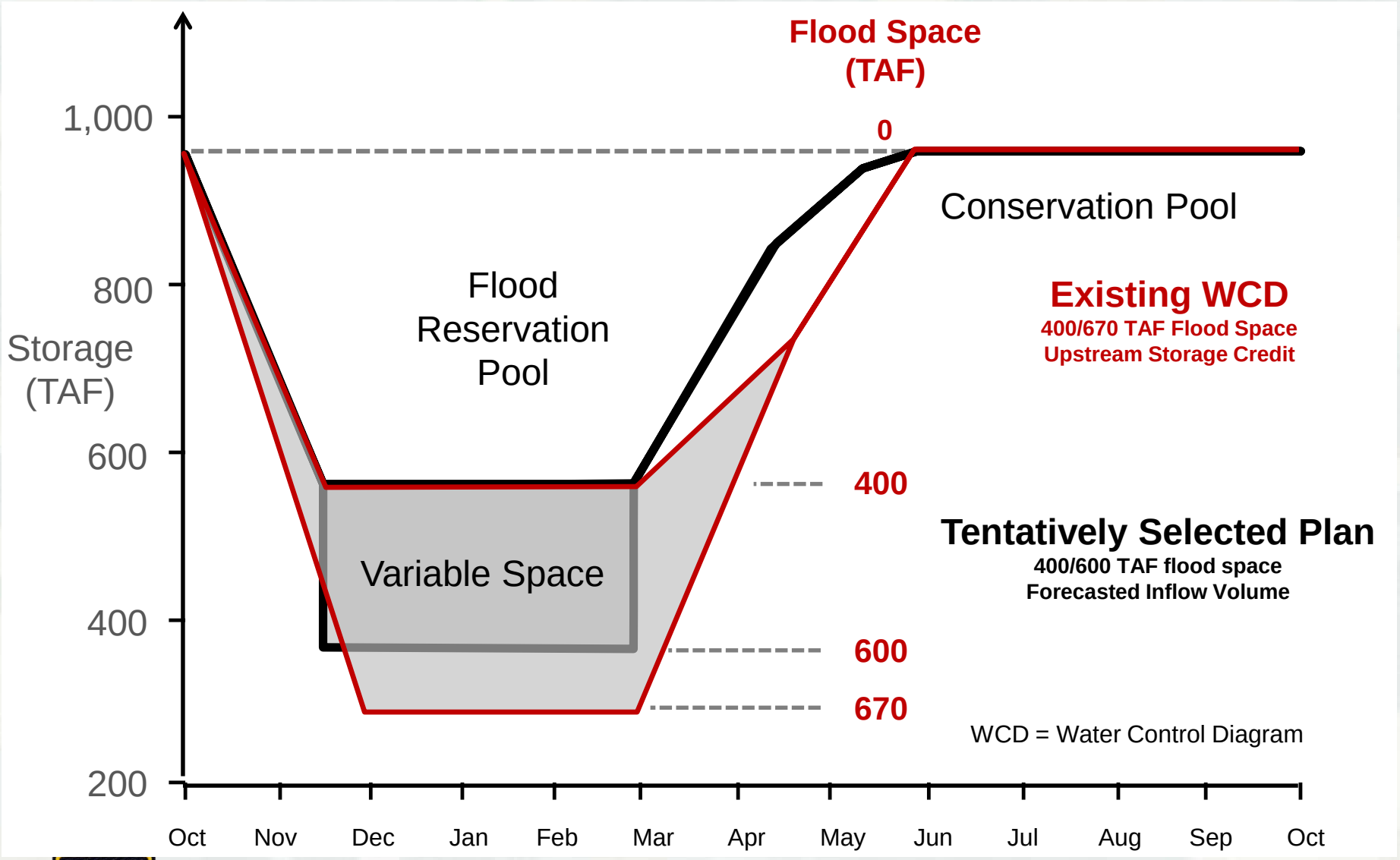


Summary

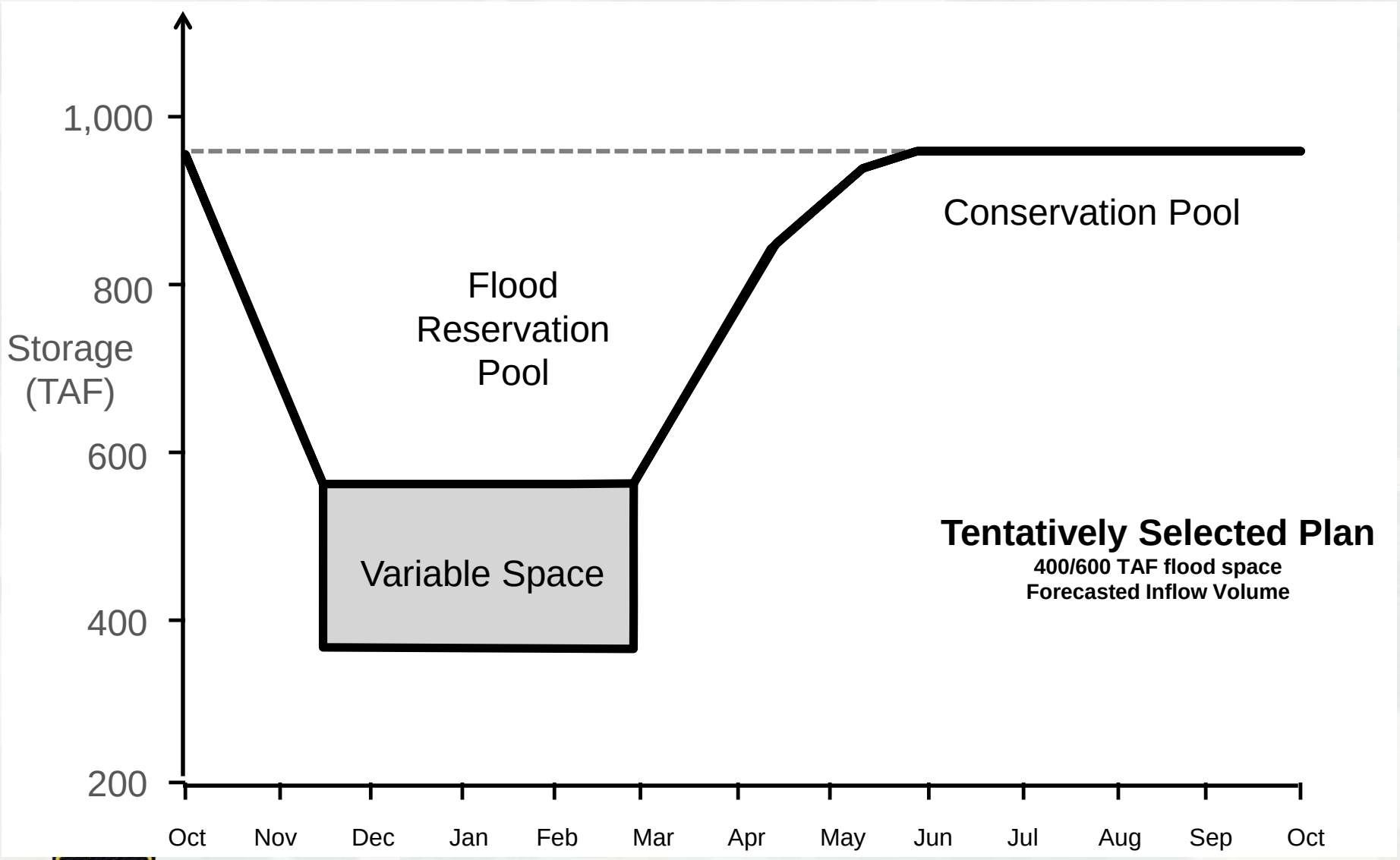
- Both the TSP and Alternative 1 satisfy project goals.
- The TSP allows larger events to be routed at peak releases of 115 and 160 kcfs.
- The TSP allows greater storage during winter, and promotes end of event refill.

ENVIRONMENTAL EFFECTS OF THE TENTATIVELY-SELECTED PLAN

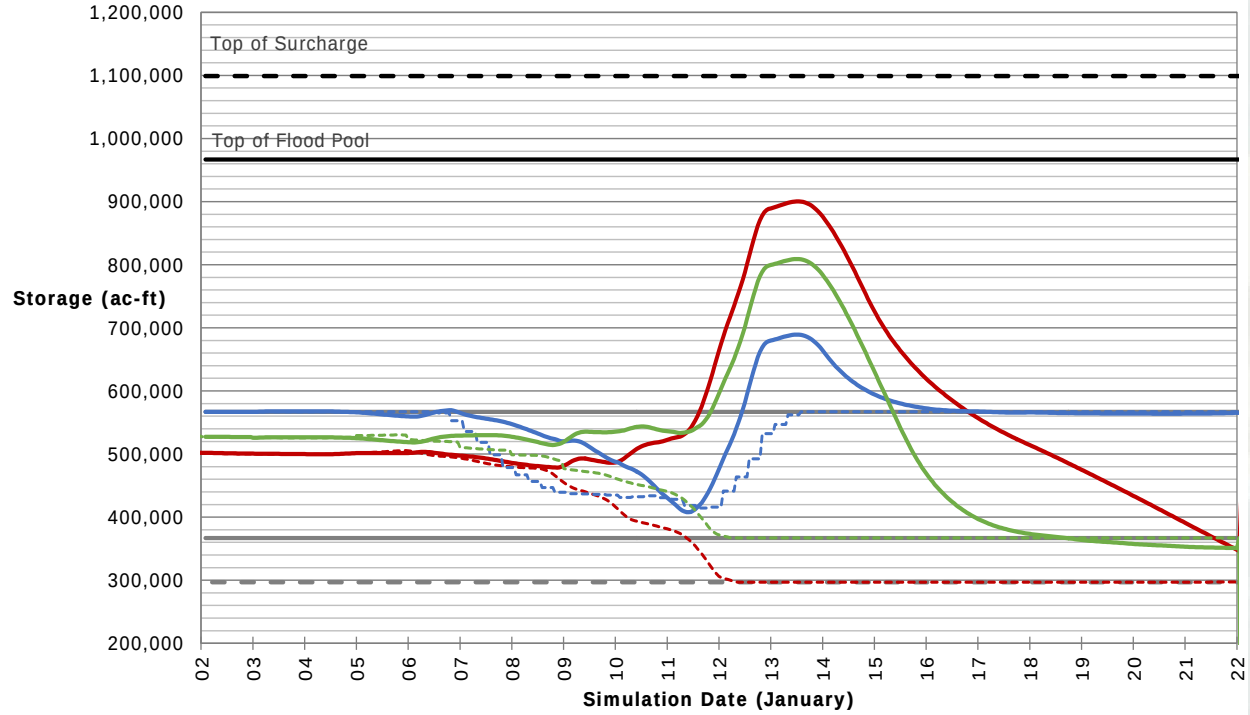
FOLSOM DAM OPERATIONS

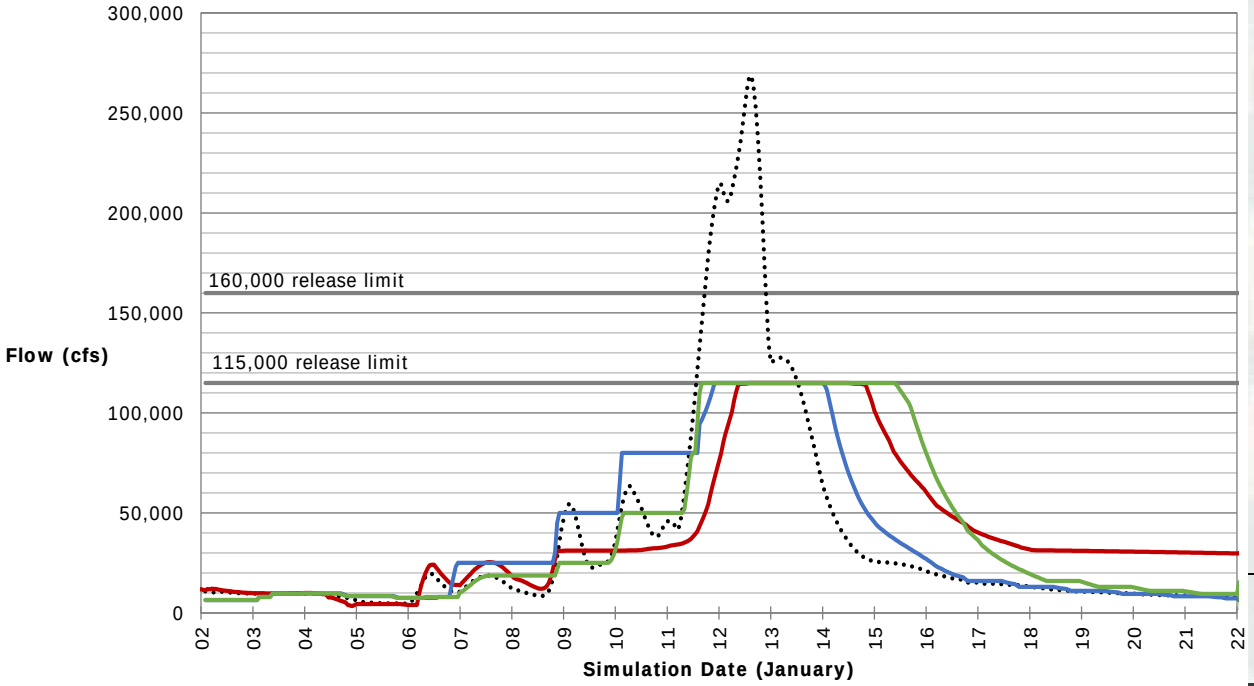


TENTATIVELY-SELECTED PLAN WATER CONTROL DIAGRAM



1997 EVENT PATTERN SCALED TO 100-YR





Existing Operations

US storage and basin wetness alternative

Tentatively Selected Plan

Forecasted inflow

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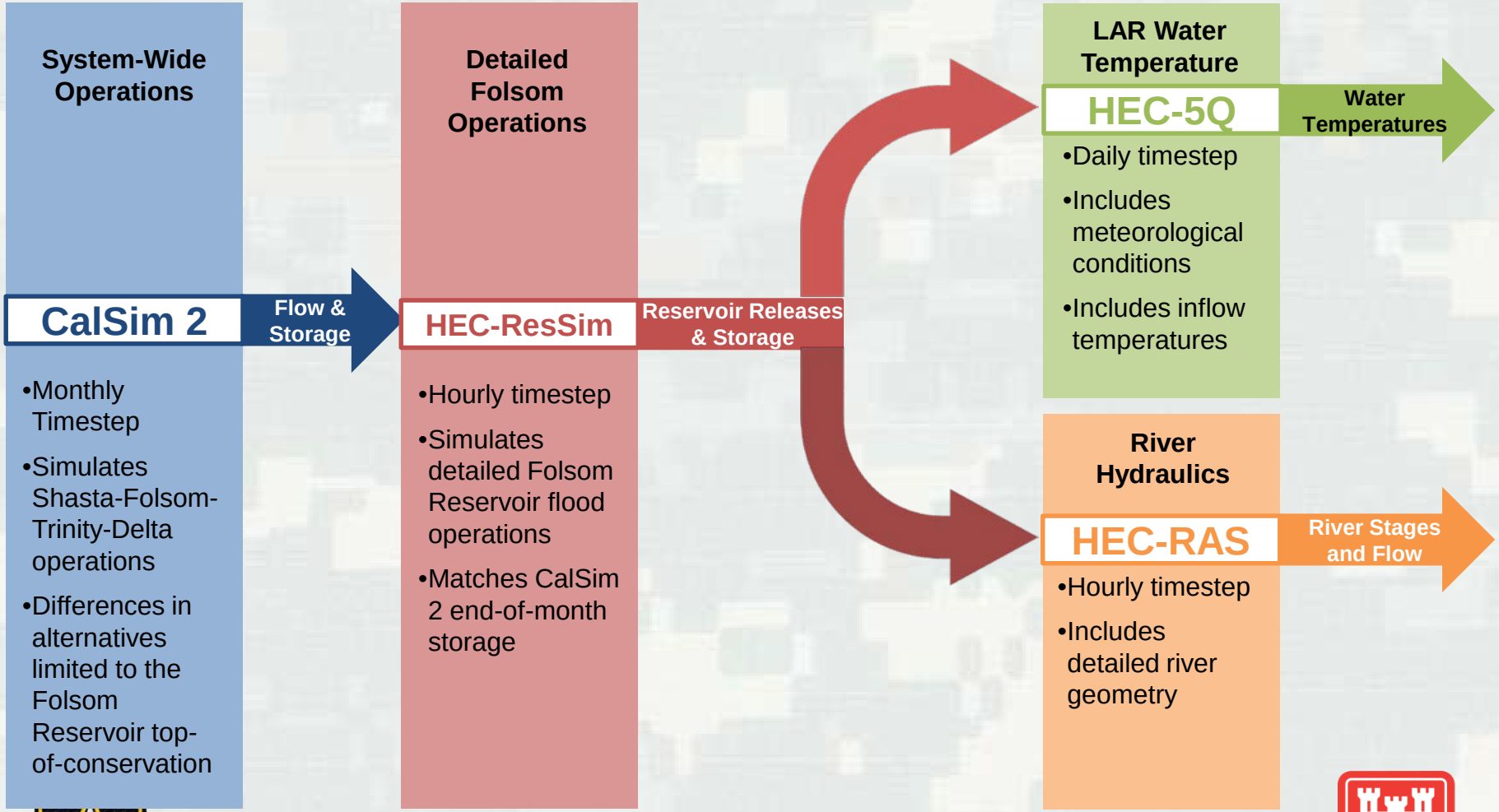
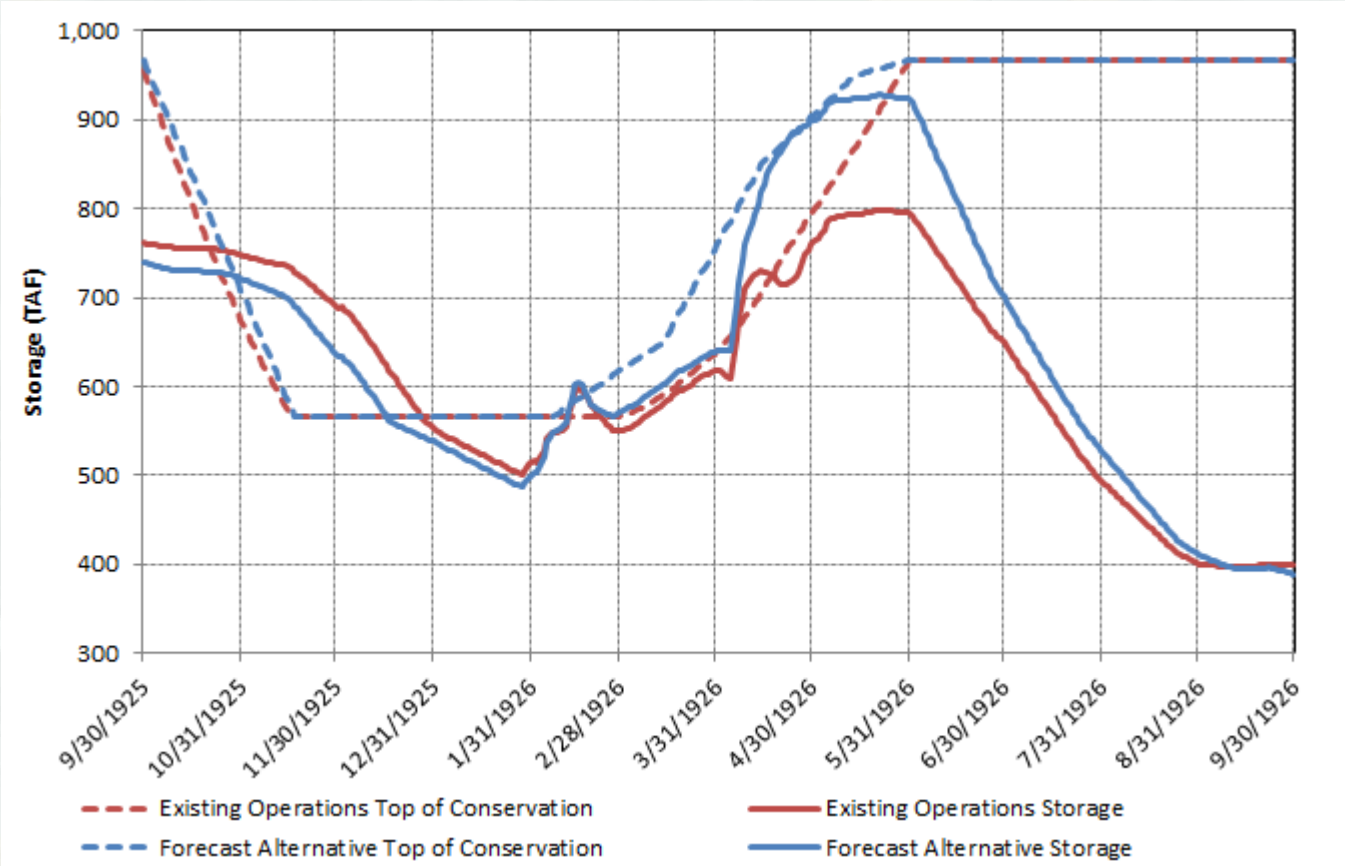
COMPARATIVE MODELING APPROACH AND RESULTS

LOWER AMERICAN RIVER (LAR) MODELING APPROACH



RESERVOIR STORAGE

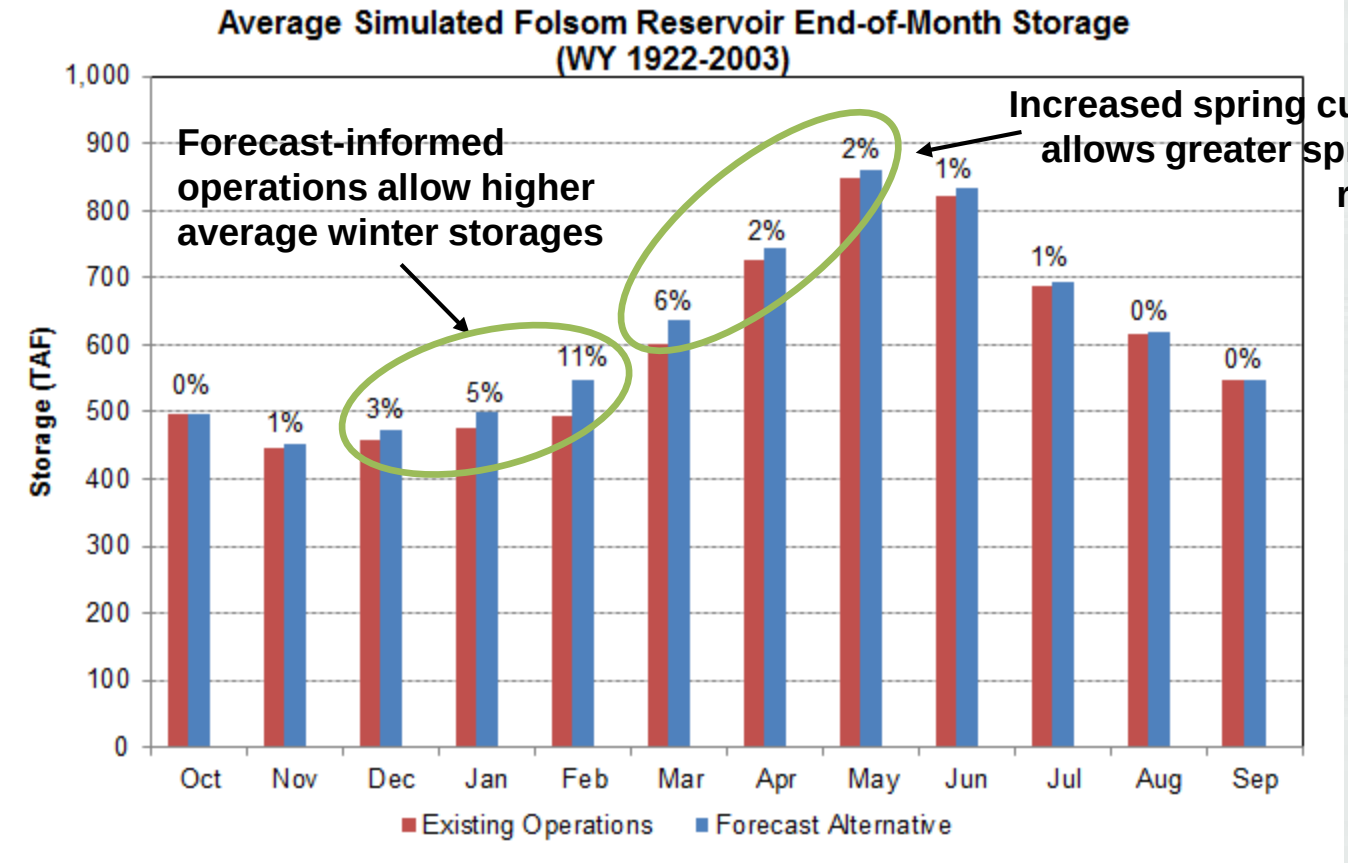
Period of Record Hydrology Presents Some Opportunities for Water Supply Benefits



13 of 82 years (16%) provide a benefit to water supply

Folsom Storage

Folsom storage increased during most months



Folsom End-of-Month Storage

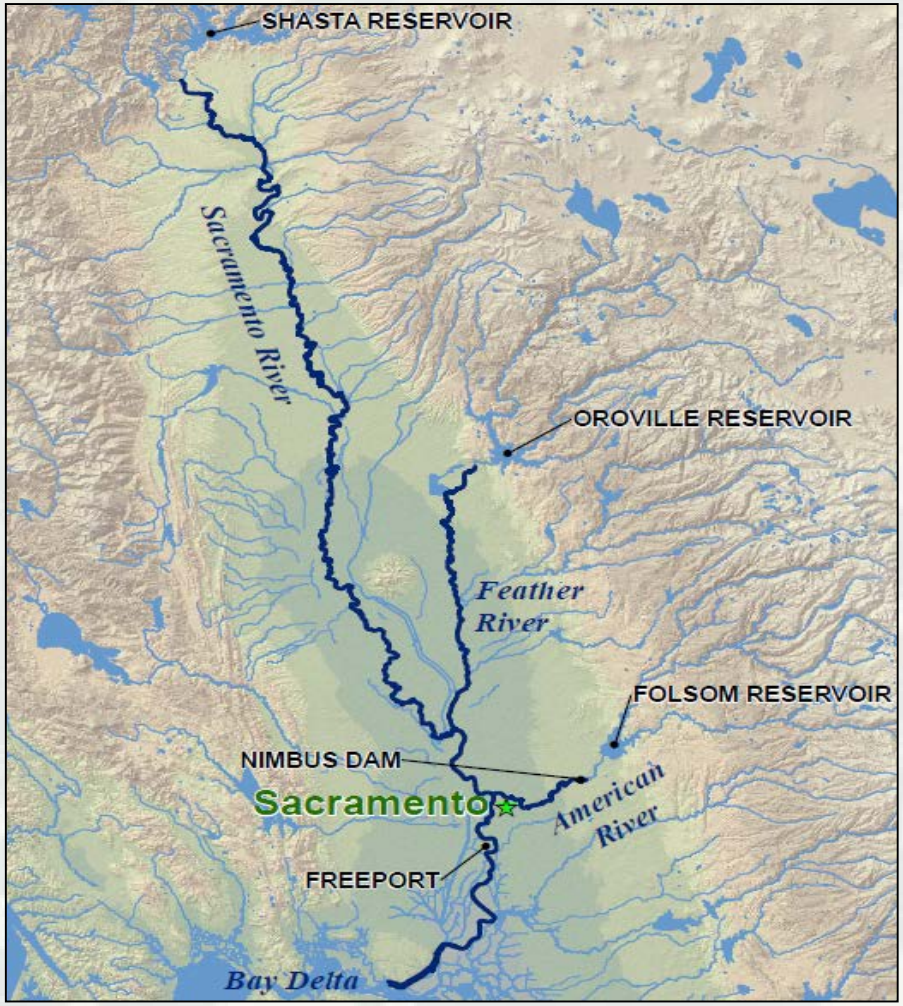
Existing Operation vs Tentatively Selected Plan

Analysis Period	Average Storage (TAF) Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	496	445	458	477	494	601	728	852	826	689	618	546
With-Project (J602F1 ELD)	496	451	472	501	549	636	747	865	838	695	621	547
Difference	0	6	14	24	55	35	19	13	12	6	3	1
Percent Difference[3]	0.0	1.3	3.1	5.0	11.1	5.8	2.6	1.5	1.5	0.9	0.5	0.2
Water Year Types[1]												
Below Normal												
CEQA Existing Condition (E504 ELD)	517	472	469	510	553	643	787	923	902	697	661	635
With-Project (J602F1 ELD)	511	470	467	510	583	670	808	940	914	708	668	638
Difference	-6	-2	-2	0	30	27	21	17	12	11	7	3
Percent Difference	-1.2	-0.4	-0.4	0.0	5.4	4.2	2.7	1.8	1.3	1.6	1.1	0.5
Dry												
CEQA Existing Condition (E504 ELD)	496	448	457	458	501	605	710	786	723	558	486	468
With-Project (J602F1 ELD)	493	446	454	455	515	639	743	812	747	567	493	472
Difference	-3	-2	-3	-3	14	34	33	26	24	9	7	4
Percent Difference	-0.6	-0.4	-0.7	-0.7	2.8	5.6	4.6	3.3	3.3	1.6	1.4	0.9
Critical												
CEQA Existing Condition (E504 ELD)	437	382	358	350	379	438	480	502	470	392	327	305
With-Project (J602F1 ELD)	442	390	368	360	392	453	494	516	483	386	316	293
Difference	5	8	10	10	13	15	14	14	13	-6	-11	-12
Percent Difference	1.1	2.1	2.8	2.9	3.4	3.4	2.9	2.8	2.8	-1.5	-3.4	-3.9

FISHERIES

Fisheries Evaluation Approach

- By species
- By life stage
- Flow & water temperature
- Spawning habitat
- Redd dewatering (LAR only)
- Early life stage mortality (LAR only)
- Delta parameters



Evaluated Species at a Range of Locations

	American River	Sacramento River	Feather River	Yolo Bypass	Delta
Winter-Run Chinook Salmon		✓		✓	✓
Spring-run Chinook Salmon	✓	✓	✓	✓	✓
Fall- and late fall-run Chinook Salmon	✓	✓	✓	✓	✓
Steelhead	✓	✓	✓	✓	✓
Green sturgeon		✓	✓	✓	✓
Delta smelt				✓	✓
Longfin smelt					✓
River lamprey	✓	✓	✓		✓
Pacific lamprey	✓	✓	✓		✓
Sacramento splittail				✓	
Hardhead	✓	✓	✓		
White sturgeon		✓	✓	✓	✓

Lower American River Flow

Similar most of the time during most months

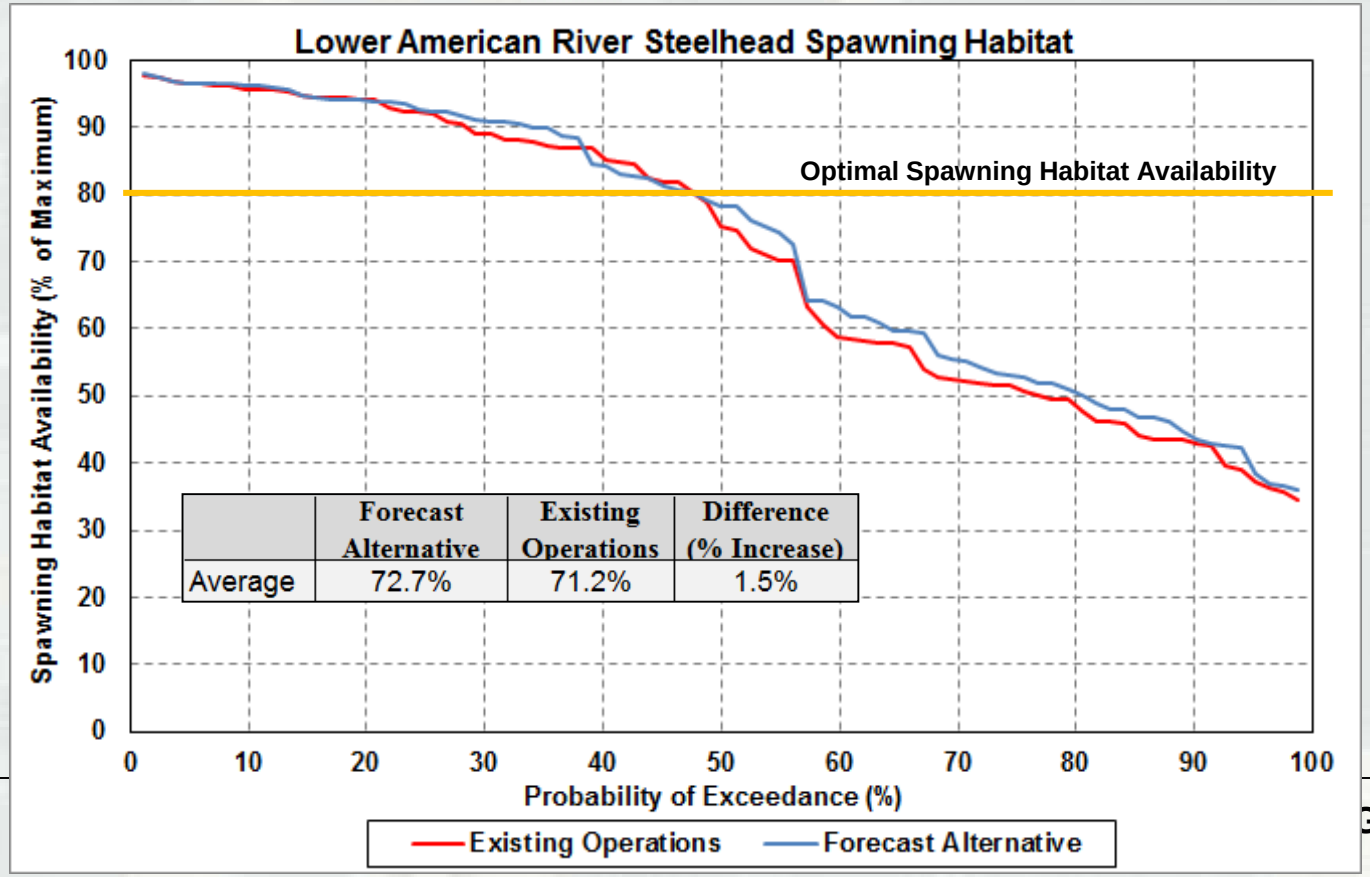
	Long-term Average Flows (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing Operation	2,127	3,082	3,585	4,825	5,441	4,227	3,146	3,639	3,475	3,439	2,434	2,582
Tentatively Selected Plan	2,074	3,005	3,515	4,439	5,025	4,119	3,667	3,767	3,449	3,384	2,411	2,562
Difference	-53	-77	-70	-386	-416	-108	521	128	-26	-55	-23	-20
Percent Difference	-2.5	-2.5	-2.0	-8.0	-7.6	-2.6	16.6	3.5	-0.7	-1.6	-0.9	-0.8

During Dry Years – Lower During Fall, Higher During Summer

	Dry Years - Long-term Average Flows (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing Operation	2225	2510	2050	1744	1873	2456	1714	1711	2054	3203	2081	1537
Tentatively Selected Plan	2,172	2,486	1,981	1,718	1,574	2,045	1,798	1,826	2,073	3,270	2,048	1,514
Difference	53	24	69	26	299	411	84	115	19	67	33	23
Percent Difference	-2	-1	-3	-2	-16	-17	5	7	1	2	-2	-2

American River
Steelhead Spawning Habitat (WUA)

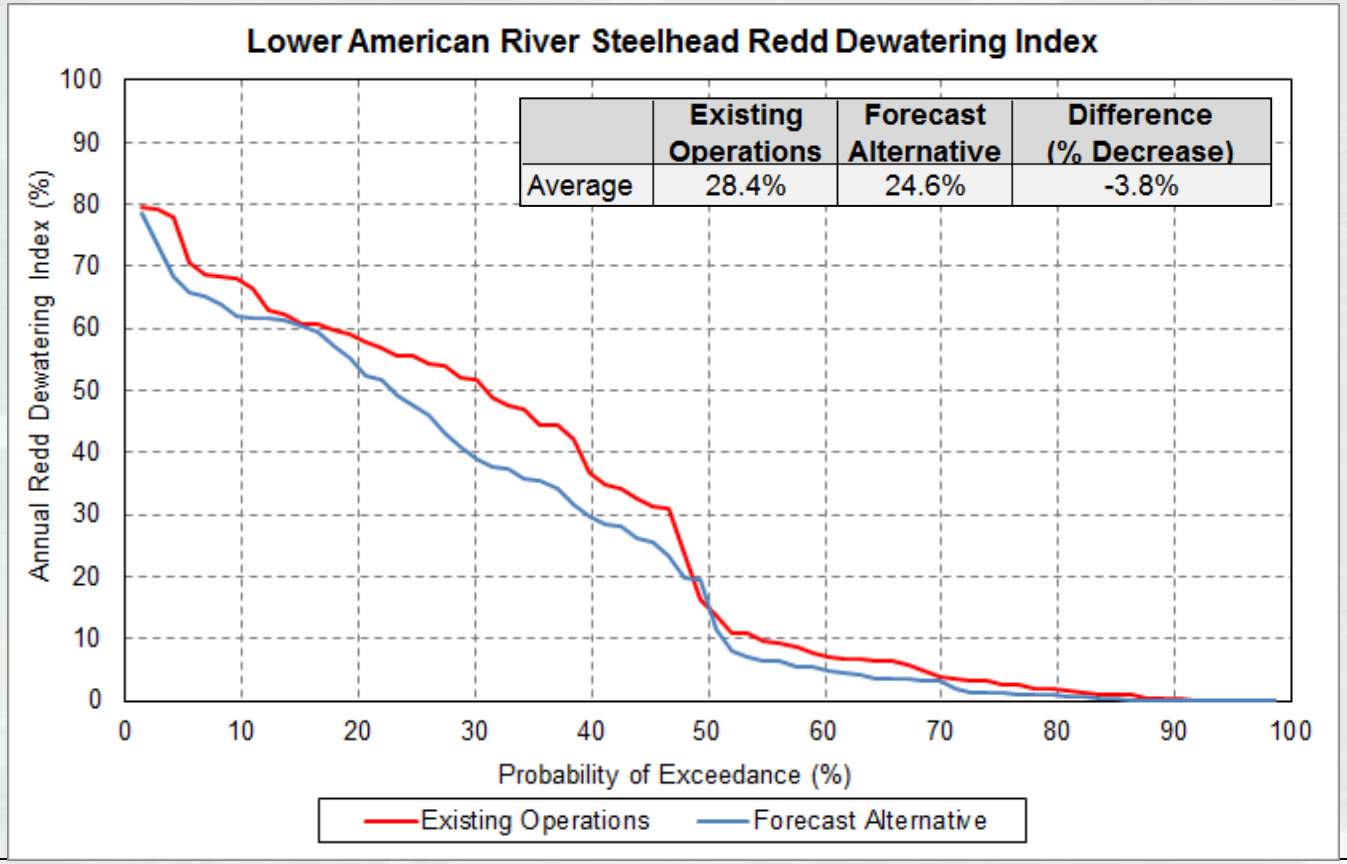
- Spawning Habitat is at optimal almost 50 percent of the time.
- More spawning habitat availability with tentatively selected plan than with existing operations.



	Forecast Alternative	Existing Operations	Difference (% Increase)
Average	72.7%	71.2%	1.5%

American River Steelhead Redd Dewatering

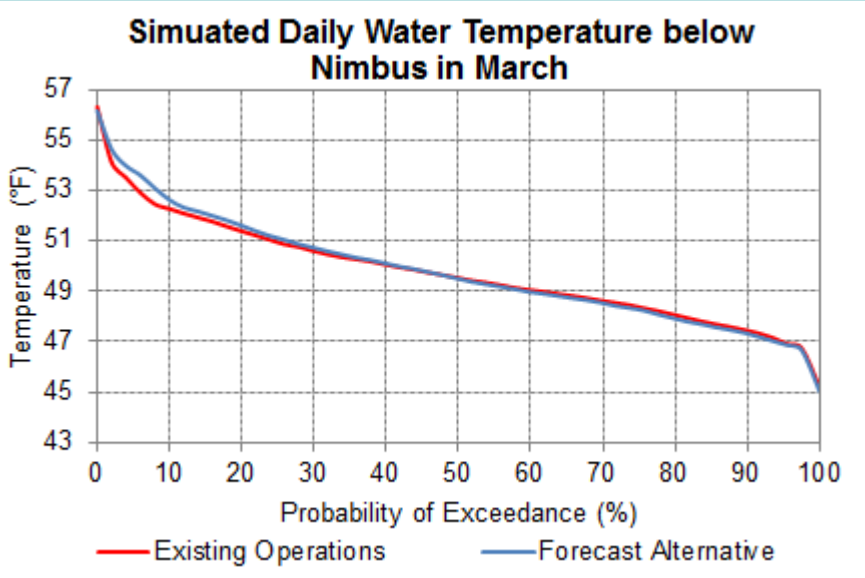
- Reduced Redd Dewatering Conditions with the tentatively-selected plan than with existing operations

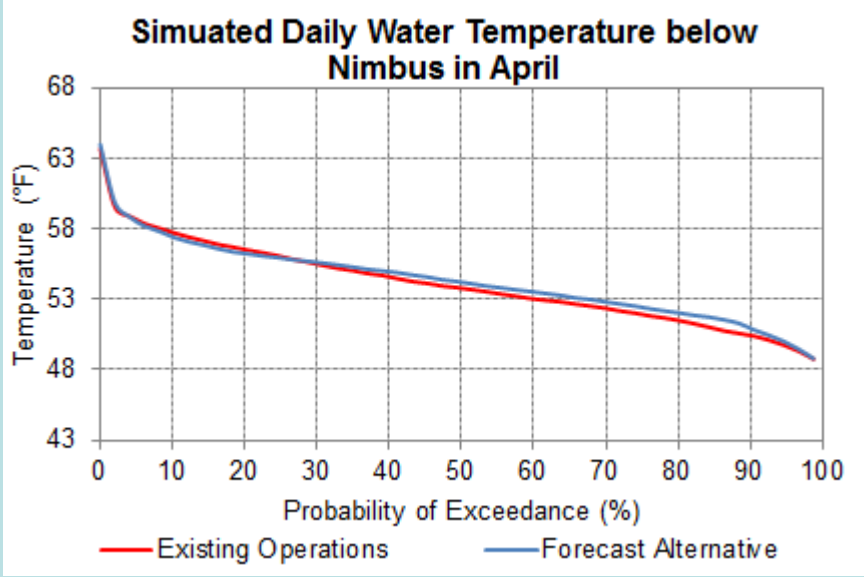


American River Water Temperature

Similar most of the time during most months

Warmer during March & April



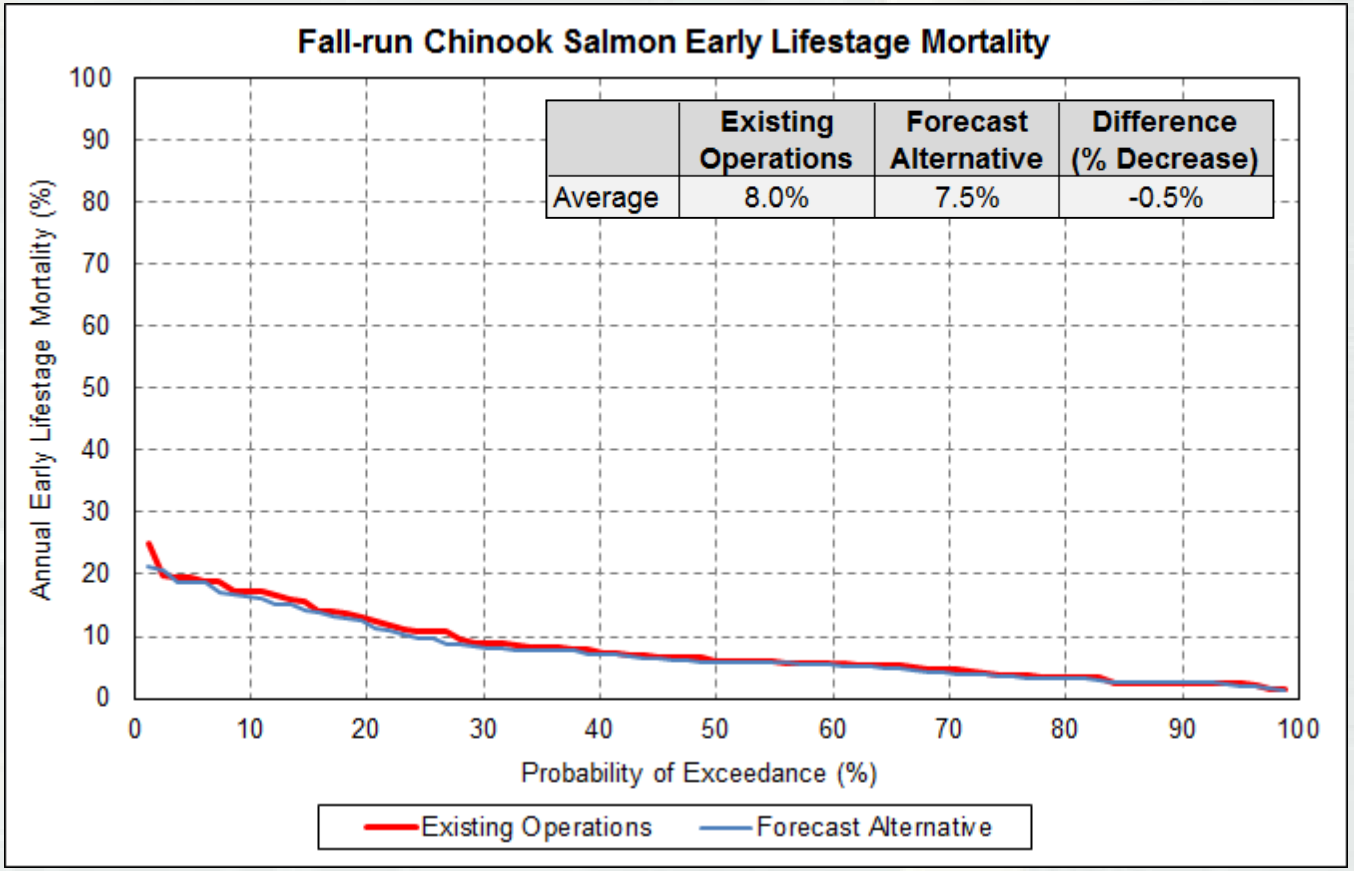


Slightly cooler during May, June, and August under relatively warm conditions

	Dry Years - Average Temperatures (°F)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing Operation	63.0	57.1	50.8	46.5	47.0	50.4	54.9	60.2	63.8	64.8	64.6	65.7
Tentatively Selected Plan	62.7	57.0	50.6	46.5	47.0	50.6	55.1	59.6	63.4	64.9	64.5	65.6
Difference	-0.3	-0.1	-0.2	0.0	0.0	0.2	0.2	-0.6	-0.4	0.1	-0.1	-0.1

American River
Fall-Run Chinook Early Life-Stage Mortality

Slight improvement to Chinook early life-stage mortality



Fisheries Evaluation Summary

- Slight benefits to evaluated species in the Lower American River and CVP/SWP system-wide area
  - ► Flow fluctuations
  - ► Water temperature
- Improved end-of-May storages at Folsom Dam provide for increased cold water pool volumes
  - ► Improved management of Lower American River temperatures during summer and fall

RECREATION

Recreation Metrics
Reservoirs

- Boating Recreation Metric: Reservoir pool elevations vs. boat ramp access elevations

- Shoreline Recreation Metric: Reservoir pool elevations vs. optimum general recreation elevation and optimum shoreline use elevation

Reservoir Recreation Folsom Comparison Results

Folsom Reservoir Boat Ramp Access Threshold – Existing Operations vs. Tentatively-Selected Plan

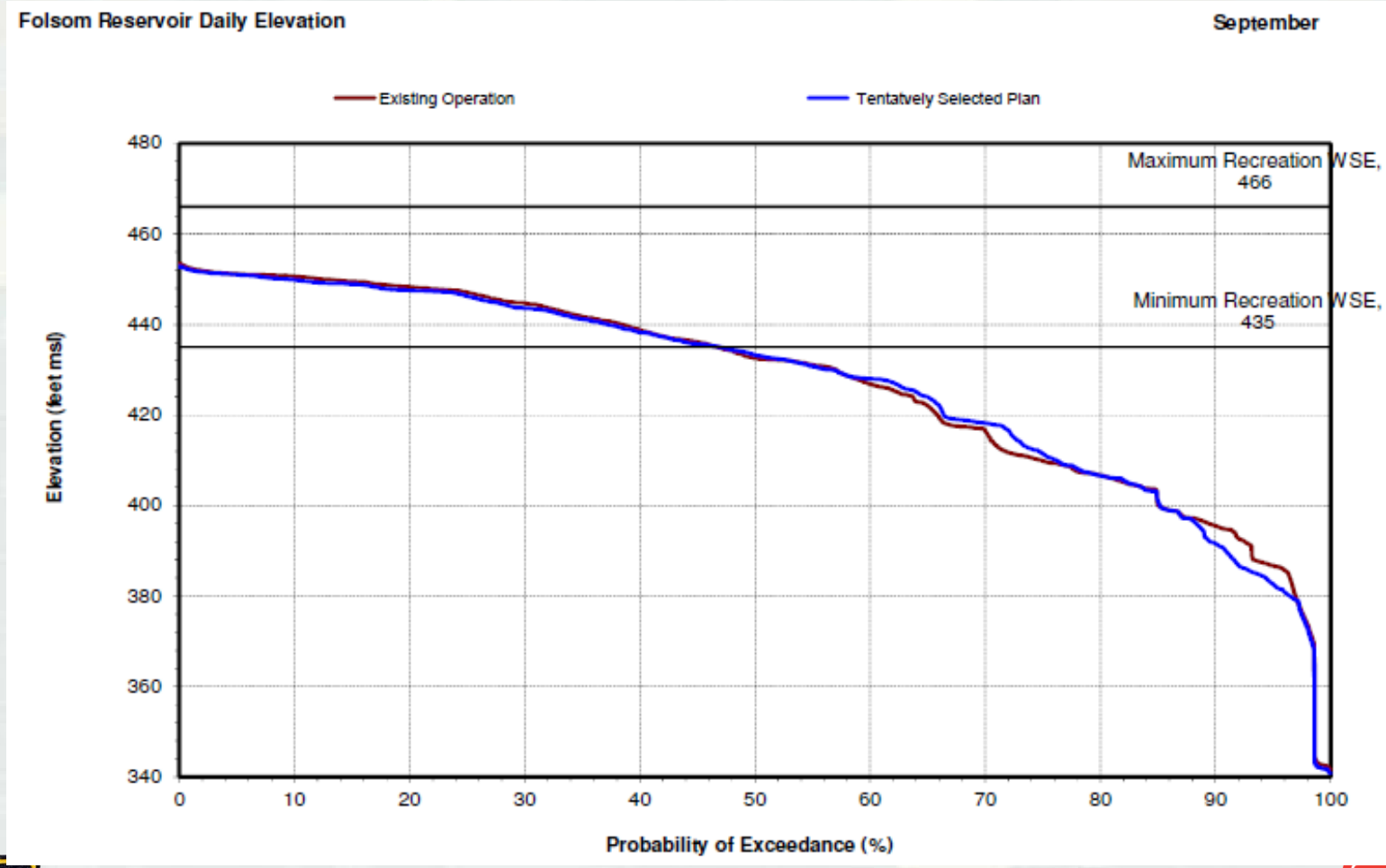
Minimum Boat Ramp Elevation (ft)	Beal's Point 420	Dike 8 405	Brown's Ravine Main 395	Hobie Cove 375	Granite Bay 360
May	-1.1%	0.9%	0.0%	*	*
June	0.6%	1.2%	0.0%	0.0%	*
July	0.8%	0.6%	–0.9%	0.0%	*
August	2.1%	1.3%	-2.0%	0.0%	0.0%
September	0.6%	0.3%	-1.8%	-0.1%	0.0%

Note: * Threshold of significance is not crossed.

Folsom Reservoir Swim Access Threshold – Existing Operations vs. Tentatively-Selected Plan

Swim Beaches Minimum Elevation (ft)	Granite Bay – Main Swim Beach 450	Granite Bay – Oak Point Swim Beach 440	Rattlesnake Bar – Jet Ski Cove 425	Rattlesnake Bar – Vista Shoreline Access 420
May	5.9%	0.8%	0.0%	-1.1%
June	4.9%	1.5%	1.0%	0.6%
July	0.5%	3.6%	1.2%	0.8%
August	-1.0%	1.9%	0.4%	2.1%
September	-2.9%	–1.2%	1.7%	0.6%

Folsom Reservoir Recreation Elevations



Recreation Metrics
American River

- Boating Recreation Metric: Flow stage vs. acceptable flow ranges for recreational activities and recreational facility availability

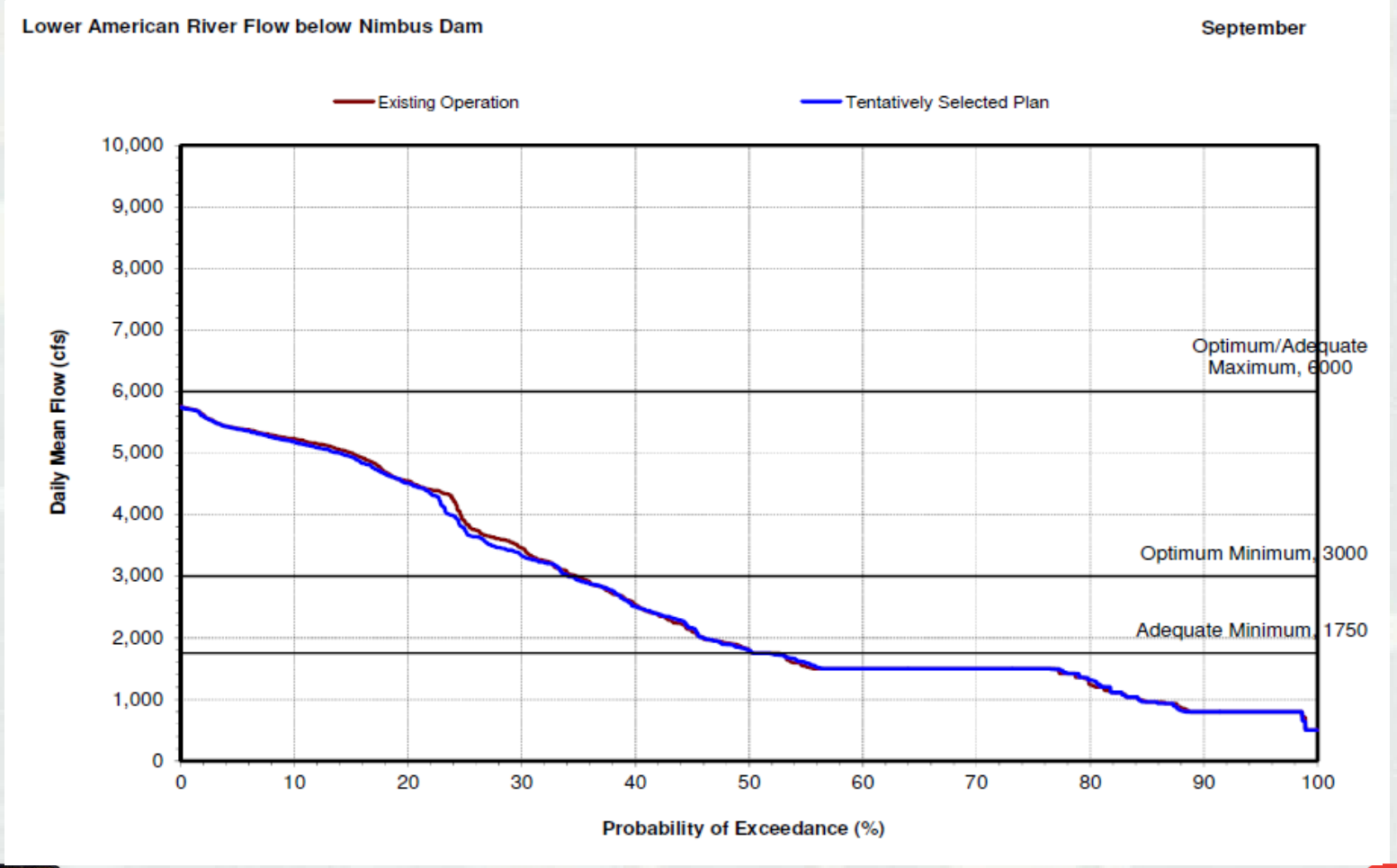
- Consistency of LAR flows with the American River Parkway Plan and the California and National Wild and Scenic Rivers Acts.

Lower American River Recreation Threshold Difference

Lower American River Thresholds of Significance Flows (cfs)	Maximum Optimal 6,000	Minimum Optimal 3,000	Minimum Adequate 1,750
May	0.8%	1.1%	-1.5%
June	–1.2%	–1.0%	–1.5%
July	0.0%	–4.2%	1.6%
August	*	-0.5%	-0.1%
September	*	-0.8%	0.0%

Note: * Threshold of significance is not crossed.

Lower American River Recreation Threshold Difference



LOWER AMERICAN RIVER TERRESTRIAL HABITAT

Lower American River Cottonwood Growth

- No decrease in average number of days for cottonwood radial growth maintenance and optimal growth

- No substantial difference in peak flows necessary to inundate terraces for cottonwood dispersal and regeneration

Lower American River Backwater Recharge

- Minor fluctuation in backwater flows
- Not enough to alter existing backwater recharge

FIXED-400,000 AF OPERATION VS. TENTATIVELY-SELECTED PLAN

See Hand-Outs

PROJECT MILESTONE SCHEDULE

APRIL 2016	USACE COMPLETES ADMINISTRATIVE DRAFT ENGINEERING REPORT & WATER CONTROL MANUAL UPDATE
MAY 2016	PUBLIC WORKSHOP: TENTATIVELY-SELECTED PLAN & ENVIRONMENTAL EFFECTS OF THIS PLAN
APRIL – SEPTEMBER 2016	USACE/PARTNER REVIEW; USACE-REQUIRED INDEPENDENT SAFETY ASSURANCE REVIEW USACE COMPLETES DRAFT NEPA / CEQA DOCUMENTS
AUGUST – SEPTEMBER 2016	PUBLIC REVIEW OF **DRAFT** NEPA / CEQA DOCUMENTS PUBLIC MEETING FOR **DRAFT** NEPA / CEQA DOCUMENTS
AUGUST – DECEMBER 2016	OBTAIN BIOLOGICAL OPINION (135-DAY REVIEW)
MARCH 2017 – APRIL 2017	PUBLIC & ENVIRONMENTAL AGENCIES' REVIEW OF **FINAL** NEPA / CEQA DOCUMENTS

DISCUSSION