



INTERCONNECTED SURFACE WATER DEPLETION MODELING UPDATE

MAY 14, 2026



OVERVIEW

- **Background**
- **Uncertainty Analysis Results**
- **Depletion Modeling Approach Review**
- **Depletion Modeling Results Summary**

BACKGROUND

- GSP calls for development of actions to address indirect depletion of ISW
 - Address groundwater level data gaps ✓
 - Model update, including uncertainty eval. ✓
 - Update depletion estimates ✓
 - Develop projects or management action(s)
 - Current work provides preliminary information to facilitate planning

UNCERTAINTY ANALYSIS

- 55 models with “acceptable” calibration used to quantify uncertainty
 - Depletion uncertainty = +/-0.8 cfs for flows of interest (i.e., <10 cfs)
- Uncertainty sources:
 - ~50% Foster Park gauge error
 - Variable measurement locations, obstructions, multiple channels, etc.
 - ~50% model uncertainty

DEPLETION MODELING APPROACH

- Approved by board in March
- Two minimum threshold exceedances over 50 year projection period analyzed
 - Six well groups
 - Pumping for each well group curtailed going backwards in time to determine streamflow increase at Foster Park
 - Cumulative curtailment
 - Non-cumulative curtailment

WELL GROUPS

Depletion Analysis Pumping Groups

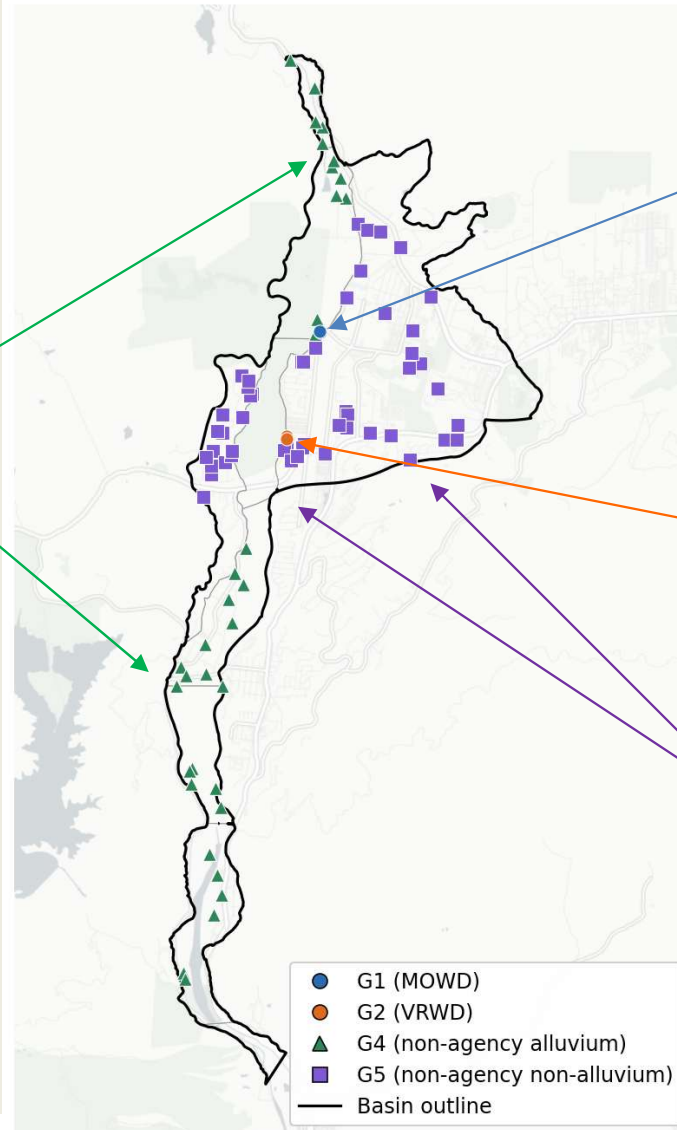
Group 1: MOWD

Group 3: MOWD & VRWD

Group 2: VRWD

Group 5:
All other wells
located outside
of river alluvium

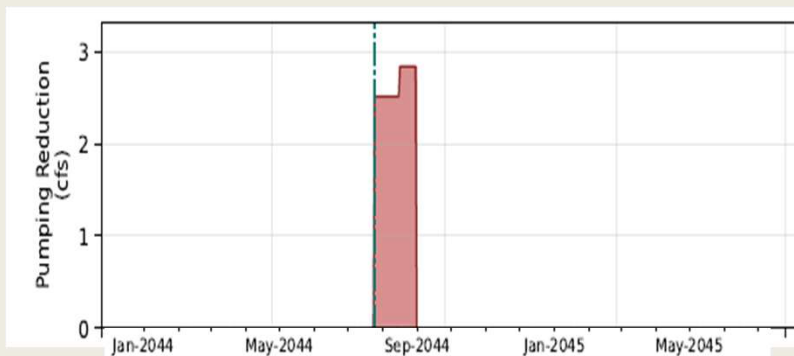
Group 4:
All other wells
located within
river alluvium



MODELING METHODS

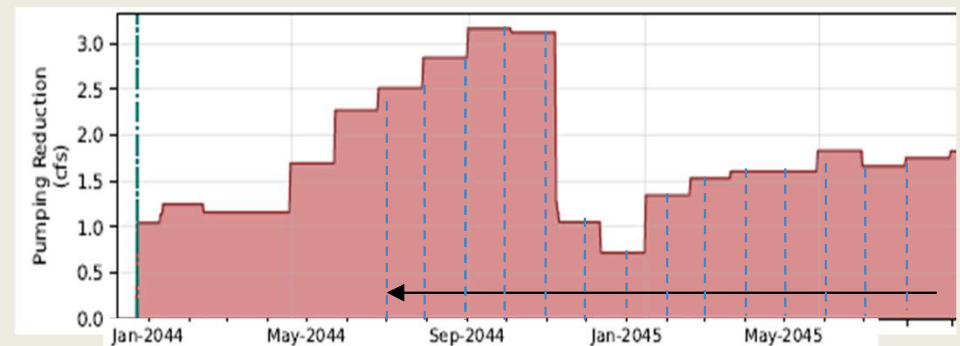
Non-Cumulative Scenarios

- Simulate pumping curtailment in individual, discrete increments (30 or 90 days at a time)
- Helps inform lag time and duration of effects



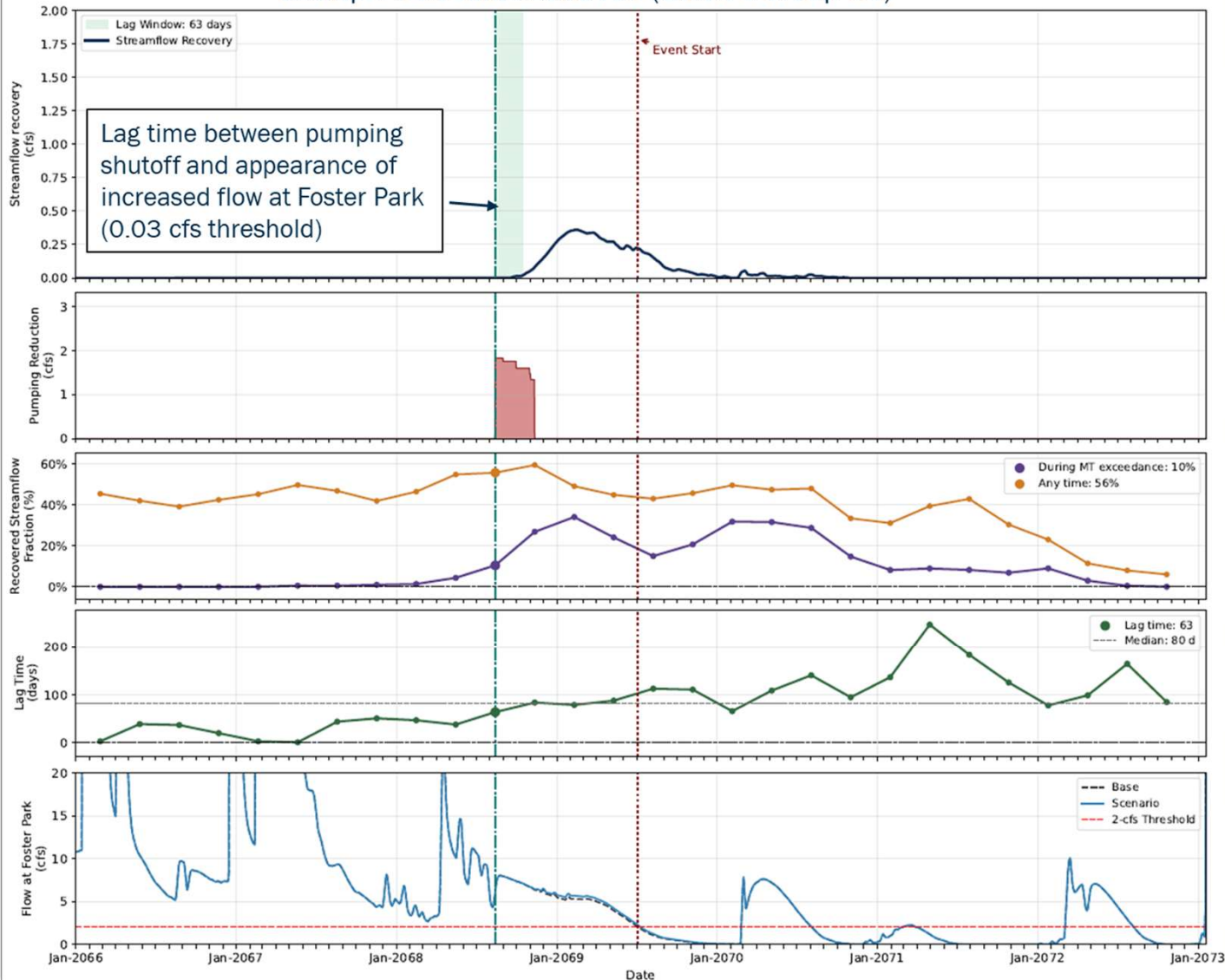
Cumulative Scenarios

- Simulate effect of ongoing pumping curtailment over time
- Helps inform maximum increase in streamflow



EXAMPLE NON-CUMULATIVE RESULT

Example non-cumulative run (Event 6 Group #3)



Lag time between pumping shutoff and appearance of increased flow at Foster Park (0.03 cfs threshold)

Recovered Streamflow at Foster Park and duration of increased flow in response to pumping shutoff

Pumping reduction for current scenario (G3)

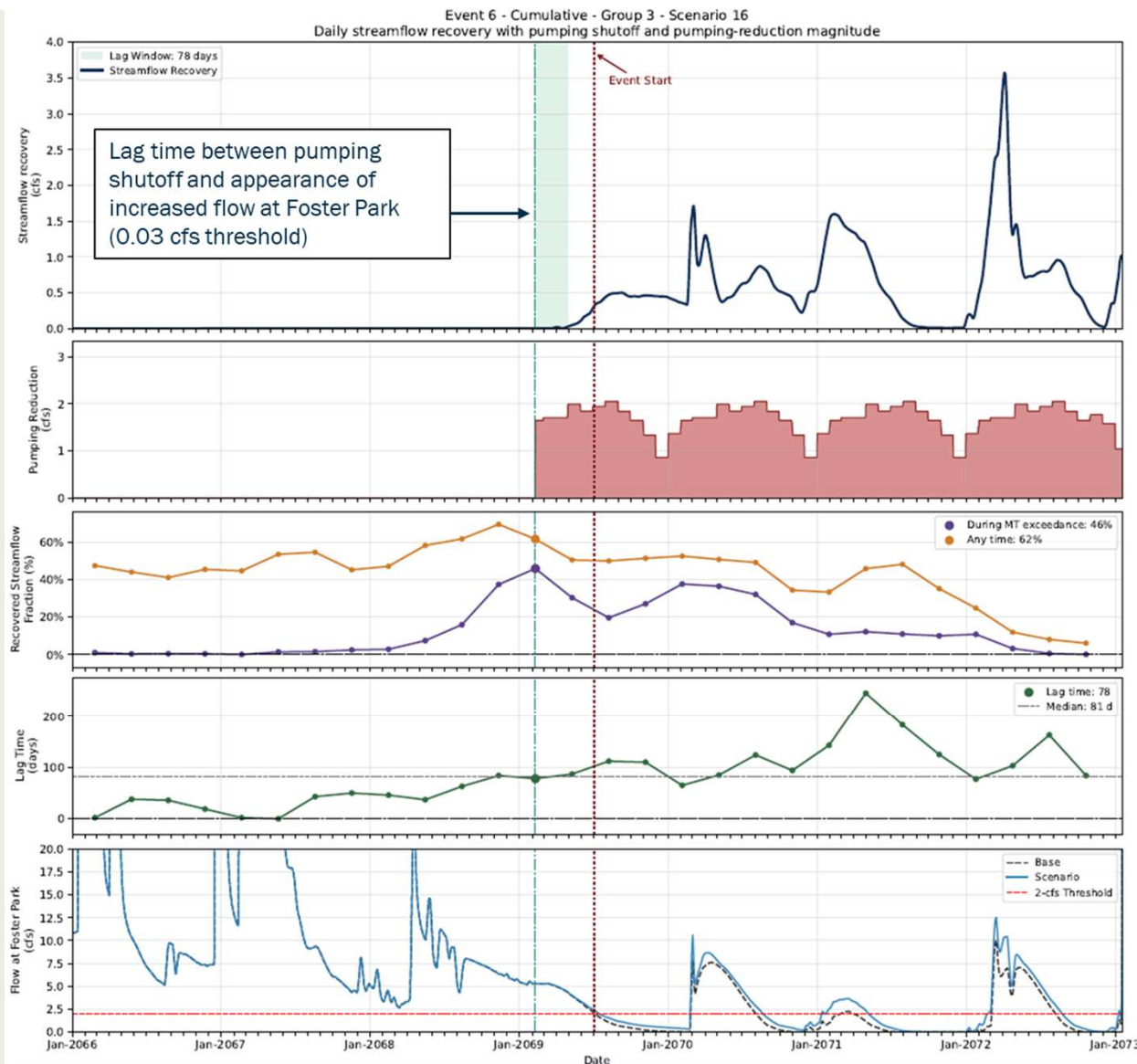
Fraction of current scenario's pumping shutoff that manifests as streamflow increase at Foster Park during the depletion event (purple) and at any time (orange)

Lag Time for current scenario relative to all other scenarios

Base model vs current scenario simulated streamflow

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EXAMPLE CUMULATIVE RESULT



Cumulative recovered Streamflow at Foster Park

Cumulative Pumping Shutoff (G3)

Fraction of current scenario's pumping shutoff that manifests as streamflow increase at Foster Park during the depletion event (purple) and at any time (orange)

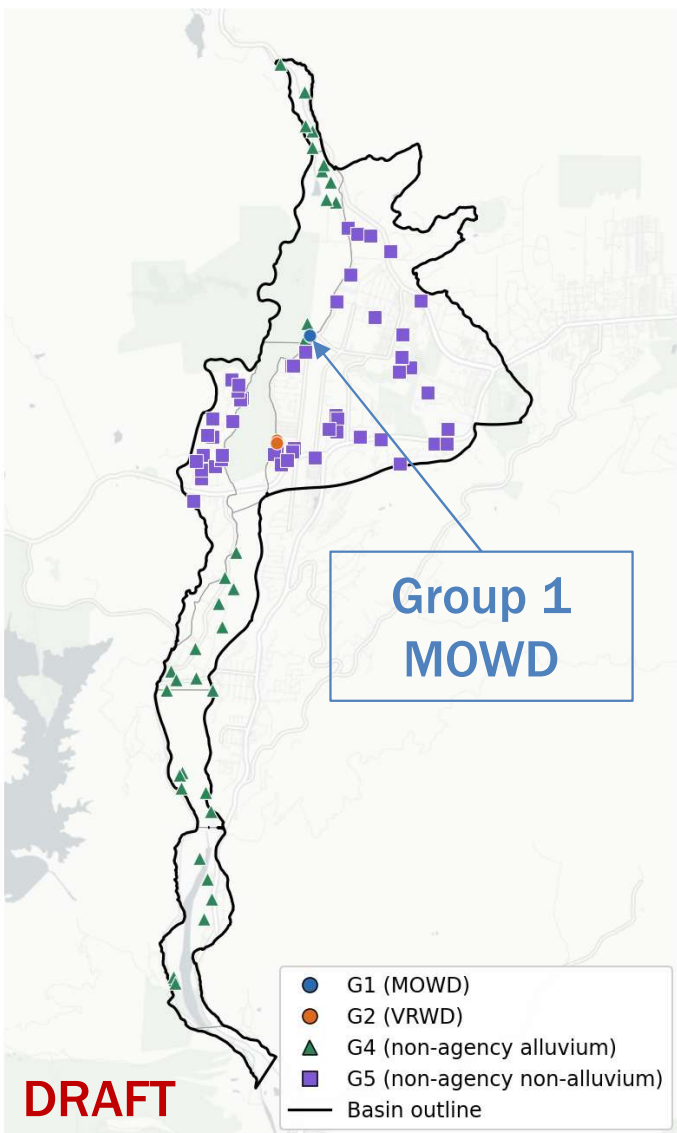
Lag Time Timeseries

Base model vs current scenario streamflow

RESULTS SUMMARY

GROUP 1 WELLS (MOWD)

Depletion Analysis Pumping Groups



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Lag Time (days)

Median	Maximum	Minimum
132 - 150	206 - 377	15 - 20

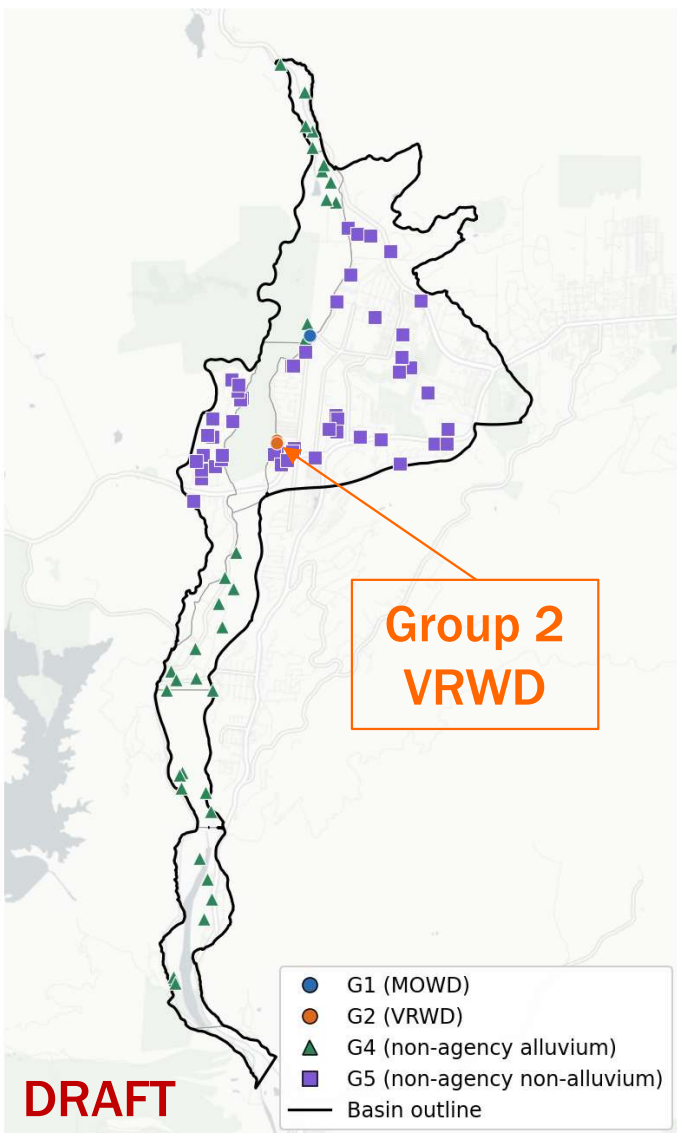
Percentage of Curtailed Pumping Adding to Streamflow (%)

When	Median	Maximum	Minimum
Arrives Anytime	43 - 51	60 - 81	2 - 18
Arrives During Critical Period	3 - 7	29 - 31	0

RESULTS SUMMARY

GROUP 2 WELLS (VRWD)

Depletion Analysis Pumping Groups



Lag Time (days)

Median	Maximum	Minimum
70 - 82	117 - 337	1 - 3

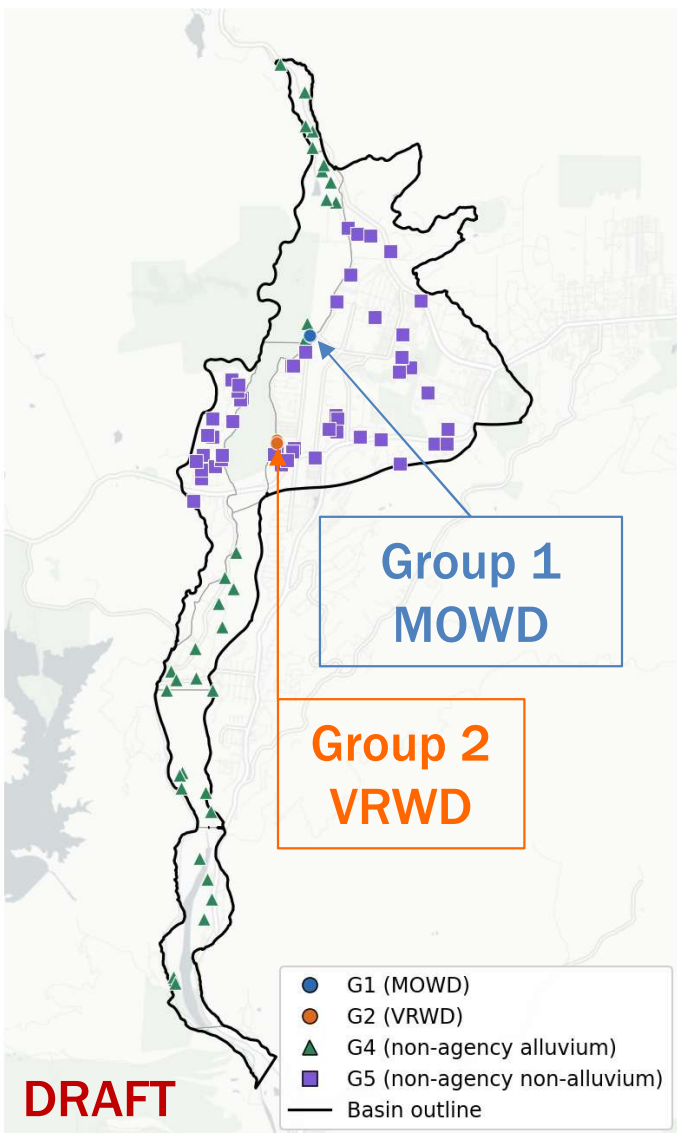
Percentage of Curtailed Pumping Adding to Streamflow (%)

When	Median	Maximum	Minimum
Arrives Anytime	48 - 52	70 - 78	7 - 24
Arrives During Critical Period	3 - 10	43 - 47	0

RESULTS SUMMARY

GROUP 3 WELLS (MOWD & VRWD)

Depletion Analysis Pumping Groups



Lag Time (days)

Median	Maximum	Minimum
68 - 84	117 - 246	0 - 3

Percentage of Curtailed Pumping Adding to Streamflow (%)

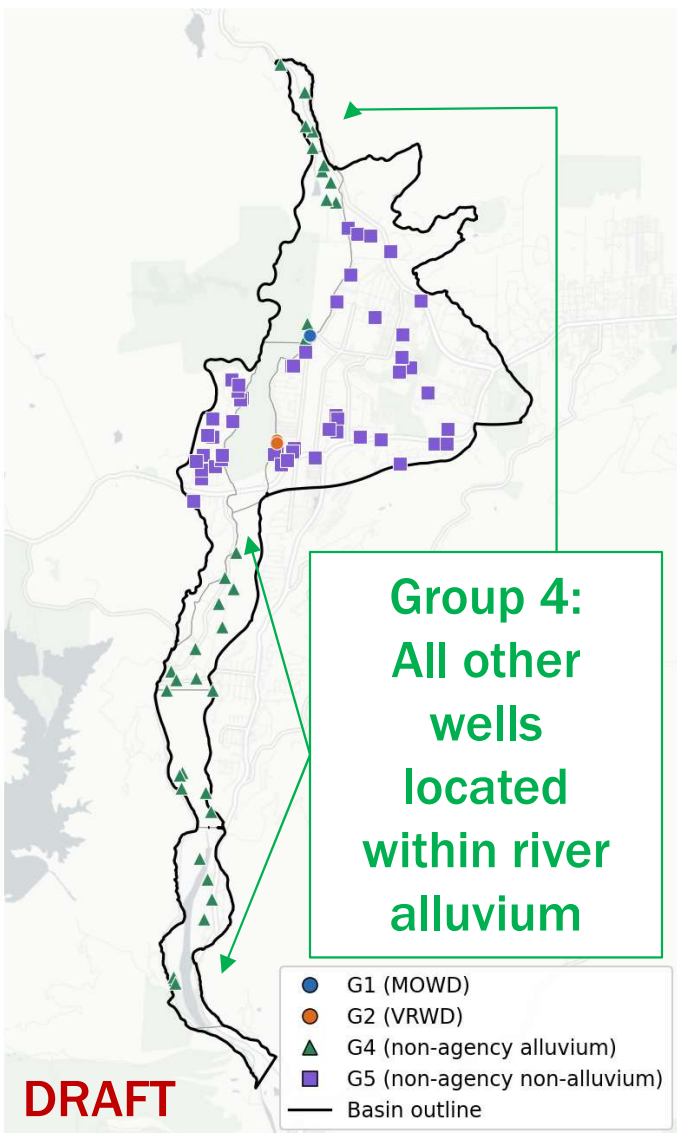
When	Median	Maximum	Minimum
Arrives Anytime	47 - 52	70 - 78	6 - 23
Arrives During Critical Period	4 - 10	41 - 46	0

RESULTS SUMMARY

GROUP 4 WELLS

(OTHER RIVER ALLUVIUM WELLS)

Depletion Analysis Pumping Groups



Lag Time (days)

Median	Maximum	Minimum
29 - 39	91 - 158	0

Percentage of Curtailed Pumping Adding to Streamflow (%)

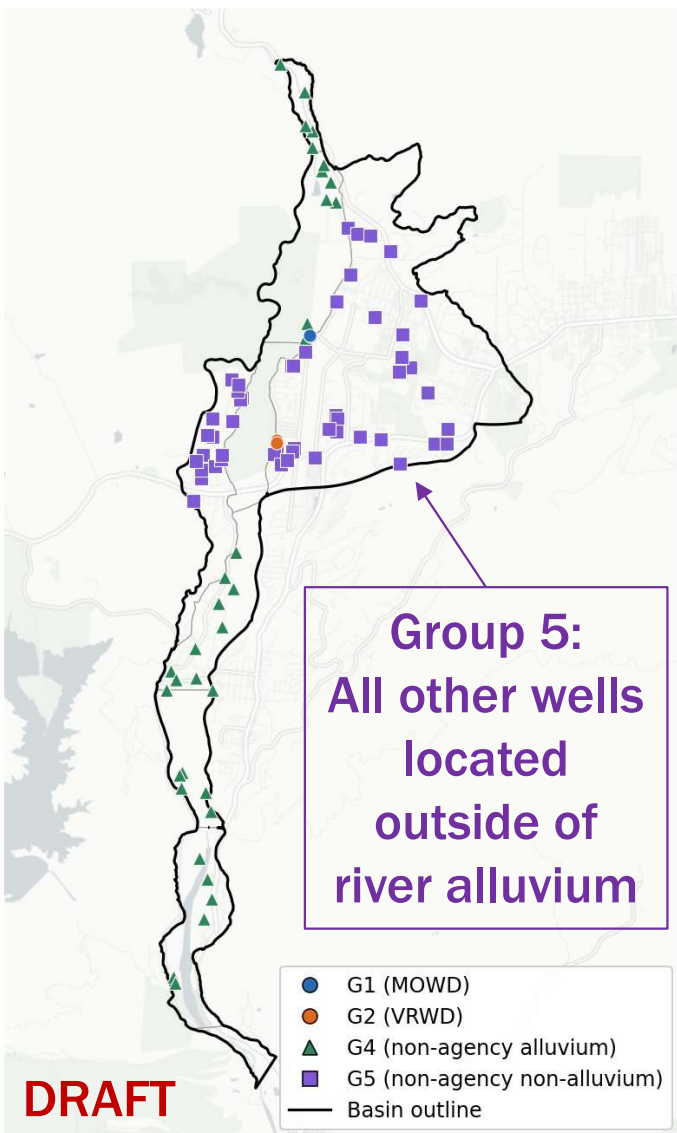
When	Median	Maximum	Minimum
Arrives Anytime	43 - 51	62 - 72	5 - 20
Arrives During Critical Period	7	22 - 30	0

RESULTS SUMMARY

GROUP 5 WELLS

(OTHER NON-ALLUVIUM WELLS)

Depletion Analysis Pumping Groups



Lag Time (days)

Median	Maximum	Minimum
159 - 184	401 - 468	23 - 34

Percentage of Curtailed Pumping
Adding to Streamflow (%)

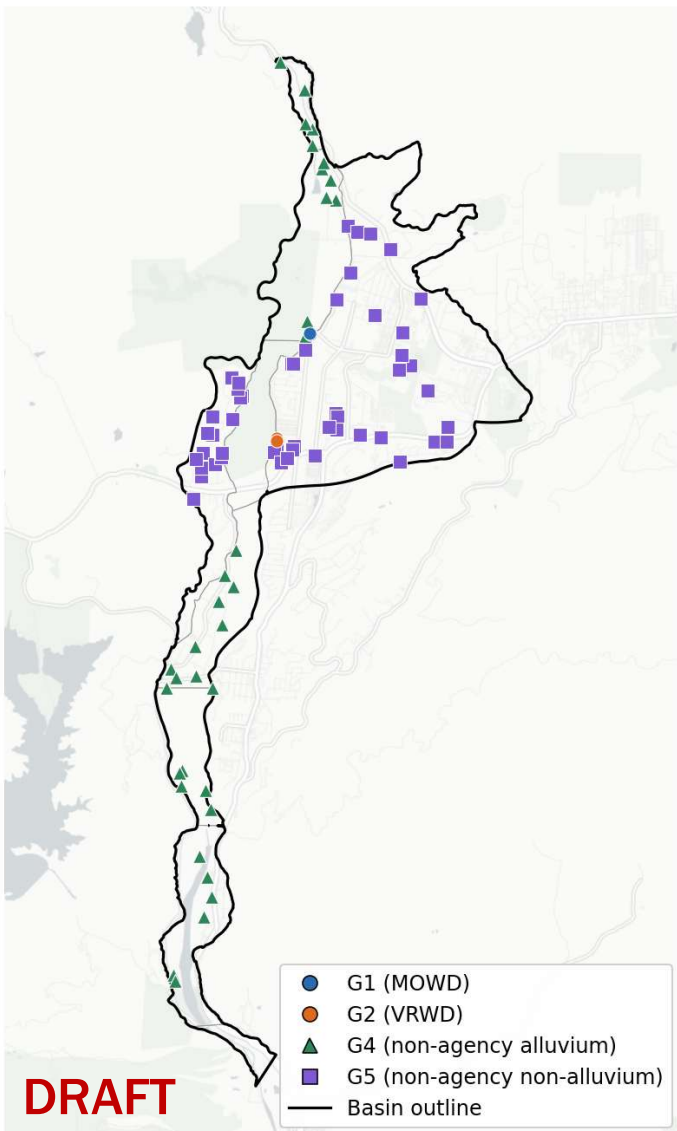
When	Median	Maximum	Minimum
Arrives Anytime	23 - 29	44 - 56	2 - 9
Arrives During Critical Period	2 - 3	12 - 16	0

RESULTS SUMMARY

GROUP 6 WELLS

(ALL WELLS)

Depletion Analysis Pumping Groups



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Lag Time (days)

Median	Maximum	Minimum
28 - 39	86 - 157	0

Percentage of Curtailed Pumping Adding to Streamflow (%)

When	Median	Maximum	Minimum
Arrives Anytime	45 - 50	68 - 69	7 - 21
Arrives During Critical Period	4 - 11	45 - 47	0

LAG TIME OBSERVATIONS

- Lag times vary with groundwater levels (and streamflow)
 - Lowest when GW levels (and streamflow) are higher.
 - Longest when GW levels (and streamflow) are low.
- Lag times vary with location relative to Foster Park
 - Lag times increase with distance from FP.
 - Longer lag times for wells located outside of river alluvium.

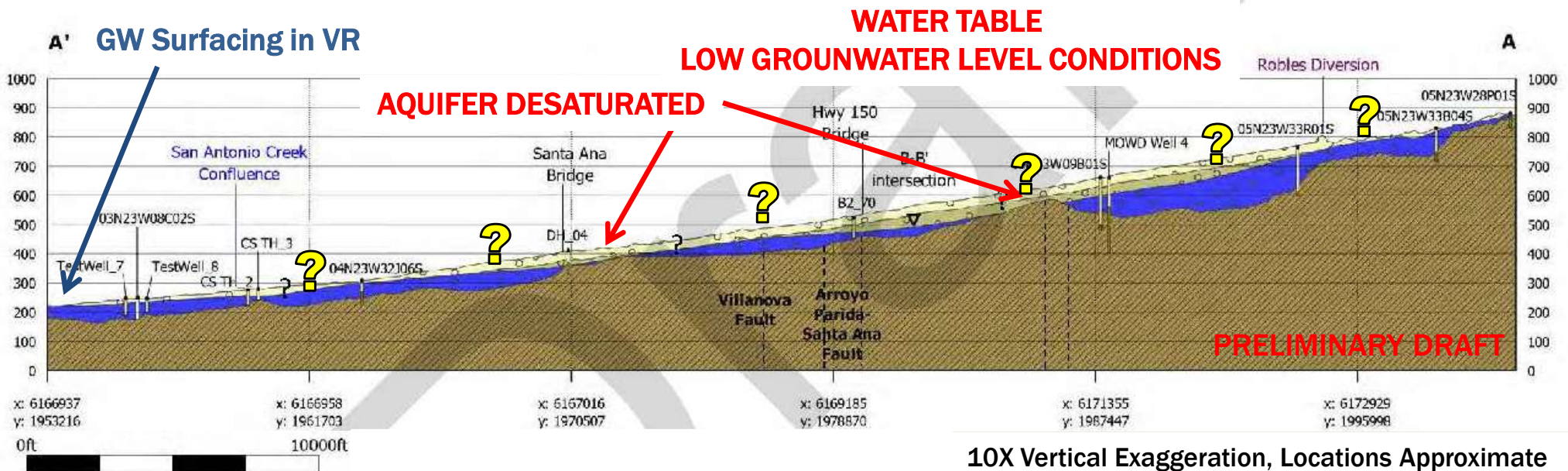
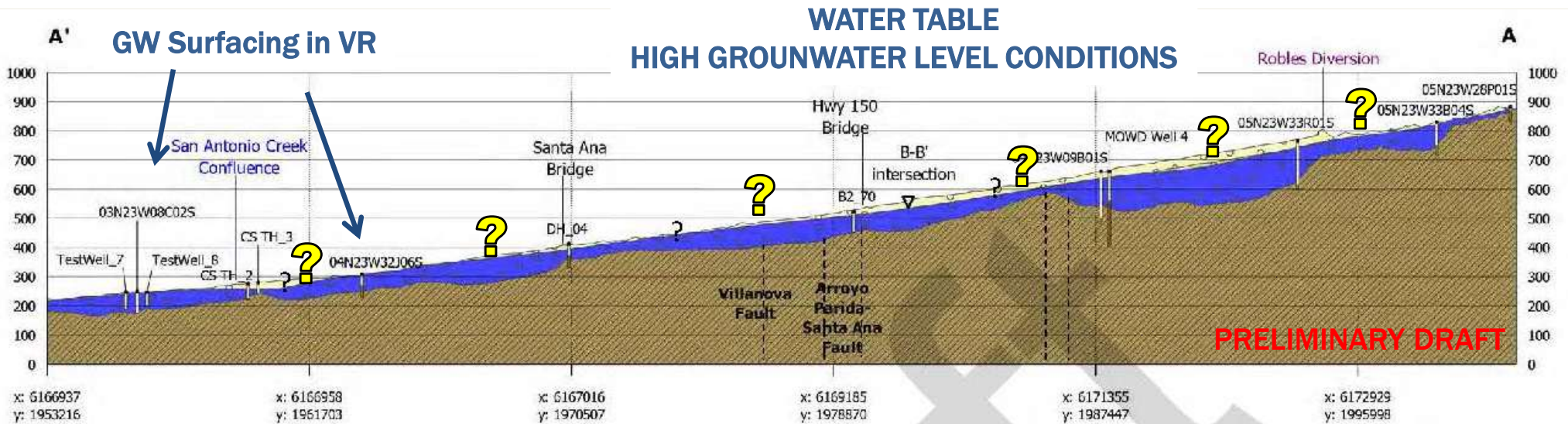
STREAMFLOW AUGMENTATION OBSERVATIONS

- Augmentation also varies with groundwater levels (and streamflow)
 - Highest when GW levels (and streamflow) are higher.
 - 60 to 81% of curtailed pumping for alluvial wells
 - Lowest when GW levels (and streamflow) are low.
 - 3 to 10% of curtailed pumping for alluvial wells
 - Overall, median values are 43 to 52%

HYDROGEOLOGIC FACTORS CONTROL THE RESPONSES

- The geometry of the basin aquifer and water table conditions control lag times and percentage of curtailment that arrives at FP
 - Saturated thickness of basin aquifer controls the rate of down valley groundwater to areas where it emerges in river channel and becomes streamflow
 - Saturated thickness is controlled by aquifer thickness and water table depth
 - Slope of the water table that drives down valley groundwater flow also decreases as basin drains

CROSS SECTION ALONG VENTURA RIVER



WATER TABLE ANIMATION

Modeled Surface Water and
Groundwater Conditions

Historical No-Pumping Scenario

January 2011 - March 2017

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KEY OBSERVATIONS

- Pumping curtailment is not particularly effective at increasing flow at Foster Park.
 - Curtailment benefits are modest when flows are moderate (<~50% of curtailed pumping arrives at FP)
 - Curtailment benefits are very low during critical periods (<~10% of curtailed pumping at FP).
- Curtailment does not prevent flow from dropping to critically low levels during very dry periods; it only shortens the *duration* of critically low flows.
- Significant lag times , which can be more than a year, create obvious implementation challenges.



QUESTIONS?

