Staff Workshop on Potential Legal Delta and Return Flow Water Supply Refinements to the Water Unavailability Methodology for the Delta Watershed

March 10, 2023

CALIFORNIA
Water Boards

Division of Water Rights

Workshop Logistics

- Recording will be posted – waterboards.ca.gov/drought/delta/
- Staff presentation available – waterboards.ca.gov/drought/delta/
- **To view the workshop only** – watch the webcast at: video.calepa.ca.gov (closed captioning available)
- **To participate and provide oral comments or ask clarifying questions** – fill out virtual speaker card at link in notice or at: forms.office.com/g/5KvMTaAWrc
- **For additional questions or to submit written comments** – email Bay-Delta@waterboards.ca.gov
  - Comments are due by **5:00 PM on March 24**

Agenda

- Workshop Background and Purpose
- Staff Presentations
  - Legal Delta Supply
  - Return Flow Estimations
- Agency and Public Comments

Workshop Background and Purpose

Background

- Water Unavailability Methodology compares water supply and demand at local and watershed scales to determine unavailability by priority date
- Emergency curtailment regulation authorizes use of Methodology to support curtailments in the Delta watershed
- Methodology has been improved through public feedback and multiple workshops since 2021

Purpose

- Address comments received regarding unique Legal Delta water supply conditions
- Address comments received regarding return flow estimations
- Solicit public input for potential future updates to the Methodology

Methodology Next Steps

- Consideration of verbal and written comments received
- Possible additional follow-up on specific issues
- Possible release of 9th revision of the Water Unavailability Methodology report (expected late spring/early summer)
- Possible readoption of the emergency regulation (expected July 2023)

Possible Legal Delta Supply Adjustments

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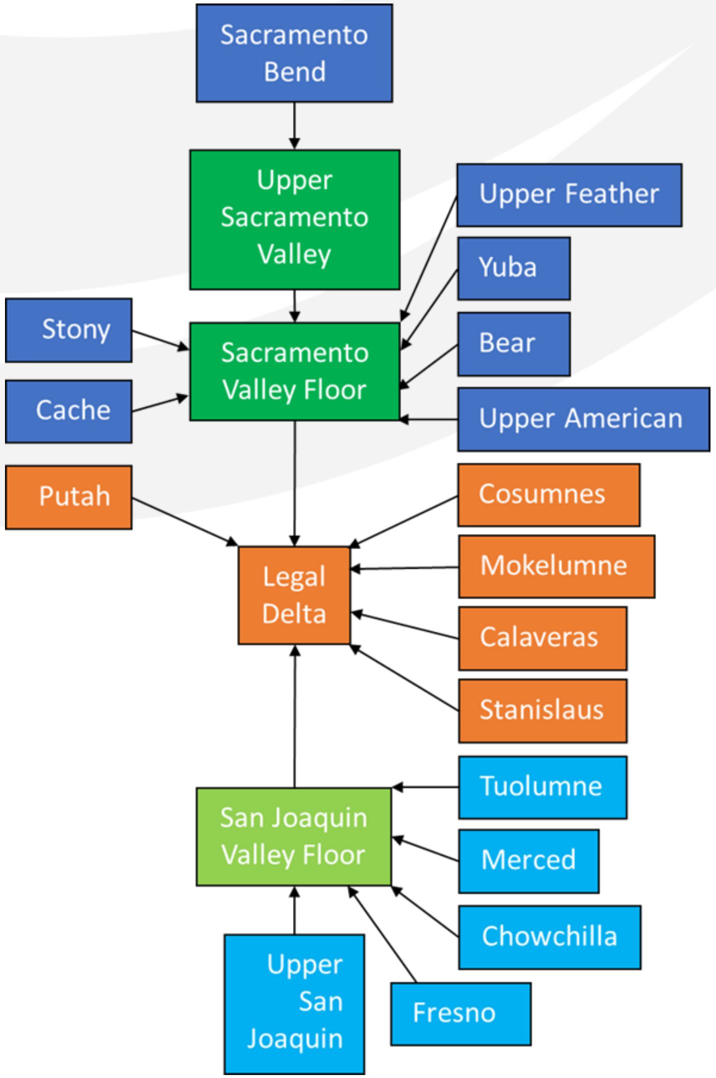
Sr. Water Resource Control Engineer

CALIFORNIA Water Boards

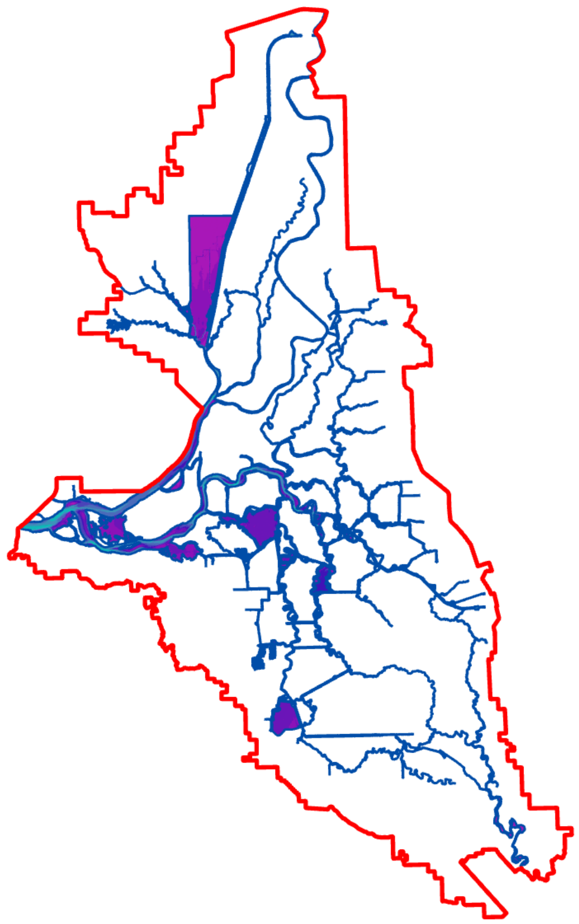
Current Methodology Assumptions

- Legal Delta demands supplied by all upstream tributaries
- Curtailment only when zero supply available from all sources at a given priority
- Curtailment of riparian claims only when zero total supply available (i.e., all tributaries dry)
- Legal Delta unavailability only determined with analysis periods of at least one month
- Comments received that approach fails to acknowledge unique Delta water supply conditions



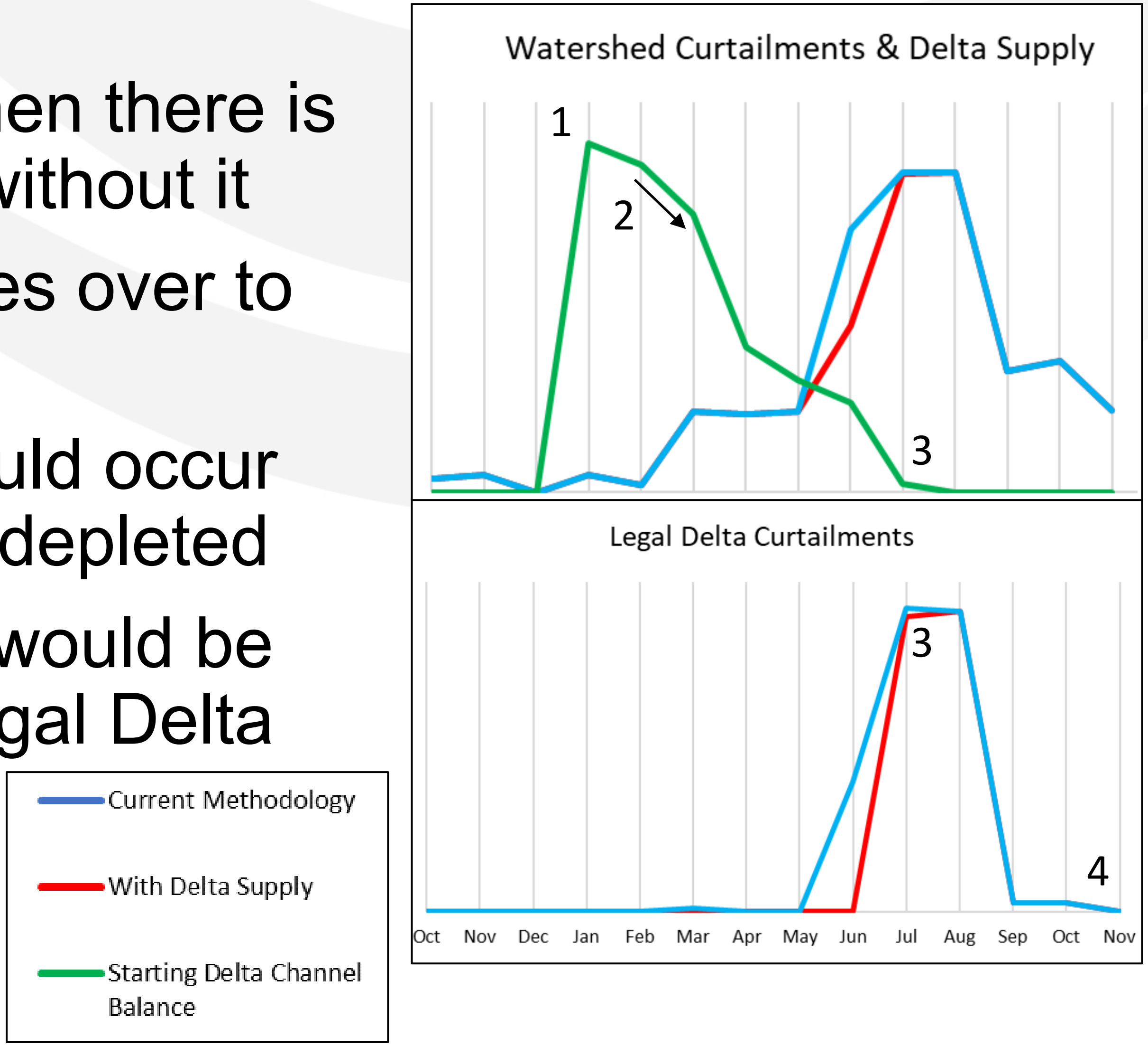
Proposed Delta Supply Adjustments

- Additional supply from water within Delta channels available to all Legal Delta users
- Delta supply considered to meet demands in addition to all upstream tributaries
  - Not first or last source of water for Delta users
- Delta supply volume = water in Delta channels below mean sea level at San Francisco (0.97m), assumed to be entirely freshwater
- Starting Delta supply volume = 893,919 acre-feet
  - Estimated by Department of Water Resources Delta Modeling Section from current bathymetry data



Proposed Delta Supply Adjustments

1. Delta supply made available when there is watershed-scale unavailability without it
2. Remaining unused supply carries over to next analysis timestep
3. No Legal Delta curtailments would occur until the Delta supply has been depleted
4. Replenishment of Delta supply would be considered when there is no Legal Delta unavailability



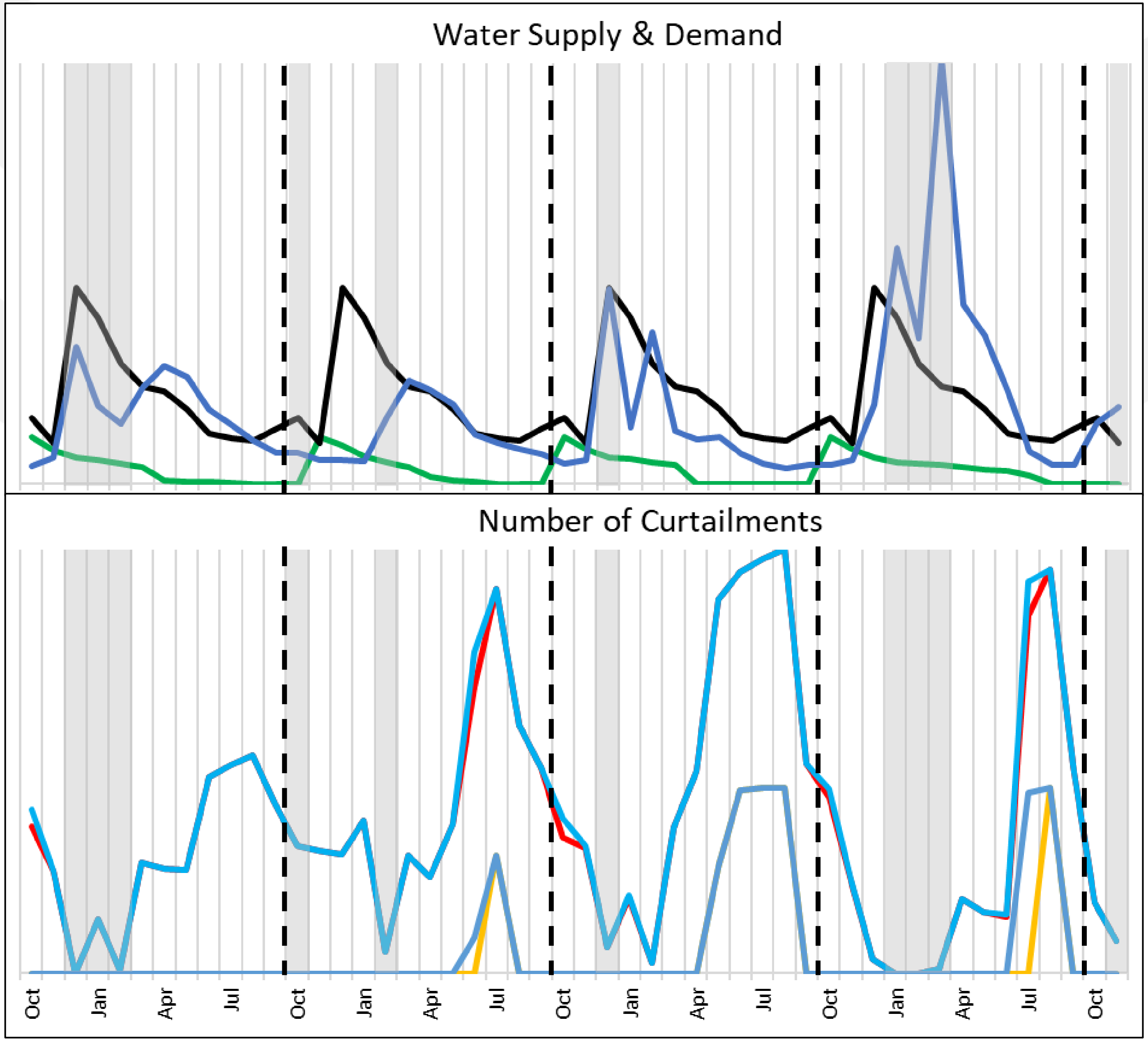
Comparison of Approaches

- Additional supply being available would only result in fewer curtailments throughout the Delta watershed
- Legal Delta curtailments may still be warranted when Delta supply is depleted (same output as current Methodology)
- Delta supply depletion depends on supply and demand patterns
  - Dry fall and winter → supply initiated earlier → supply depleted earlier → curtailments more likely in spring and summer
  - Wet fall and winter → supply initiated later → supply available longer → curtailments less likely until later in summer

Comparison of Approaches

- No Watershed-Scale Unavailability without Delta Channels
- Watershed Total Supply
- Watershed Total Demand
- Starting Delta Channel Balance

- Watershed Current
- Watershed with Delta Channels
- Legal Delta Current
- Legal Delta with Delta Channels

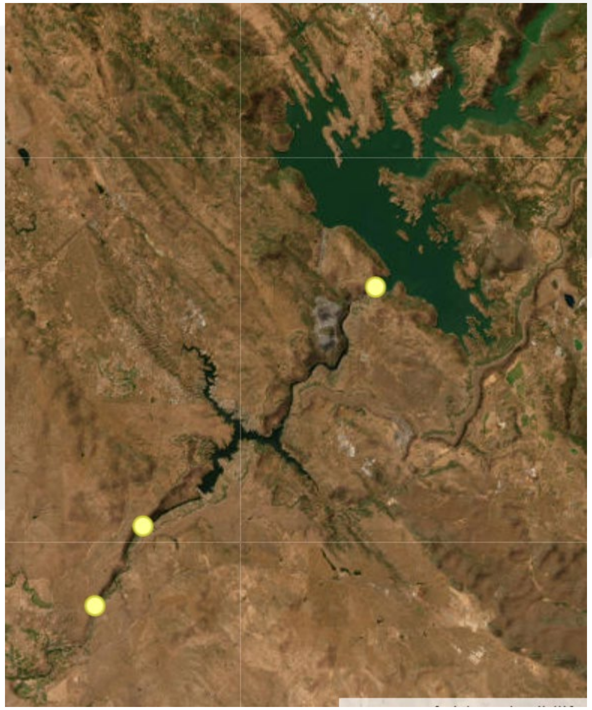


Conclusions

- Conservative assumption decreases likelihood of Legal Delta curtailments, assumes additional supply available to junior rights
- Assumes additional supply in Delta channels would always be of adequate quality for beneficial uses
- In reality, absent freshwater supplementation the Delta supply would degrade in quality before being depleted
- Focused meetings with stakeholders have been held or scheduled, and Board staff are open to additional feedback

Other Methodology Adjustment

- Adjust priority date of one New Melones water right
  - A019304 (Permit 16600)
  - Currently assumed junior “Project” priority
  - Rediversion points in Legal Delta
  - Water not exported outside of the Delta watershed under this right
  - Will be adjusted to 3/11/1960
  - Zero demand assumed in the Methodology



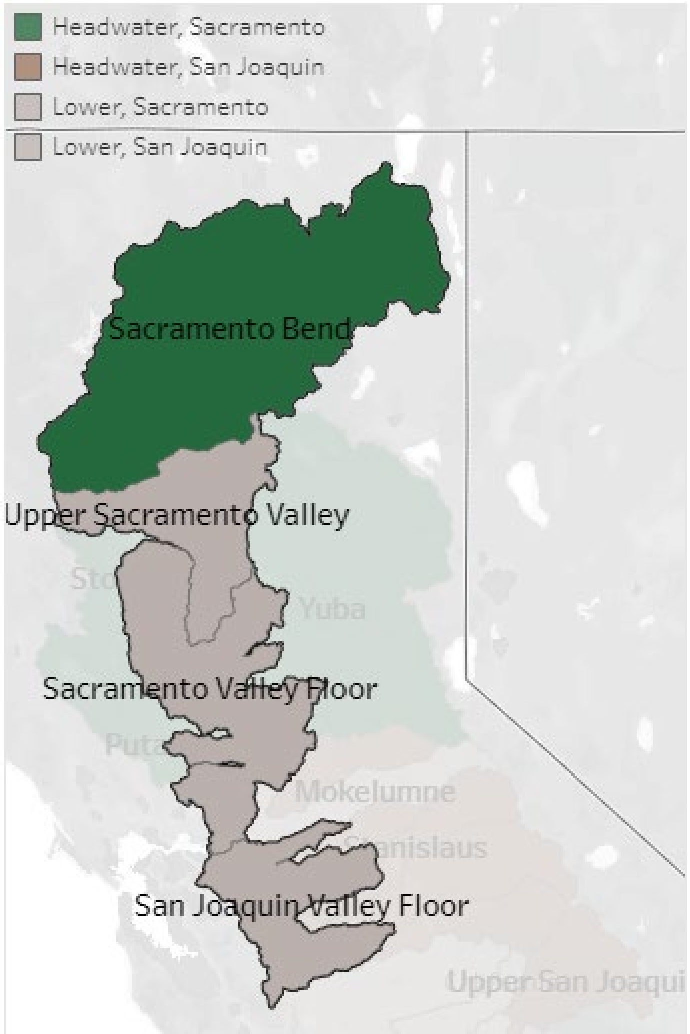
Possible Methods to Refine Return Flow Estimations

Lauren Adams, Ph.D.
Water Resource Control Engineer

CALIFORNIA
Water Boards

Current Return Flow Assumptions

- Demands in each watershed scaled by demand factor
- Demand factors derived from ratio of modeled monthly return flows from all supply sources to modeled diversions to meet surface water demands (CalSim 3.0, valley floor demand units)
  - Demand factor = 1 – Returns/Diversions
  - Calculated at watershed scale (Sacramento, San Joaquin)
- Demand for diversion to storage not scaled by demand factor



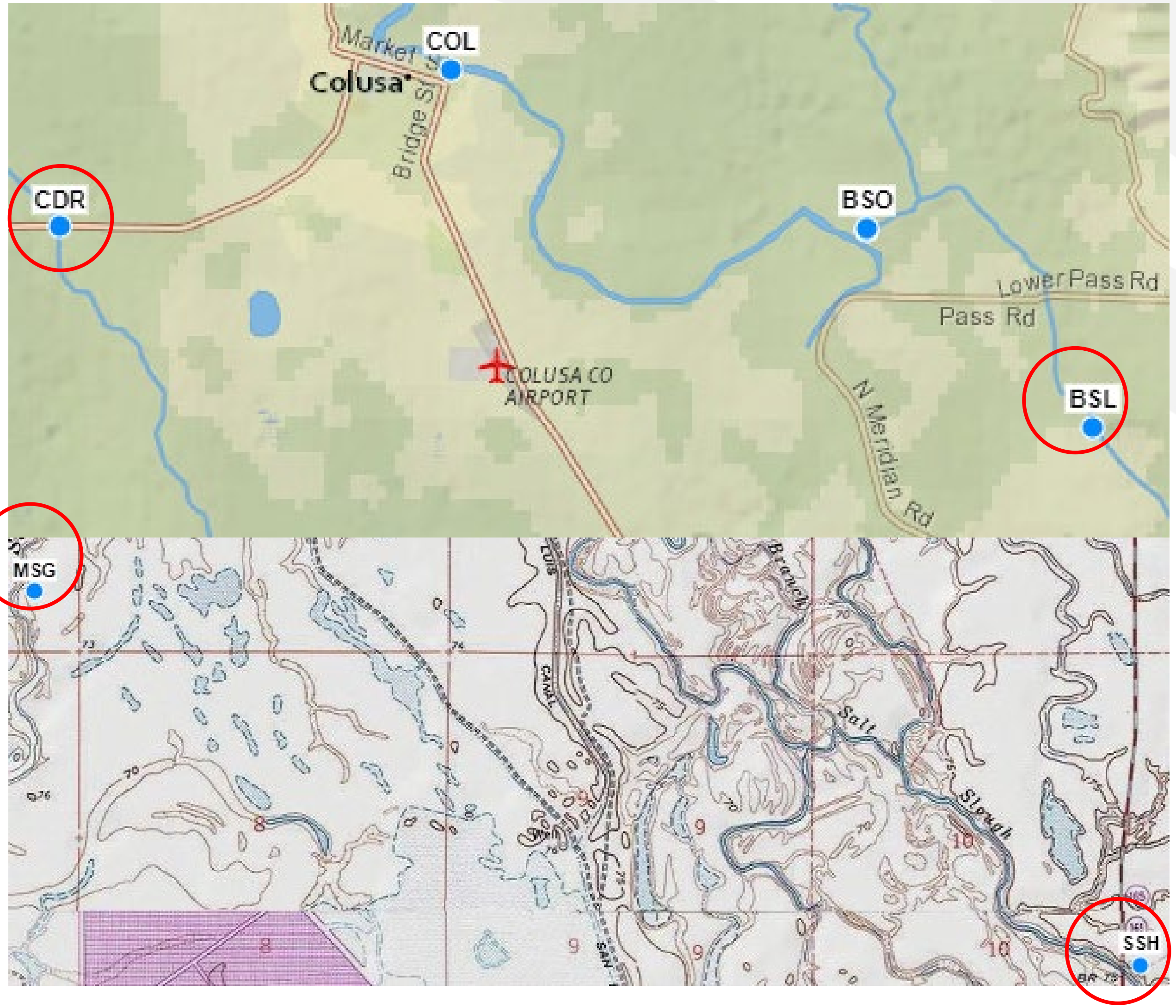
Return Flow Comments

- Public comments received contend that modeled return flows may be over-estimated, or conversely, under-estimated
- Parties requested comparison of the timing and quantity of estimated return flows with observed data
- “Fingerprinting” was requested to determine source water at certain locations
- Reclamation claimed the right to retain its return flows from deliveries of water to its in-basin contractors

Return Flow Challenges

- Return flow discharges are not generally required to be measured or reported in California
- Most return flows are ungaged, and are distributed broadly throughout a watershed
- Return flows have a complex diversity of diffuse and localized sources
- Dynamic landscape of active streamflow gages and land use and other practices
  - Fluctuating acreages, crop types, irrigation practices, and other factors in different years
  - Potential for conservation and recapture of return flows

Historical Flows at Index Locations

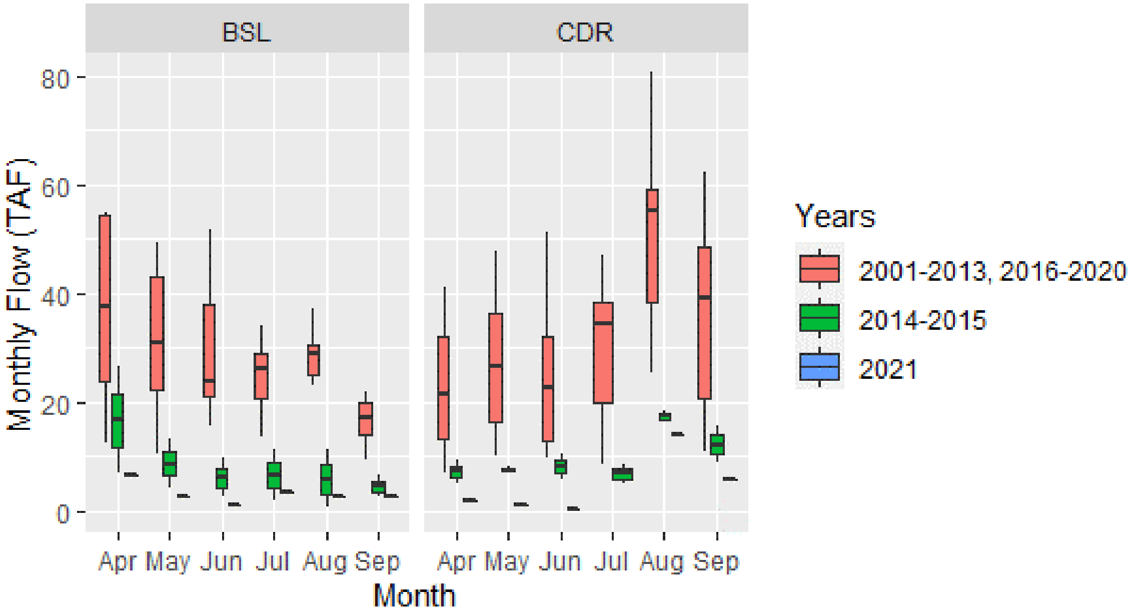


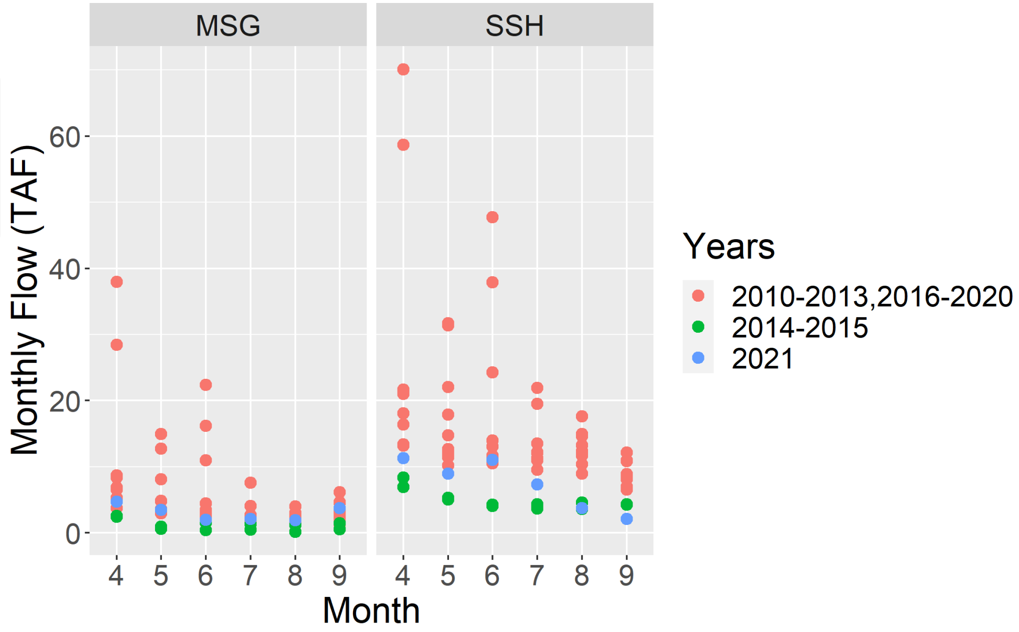
- Long-term gage data for return flow dominated locations limited
- CDEC stations CDR (Colusa Basin Drain near Highway 20), BSL (Butte Slough), MSG (Mud Slough) and SSH (Salt Slough)
- Locations generally dominated by irrigation return flows, but also convey rainfall runoff
- Substantial return flows occur downstream
- Represent significant portion of CalSim3 modeled return flows (e.g., return flows at MSG/SSH (not full MSG/SSH flow) are ~15% of CalSim3 San Joaquin River return flows)

Data/Map sources: California Data Exchange Center (CDEC), https://cdec.water.ca.gov/

Gaged Flow at Index Locations

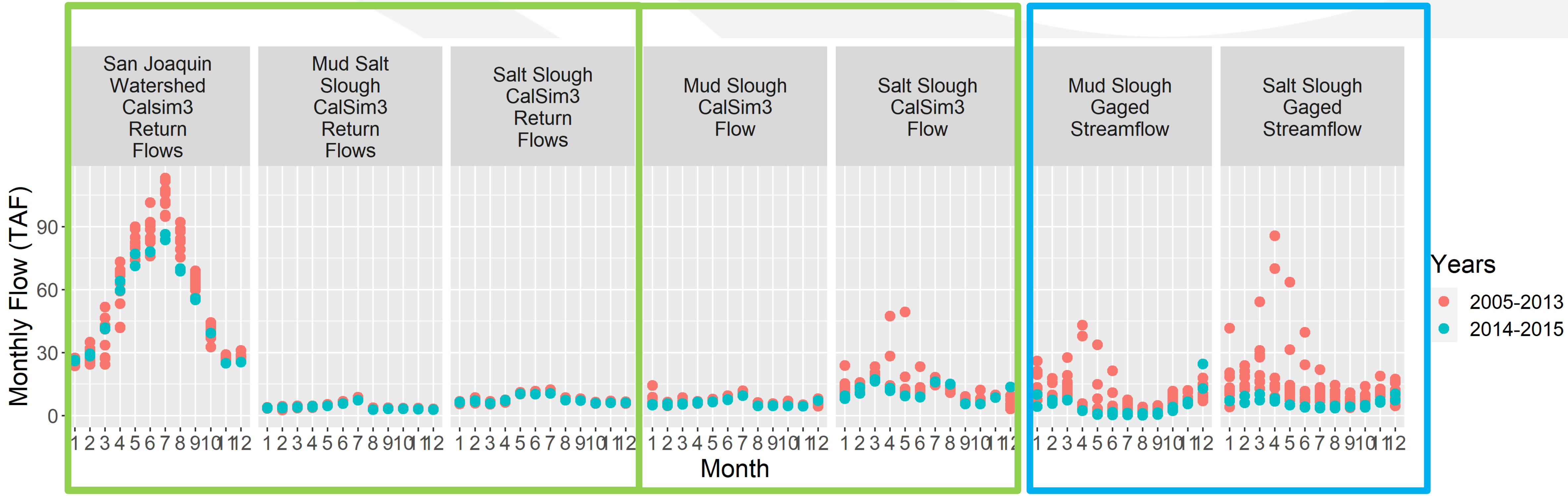
- Gaged BSL + CDR Jun – Jul approx. 50 TAF/mo; gaged MSG + SSH Jun – Jul approx. 14 TAF/mo





- Gaged flows lower in drought than other years
- Gaged Butte Slough and Salt and Mud Sloughs flows peak earlier (April, May) and Colusa Basin Drain peak later (August)

CalSim Comparison at Index Locations



- Gaged MSG/SSH flow (far right blocks) during drought was less than CalSim3 estimated return flow (and full flow) at Mud and Salt Sloughs, even with CalSim3's modeled Closure Term at Salt Slough
- Gaged MSG/SSH had a dampened inverse pattern of CalSim3 return flows at Mud and Salt Sloughs as well as the San Joaquin Watershed (far left blocks)

Return Flow Observations

- Further analysis is needed of return flow characterizations and of return flows and other streamflow accretions observable with Delta Watershed streamflow gages

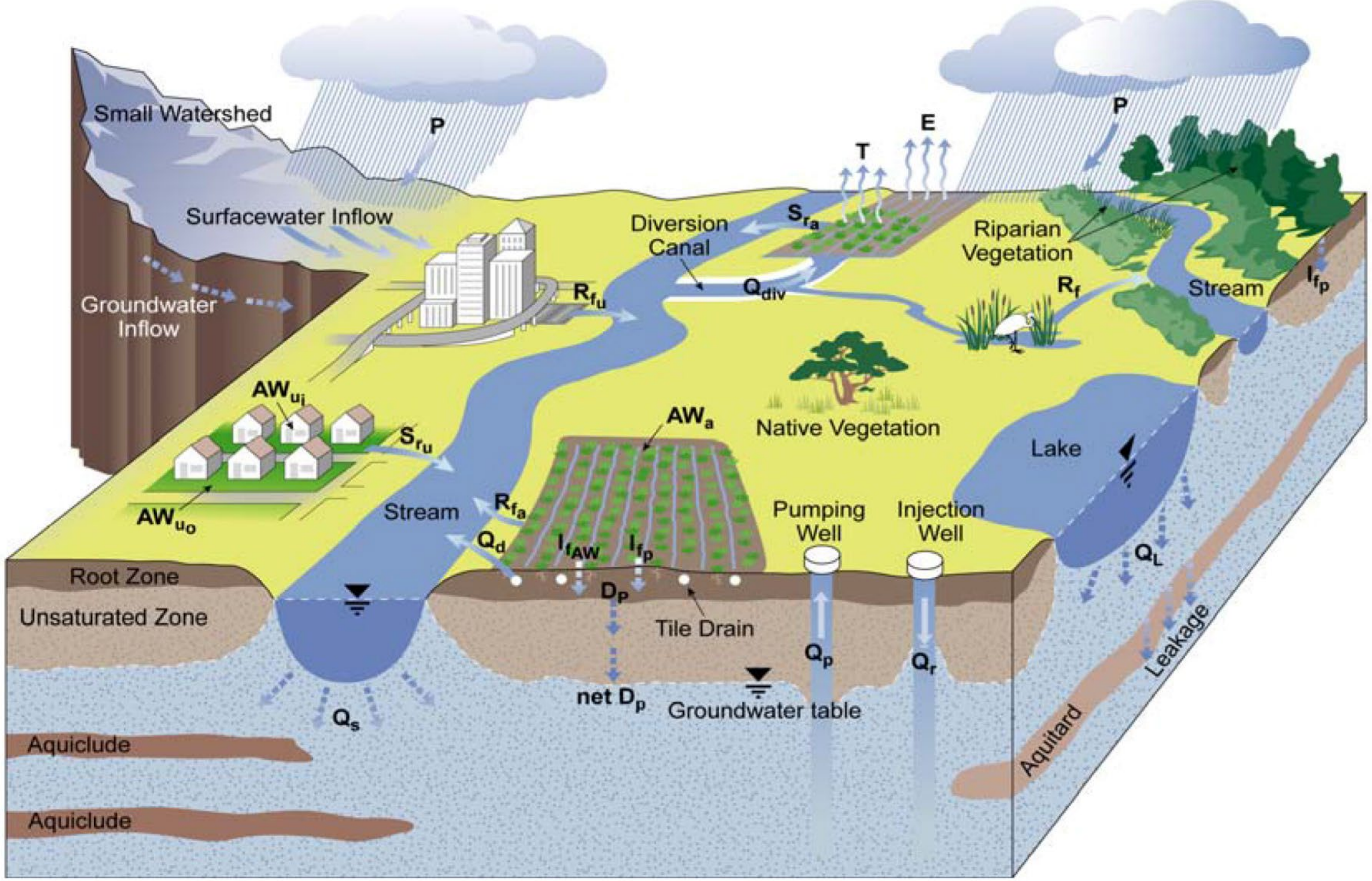


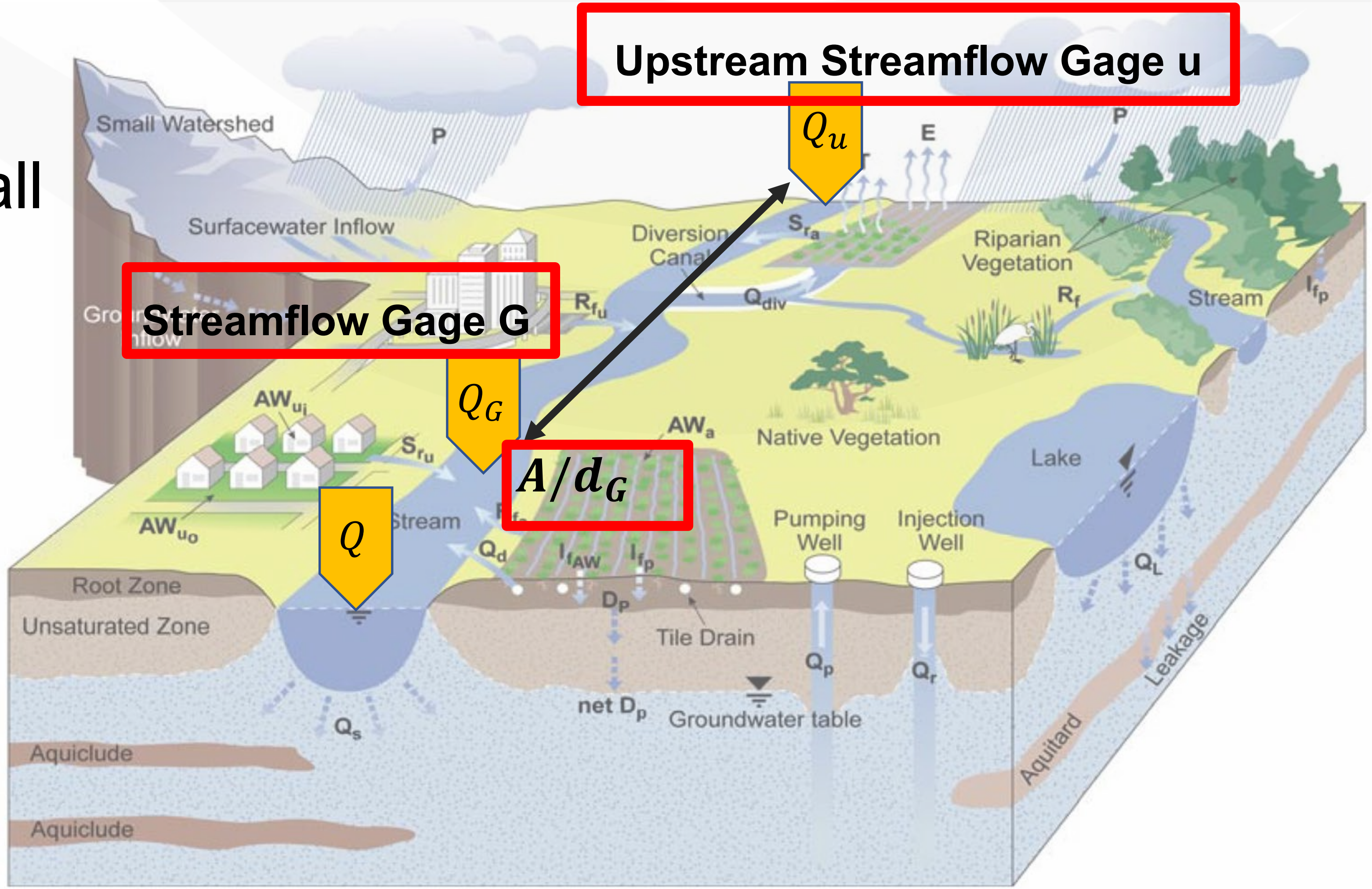
Figure reference: Dogrul, Brush, and Kadir, 2016

Return Flow Observations

- Accretions/depletions calculated at active streamflow gages (G) from all upstream gages (u)

$$A/d_G = Q_G - \Sigma_u Q_u$$

Measured



Underlying figure reference: Dogrul, Brush, and Kadir, 2016. Annotation added by SWRCB.

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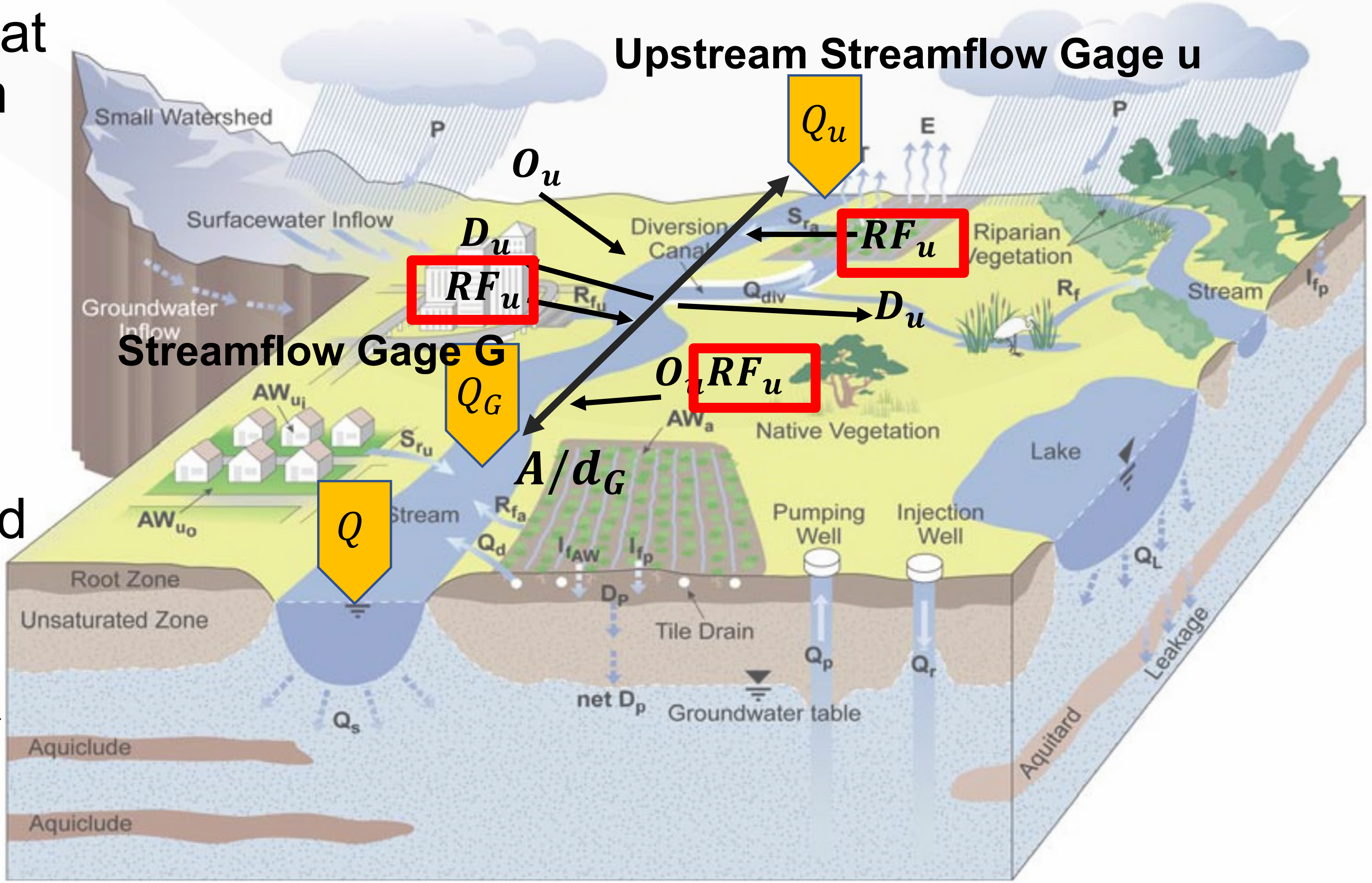
$$A/d_G = Q_G - \Sigma_u Q_u$$

Measured

- Accretion/depletions factors causing streamflow increases and decreases include return flows

$$A/d_G = \Sigma_u SW_u - \Sigma_u D_u + \Sigma_u RF_u + \Sigma_u O_u$$

Measured/ Reported



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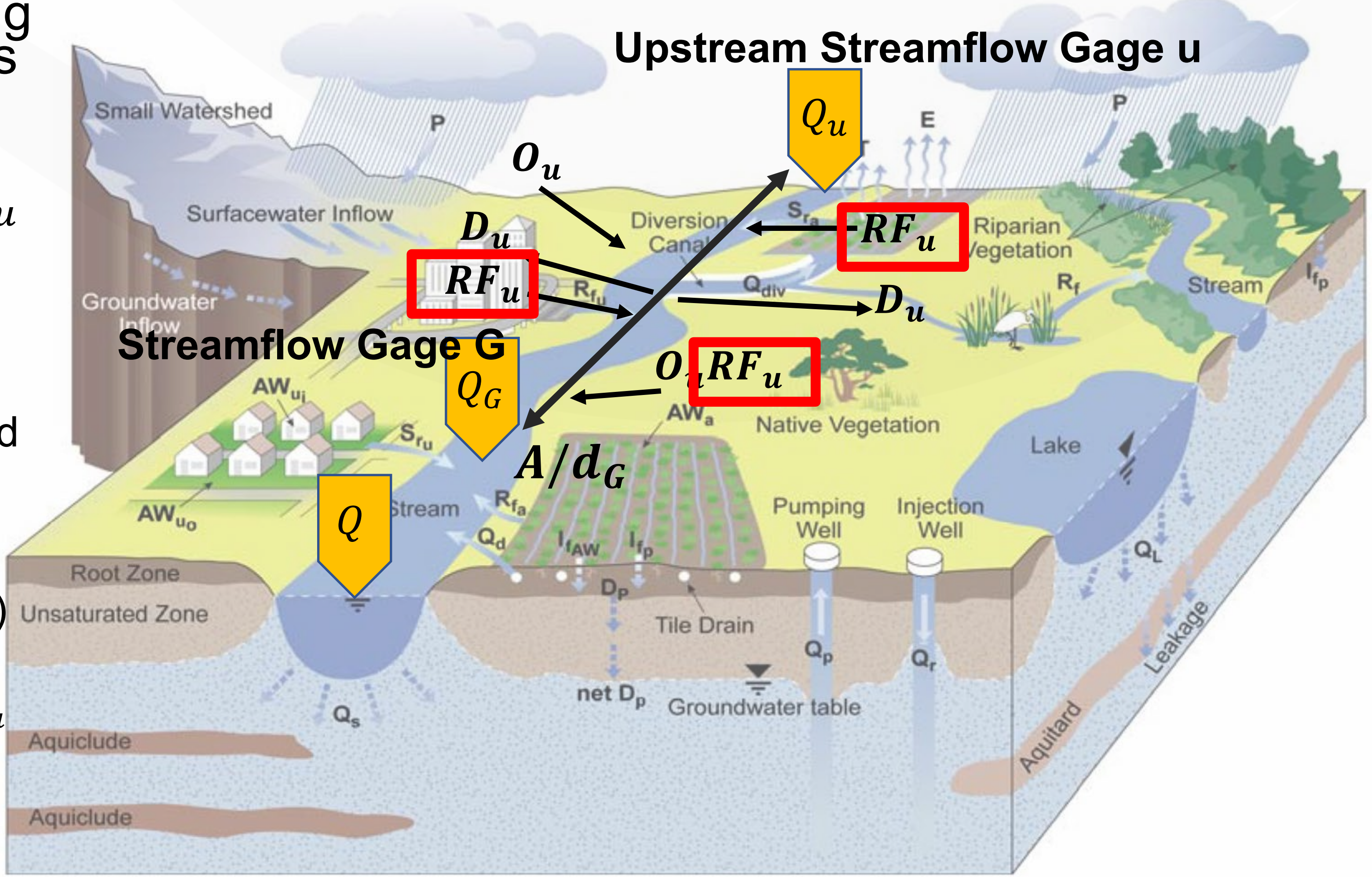
$$A/d_G = \Sigma_u SW_u - \Sigma_u D_u + \Sigma_u RF_u + \Sigma_u O_u$$

- Flows returning to surface water could have been diverted or used from storage withdrawal *(SW)*, precipitation already routed into the stream (Q_u), precipitation routed below Q_u into the stream from overland flow, interflow, or groundwater discharge (*O*), and rediversion of returned flow (*RF*) previously diverted or used for non-consumptive (*NCU*) or consumptive purposes (*CU*)

$$RF_G = RF_{SW}^{cu,ncu} + RF_Q^{cu,ncu} + RF_O^{cu,ncu} + RF_{RF}^{cu,ncu}$$



Underlying figure reference: Dogrul, Brush, and Kadir, 2016. Annotation added by SWRCB.

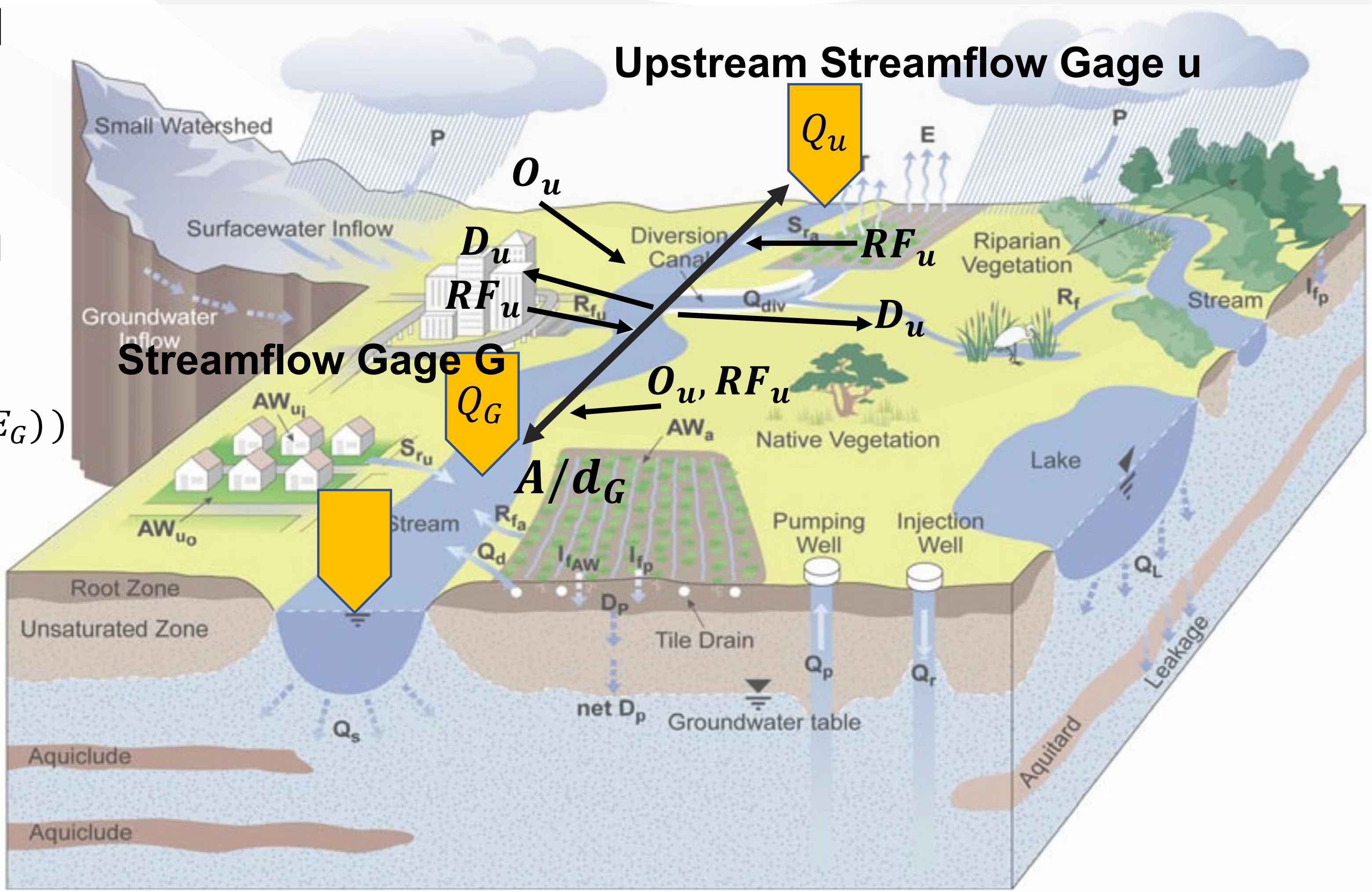
Return Flow Observations

- Return flow estimations = measured accretions excluding storage withdrawals, ungaged upper watershed tributary flows, return flows from diversions reported for non-consumptive use, and including accretions lost to local diversions

$$\sum_{G \in W} RF_G = \sum_{G \in W} \max(0, (A/d_G + \Sigma_u D_u - \Sigma_u SW_u \pm \Sigma E_G))$$

Measured/ Reported

- Overestimations occur in the wet season from overflow and interflow, transfers. Underestimations occur from unreported diversions. Errors are also from gaged error and groundwater interactions.



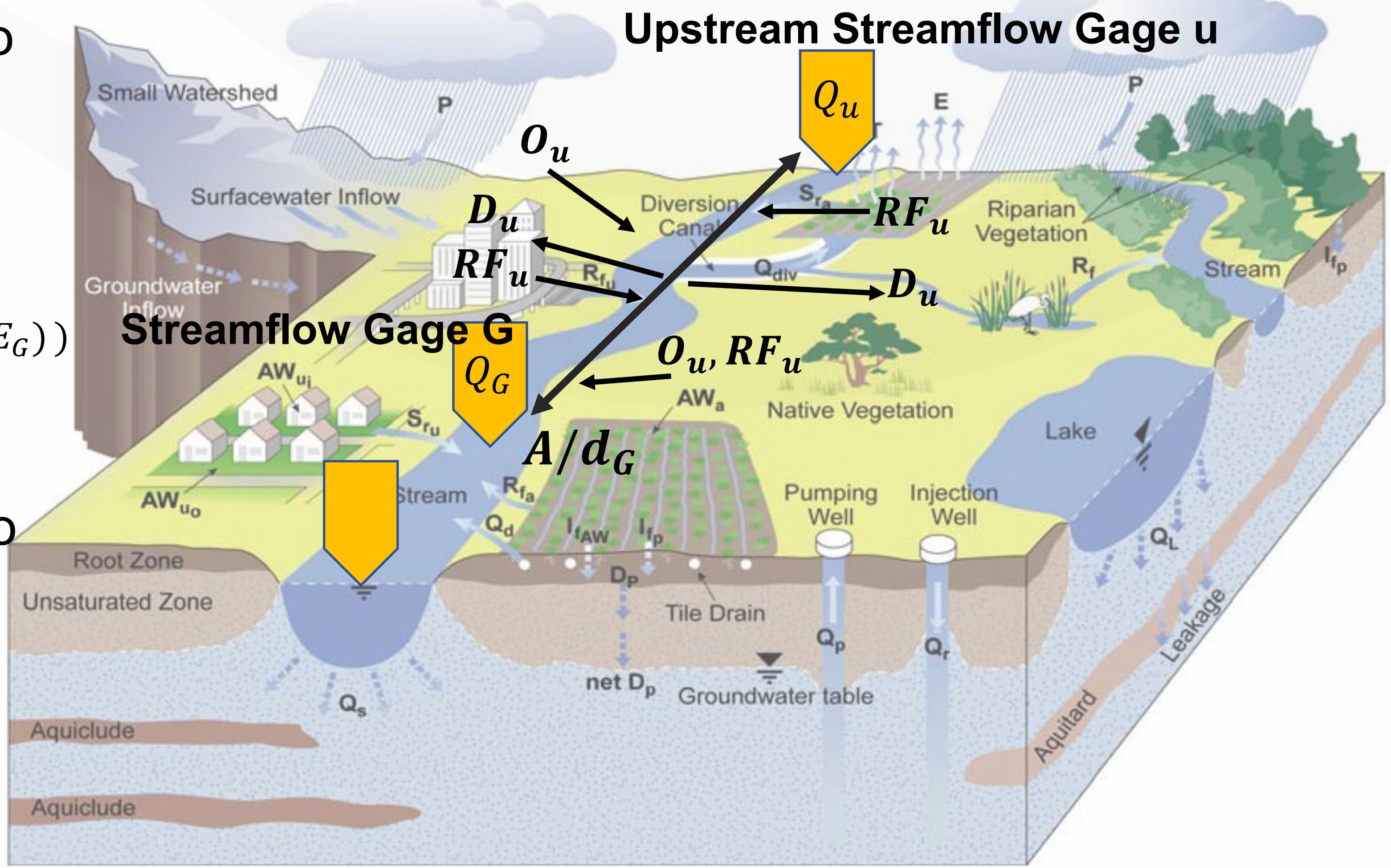
Underlying figure reference: Dogrul, Brush, and Kadir, 2016. Annotation added by SWRCB.

Return Flow Observations

- Net accretions/depletions, and accretions that could be attributed to return flows, calculated at each active Delta gaging station for the past 20 years at 15-min, hourly, daily, and monthly time-scales

$$\sum_{G \in W} RF_G = \sum_{G \in W} \max(0, \underbrace{(A/d_G + \Sigma_u D_u - \Sigma_u SW_u \pm \Sigma E_G)}_{\text{Measured/ Reported}})$$

- Reported diversions are attributed to the nearest upstream gage
- Accretions are calculated dynamically using nearest active gages and watershed aggregated
- Watersheds have monthly and subwatershed variability



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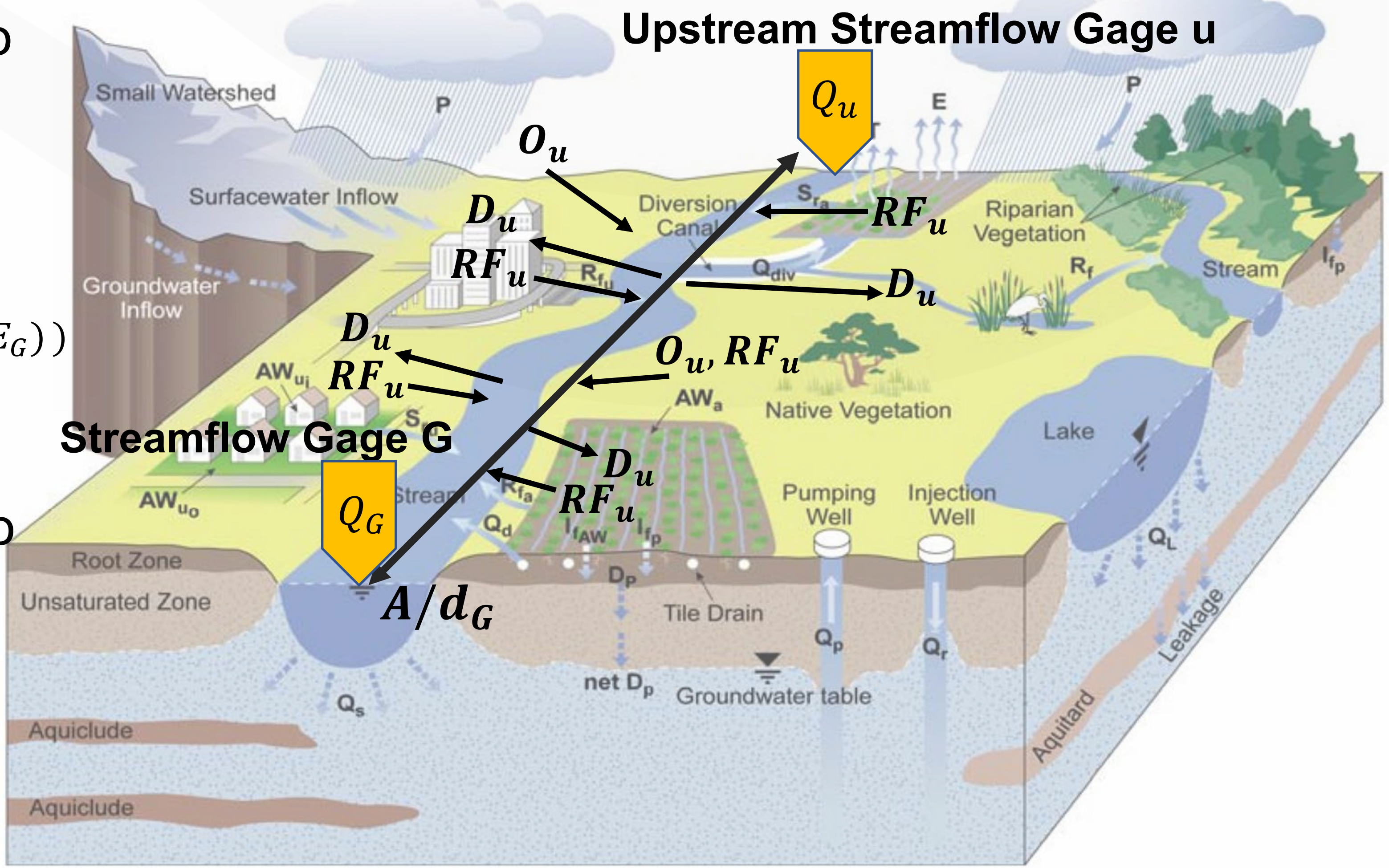

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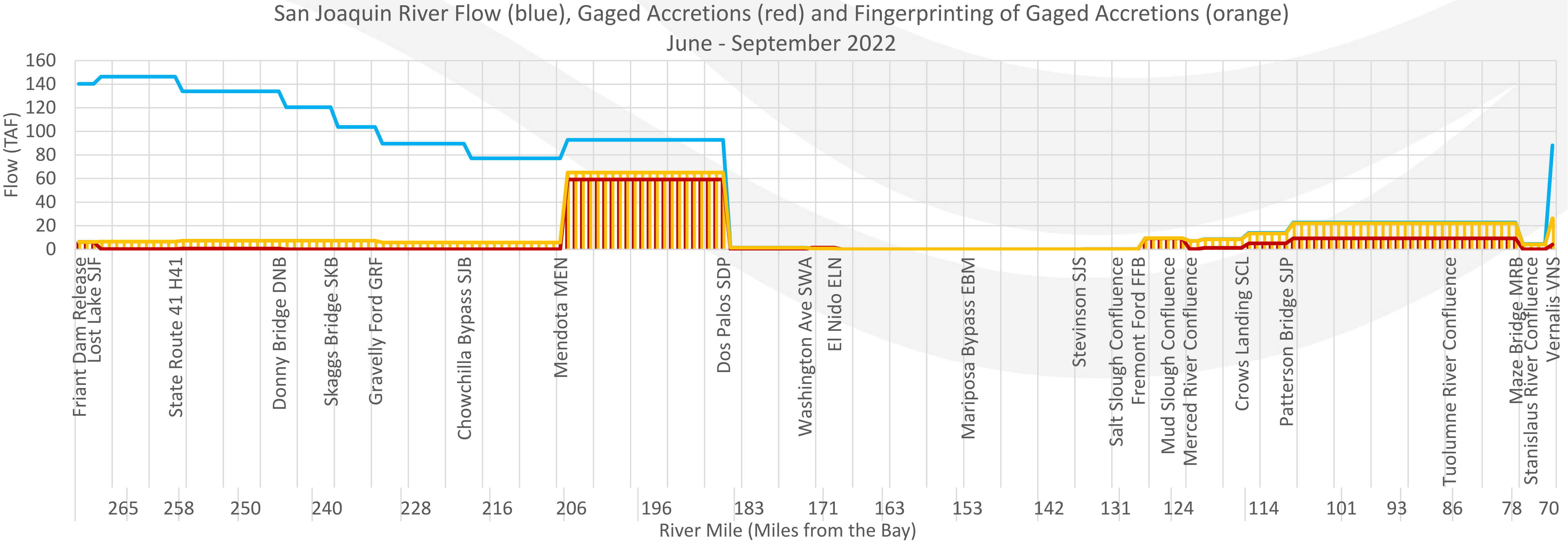
Fingerprinting



- Fingerprinting traced the proportion of gaged streamflow that could be attributed to net accretions measured at that gage and its upstream gages.
- Even with the conservative assumption that return flows and other accretions are lost from the stream after all other water sources, fingerprinting identified losses to accretions as they flowed downstream. At its extreme, for example, all return flows that entered the SJR watershed above Maze Bridge, above the Stanislaus River confluence, were lost. Maze Bridge went dry between June and September.
- Observed return flow losses could warrant application of estimated loss factors to modeled return flow estimations.

Return Flow Analysis Summary

- Potential modifications:
  - Informed by observation of return flows and other accretions at a sub-watershed or reach-scale, future estimates could consider gaged error, groundwater interactions, and transfers
  - Application of return flow loss factors based on fingerprinting of net accretions during drought
  - Modifications informed by enhanced monitoring of return flows from key irrigation discharge locations and locations with consistently large accretions or occasional very large accretions, and/or enhanced reporting of return flows by the Delta's largest diverters
  - Continued QA/QC of diversion data
  - Adjustment for return flows from diversions for non-consumptive use that do not return to the stream at the same location and time at which they were diverted
  - Shift to more sophisticated modeling, such as a real-time curtailment tool with forecasting, real-time measurements, and fingerprinting
- Input on these options or other modeling tools and analyses is invited, including with respect to Reclamation's claim to the right to retain its return flows to deliveries of water to its in-basin Contractors

Public Comments and Questions

Resources and Contact

Email: Bay-Delta@waterboards.ca.gov

Delta Drought Phone Line:

Call (916) 319-0960 and leave a message and staff will return your call as soon as possible

Webpages:

Delta Drought Webpage:
waterboards.ca.gov/drought/delta/

Water Unavailability Methodology Webpage:
waterboards.ca.gov/drought/drought_tools_methods/delta_method.html

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