

Long-term Decline of Ungaged Inflows and the Beginning of Seepage Losses from the Lower San Joaquin River

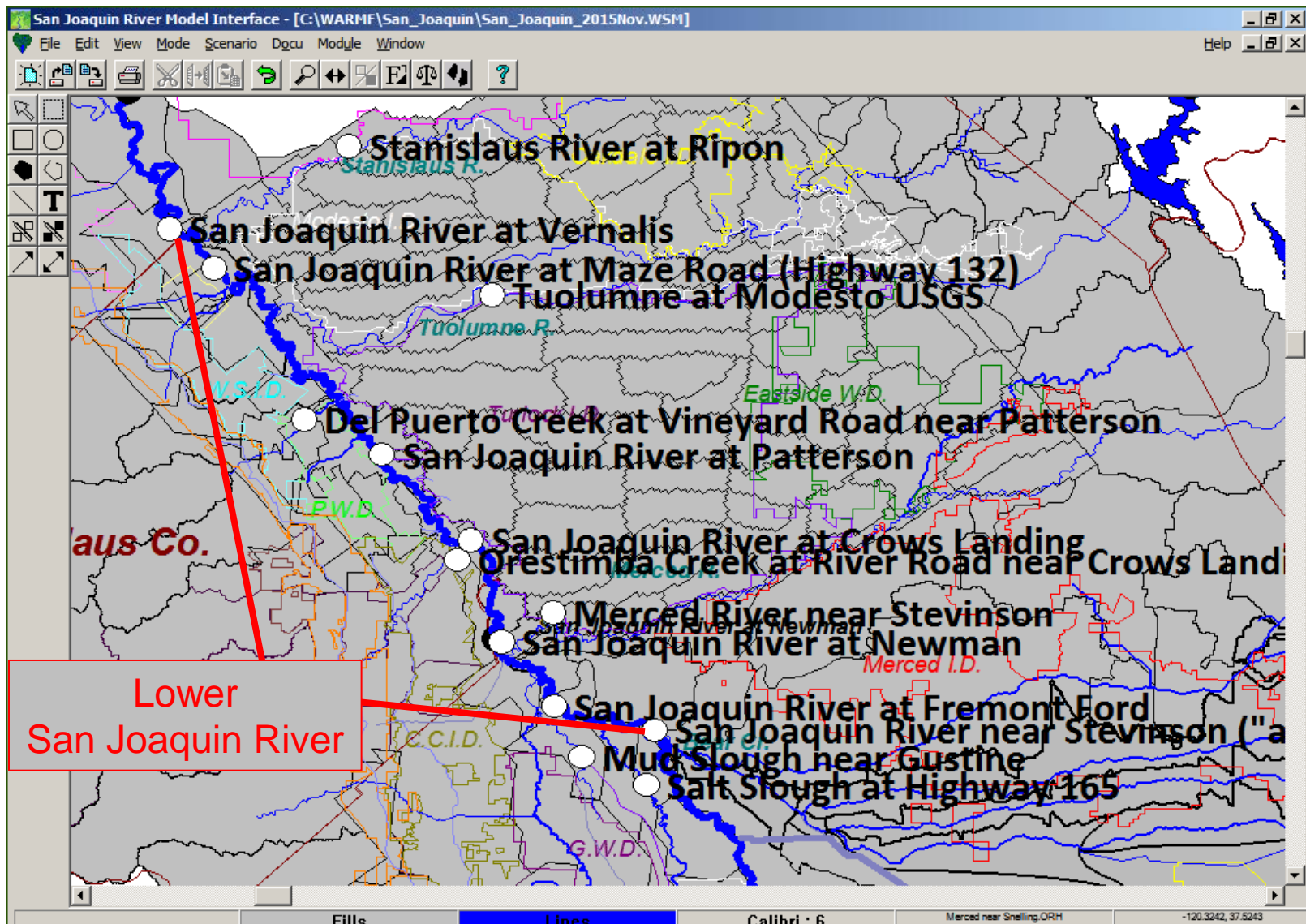
California Water and Environmental
Modeling Forum

April 12, 2016

Joel Herr
Systech Water Resources, Inc.



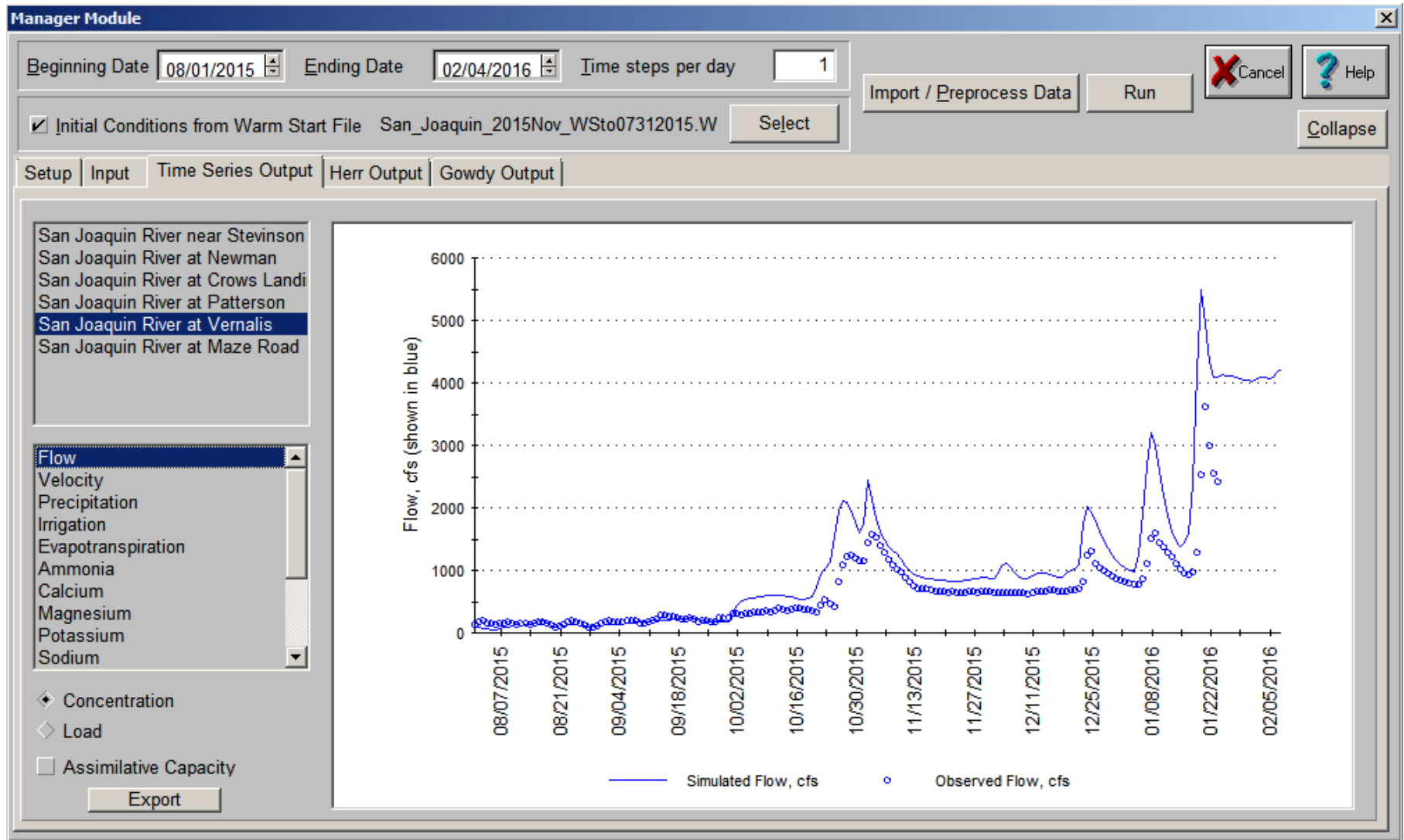
Lower San Joaquin River with Stream Flow Gages



Background

- Lower San Joaquin River
 - Stevinson gage to Vernalis gage
 - Flow inputs from tributaries, wetlands, agricultural drainage, groundwater accretions
 - Historically always a “gaining” river reach
- WARMF model applied to Lower San Joaquin River
 - Accepts tributary inflows as upstream model boundary conditions
 - Simulates diversions, irrigation, evapotranspiration, groundwater recharge, drainage, shallow groundwater accretions to the San Joaquin River
 - Assumes no seepage losses from river to groundwater
 - Predicts flow & water quality along the river downstream to Vernalis
- Error in Real-time WARMF Simulations Winter 2015-2016
 - Too much simulated flow, especially during flow peaks
 - Error is opportunity to learn something about the San Joaquin River

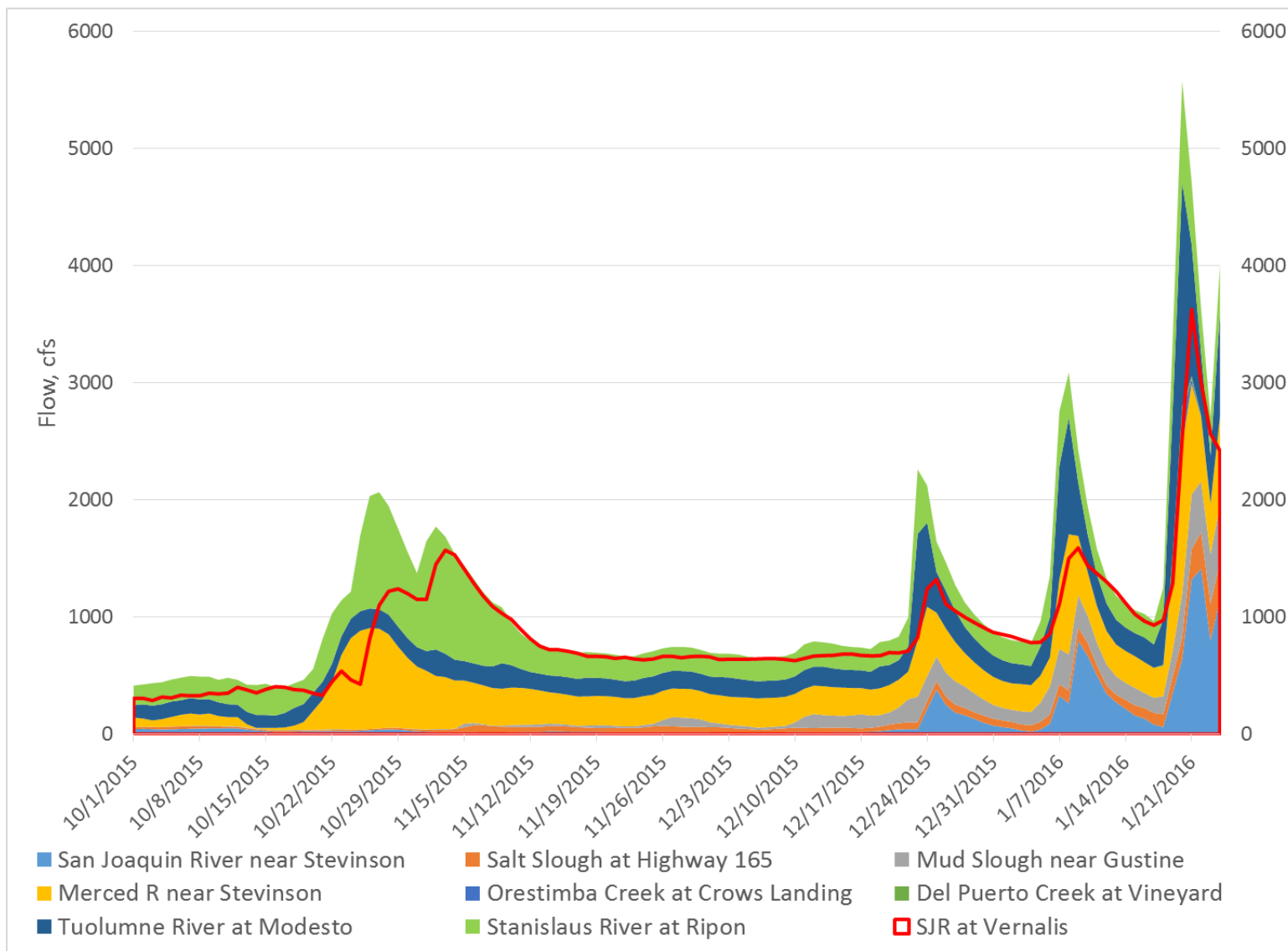
WARMF Predicts More Flow (solid line) than Measured (circles) in Winter 2015-2016



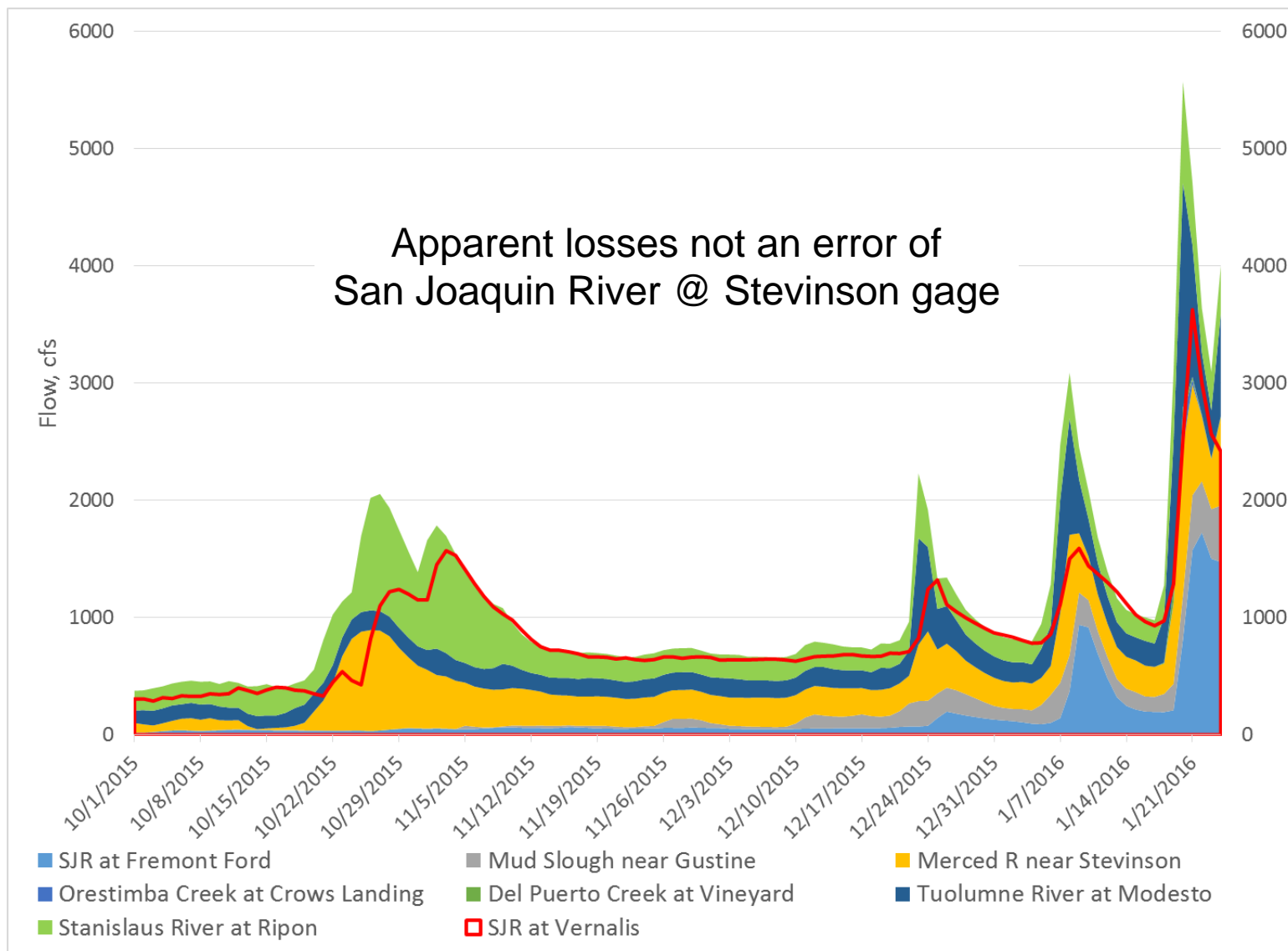
Why would WARMF flow be too high?

- Predicting too much ag drainage / groundwater inflow?
- Not enough diversions?
 - Unlikely – not much water diverted in winter, losses greatest during peak flow
- Problem with one or more gages?
- Something happening that we don't expect?
- Step 1: Check measured flow, see if outflow > inflow

Measured Inflow Greater Than Measured Outflow: San Joaquin River from Stevinson to Vernalis



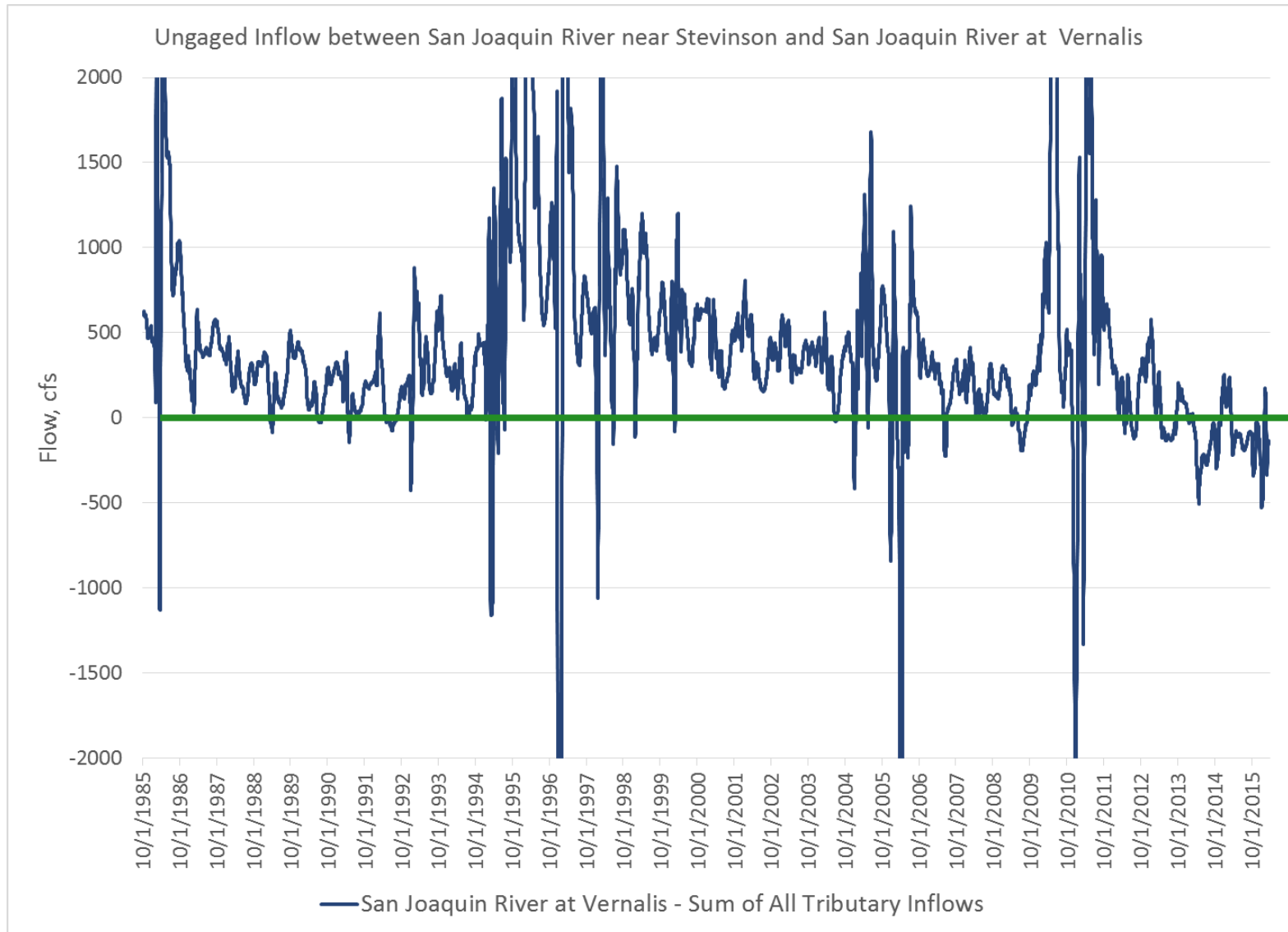
Measured Inflow Greater Than Measured Outflow: San Joaquin River from Fremont Ford to Vernalis



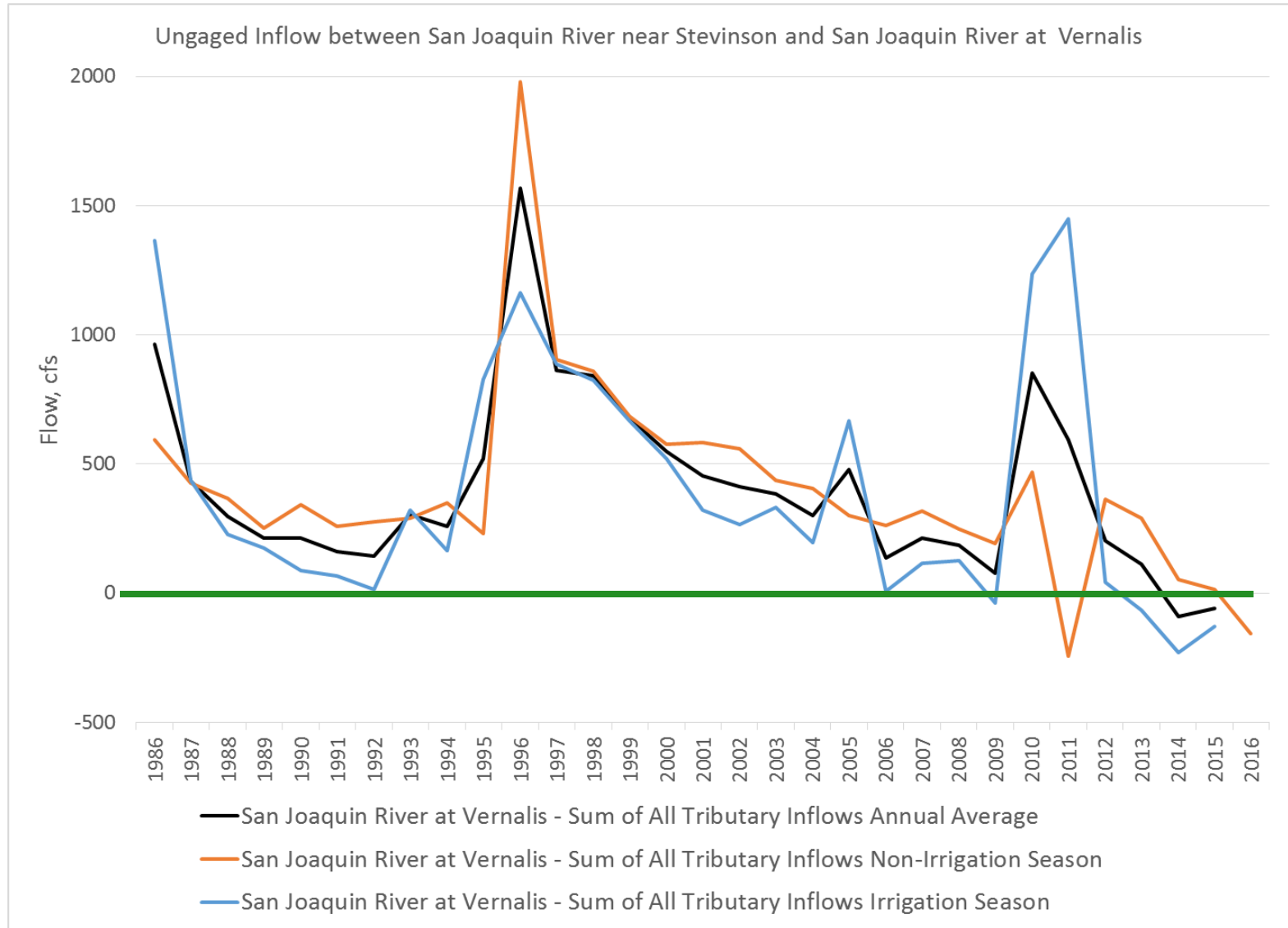
Gaining Versus Losing Rivers

- Gaining River receives unengaged inputs
 - Agricultural drains
 - Diffuse shallow groundwater exfiltration
- Losing River has unengaged output
 - Losses through river bank
 - Losses through river bed
- Calculate unengaged inflows from measured flow
 - San Joaquin River at Vernalis – sum of tributary inflows
 - Positive is gaining river; negative is losing river

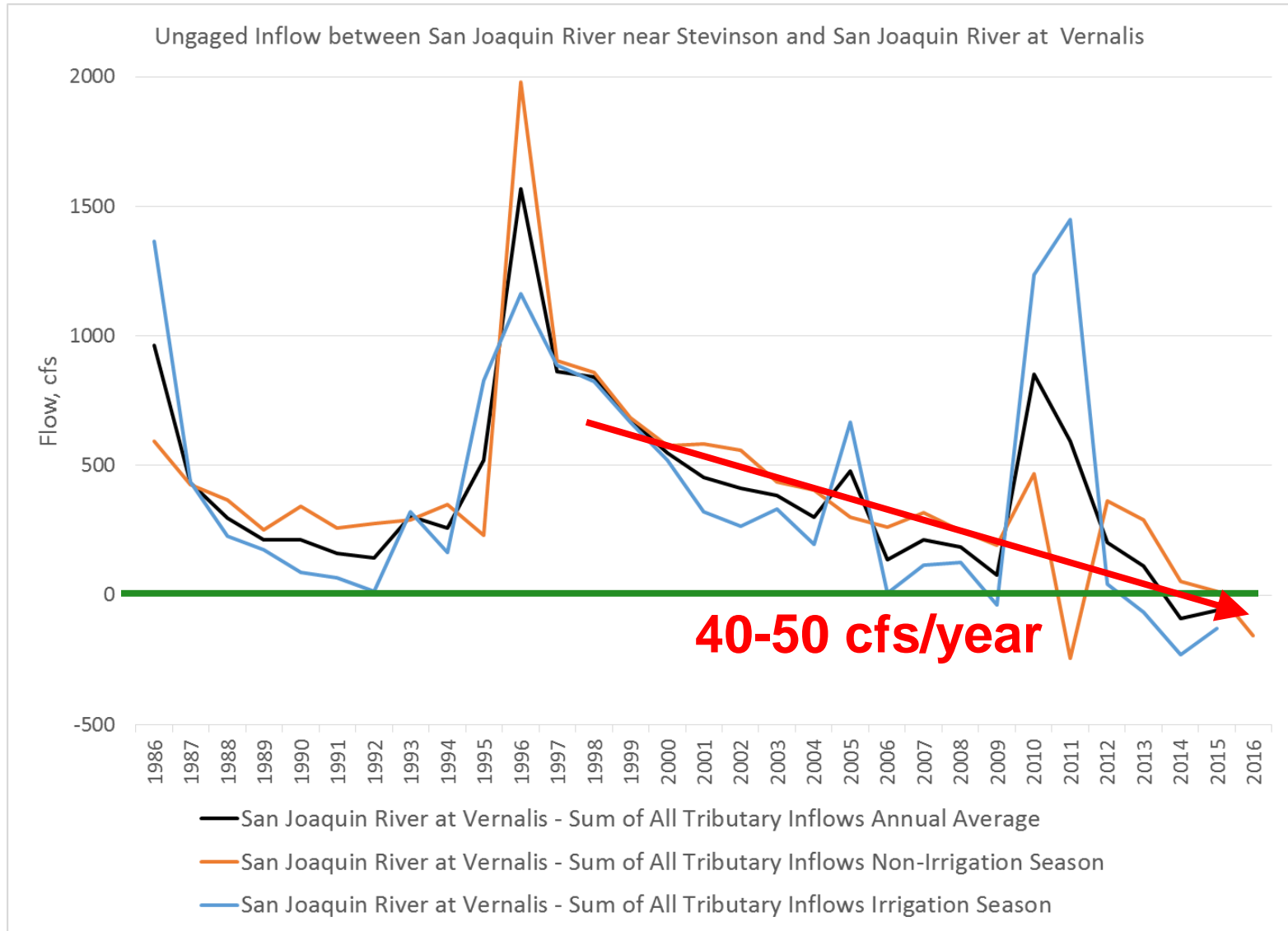
Net 30-day Average Ungaged Inflows



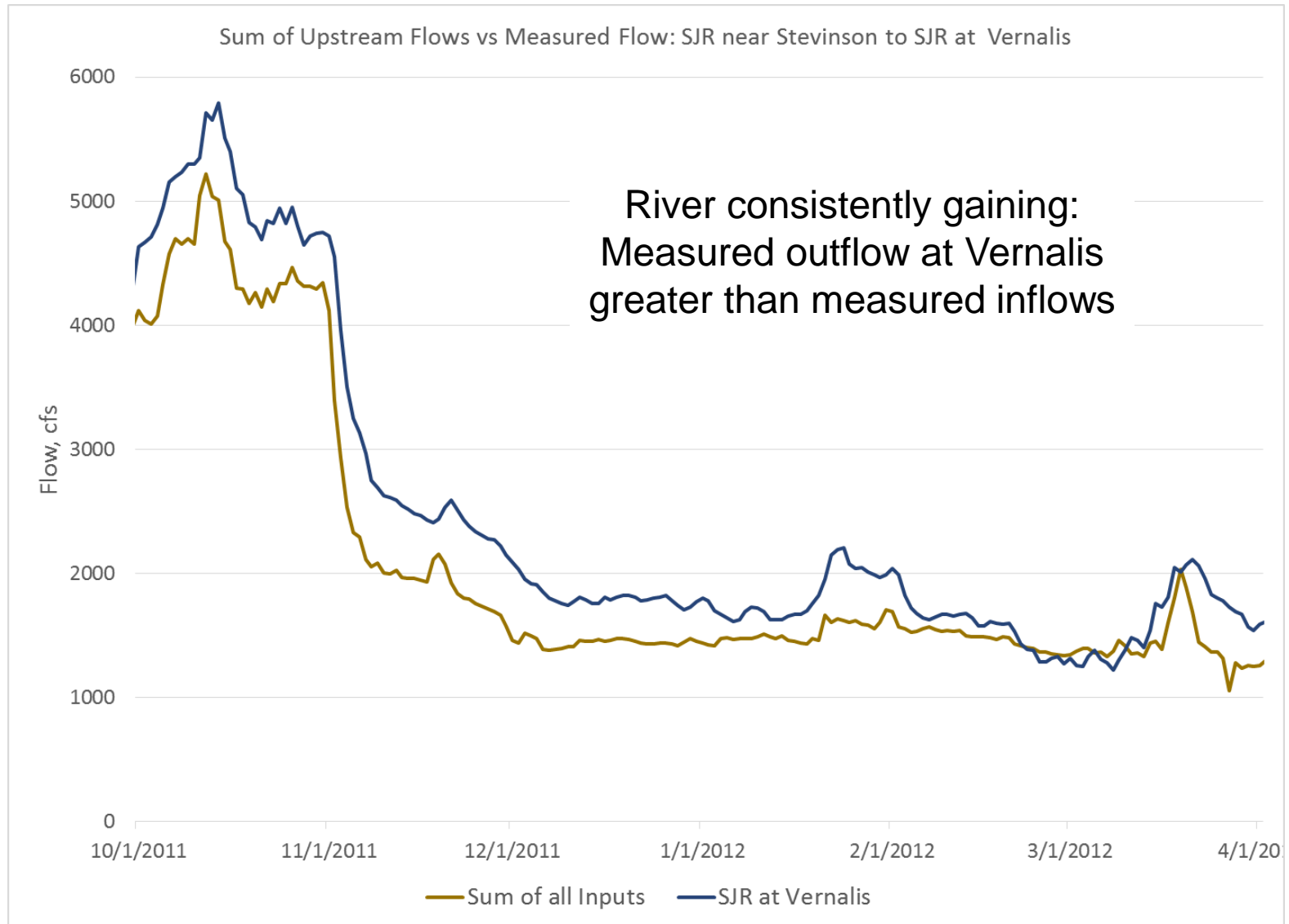
Net Annual Ungaged Inflows



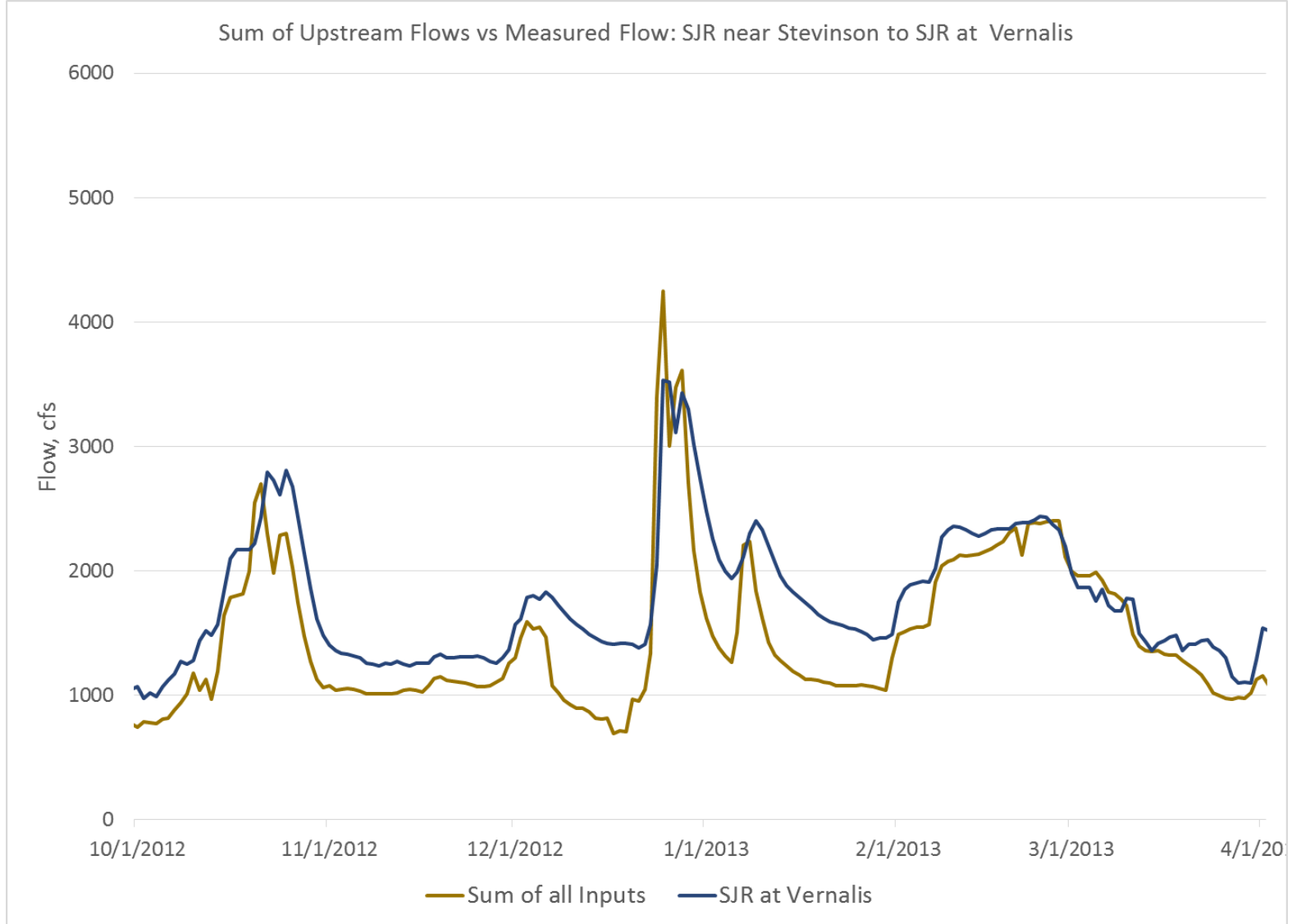
Trend of Ungaged Inflows



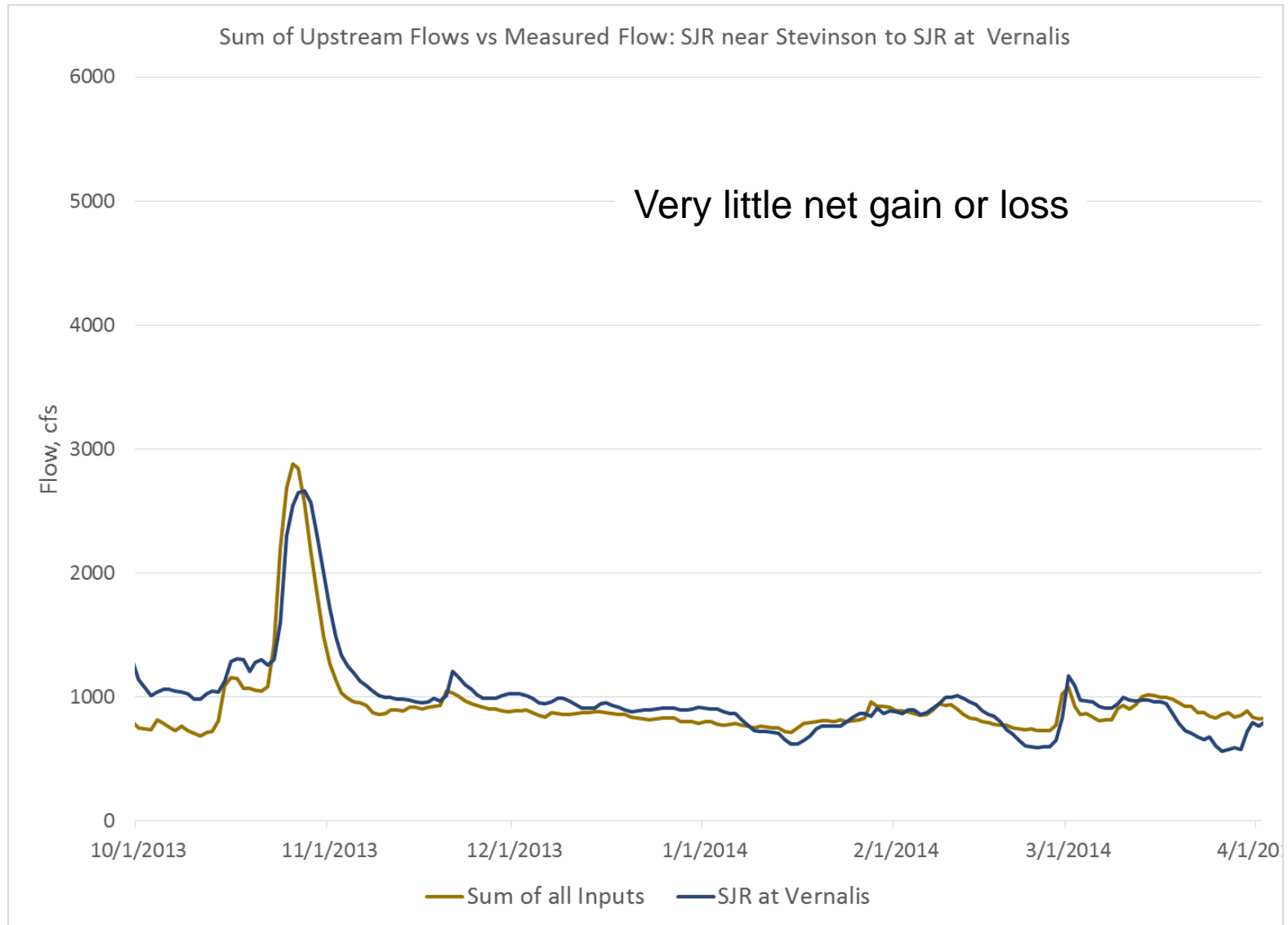
Vernalis Flow vs Sum of All Inflows: Winter 2011-2012



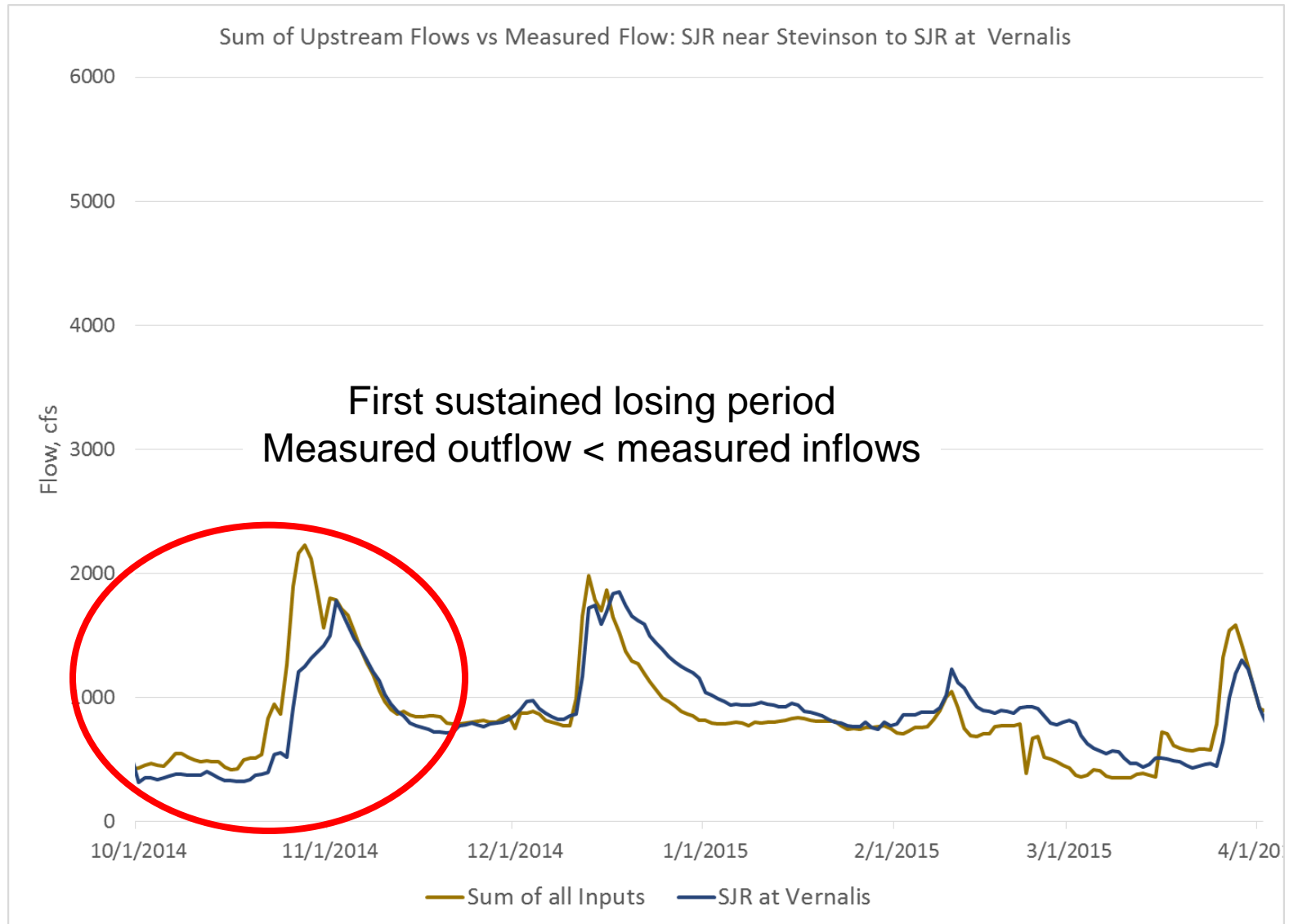
Vernalis Flow vs Sum of All Inflows: Winter 2012-2013



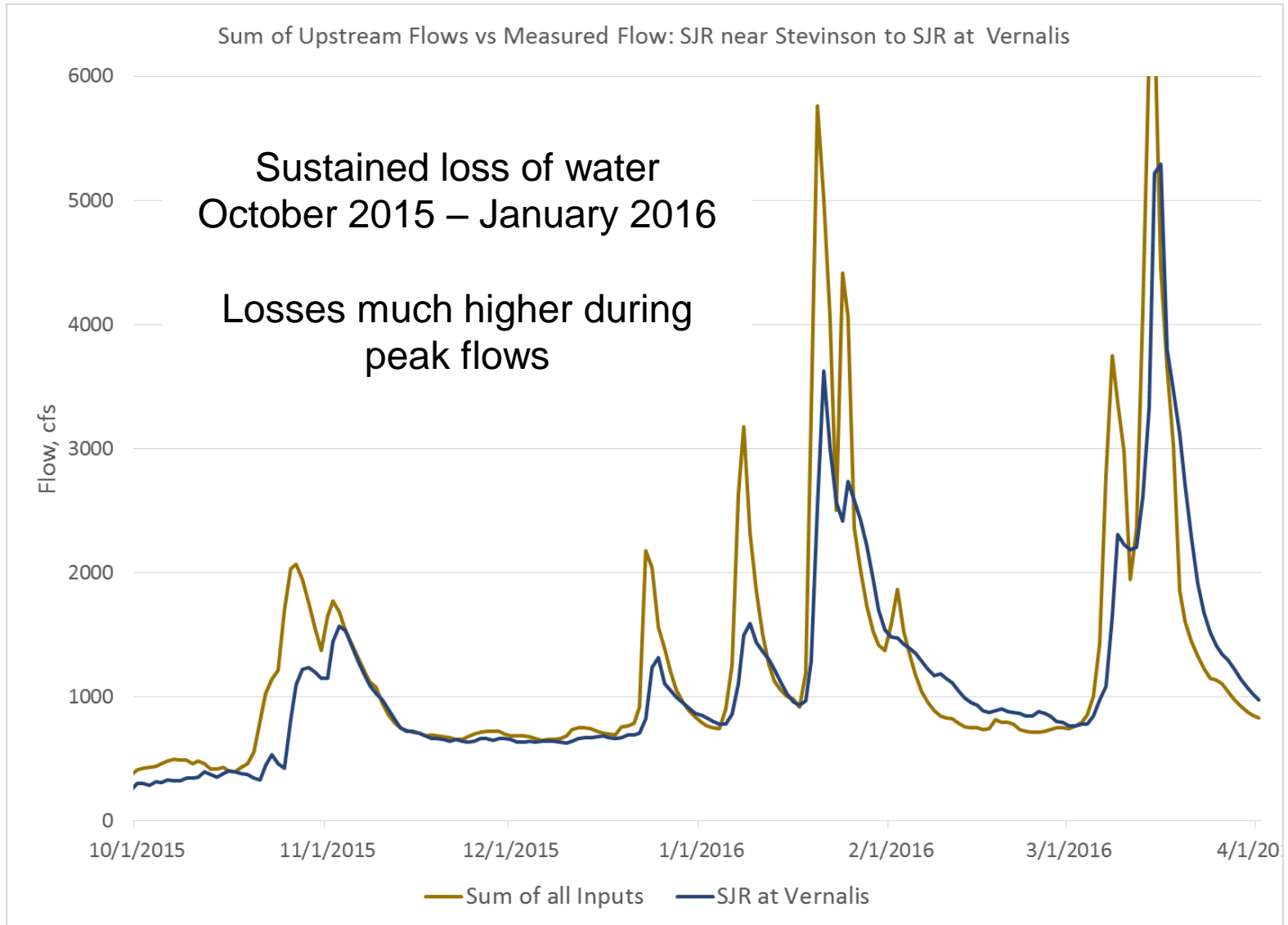
Vernalis Flow vs Sum of All Inflows: Winter 2013-2014



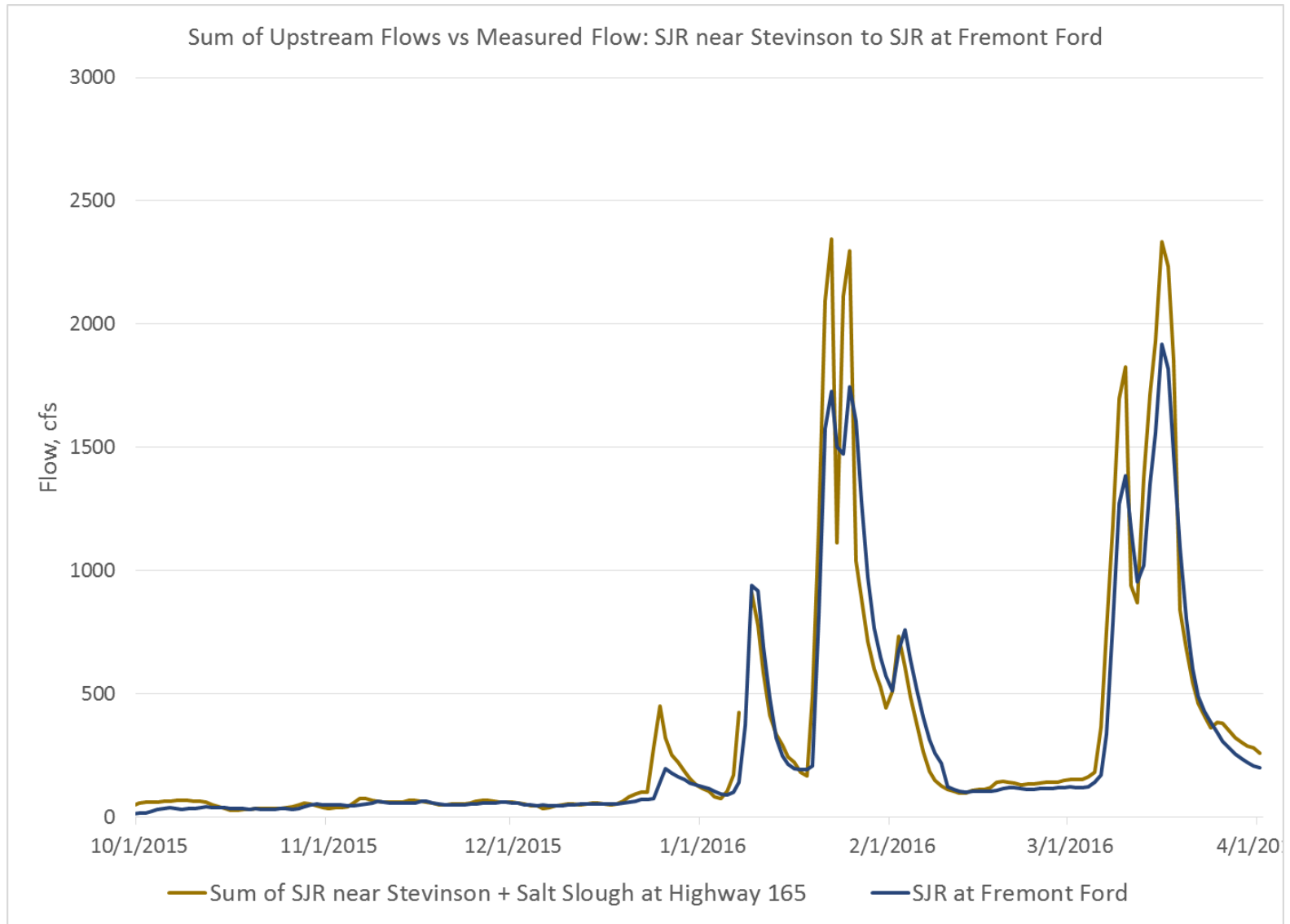
Vernalis Flow vs Sum of All Inflows: Winter 2014-2015



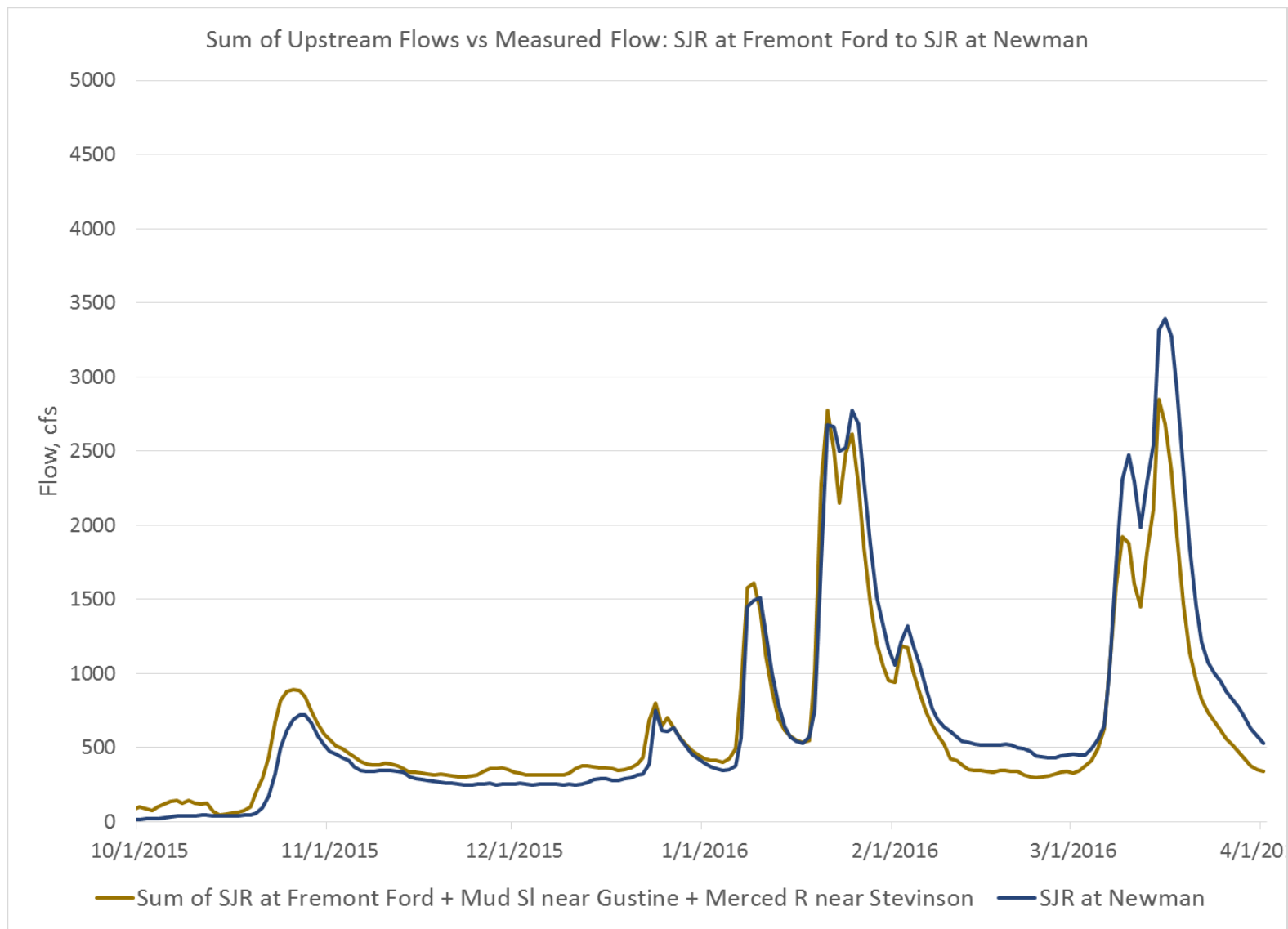
Vernalis Flow vs Sum of All Inflows: Winter 2015-2016



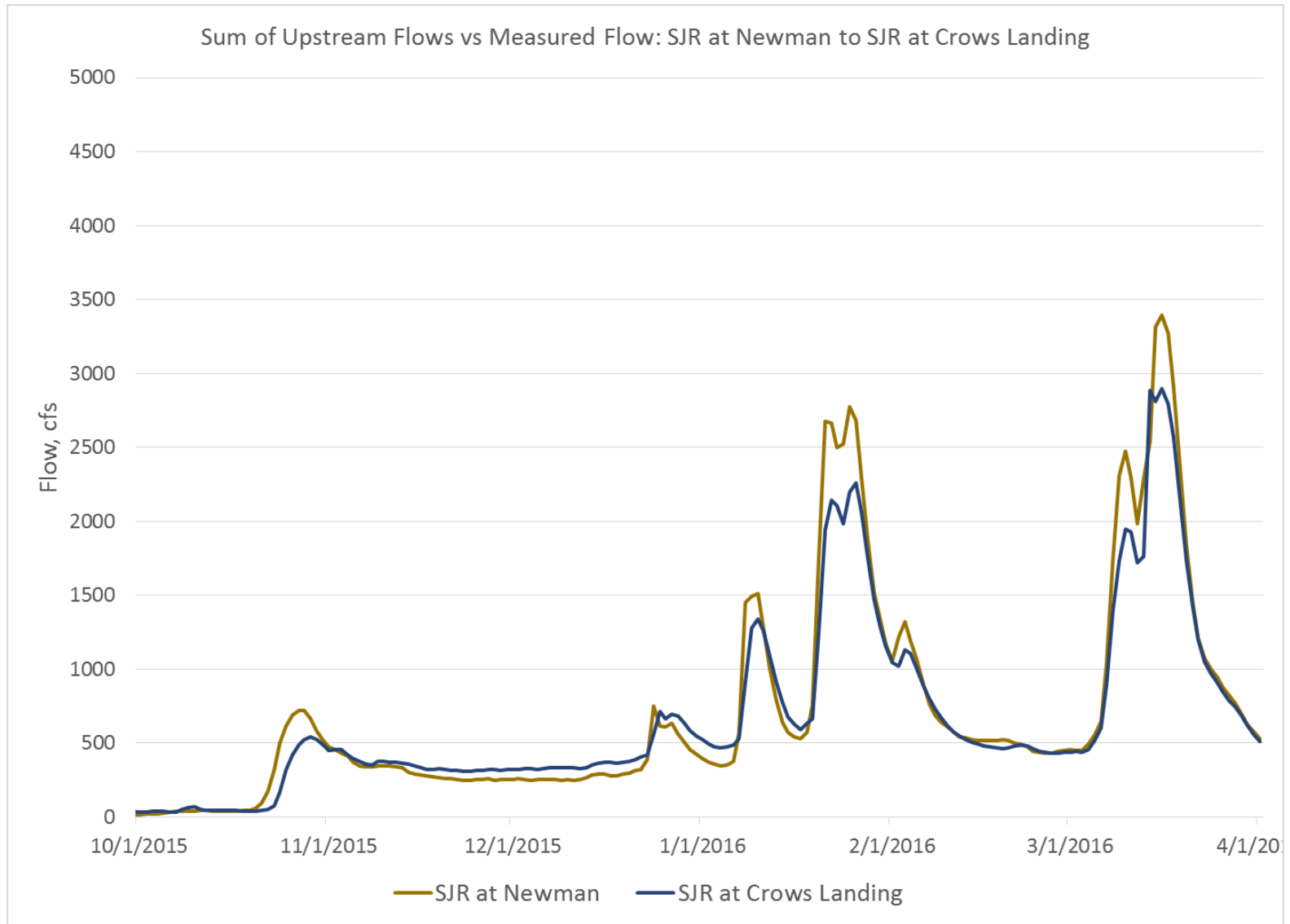
Stevinson to Fremont Ford: Winter 2015-2016



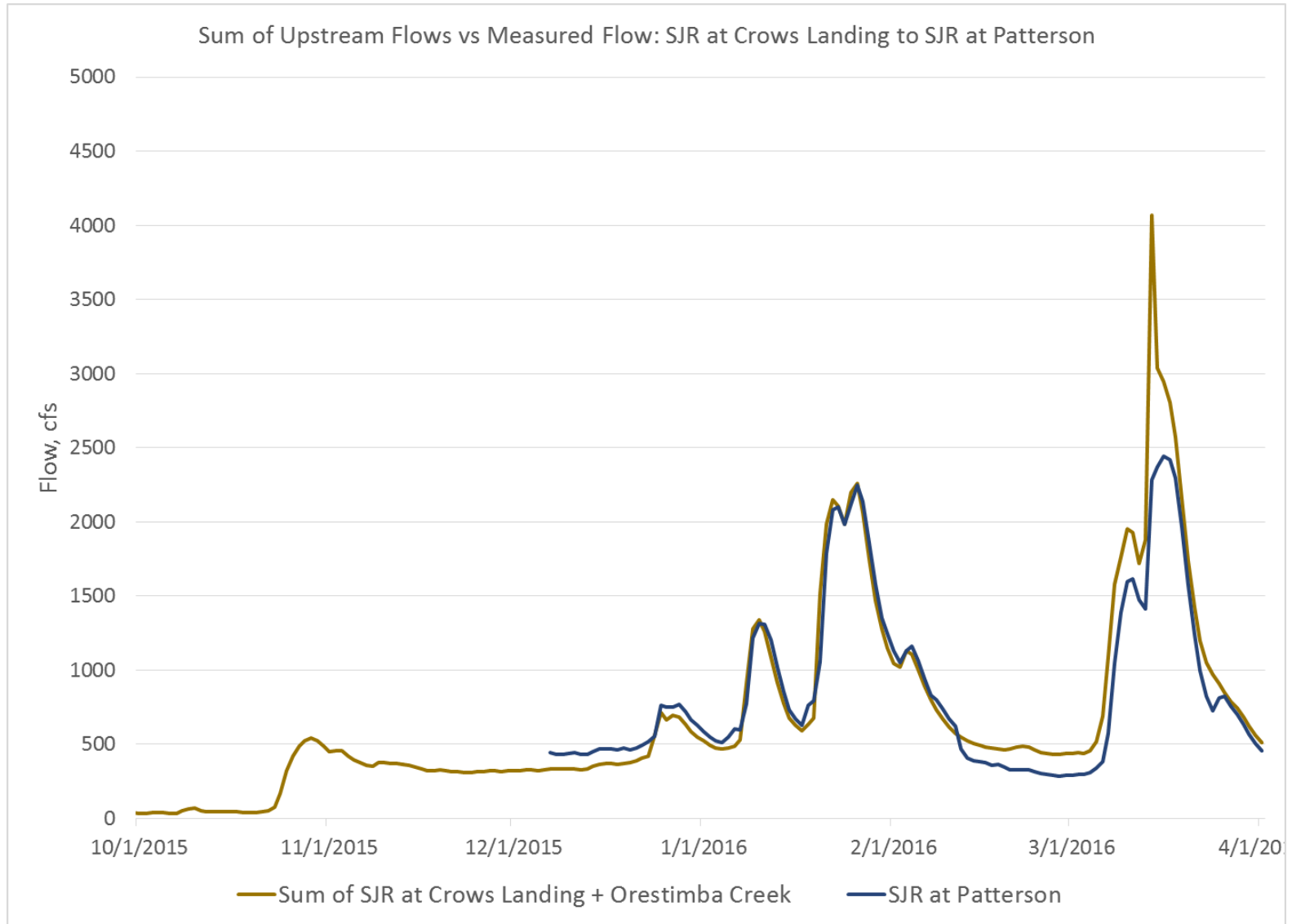
Fremont Ford to Newman: Winter 2015-2016



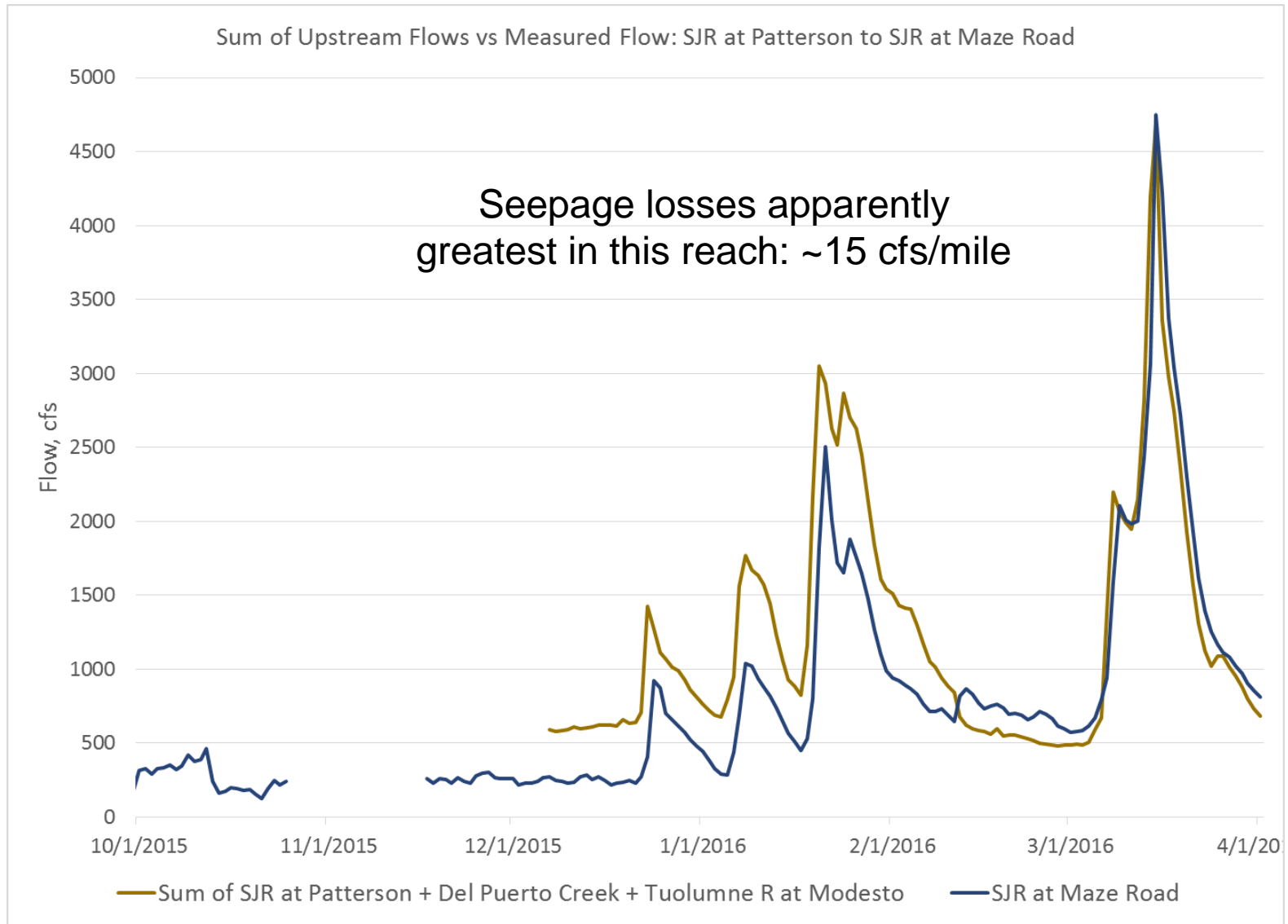
Newman to Crows Landing: Winter 2015-2016



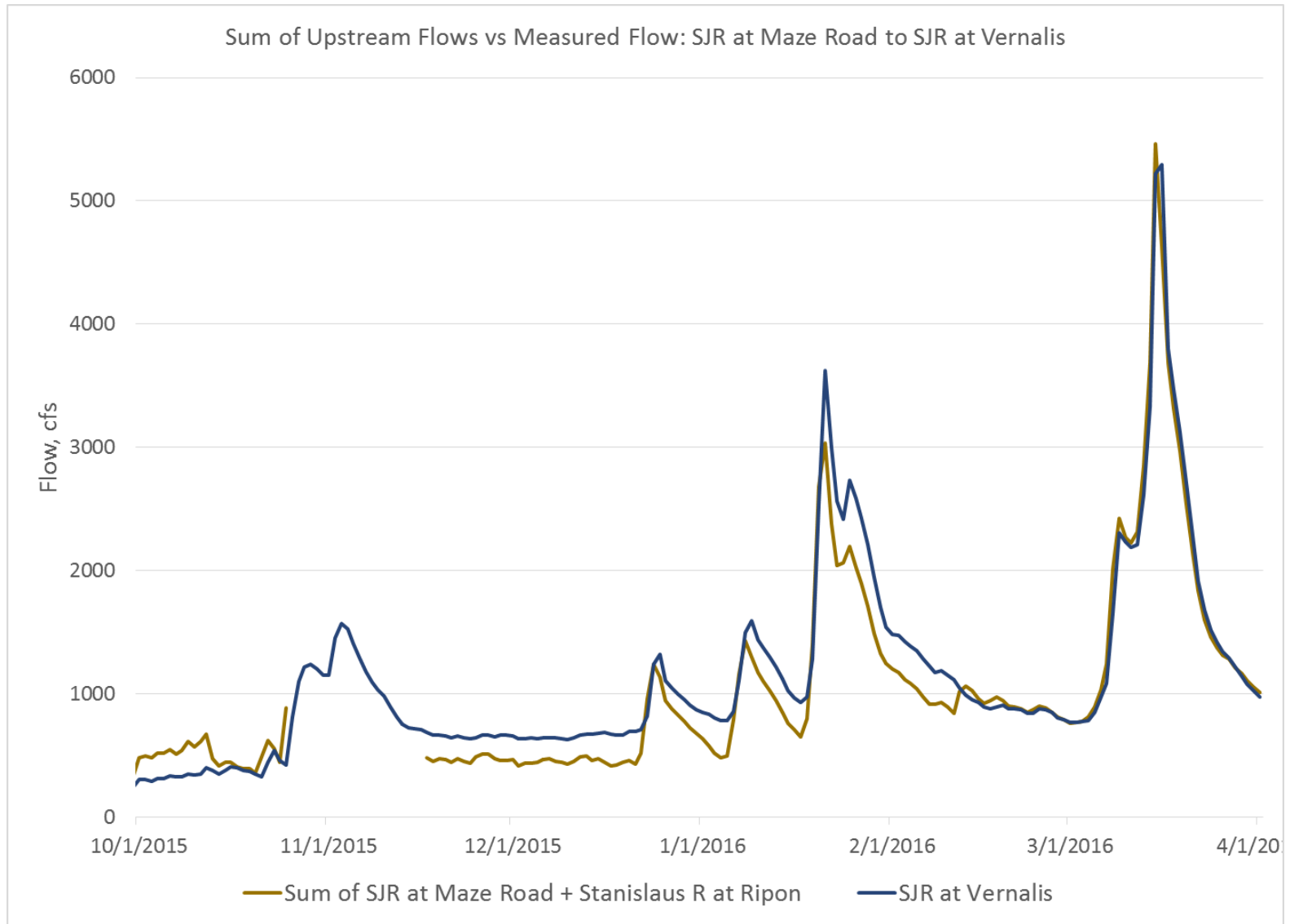
Crows Landing to Patterson: Winter 2015-2016



Patterson to Maze Road: Winter 2015-2016



Maze Road to Vernalis: Winter 2015-2016



Average Ungaged Inflows, Stevenson to Vernalis October 1 – March 31

Water Year:	2012	2013	2014	2015	2016
Ungaged Inflow	364 cfs	289 cfs	51 cfs	16 cfs	-90 cfs

■ 2015

- First year with peak flow losses (first peak only)

■ 2016

- First year with average net loss during non-irrigation season
- Lost flow in first 6 peak events through January
- Much of flow apparently lost between Patterson and Maze Road

Questions

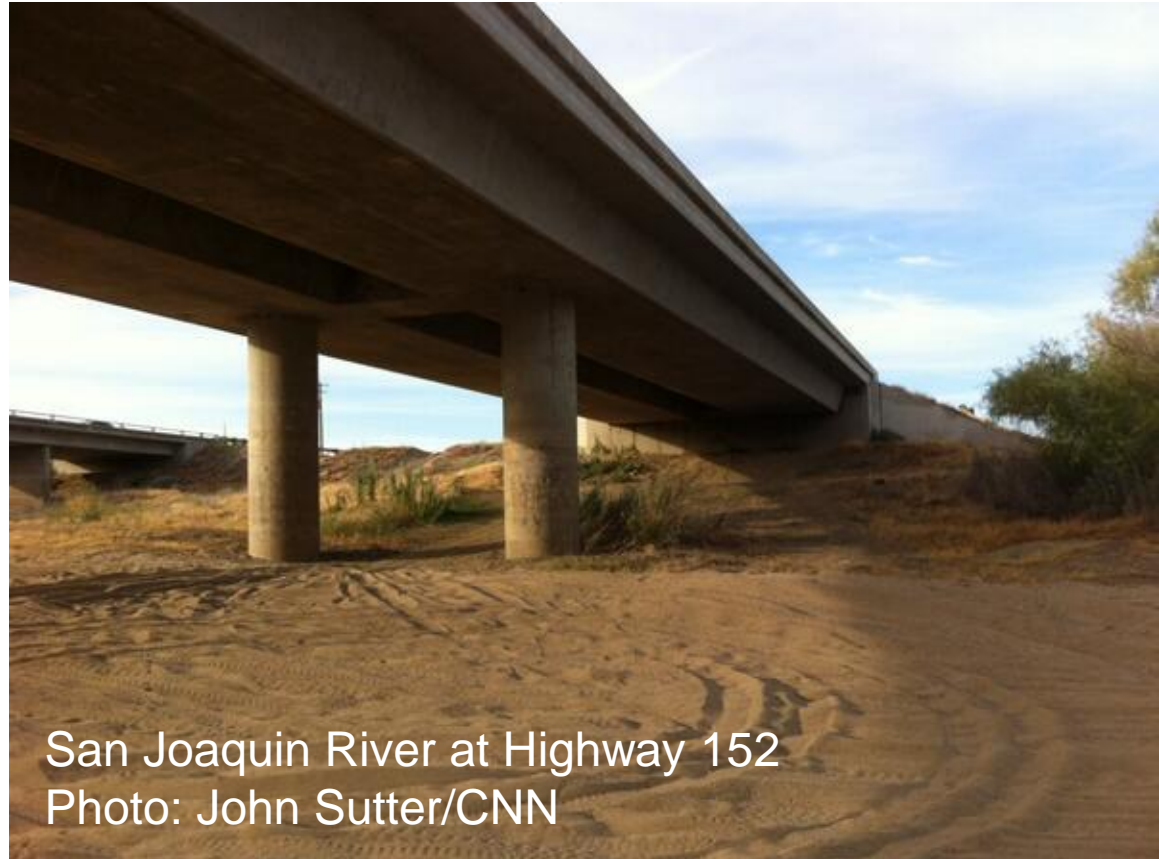
- Is SJR losing water caused by drought?
 - Trending downward for 20 years, not just during drought
- Will wet periods alleviate the problem?
 - 2005-2006 and 2010-2011 did little to alter long-term downward trend
 - 1995-1999 was wettest period since DWR started categorizing water years in 1922, can't be expected to repeat
- What will happen next?

Summary

- Ecosystem and water users have depended on unengaged inflows from drains, groundwater
- Ungaged inflows have disappeared
- River water is now being lost to groundwater
- Continuation of trend will result in increasing sections of lower San Joaquin River running dry within 5-10 years
- Profound ecological & economic impact

Urgent Action Needed

- Independent verification of the problem
- Coordinated effort of surface & groundwater modeling
 - Learn how & where losses are occurring, how much, future trends
 - Potential solutions
- Educate stakeholders





Questions? Please contact us at:

**Systech Water Resources, Inc.
1200 Mount Diablo Blvd., Suite 102
Walnut Creek, CA 94596
Phone 925-355-1780**