Delta Salinity Responses

Project Implications to Flows and Salinity

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Current Conditions

Region dominated by Sacramento River Flows, existing project diversion can use both Sacramento River flows and San Joaquin.

Tidally controlled-twice a day tidal signal from the Pacific, through San Francisco Bay, Suisun, and up the rivers and sloughs.

Relatively high energy tidal flow upriver can dominate Sacramento River outflow and allow salinity to migrate (advect) upriver. We understand and track that salinity through Electrical Conductivity (EC).

Existing conditions allow ‘freshening’ of entire northern and central Delta parts of the system before export pumps.

Outflow Control

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Salinity-EC

Instead of measuring chloride (Cl) or the sum of soluble salts, we use a simple and easy to measure surrogate of Cl. EC is correlated to salinity and allows for field measurements in real time (no lab work) that can go from the river or slough, to the diversion, to the field ditch, and to the soils of that field.

Hundreds of years of experience and study have identified how soils and plants respond to salinity, and research correlates those responses to EC.

Petition

New diversions intended to take off higher quality water (EC/TDS/Br/Cl) much further upstream.

Proposed project rules and likely operations mirror drought conditions on the Sacramento River.

- 6,000 cfs, 300 cfs would be diverted, leaving 5,700 cfs in the river.
- 15,000 cfs, 3,000 cfs would be diverted, leaving 12,000 cfs in the river.
- 22,000 cfs, 9,000 cfs would be diverted, leaving 13,000 cfs in the river.

These flows are directly equivalent to the range of flows at Freeport during critically dry year (mean 9,345 cfs 1922) to a dry year (mean 16,003 cfs 1989). (II-28, ICF 2016, Pg. 2-3).

Petition

Operations influenced by many factors, but one, two or three north Delta intakes can be operated over a range of flows until that maximum can be reached, essentially interoperation of the facilities North and South can occur, Delta Cross Channel (DCC) can be open or closed.

In addition to those general factors, the temporary barriers can be installed on sloughs, the Yolo Bypass can flow, and of course salinity standards and/or points of compliance can be modified. Each of these factors influence circulation of water within the Delta and have direct and indirect effects on salinity.

Project Salinity

Project impacts on salinity are difficult to ascertain for a variety of reasons:

- Use of comparative rather than operational or predictive models to bound changes in EC.
- Use of model data for D-1641 compliance, not for operational impacts on agriculture.
- Use of averages, use of old data, and weak calibration and correlation to contemporary drought conditions.
- Use of running averages as compliance.

Averages and Reality

Using averages to describe the salinity at a given location is a compromise of convenience.

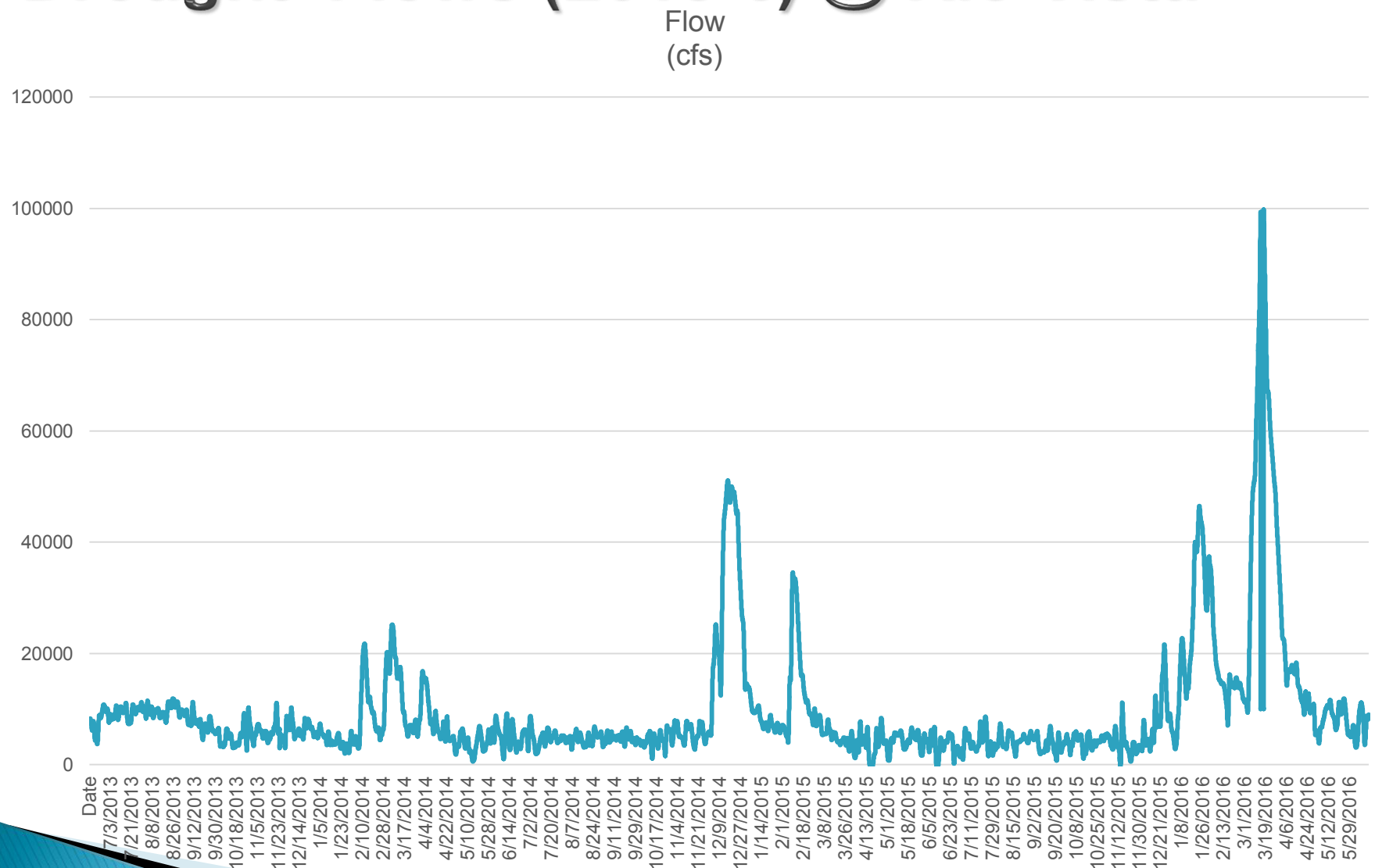
Since the tides changes daily, there are a range of salinity values expressed over a day. A mean is the average of that range and does not describe the ecological or agriculturally important salt concentration.

Averages and Reality

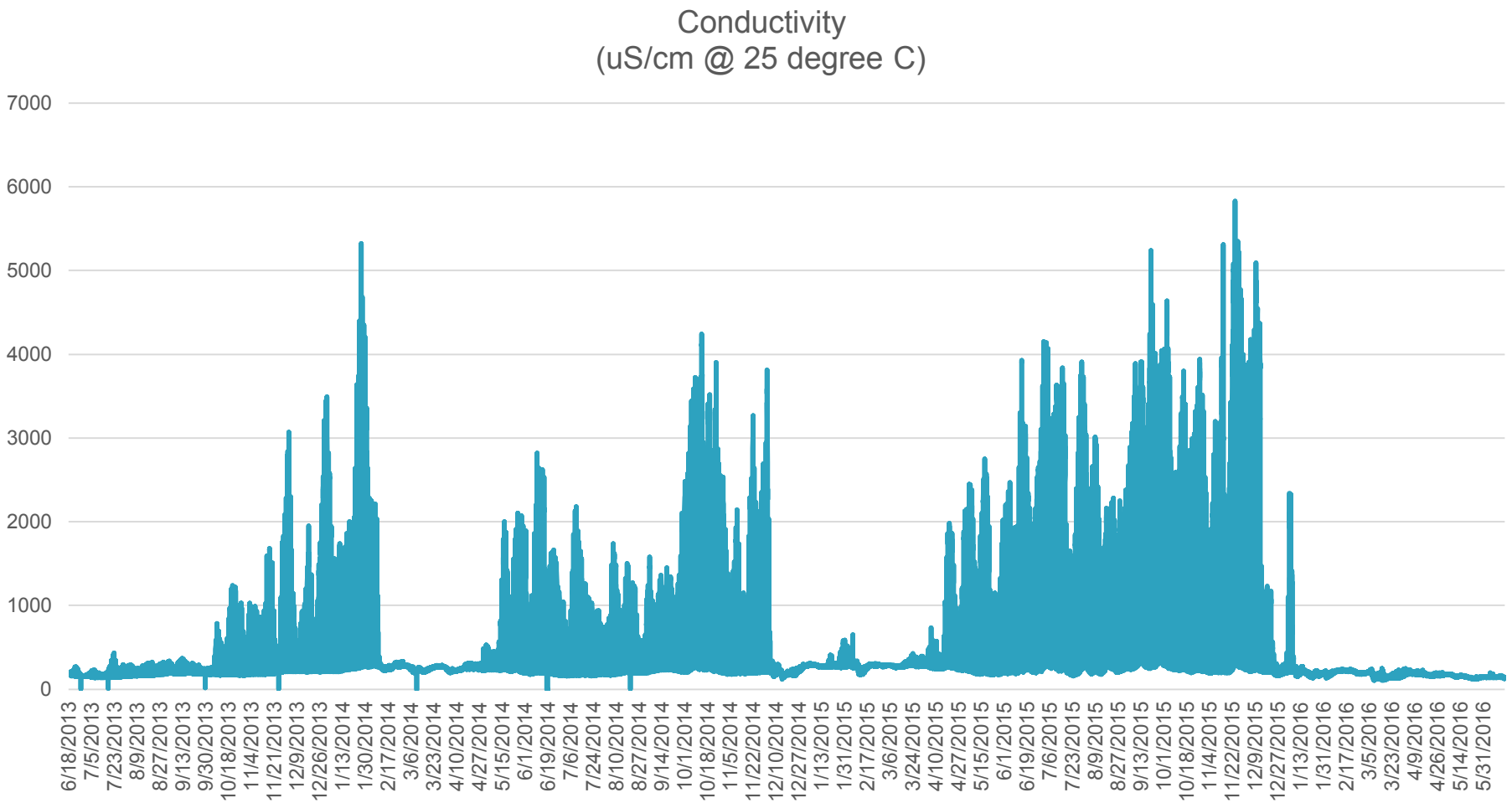
For agriculture, it is the timing of the salinity during the agricultural growing season, pre-irrigation and salinity flushing.

The important levels are both the peak salinity, and for the season, the area under the curve that leads to the seasonal loading, which is the sum total of the salinity load (net).

Drought Flows (2013-6) @ Rio Vista



Drought (2013-6) EC@ Rio Vista

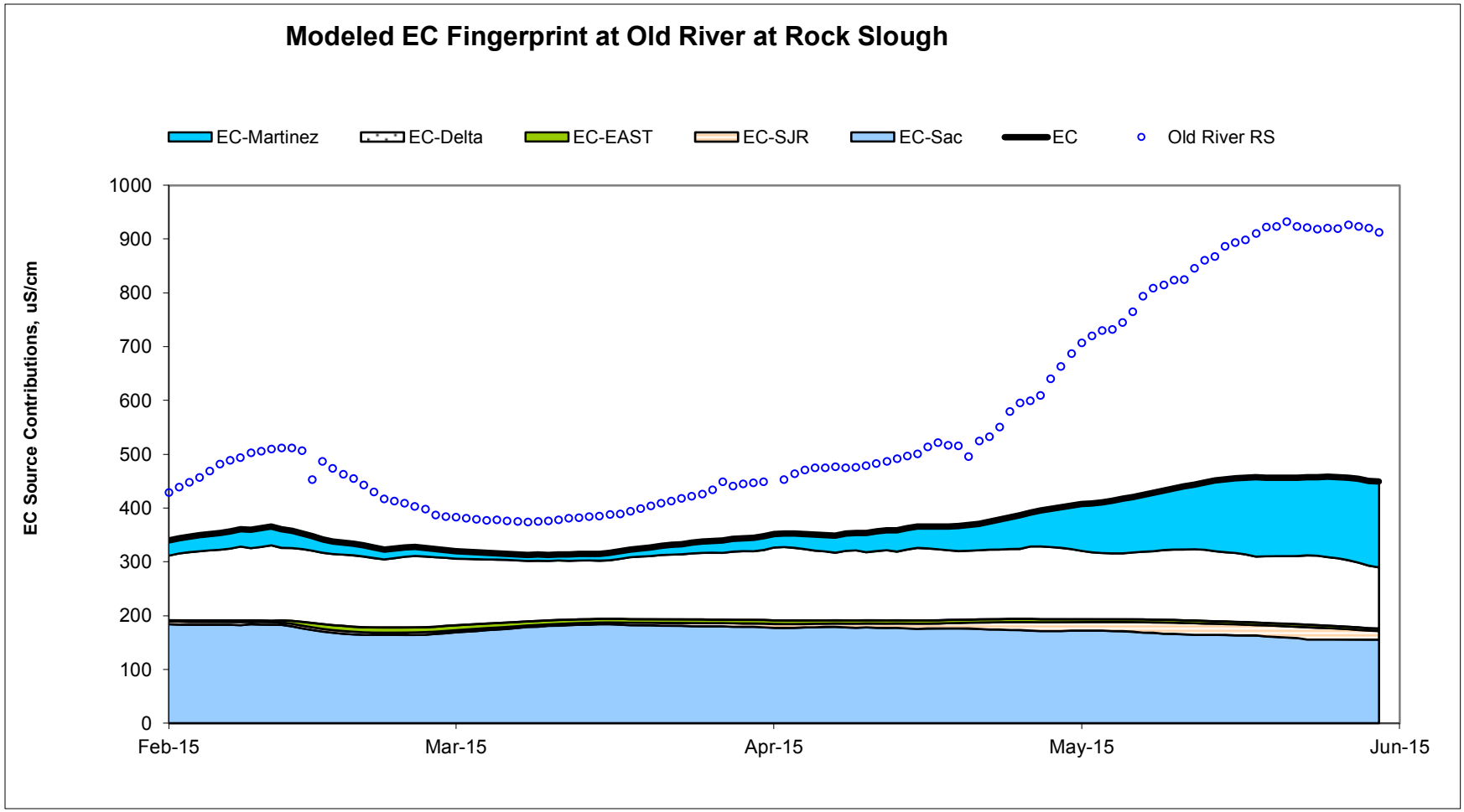


Outflow Control

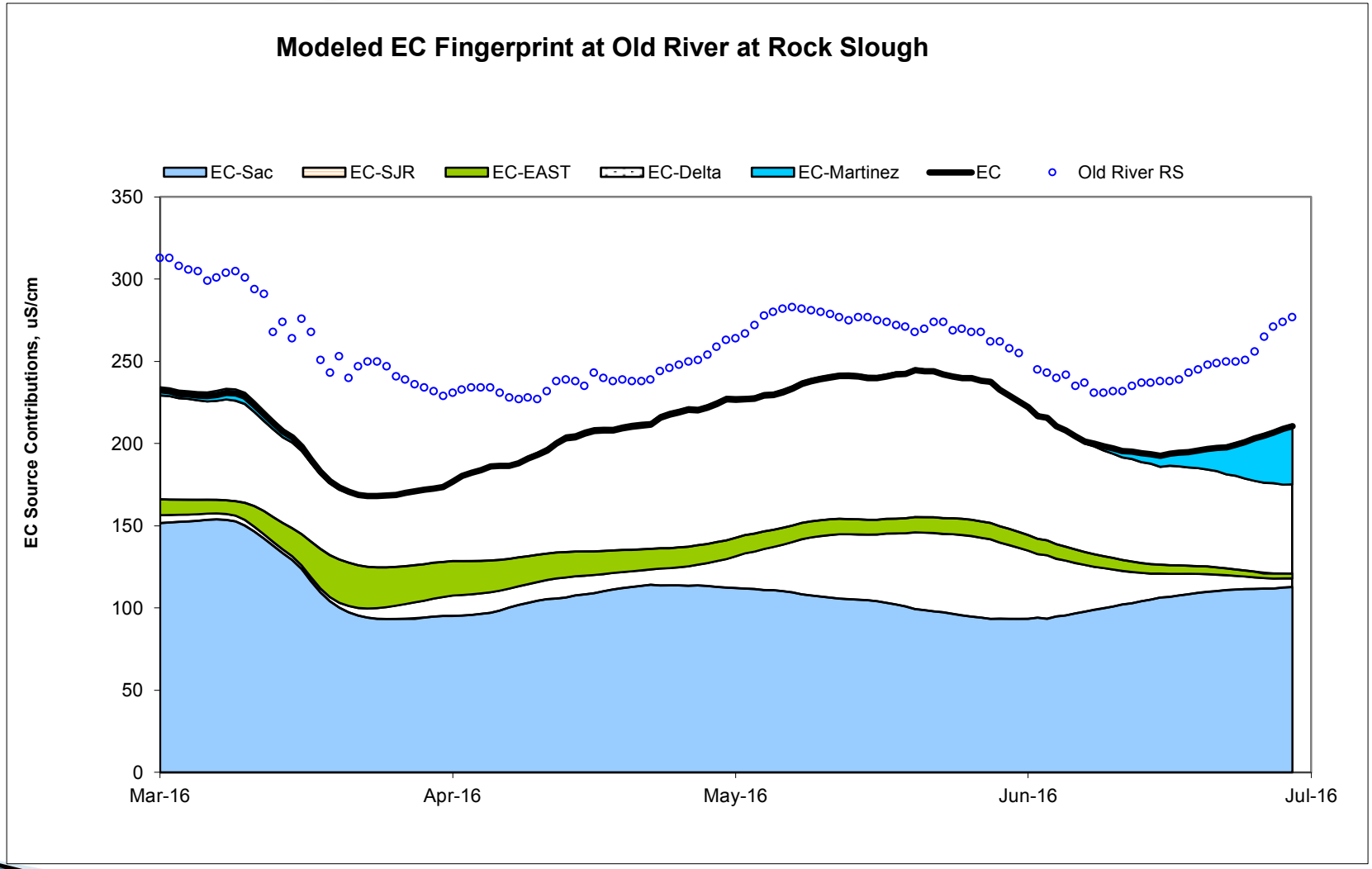
Salinity gradient is controlled by freshwater outflow, and changes constantly due to tides (and monthly and seasonal tidal differences). This is most obvious in droughts.

Outflow control is shown by EC levelling off even in droughts at flows above 12,000 cfs and salinity retreating from Rio Vista above 20,000 cfs. Flows below 12,00 cfs allow salinity to intrude, build, and ultimately spike.

2015 Fingerprint



2016 Fingerprint



Project Salinity

The Project could complete the type of modeling that would demonstrate predictive impacts under operational scenarios that bound the project maximum salinity impacts to the North Delta, but despite repeated requests overs several years to do so, still not provided.

A bounding scenario would be the months of July-November, king tide, dry and very dry water year, third and fourth years of drought, Winter Salmon Run temperature protection, 0/1/2 barriers installed. These are not hyperbolic bounds, but are exactly what occurred in the last two years in the Delta.

Salinity Conclusions

What can we infer from what was provided by the Petitioners?

The project can take, according to its operational bounds, typically 40% of the Sacramento River flow.

Salinity would increase through advection as a result of those lower flows, and increase to similar levels as were seen in the last 3 years of the drought with Southern Delta operations. If operational constraints to protect Central/South Delta fish remain, and are indeed on of the project purposes, the sustained operation of the North Delta diversions would institutionalize permanent drought-like flow conditions, and therefore increase EC and salinity in the Delta.

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