

PARR HYDROELECTRIC PROJECT – FERC No. 1894
PARR SHOALS DAM TURBINE VENTING – MEMORANDUM 2

TO: Water Quality Technical Working Committee
FROM: Kleinschmidt Associates
DATE: November 6, 2017
RE: 2017 Turbine Venting Test Results

INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) is the Licensee for the Parr Hydroelectric Project (FERC No. 1894) (Project). The Project consists of the Parr Shoals Development and the Fairfield Pumped Storage Development. Both developments are located along the Broad River in Fairfield and Newberry Counties, South Carolina.

The Project is in a relicensing process which involves cooperation and collaboration between SCE&G, as licensee, and a variety of stakeholders including state and federal resource agencies, state and local government, non-governmental organizations (NGO), and interested individuals. SCE&G has established several Technical Working Committees (TWC's) whose members include interested stakeholders. The TWC's objectives include the evaluation of relicensing issues and making recommendations to address these issues in the new license.

Following the completion of the Parr Hydroelectric Project Baseline Water Quality Report, there were questions regarding occasional low dissolved oxygen (DO) in the tailrace downstream of Parr Shoals Dam. At a Water Quality TWC meeting on February 4, 2014, the TWC noted that the Baseline Water Quality Report identified periodic excursions of dissolved oxygen (DO) levels less than 4.0 mg/L in the Parr Shoals Dam tailrace, as reported by the USGS station 02160991. SCE&G consolidated historic USGS data to examine these excursions and issued an addendum to the Baseline Water Quality Report in June 2014. At the request of the Water Quality TWC, SCE&G collected additional water quality data in the summer of 2014 in the tailrace and forebay of Parr Shoals Dam to determine whether project operations are causing these excursions. These results were summarized in a memo issued on March 2, 2015. SCE&G followed up this effort by collecting another series of water quality data in the Parr forebay from

May through mid-October 2015. The results of that data collection effort were summarized in the October 2016 Parr Shoals Dam Turbine Venting Report.

Additionally, SCE&G tested each of the Parr turbines for their ability to self-vent and potentially increase the dissolved oxygen in the tailrace during specific periods of the year. An initial test of the turbines' capacity to vent was performed August 2014; a second test to determine which turbines had the most significant impact on increasing DO was performed in July 2015. The results of the testing, along with the findings published in the Baseline Water Quality Report were used to develop a Turbine Venting Plan. SCE&G conducted a test of the Turbine Venting Plan from June 15 through July 31 of 2016. The results of this test were reported as a Memorandum dated August 15, 2016 and included as Appendix B to the April 2017 Parr Shoals Dam Turbine Venting Plan. In this Memorandum SCE&G proposed to perform turbine venting tests during 2017, and to extend the venting operation period in the Turbine Venting Plan to June 15 through August 31.

SCE&G operated the Parr Development according to the Turbine Venting Plan from June 15 to August 31, 2017. This memo compares DO levels measured at the USGS gauge in the tailrace to generation data during this period to determine how successful the Turbine Venting Plan was during 2017.

METHODS

Dissolved oxygen data was obtained from the Jenkinsville river gage (USGS 02160991; USGS 2017) and generation data was provided by SCE&G. Dissolved oxygen and generation data were compared from June 15, 2017- August 31, 2017, during the period when SCE&G operated Parr according to the Turbine Venting Plan. Hourly and daily mean dissolved oxygen levels were compared to hourly and daily mean generation, which was described by total megawatts produced (MW).

RESULTS

Daily mean DO levels between June 15 and August 31, 2017 ranged from 4.1 to 7.4 mg/l. A total of 6 days (July 22-24 and August 15-16, & 22) had mean DO levels below 5.0 mg/l, and 71 days

had a daily mean DO at or above 5.0 mg/l (Figure 1). A total of 28 out of 1,863 measurements recorded DO levels below 4.0 mg/l (Figure 2). DO levels less than 4.0 mg/l were recorded over several measurements each on July 21st, 22nd, 23rd, and 25th., as well as once on August 19.

Daily generation ranged from 39.1 MW to 190.8 MW (Figure 1).

Instantaneous DO levels generally remained above 6 mg/l during June, and briefly dropped below 5 mg/l for one hour on June 22nd (Figure 3). Instantaneous DO levels were highly variable during July, and generally remained above 5 mg/l except for a five-day period in late July (July 21st- July 25th) where DO levels dropped below 5 mg/l (Figure 4). Instantaneous DO levels generally remained above 5 mg/l in August, and dropped below 4 mg/l for one hour on August 19th (Figure 5).

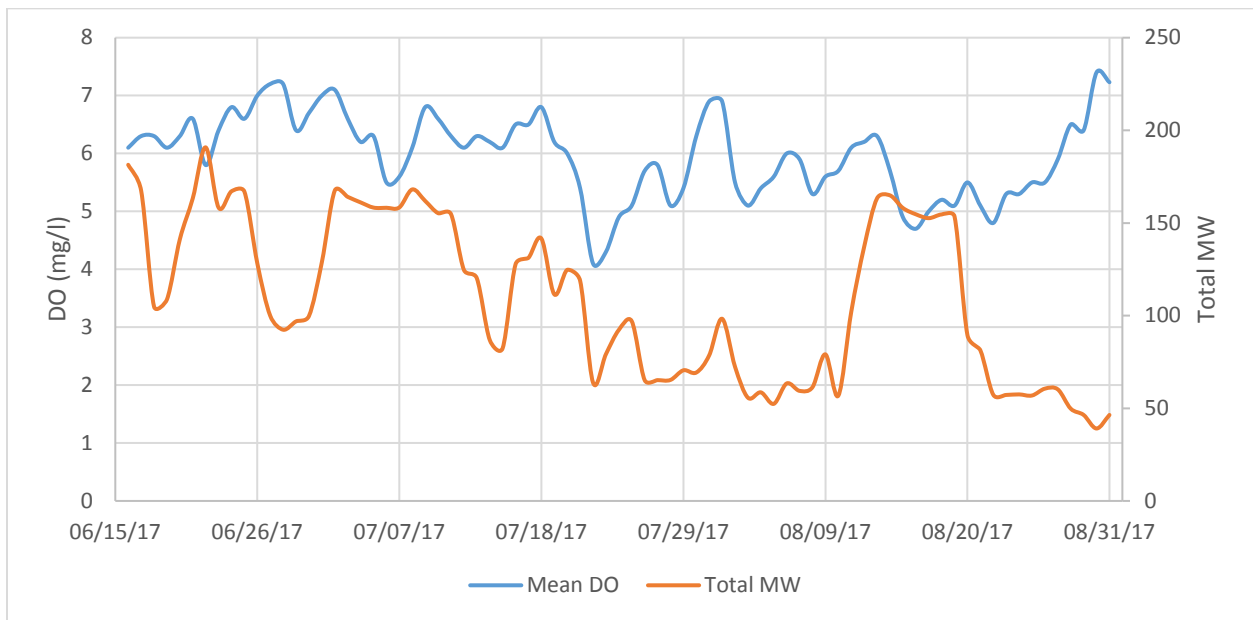


FIGURE 1. TOTAL DAILY GENERATION AND DAILY MEAN DO AT THE JENKINSVILLE GAGE LOCATED DOWNSTREAM OF PARR SHOALS DAM

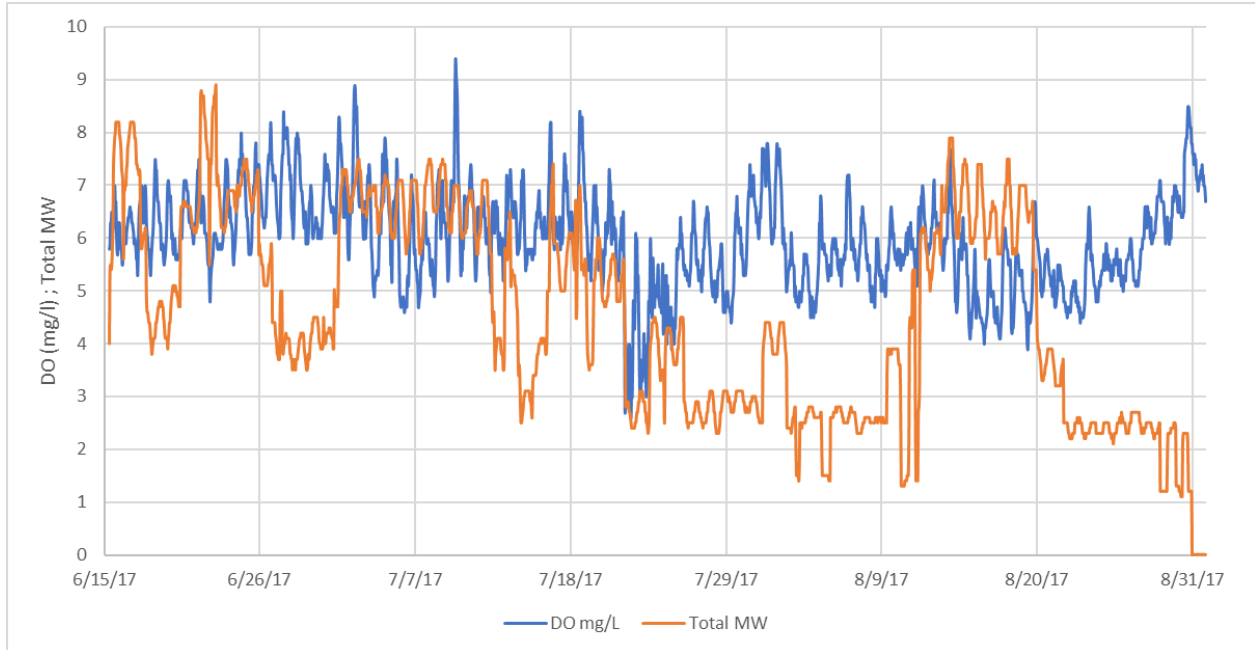


FIGURE 2. HOURLY DO LEVELS AND HOURLY GENERATION (JUNE 15-AUGUST 31)

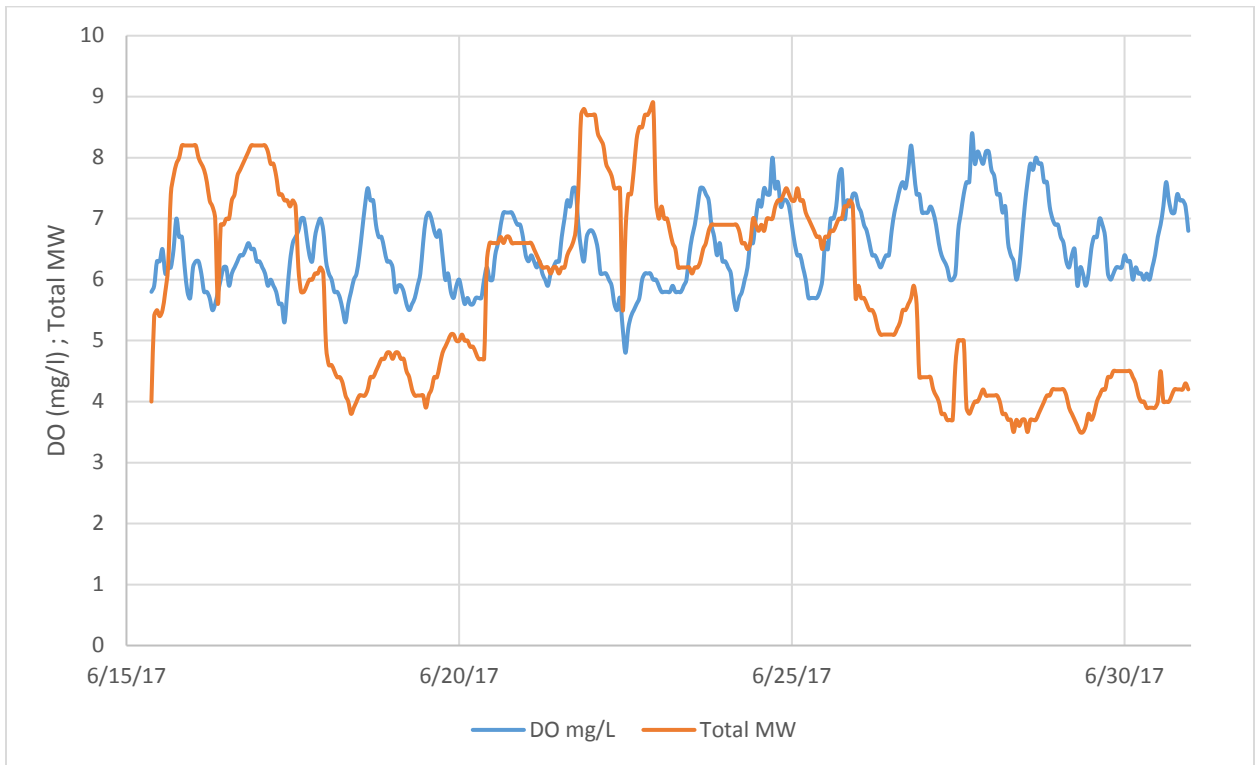


FIGURE 3. HOURLY DO LEVELS AND HOURLY GENERATION (JUNE 15- JUNE 30)

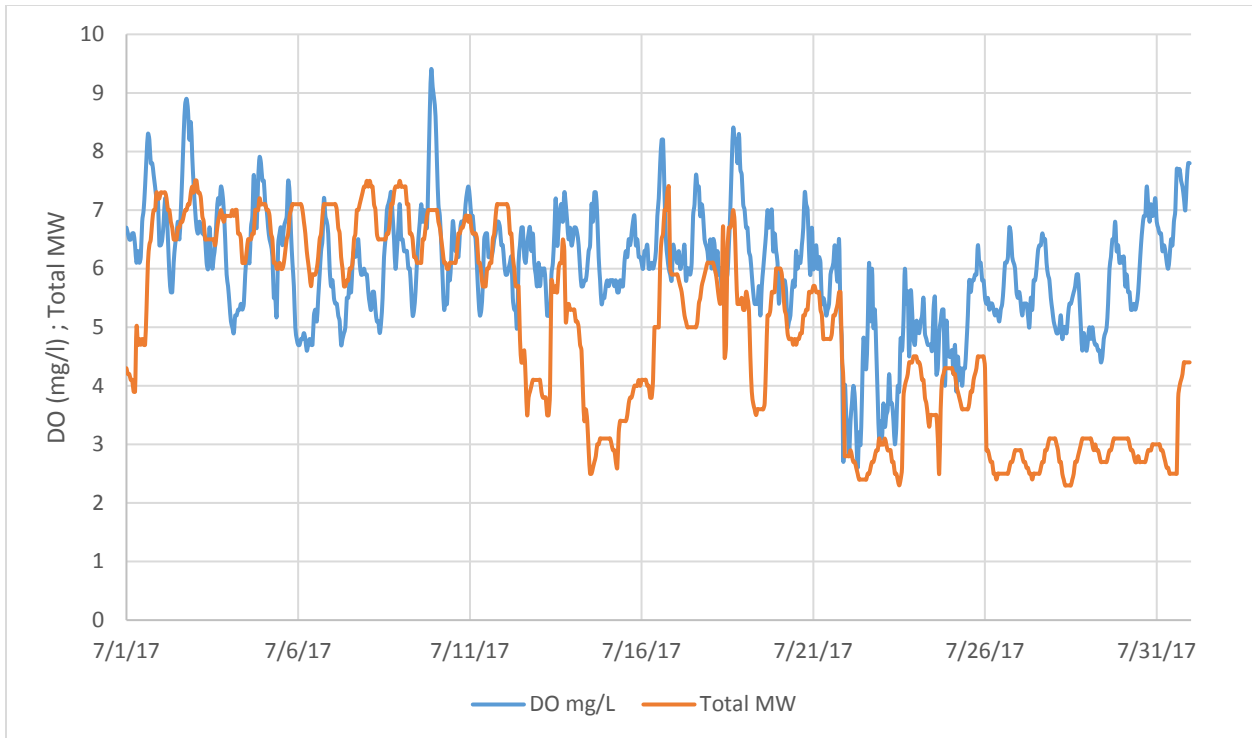


FIGURE 4. HOURLY DO LEVELS AND HOURLY GENERATION (JULY 1- JULY 31)

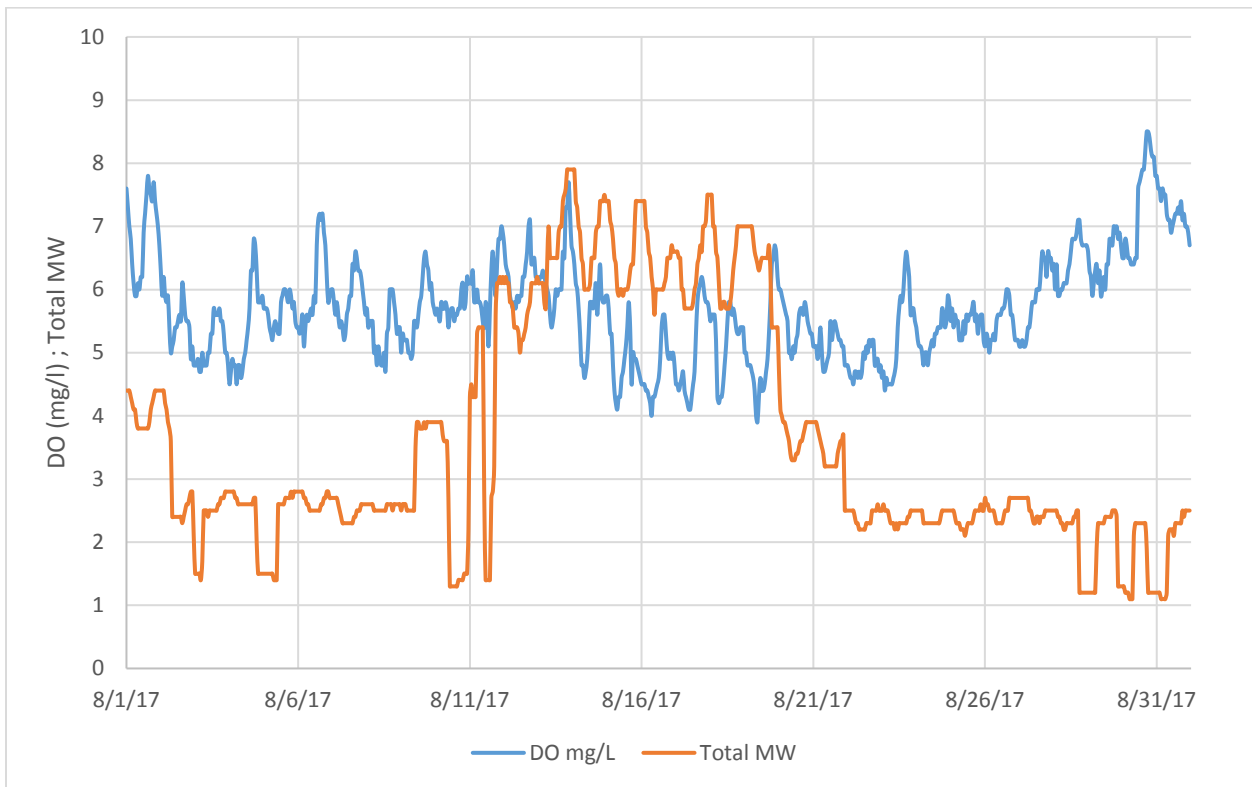


FIGURE 5. HOURLY DO LEVELS AND HOURLY GENERATION (AUGUST 1- AUGUST 31)

DISCUSSION

In mid-August, SCE&G attempted to monitor DO levels in the forebay using HOBO loggers, but fouling from extensive growth of aquatic vegetation was an issue throughout the study period and meaningful data was not collected. As such, the extent to which turbine venting increased DO levels in releases from Parr could not be accurately determined. Additionally, fouling also affected the accuracy of DO readings at the USGS Jenkinsville gage. However, SCE&G notified the USGS of the situation, and the data was corrected and is assumed accurate as reported (C. Gaston pers. comm., October 26, 2017).

Mean daily DO levels generally remained above 5 mg/l, and hourly DO levels generally remained above 4 mg/l, although DO levels did fall below these thresholds on several occasions during July and August. One potential factor that may have contributed to these limited excursions is that rainfall in July was well below normal (2.37 inches 2017 compared to 4.23 inches during average years) (NCDC 2017). Furthermore, a storm event on July 16 that registered more than 2.5 inches on several rain gauges in the vicinity (NCDC 2017a, NCDC 2017b) may also have been a contributing factor by increasing the run-off of biological oxygen demanding nutrients and organic material into the river. Ensuing low flow conditions would increase residence time for these materials in the reservoir, providing an opportunity for increased bacterial decomposition and a resultant oxygen depletion. Additionally, river flows during this period were below the long-term daily median during late July (Figure 6).

Dissolved oxygen excursions in August were likely caused by similar scenarios as July. Rainfall for August totaled 0.52 inches, compared to a long-term average of 4.71 inches (NCDC 2017a, NCDC 2017b). A high flow pulse experienced August 15-16 (Figure 6) was likely the result of a rain event in the Upper Broad River drainage that was potentially very turbid, inhibiting photosynthetic contribution to reservoir DO levels and flushing low-DO water from the reservoir that had accumulated due to low flows and higher residence times.

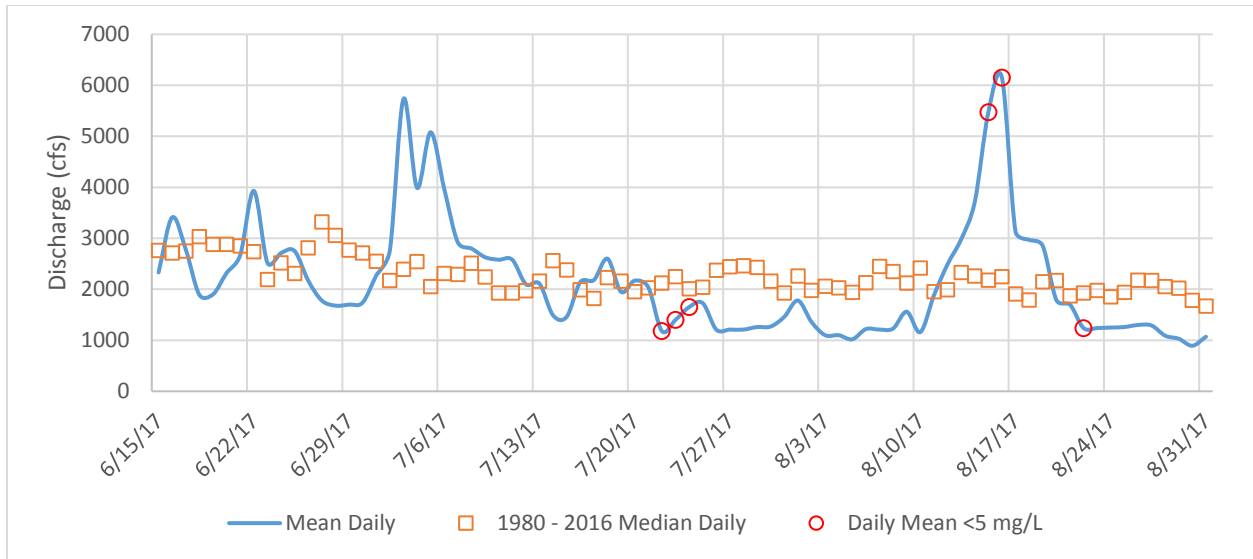


FIGURE 6. LONG-TERM MEDIAN AND MEAN DAILY DISCHARGE FOR BROAD RIVER AT ALSTON GAUGE (USGS 2017A)

CONCLUSIONS AND RECOMMENDATIONS

Based on these findings, SCE&G proposes to perform turbine venting tests again during 2018 from June 15 through August 31. SCE&G will use the results of the 2016, 2017 and 2018 testing to update and modify the current Turbine Venting Plan. SCE&G plans to include the updated Turbine Venting Plan as one of the proposed protection, mitigation, and enhancement measures in the Final License Application for continued operation of the Parr Hydroelectric Project.

REFERENCES

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