MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Water Quality, Fish and Wildlife RCG Meeting

January 21, 2016

Final KMK 02-29-16

ATTENDEES:

Bill Argentieri (SCE&G)
Ray Ammarell (SCE&G)
Randy Mahan (SCE&G)
Steve Summer (SCANA)
Byron Hamstead (USFWS)
Bill Marshall (SCDNR)
Dick Christie (SCDNR)
Ron Ahle (SCDNR)
Jim Bulak (SCDNR)
Alex Pellett (SCDNR)
Rusty Wenerick (SCDHEC)
Bill Stangler (Congaree Riverkeeper)
Malcolm Leaphart (Congaree Riverkeeper)
Gerrit Jobsis (American Rivers)
Henry Mealing (Kleinschmidt)
Bret Hoffman (Kleinschmidt)
Kelly Kirven (Kleinschmidt)

These notes serve to be a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.

Henry opened the meeting with introductions and explained that the purpose of the meeting was to discuss the Downstream Flow Fluctuations Memo. At the WQFW RCG meeting on August 26, 2015, the RCG discussed a request received during the PAD review, regarding limiting downstream fluctuation flows. An action item stemming from that request and discussion was that Kleinschmidt and SCE&G would gather the flow records for 2010-2015 from gages at Carlisle, Tyger, Enoree, Alston, Saluda downstream of Lake Murray, and the Congaree River at Columbia and compare all flows from January through May. The data was reviewed for large fluctuations in flow that may have been caused by operation of the Parr Project (which includes the Parr and Fairfield Developments), and the results were summarized in the Downstream Flow Fluctuations Memo, which was distributed to the RCG for review on December 16, 2015.

Bret began the discussion of the flow analysis by explaining how hourly flows from the Carlisle, Tyger and Enoree gages (or "upstream flows") were prorated and compared to the Alston gage flows. A time offset was applied to the dataset to aid in the visual display of peaks and valleys on the graphs. Gerrit asked how flows from Monticello were factored in and Bret said only flows from within the capacity of the project, up to 40,000 cfs, were examined. A separate analysis was completed where the flows from the Saluda gage were deducted from flows at the Congaree at Columbia gage and the resulting flow measurements were compared to the upstream flows. Bret then determined how often hourly variances occurred at different flows. He explained that this analysis was not an event-based categorization but a straight percent based categorization.

Henry said that the goal of the meeting was for the RCG to pinpoint events they would like to examine in further detail. The goal is not to show what the Project impact is, but instead to identify occurrences we would like to avoid and try to develop PM&E measures to make small changes. Gerrit said there are three different occurrences that seem to be happening: 1) there is a large peak occurring on inflow, but not on the outflow; 2) there is no peak on inflow, but a peak is occurring on outflow; and 3) inflow and outflow are in sync.

Ray pointed out that some of the peaks appear artificially high because they don't account for attenuations of flow. To do this, a hydraulic model with a routing exercise would need to be completed.

Bill A. explained that the crest gates are set at a certain level for 16 hours of the day when operators are not at the project. Crest gates can only be operated on site and not remotely, because of safety issues and to decrease the possibility of damage to the gates. An operator may need to be at the project 24 hours a day in order to make the changes needed to lessen fluctuations. Currently operators are working within the license requirements, to apportion water to Monticello and downstream. They may be able to lessen large spikes in flow during some periods of the year.

Alex said that in reference to Table 1 in the memo, the number of incidents that Project-induced flow variances occurred would be a good statistic, versus the straight percentages that are presented in the memo.

The group discussed various ways to reduce fluctuations including talking to operators about reservoir inventory and having dynamic gate operations. Gerrit said that the results of the IFIM study will play a big role in identifying the effects of flow fluctuations. The study may show that after flows reach a certain level, flow fluctuations impacts aren't as important. Jim mentioned that flows may not affect habitat, but they may affect the behavior of fish.

The group took a break and stakeholders met in a separate room to discuss recommendations for next steps.

When the group reconvened, the stakeholders had a list of five major points, which are included below.

1. The RCG is not able to reduce the current period of review (January through May) for the Downstream Fluctuation issue at this time. As additional information becomes available this window may be narrowed.
2. The RCG's goal is that the Parr Project operate so that hourly outflow is as near as reasonably possible to hourly inflow. The RCG requested that a more accurate inflow dataset be developed using flow routing to account for attenuation from the Carlisle gage to the headwaters of Parr Reservoir.
3. The RCG recognizes that the goal of outflow matching inflow is unrealistic. However there are several comparisons that should be made for both
    a. revised inflow dataset (as described above in #2) VS outflow at the Alston gage

b. Alston gage flows VS flows at the Congaree gage in Columbia (02169500 – Congaree River at Columbia, SC - gage currently being used in the analysis) with the removal of the Saluda effects.
c. revised inflow dataset VS flows at the Congaree gage without the effects of the Parr Project operations (i.e. Project inflow equals outflow) – shown with and without Saluda effects

4. The RCG wants to know if the project can be operated to reduce releases within 10% increments of inflow, knowing that this may vary for different flow ranges; can the project release be kept within 10%, 20%, 30%, and possibly 50% of inflows (during low flows)

5. The RCG emphasized how important the results of the IFIM study and dual flow analysis will be for resolving this issue. Any analysis done prior to the IFIM results may change. The true impacts of the project release variances may not be understood until the habitat data from IFIM study are considered.

Gerrit mentioned they are also interested in how different flow scenarios will affect reservoir fluctuations on Parr and Monticello. Ray said we should focus on Parr and the operation of the crest gates, then look at Monticello. The only change for Monticello would be if Fairfield couldn't be operated as it normally is for pumping and generating.

Dick asked if there was a possibility for Monticello to provide storage and help moderate flows as needed. Ray pointed out that the reservoir only holds 29,000 acre feet, so there isn't very much room for storage.

Meeting adjourned. Action items from this meeting are listed below.

ACTION ITEMS:

- Kleinschmidt and SCE&G will assemble the five major points that the stakeholders listed and send back out to the meeting attendees for verification.
- SCE&G will talk with operators to see what kinds of changes may be possible.
- Kleinschmidt and SCE&G will perform the analyses requested by the stakeholders as part of their 5 major points and reconvene the RCG to discuss results.

Parr Hydroelectric Project – FERC No. 1894
Downstream Flow Fluctuations – Memorandum

TO:	Parr/Fairfield Relicensing Water Quality, Fish and Wildlife Resource Conservation Group (RCG)
FROM:	Kelly Miller and Henry Mealing – Kleinschmidt Associates
DATE:	December 16, 2015
RE:	Downstream Flow Fluctuations – Initial Analysis

As part of the comments received on the Preliminary Application Document (PAD), several agencies requested additional information on the periodic flow fluctuations from the Parr Hydroelectric Project (Project). At the August 26, 2015 relicensing meeting, stakeholders presented concerns that flow fluctuations from the Project could impact the spawning of several species of fish in the Broad River downstream of the Project and extending downstream to where Highway 601 crosses the Congaree River. The target species identified in the meeting were shortnose sturgeon, American shad, striped bass, and robust redhorse. Target spawning months include January through May (RCG Meeting Notes 08-26-2015).

As the initial step in addressing these concerns, flow records for 2010-2015 were collected from USGS for the following gage locations: Carlisle (2156500), Tyger (2160105), Enoree (2160700), Alston (2161000), Saluda downstream of Lake Murray (2169000), and the Congaree River (2169500). Flows were compared from January through May on an annual basis, and were prorated based on drainage areas. All flow data will be provided on a CD upon request by RCG members.

Methods

Hourly inflows to the Project were prorated using data from the Carlisle, Tyger, and Enoree gages, which represent the contributing drainage area of the Parr Reservoir. A regional coefficient and exponent, which were determined by regression analysis as part of the Parr operations model inflow dataset development[1], were applied to the ratios for accuracy. These flows were graphically compared with the Project outflow data (from the Alston gage), and an offset applied to account for flow travel time; a shift of 9 hours was visually determined to best fit the datasets, based on inflow events exceeding 40,000 cfs, which are outside of the Project impact. The comparison of these datasets gave a depiction of the frequency and magnitude of how Project operations affect downstream flow. Shifts in streamflow greater than 2,000, 3,000, 5,000 and 10,000 cfs (on an hourly basis) were identified.

Flow records from Carlisle, Tyger and Enoree gages were summed and prorated to the drainage area of the Broad River, approximated by subtracting the drainage area of the Saluda gage from

[1] Kleinschmidt, "Inflow Dataset Development: Statistical Methodology," May 2014.

that of the Congaree gage. This dataset was added to flow records from the Saluda gage, then compared with the Congaree gage data. This provided an hourly estimate of downstream flows without the influence of the Parr Project operations. Flow records from the Alston gage were also prorated and added to flow records from the Saluda gage, and then compared with the Congaree gage data. This allowed for the observation of flow attenuation downstream, or the persistence of a peak wave down to the upper portion of the Congaree River. It also showed how the Saluda Hydro Project influenced flows in the Congaree River. Flows prorated down to the Congaree area were prorated using direct area only, as no regional coefficient or exponent has been determined for this additional drainage area. As with the inflow comparison with the Alston data, the upstream datasets were offset to account for flow travel time (18 hours for the three gages upstream of the Project, and 7 hours to the Alston data).

Discussion

Inflow, which was calculated by adding flows from the Carlisle, Tyger and Enoree gages, was compared to outflow, represented by the Alston gage flows (Appendix A - Figures 1 through 6).

Shifts in streamflow greater than 2,000, 3,000, 5,000, and 10,000 cfs on an hourly basis were identified for the entire period of study (January-May, 2010-2015). Because this evaluation accounts for hourly differences, the percent of time the difference occurs is provided, rather than the number of flow variance events. The average percent of time these variances occur is provided, not the number of flow variance events in any given month or year (which independently could last longer than one hour). The results of these magnitudes and frequency of occurrence are shown in Table 1 below. The frequency and magnitude of flow shifts varied with hydraulic year and operation demands.

Flow Variance	% of Occurrence
2000	20.0%
3000	11.5%
5000	4.7%
10000	0.9%

Table 1 – Project-Induced Flow Variance Magnitude and Frequency

Prorated flow datasets from Carlisle, Tyger and Enoree gages combined with flows records from Saluda, which represents Congaree River inflows without the influence of the Project operation, were graphically compared to flows as recorded by the Congaree River gage (Appendix A - Figures 7 through 12).

Finally, prorated Alston flows added to the flow records from Saluda to compare flows upstream of the Congaree River, which takes into account effects of the Parr Project operations were graphically compared to flows as recorded by the Congaree River gage (Appendix A - Figures 13 through 18).

Figures 19 through 24 in Appendix A depict flow releases from Alston with and without the addition of Saluda flow contributions. This demonstrates that some of the spikes in flow downstream at Congaree are attributed to contributions from the Saluda River, and not the Parr Project.

Next Steps

The RCG should review this information and provide their input to move to the next steps.

1. Does it look like there may be a potential impact on downstream fish spawning? If so, please provide reasons for that assumption.

2. Provide any potential RCG requests that may move towards diminishing the flow impact?

Based on RCG input, SCE&G will go to their Operations Group and determine if the suggested changes are feasible. If the RCG can provide timely input, SCE&G may be able to perform a few one-day tests at the Project to see if the operation changes can be implemented and whether they 1) diminish the peak; 2) cause inconsistencies with safety at the plant, or 3) increase the chances of upstream flooding issues.

APPENDIX A

FLOW DATA

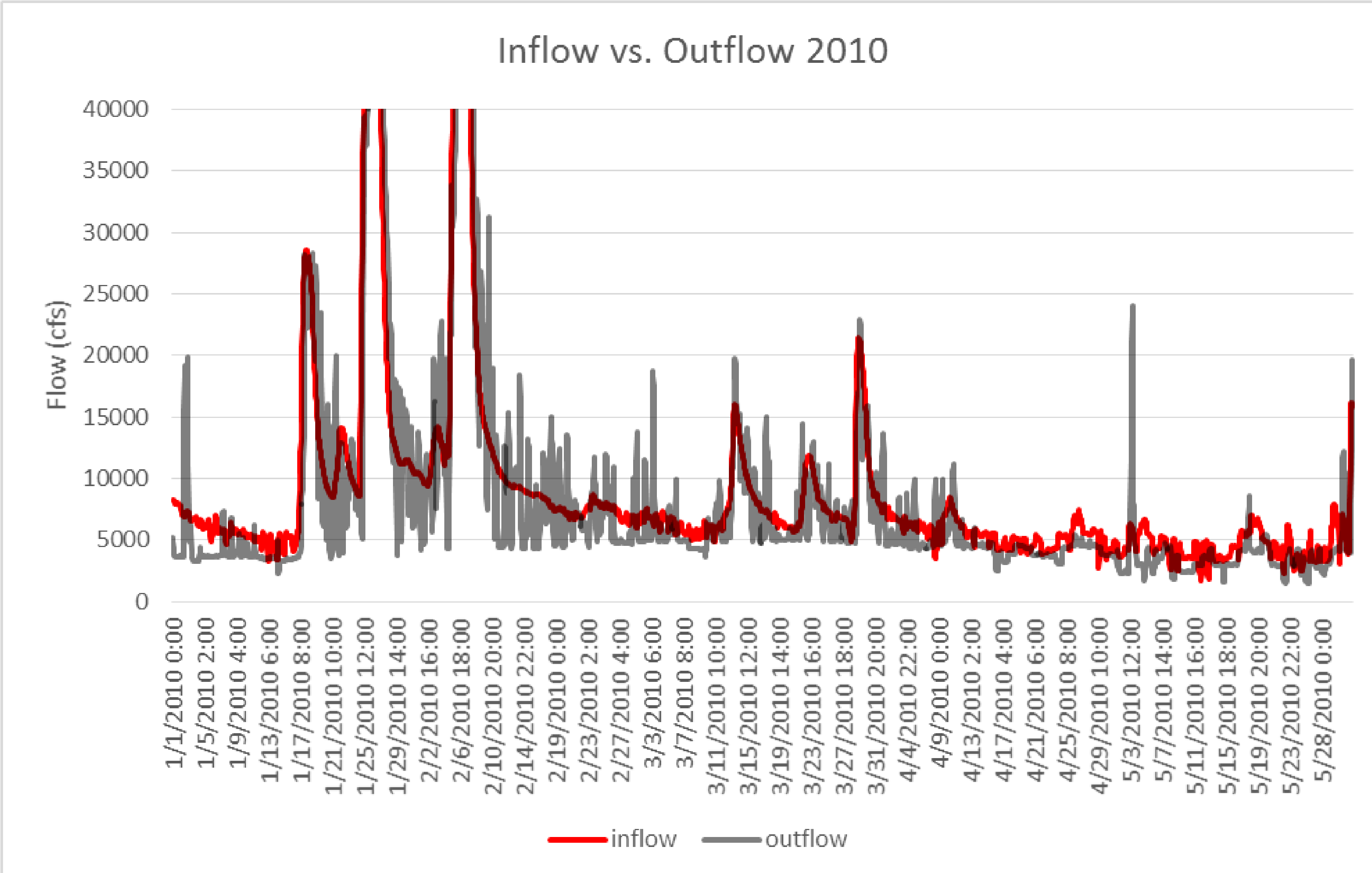

FIGURE 1 2010 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)

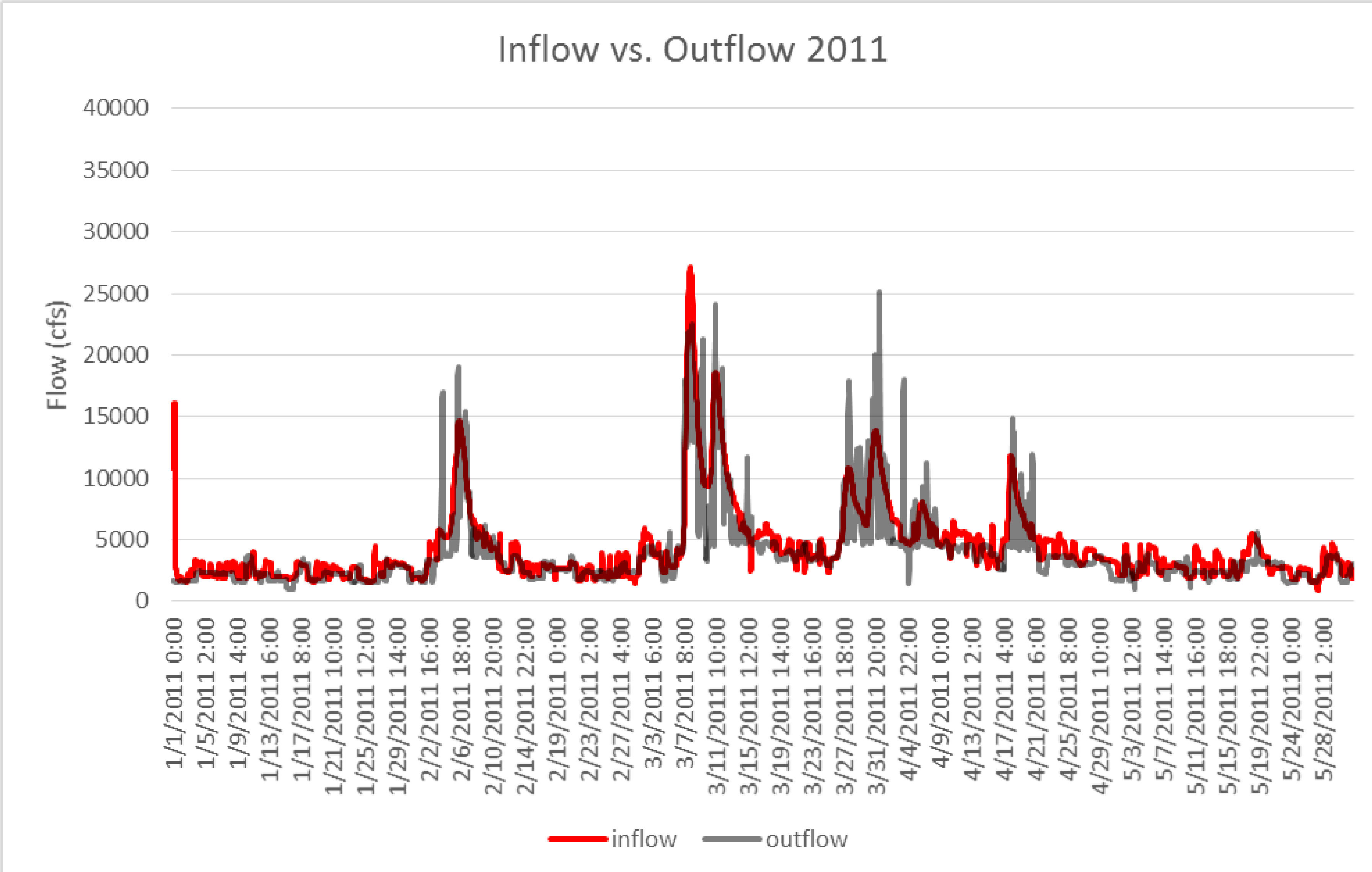

FIGURE 2 2011 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)

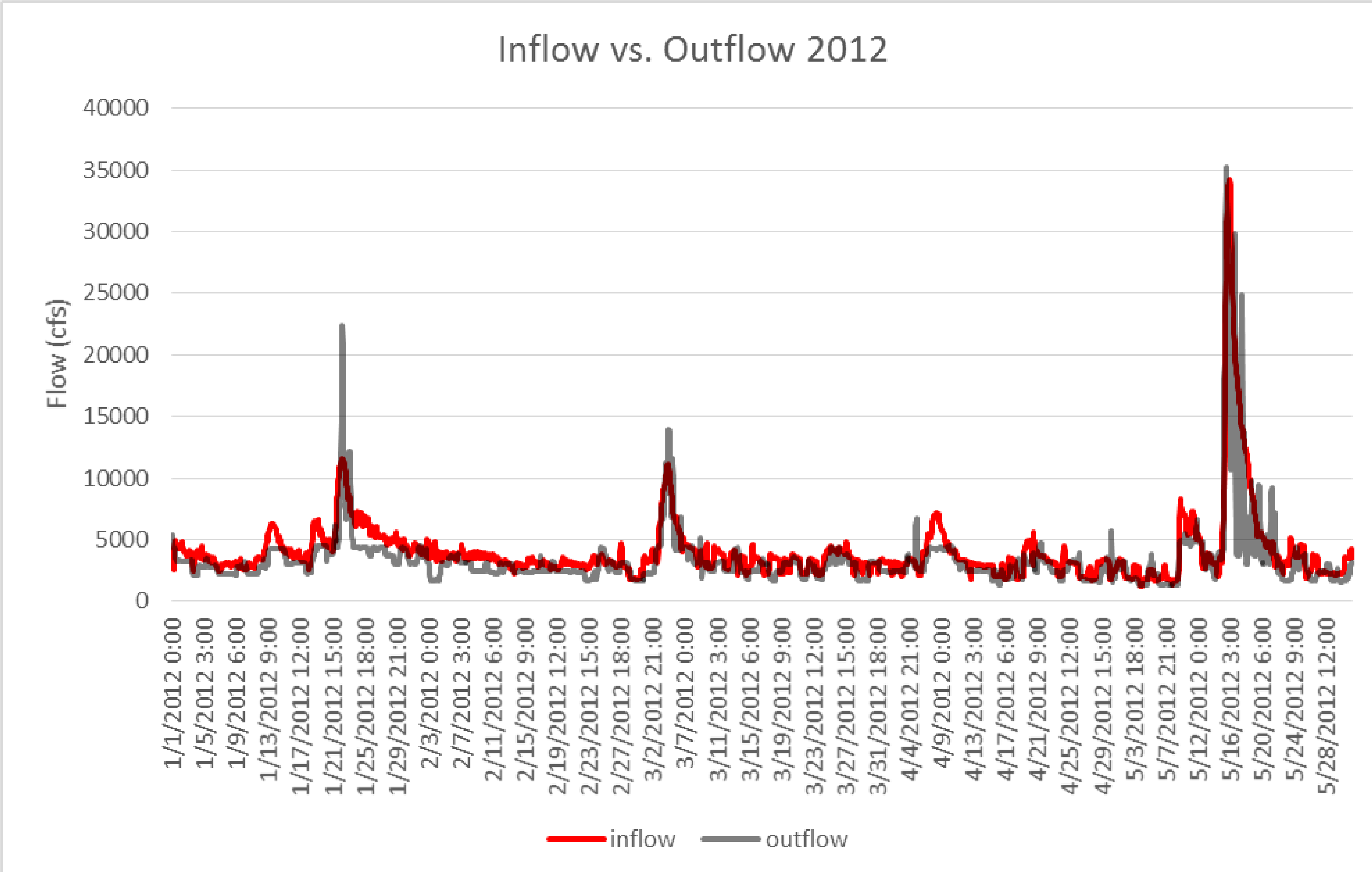

FIGURE 3 **2012 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)**

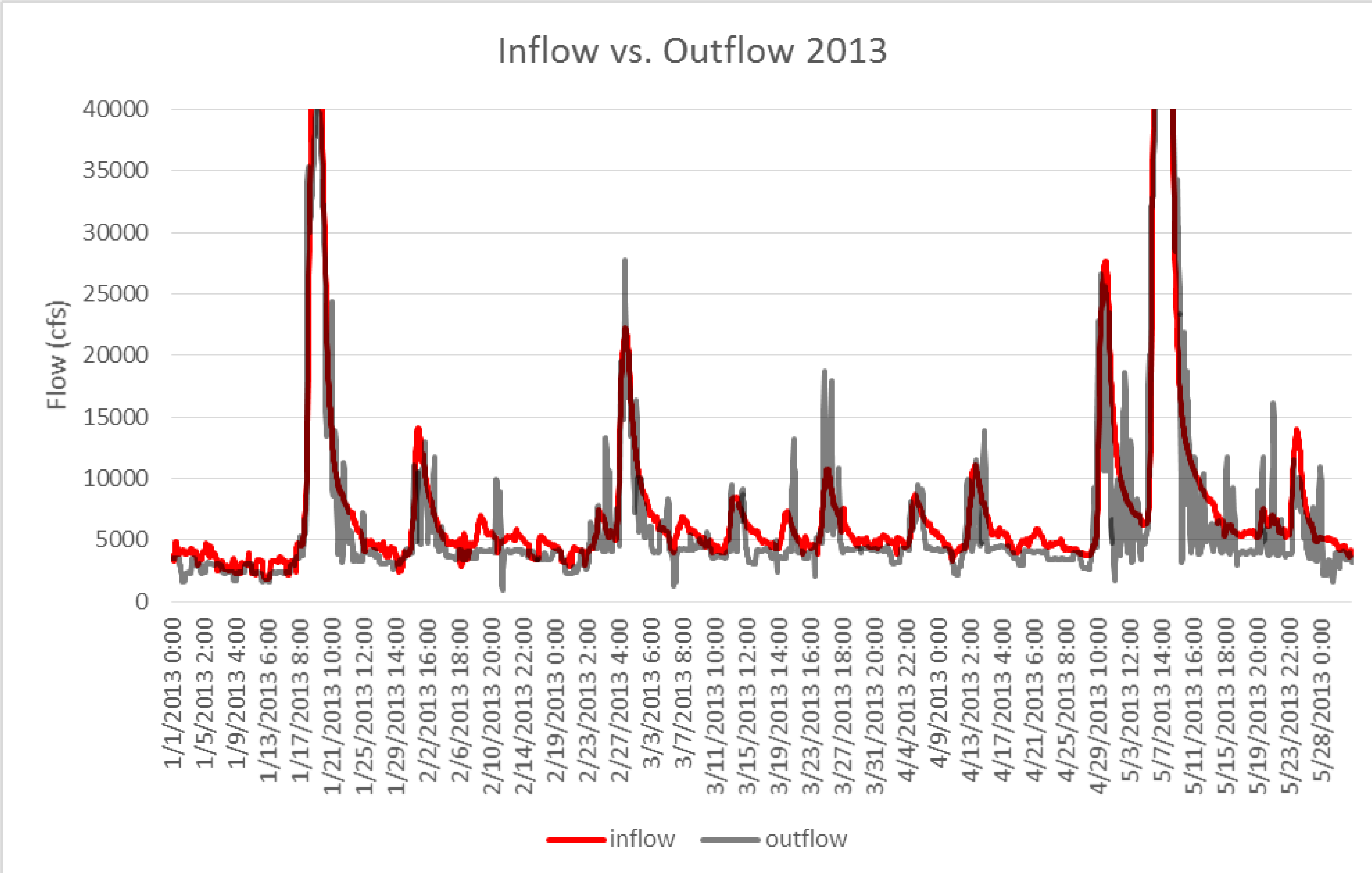

FIGURE 4 2013 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)

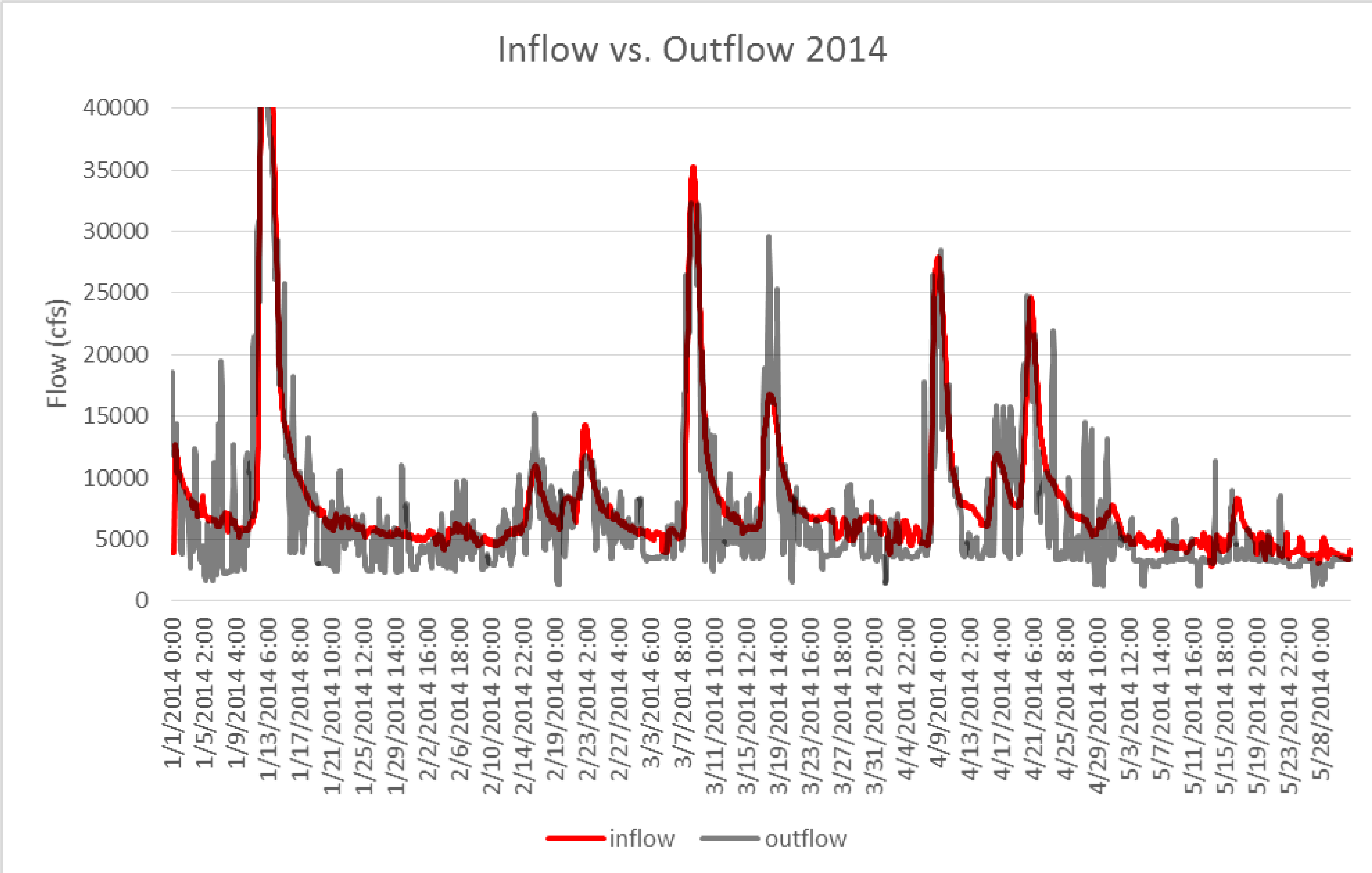

FIGURE 5 2014 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)

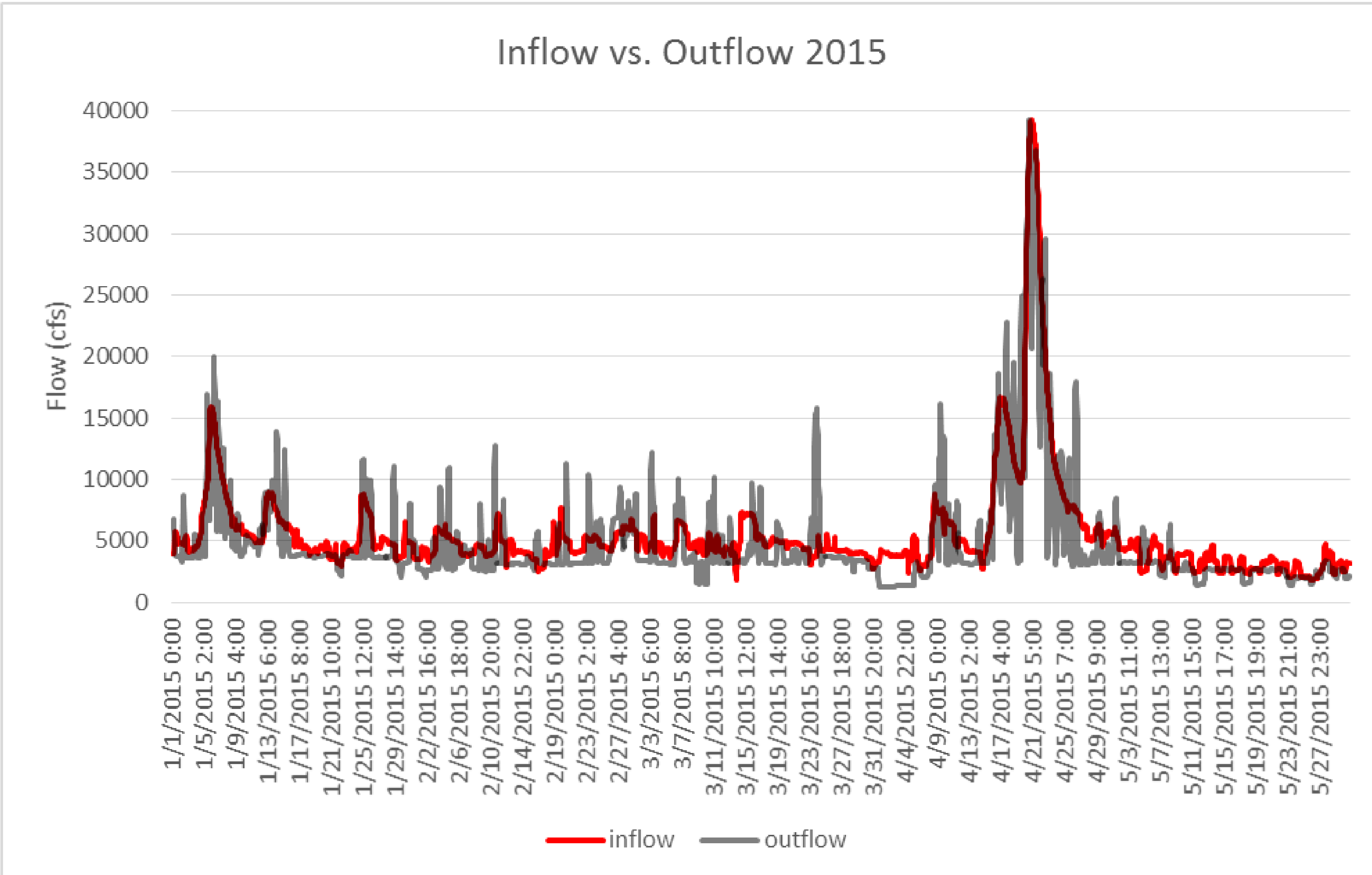

FIGURE 6 **2015 PARR PROJECT INFLOW (CARLISLE, ENOREE, TYGER GAGES) VS. OUTFLOW (ALSTON GAGE)**

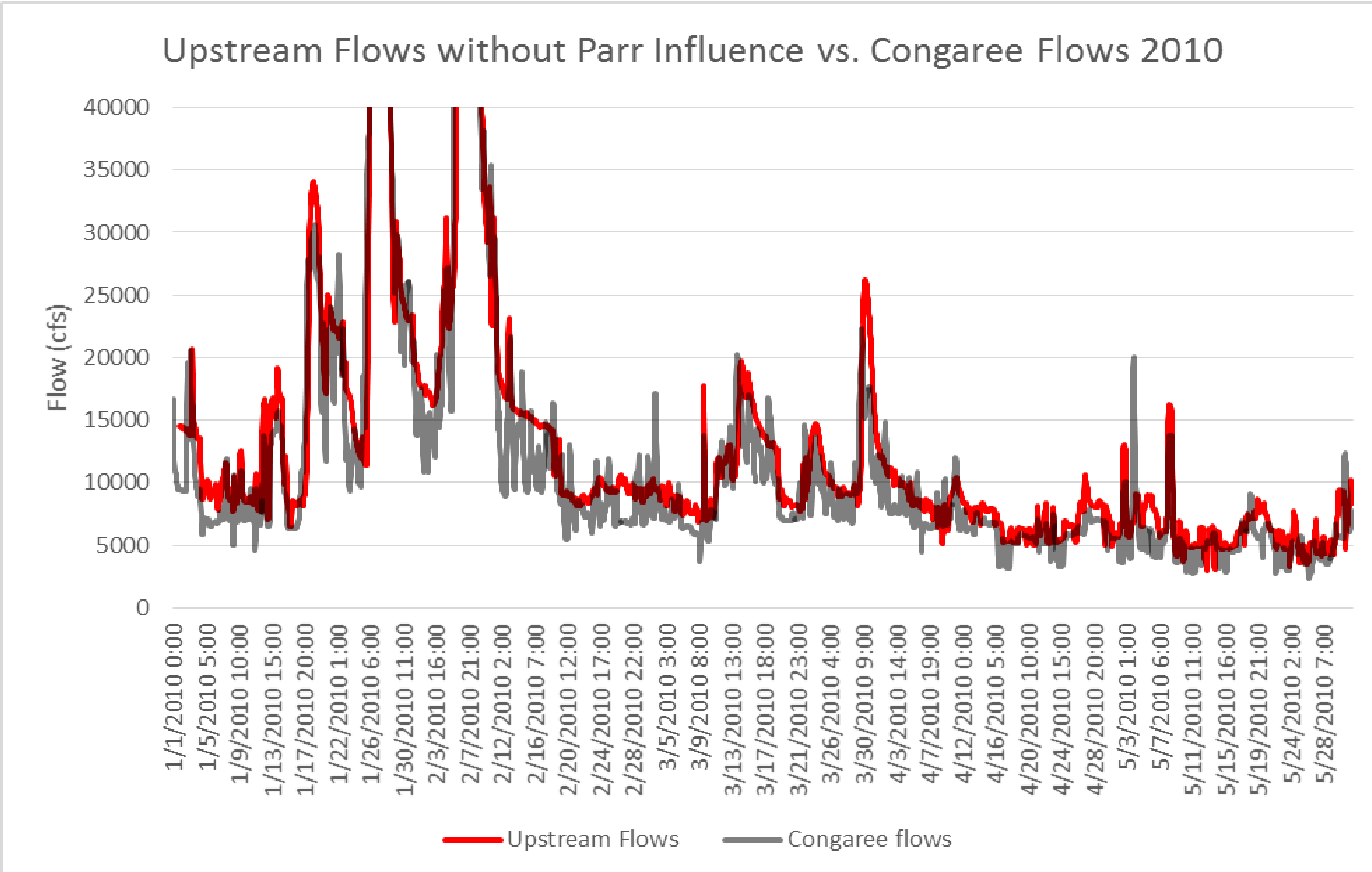

FIGURE 7 2010 UPSTREAM FLOWS (CARLISLE, ENOREE, TYGER, SALUDA GAGES) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)

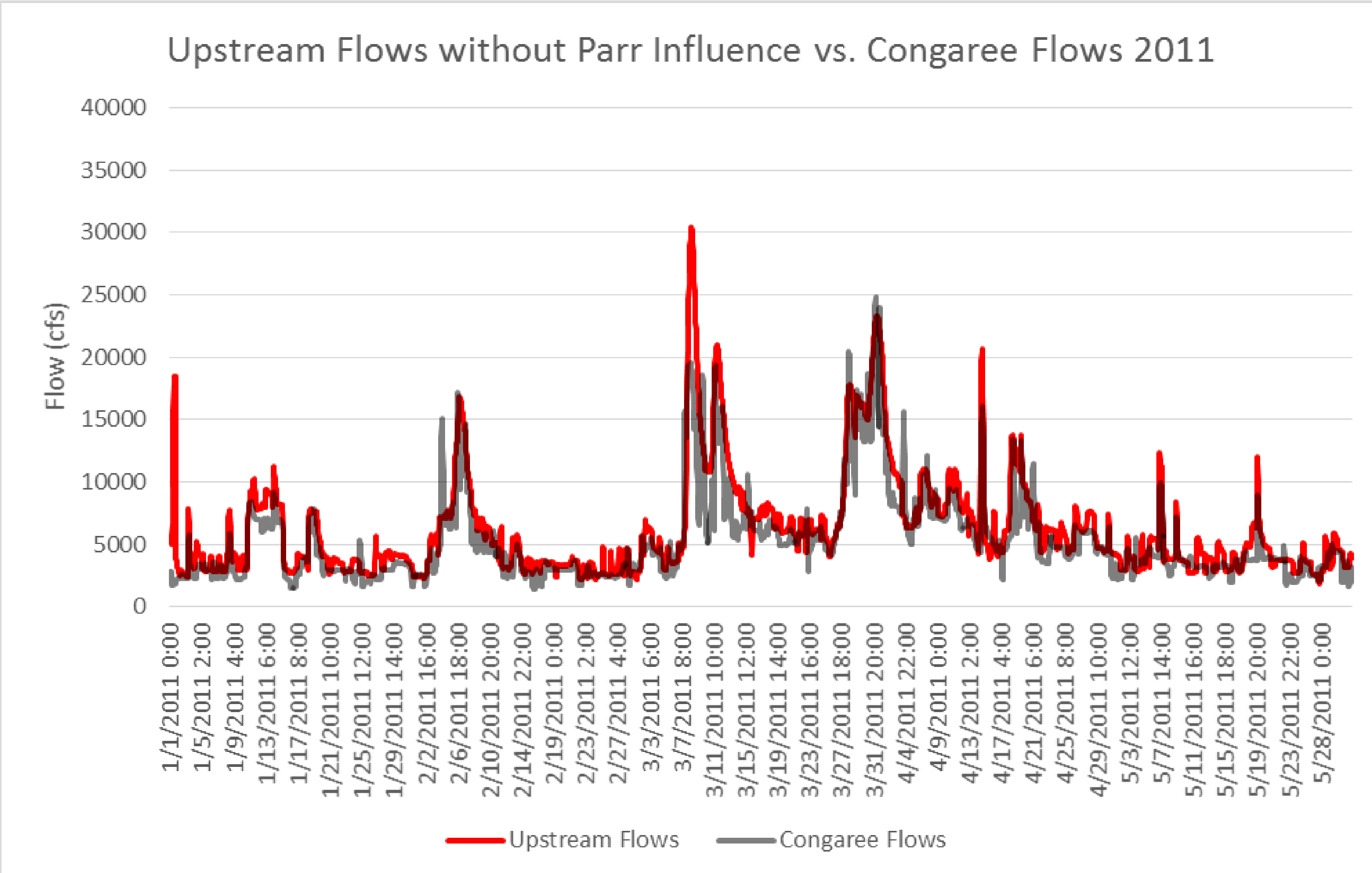

FIGURE 8 **2011 UPSTREAM FLOWS (CARLISLE, ENOREE, TYGER, SALUDA GAGES) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

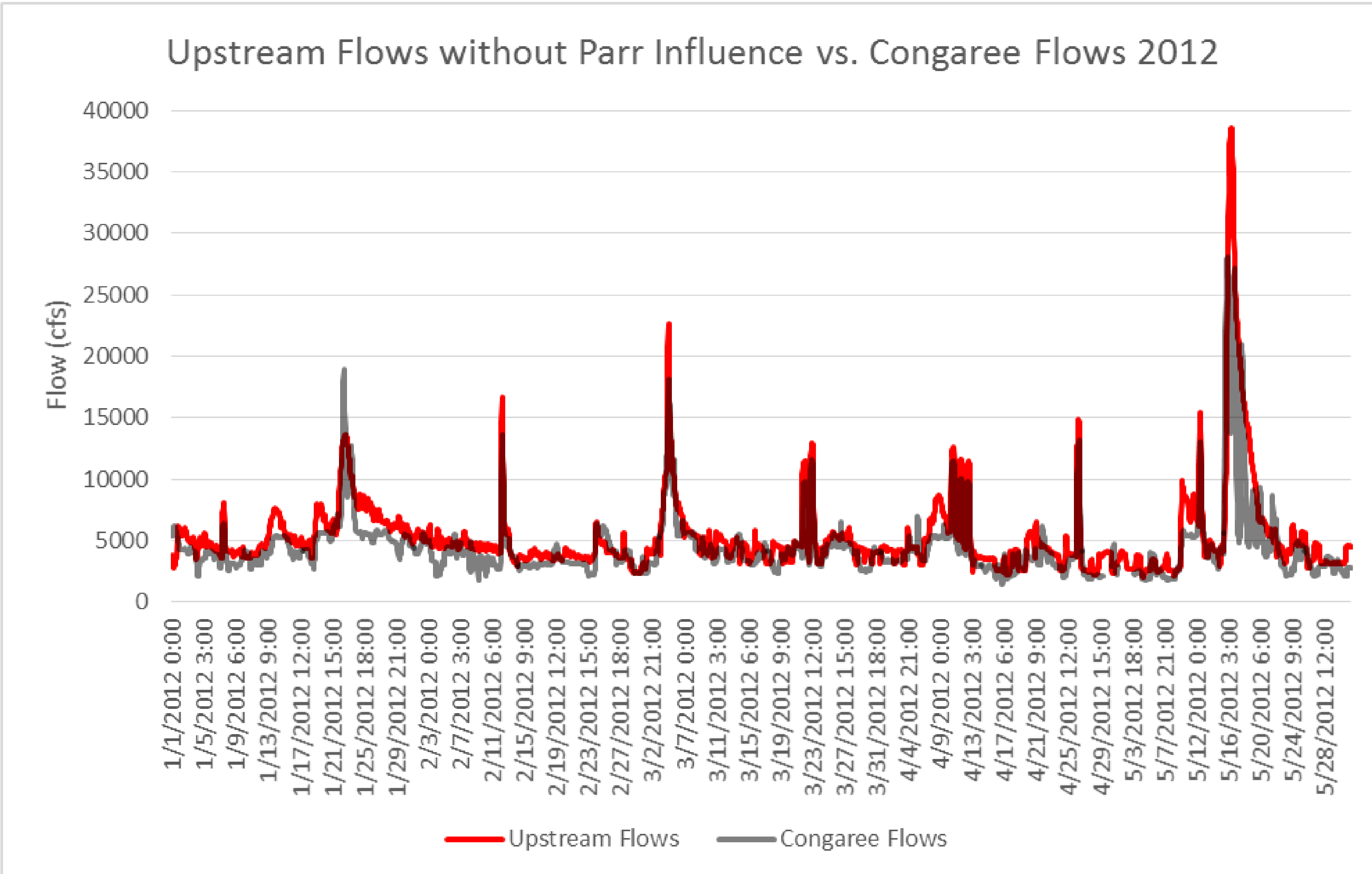

FIGURE 9 **2012 UPSTREAM FLOWS (CARLISLE, ENOREE, TYGER, SALUDA GAGES) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

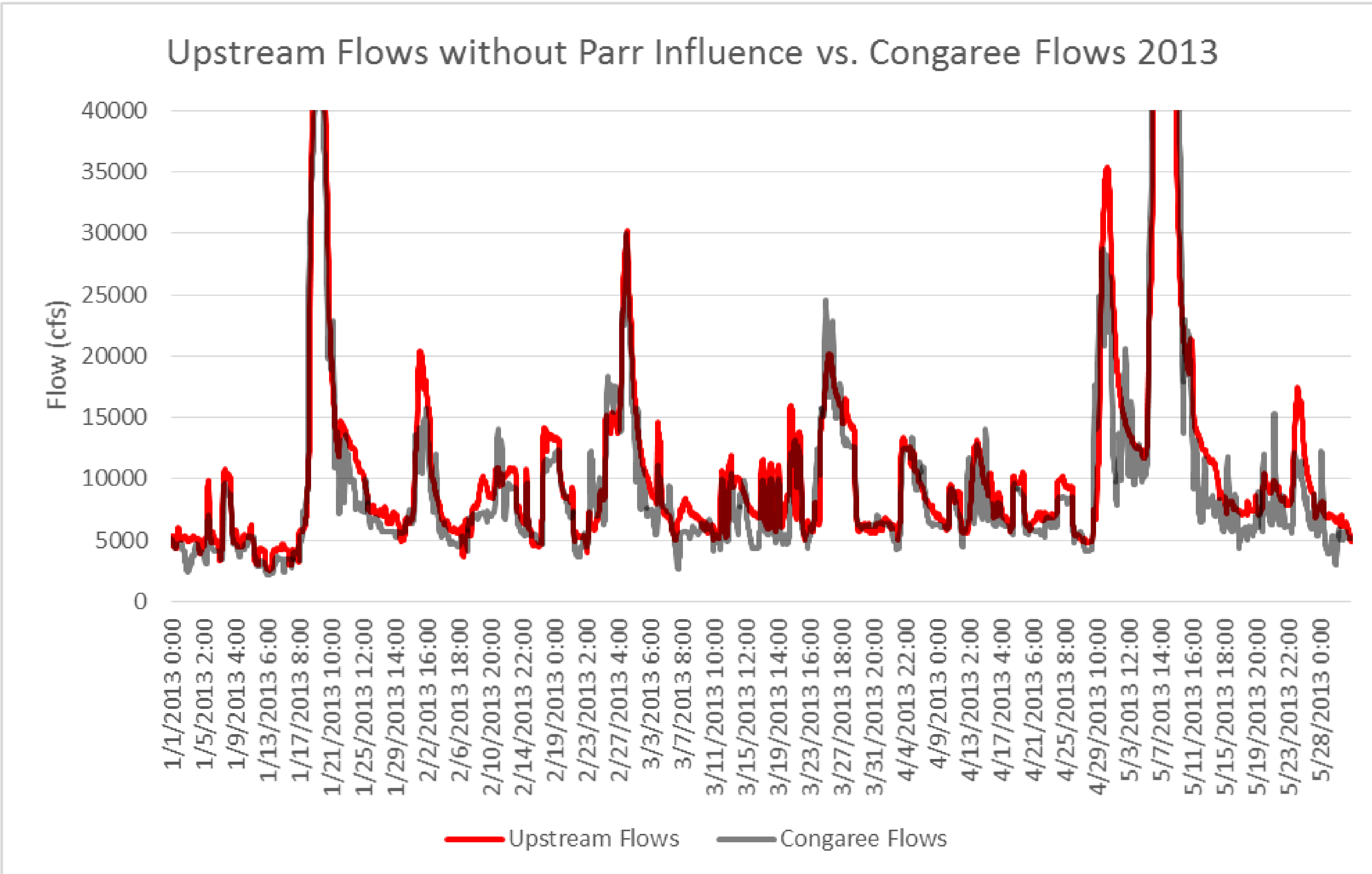

FIGURE 10 **2013 UPSTREAM FLOWS (CARLISLE, ENOREE, TYGER, SALUDA GAGES) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

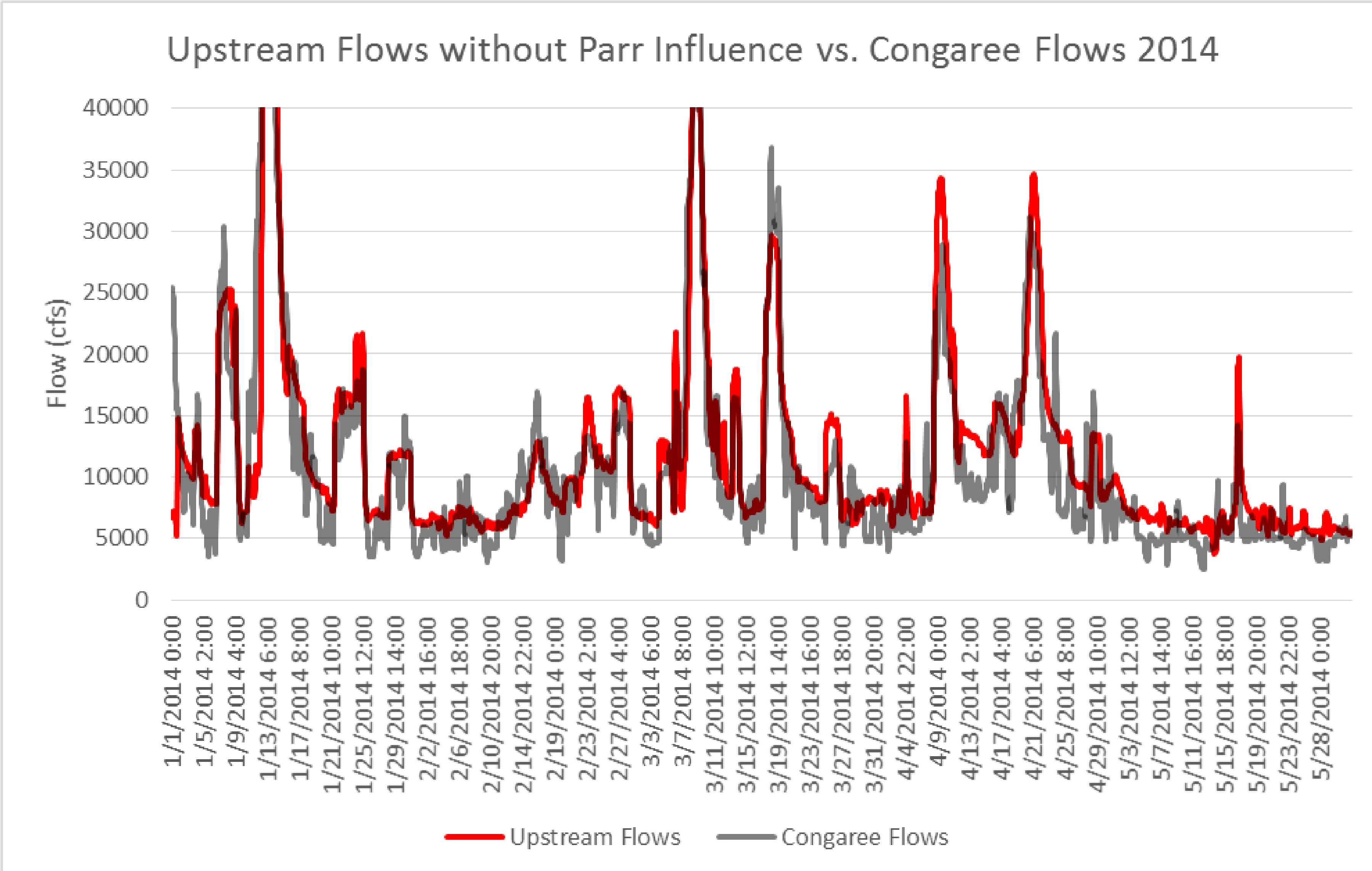

Figure 11 **2014 Upstream Flows (Carlisle, Enoree, Tyger, Saluda Gages) vs. Congaree Flows (Congaree River Gage)**

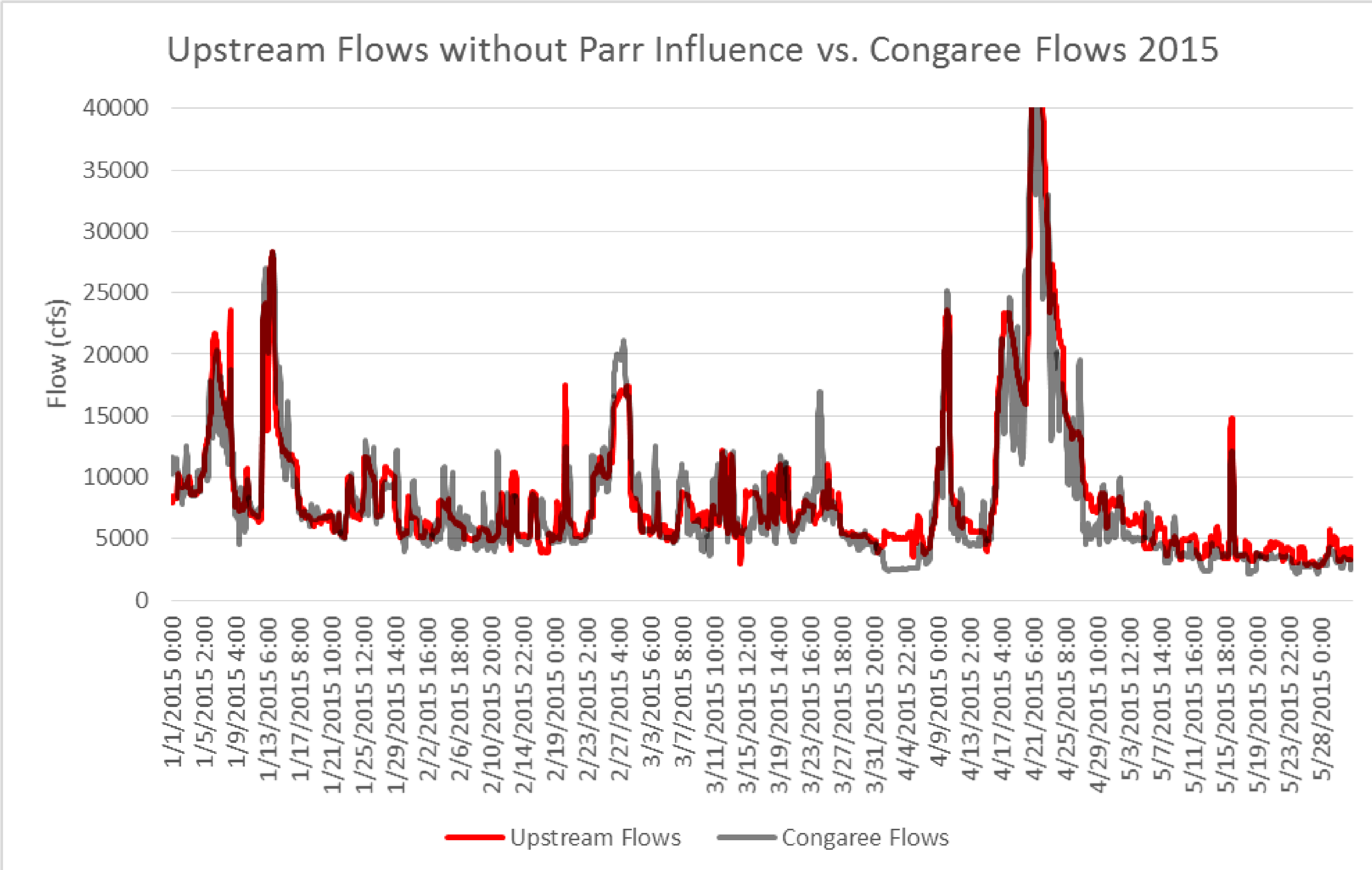

FIGURE 12 **2015 UPSTREAM FLOWS (CARLISLE, ENOREE, TYGER, SALUDA GAGES) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

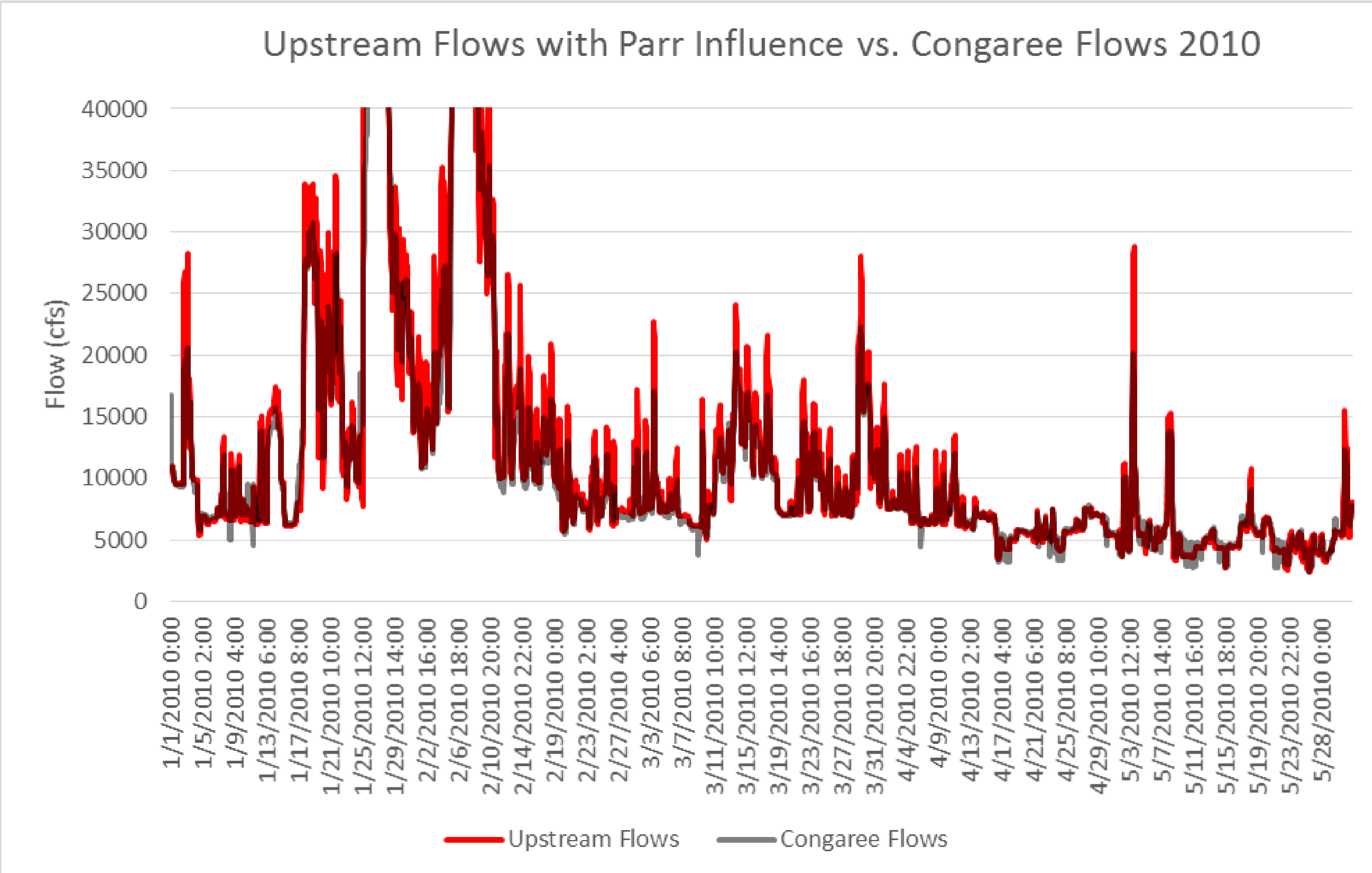

FIGURE 13 **2010 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

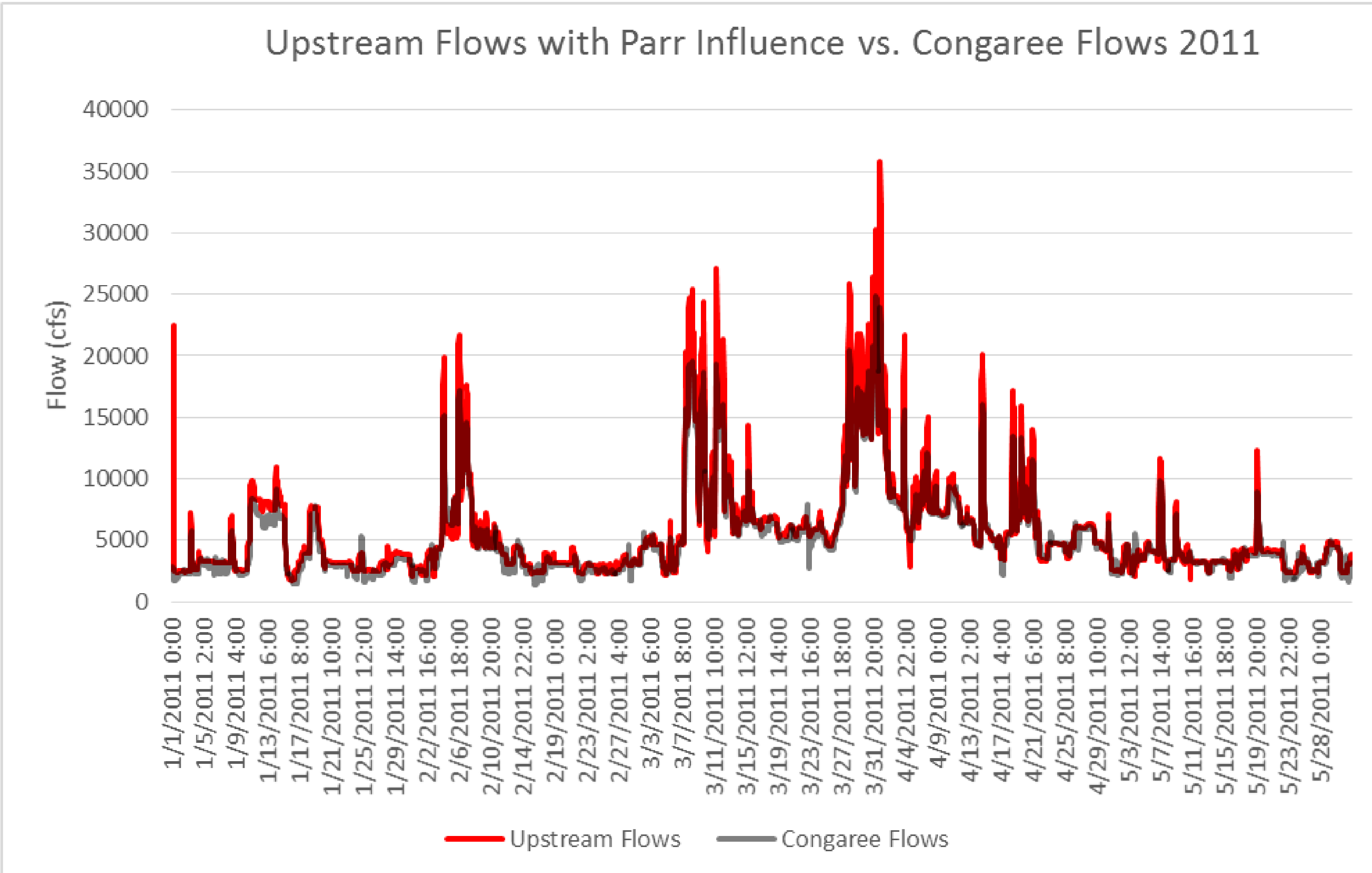

FIGURE 14 2011 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)

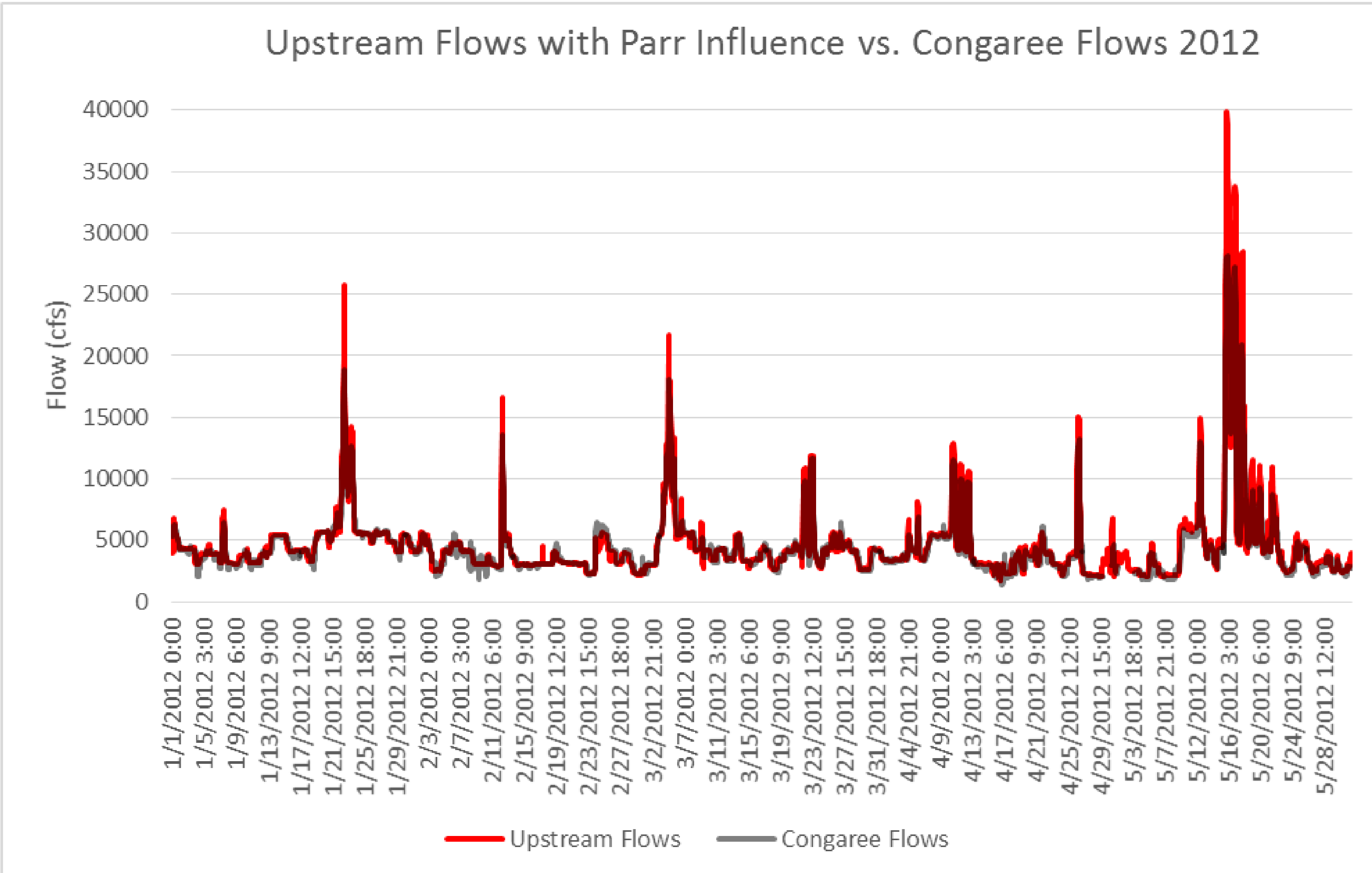

FIGURE 15 2012 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)

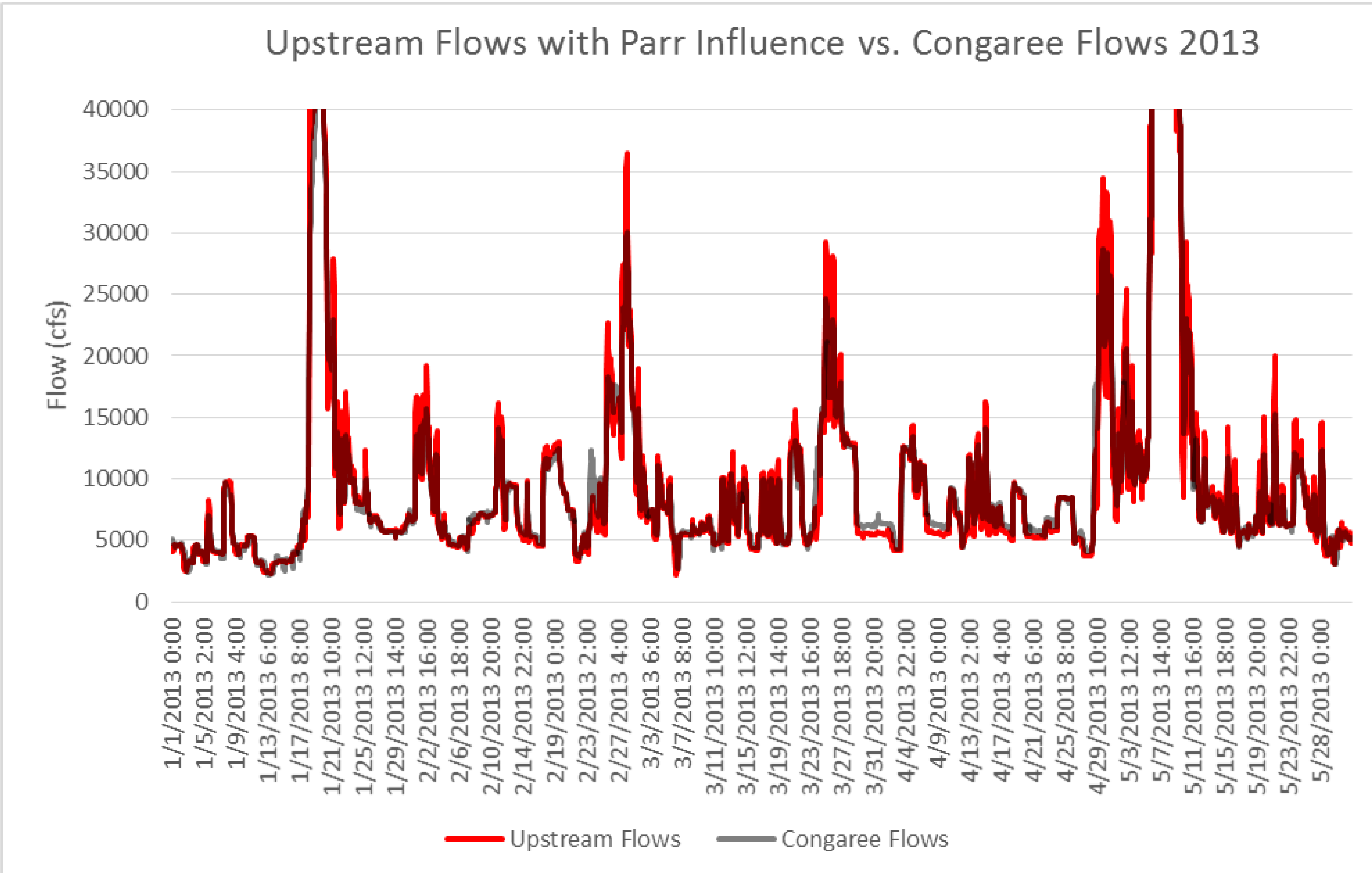

FIGURE 16 2013 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)

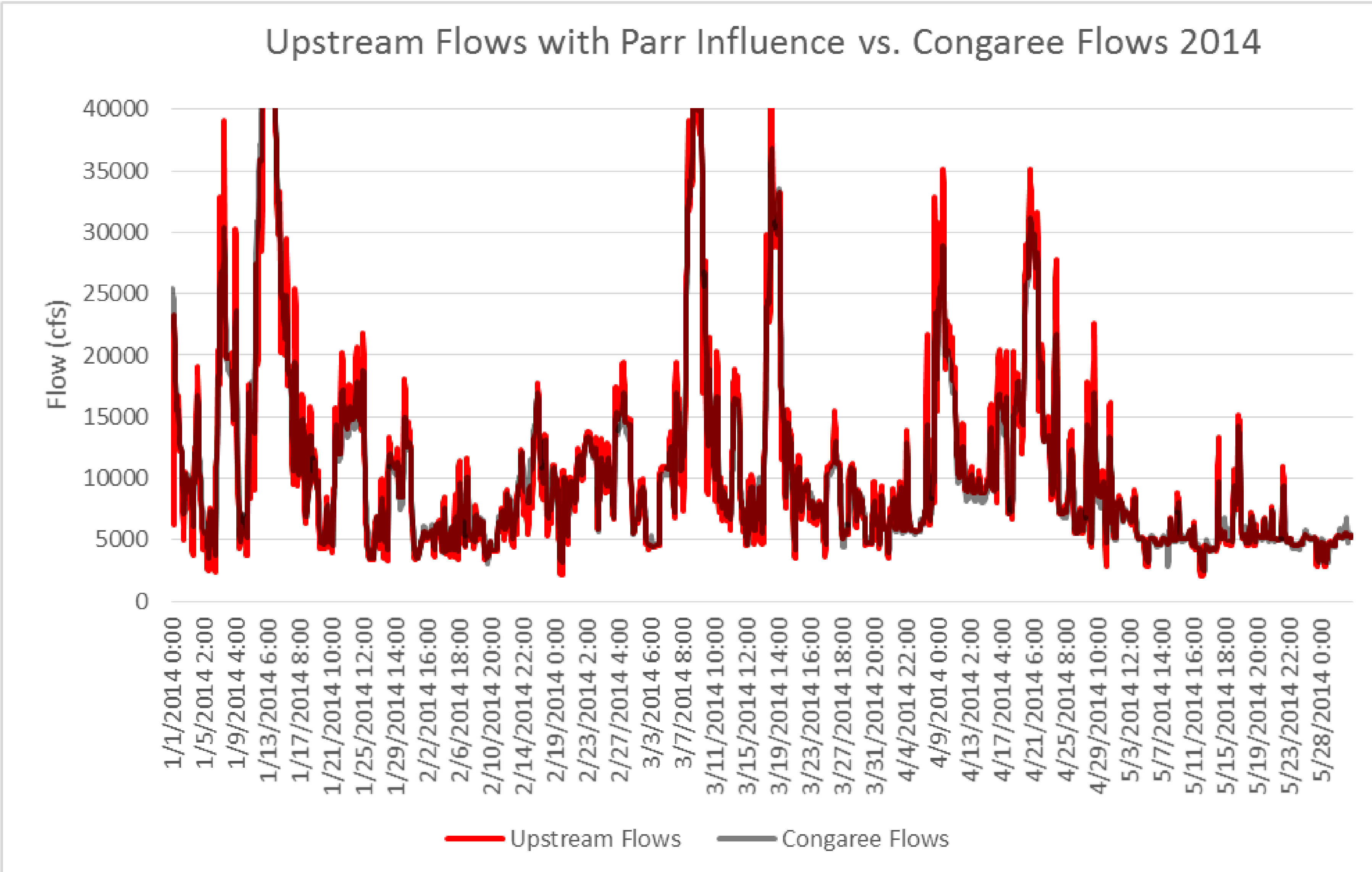

FIGURE 17 **2014 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

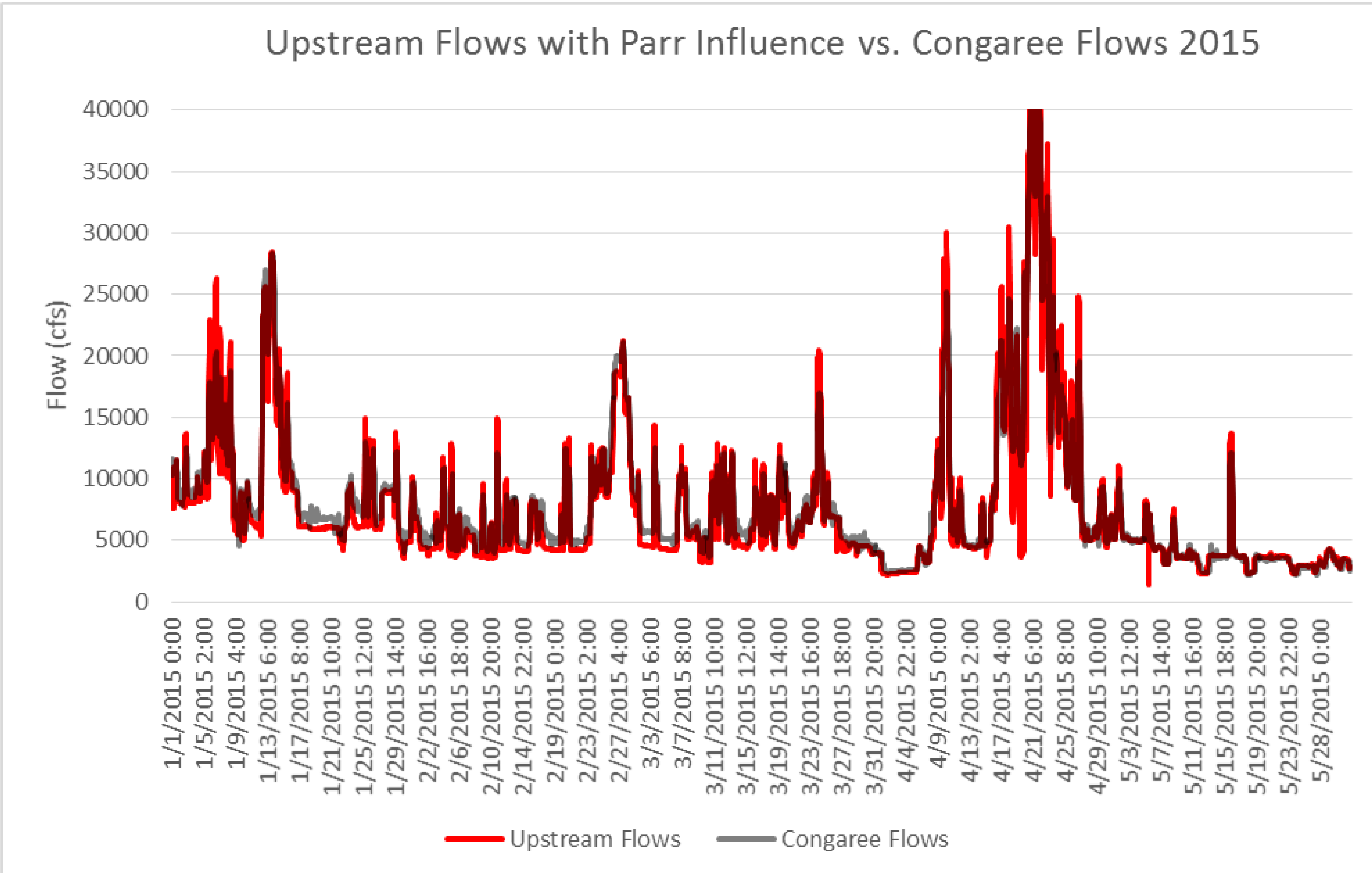

FIGURE 18 **2015 UPSTREAM FLOWS (ALSTON AND SALUDA GAGE) VS. CONGAREE FLOWS (CONGAREE RIVER GAGE)**

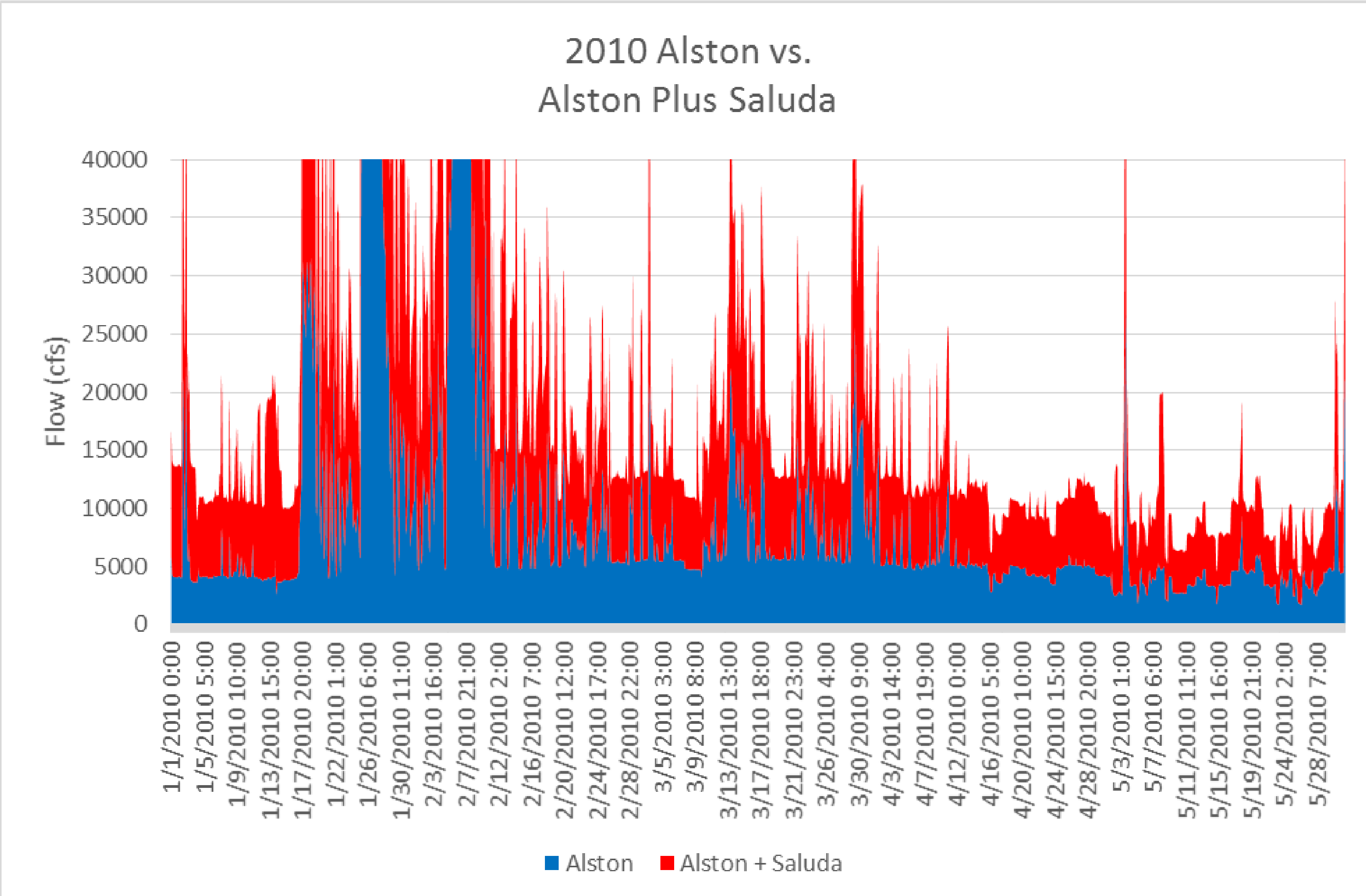

FIGURE 19 2010 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS

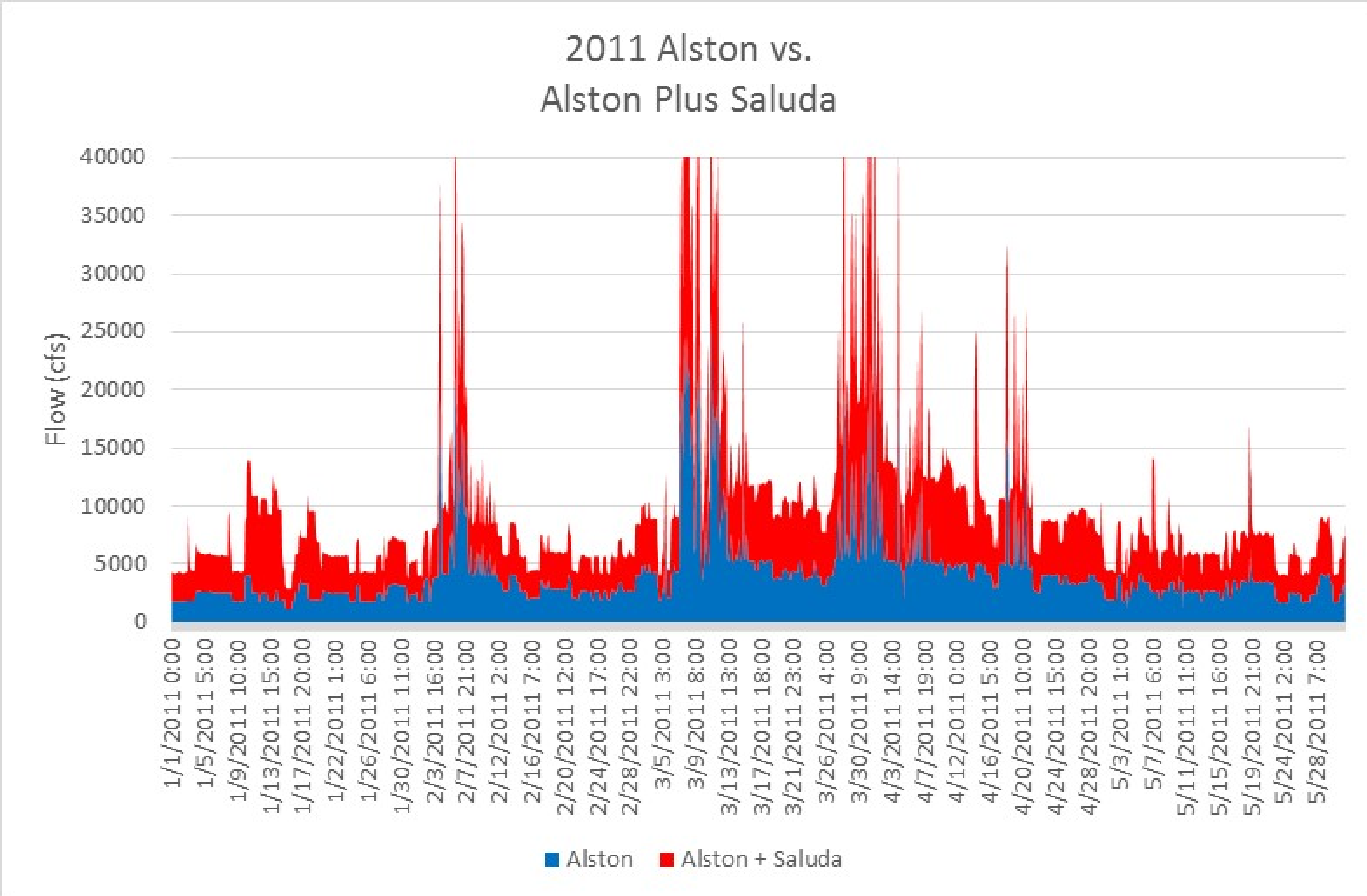

FIGURE 20 2011 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS

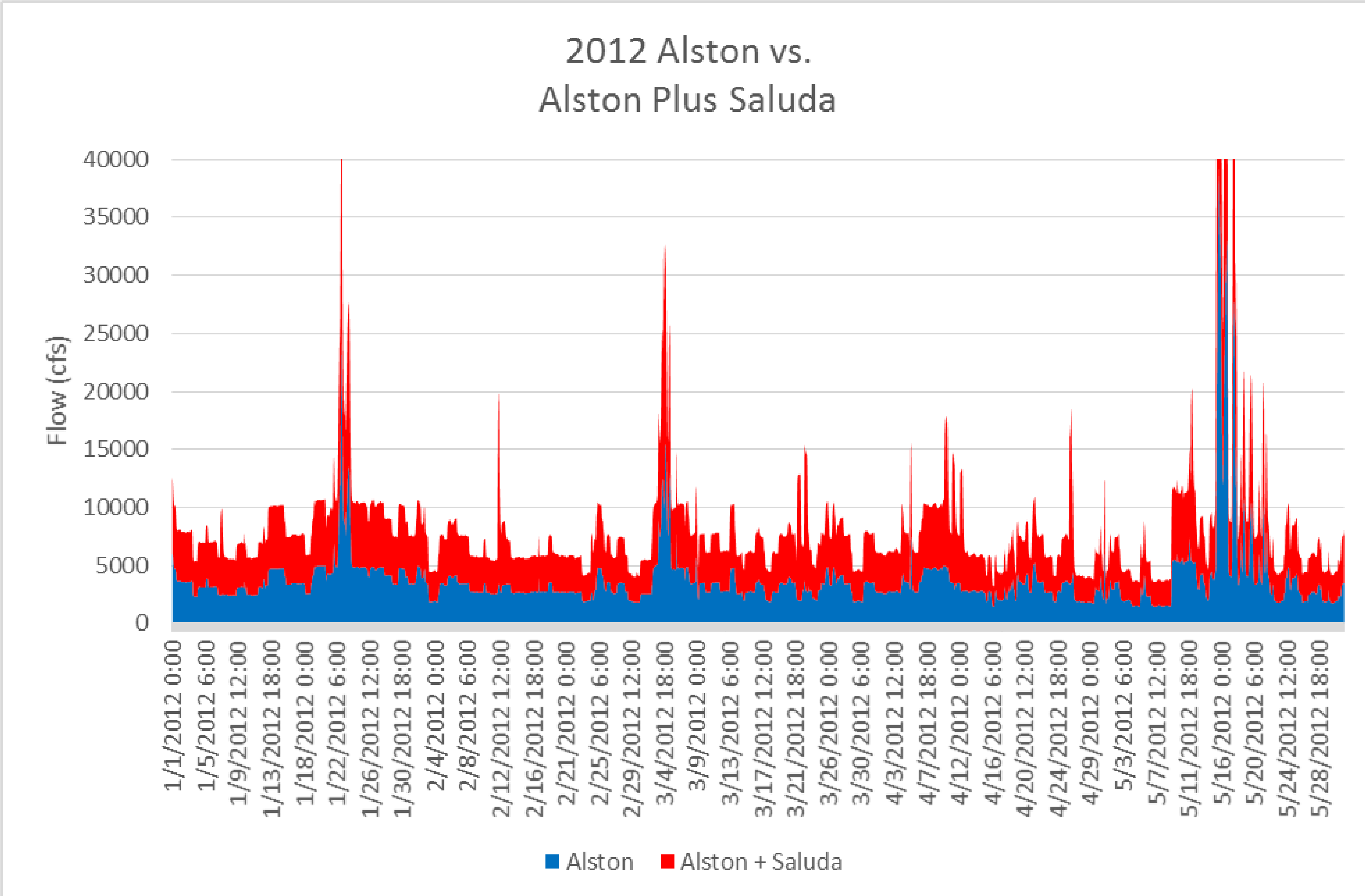

FIGURE 21 2012 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS

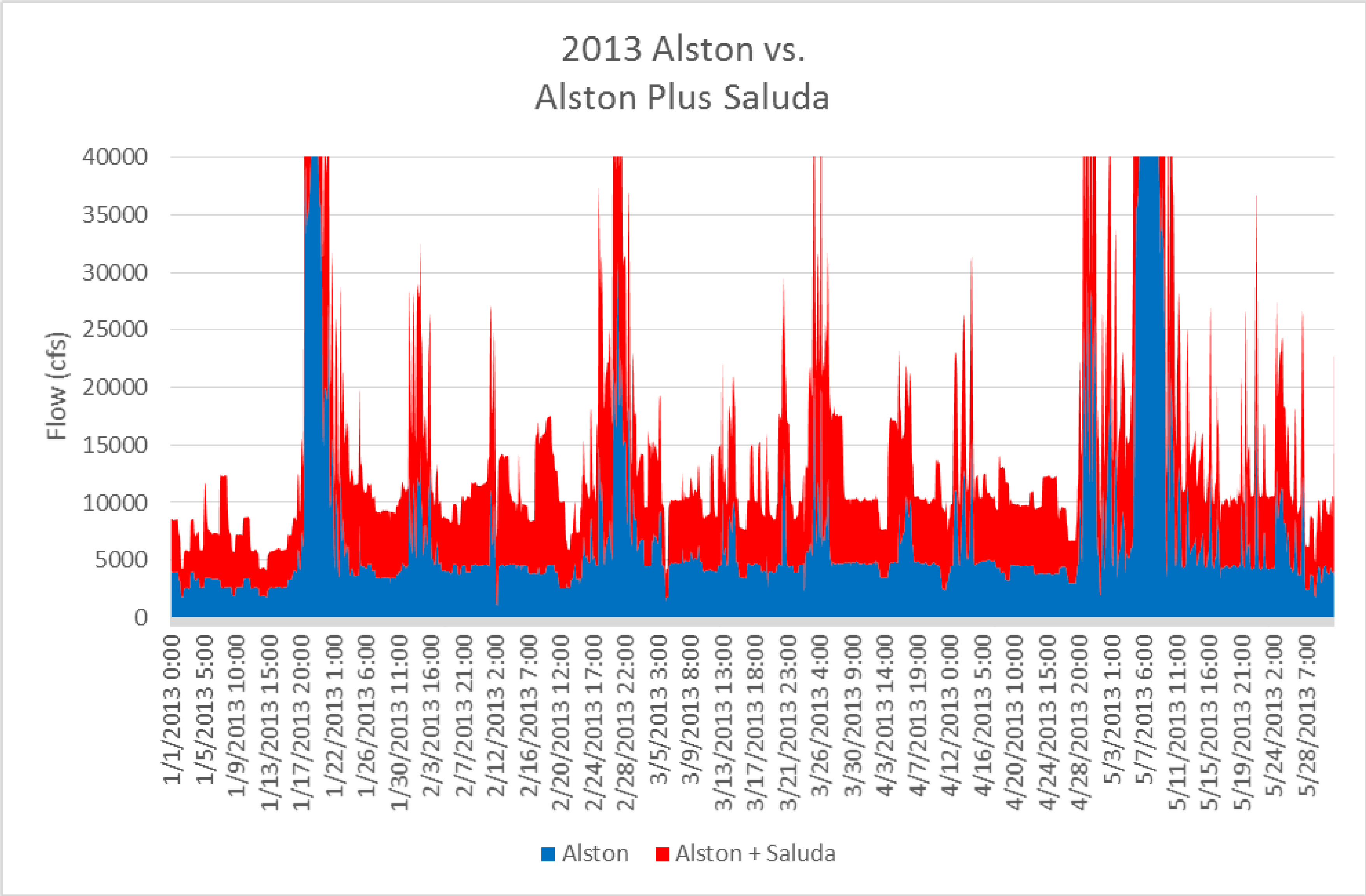

FIGURE 22 2013 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS

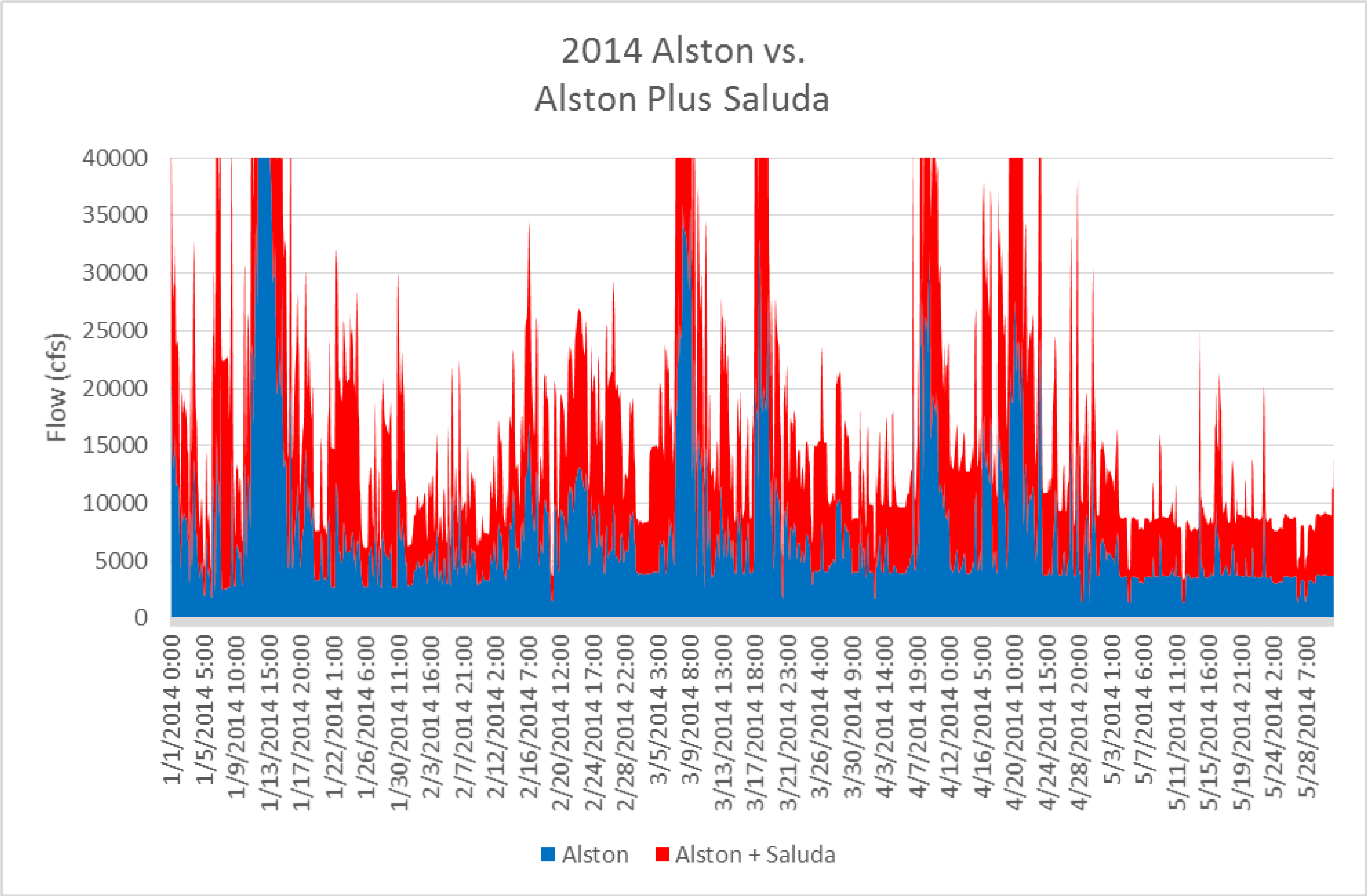

FIGURE 23 2014 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS

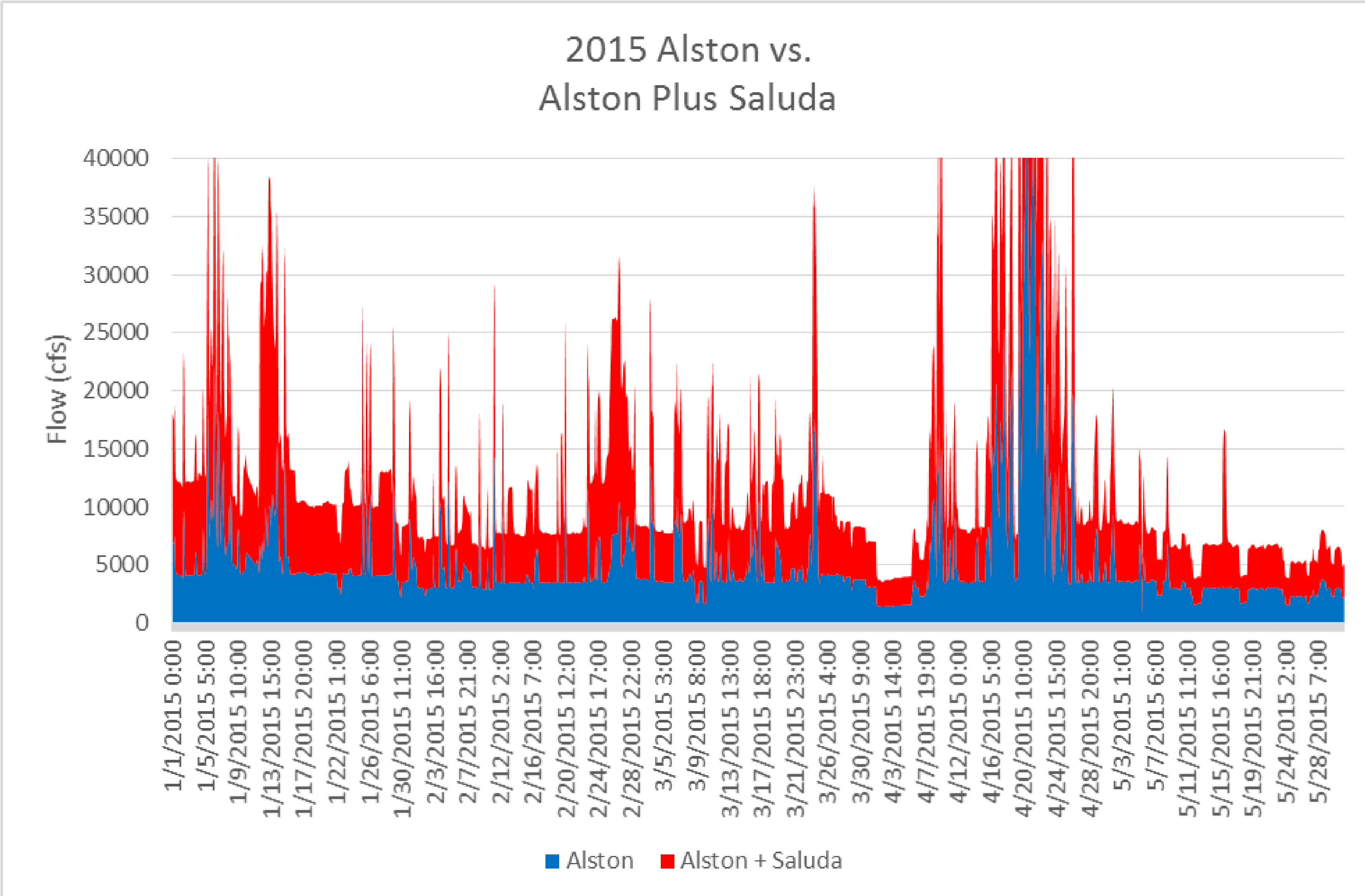

FIGURE 24 2015 ALSTON FLOWS VS. ALSTON AND SALUDA COMBINED FLOWS