

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Water Quality TWC Meeting

June 25, 2014

Final KDM 7-17-14

ATTENDEES:

Bill Marshall (SCDNR)

Milton Quattlebaum (SCANA)

Rusty Wenerick (SCDHEC)

Henry Mealing (Kleinschmidt)

Kelly Miller (Kleinschmidt)

Ron Ahle (SCDNR)

Bill Argentieri (SCE&G)

Randy Mahan (SCANA)

Steve Summer (SCANA)

Byron Hamstead (USFWS)

Bill Stangler (Congaree Riverkeeper)

Vivianne Vejdani (SCDNR)

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 by reviewing the agenda and action items from the Water Quality TWC meeting held on February 4, 2014. At that meeting, everyone agreed that Kleinschmidt and SCE&G would examine temperature and dissolved oxygen (DO) data from the USGS gages at Carlisle (02156500), Jenkinsville (02160991), Tyger River (02160105), and Enoree River (02160700); and flow data from the Alston gage (0216100) to determine potential project effects on low DO events. At the February 4th meeting, the group agreed that data from the gages listed above would be gathered from 2004 through 2013 and graphically compared to identify low DO events, determine how often, when, and how long those events occurred and to see if there are common events related to the low DO. Flow data would also be collected to determine if there is a correlation between low or high flows and low or high dissolved oxygen. These analyses were completed and summarized in an addendum to the Baseline Water Quality Report, which is attached to the end of these notes. CDs with the USGS data from the gages listed above were distributed to the TWC members attending the meeting, and are available upon request.

Henry discussed the results of the data review, as detailed in the Water Quality Report Addendum, which mainly focused on the data from the Jenkinsville gage and flow data from the Alston gage. Henry told the group that the data showed a trend of low DOs early in the morning, during periods of low generation, and during the summer months. Bill A. explained that he contacted USGS and found out that they replaced the monitoring probe located at Jenkinsville in 2011. Henry suggested that the gage may be located in a bad spot, where back flow may be occurring. If the units running are far away from the monitor the water near the monitor could become stagnant. To determine if this is true, SCE&G is planning to collect a series of water quality readings along the downstream side of Parr Shoals Dam and near the USGS gage. Milton will access the river through the windows in the powerhouse. Byron asked if flow data can also be collected. Henry said we can calculate the flow. Henry said that Milton can note which turbines are running when he is collecting the data to see if unit location is having an effect. While Milton is collecting data during July and August, he

will request the operators to run different units to see if this affects the DO readings at the USGS gage.

Byron asked to look at specific DO excursions in the USGS data at Jenkinsville. From July 18-21, 2010, the DO at the Jenkinsville gage was below 4.0mg/L. The flow data at Alston shows that only one unit is running, which might possibly be the furthest unit from the gage. During the meeting, Bill checked the online operation records, but was unable to find records of which Unit was operating during that event. Bill will continue to look for historical unit operating data for Parr.

Ron suggested we look at the flows that are occurring during the low DO excursions to determine a pattern. Although there doesn't appear to be a pattern, the excursions could correlate to which units are running.

Rusty asked if the excursions could be related to the operation of Fairfield Pumped Storage Development. The group asked if Monticello stratifies and Steve explained how the reservoir acts as three separate reservoirs, with the upper portion of the reservoir stratifying. Rusty suggested that FPS operations (through higher water levels in the Parr Reservoir) are periodically pushing low DO water towards the dam.

Henry suggested that we collect data to verify the USGS gage first, since this seems to be the easiest next step toward identifying or ruling out the cause of the DO excursions. Bill S. asked what the next step would be if the gage is determined to be in a bad location. Henry said we will talk with USGS about relocating the gage.

Kelly told the group about the turbidity information that Kerry Castle with SCDNR sent following the February 4th Water Quality TWC meeting. The data shows how turbidity increases as one moves downstream in the Broad River. Kelly will send Kerry's data to the TWC.

Henry said that although there are occasional DO excursions, there is still high biodiversity downstream of Parr Shoals Dam. Henry stated that if low DO levels were a true problem below Parr Shoals Dam, the diversity and abundance of mussels and snails should not be as high.

Byron asked how difficult it would be to start keeping track of operations at Parr Hydro, such as which unit or units are running. Bill said that SCE&G can try to keep track of this information. Milton said he will take measurements as close to each unit as possible and as close to the USGS gage as possible.

Byron asked if there was a pattern for operating the units, or a first on, last off protocol. Steve said he thought that the operators most likely just rotate units to prevent wear on a particular unit. Bill spoke with an operator at Parr Hydro and found that there was no pattern or first on, last off protocol at the plant.

Steve asked if there is a gage that records the stage in Parr Reservoir. Bill said that stage data is collected at Parr Reservoir. Steve said this information would give us an indication of what is going on at Fairfield and if the operation of the development has any correlation to the USGS data. Rusty said that if Fairfield is transferring enough water from Monticello Reservoir to raise the level of Parr Reservoir, this action is having an effect on temperature in Parr Reservoir as well. The group examined stage data from Parr Reservoir and saw a possible correlation between low DO and stage.

Steve pointed out that we don't know if Fairfield is the cause of low DO occurrences, although they appear to be correlated. However, operation of Fairfield is related to system load which is in turn related to the sunrise and sunset.

Bill asked that if anyone sees a trend in the water quality data once they start looking at the data that was distributed during the meeting, to let the rest of the TWC know. The group will meet again once Milton has collected the data downstream of the Parr Shoals Dam – starting in July and extending into August if needed. Action items stemming from this meeting are listed below.

ACTION ITEMS:

- Milton and Kelly will collect water quality data below Parr Shoals Dam during July and August, making sure to record which units are operating while measurements are being taken. They will report their findings back to the TWC.
- Kelly will distribute Kerry Castle's turbidity data to the group.
- Kelly will finalize the Water Quality Report Addendum, send it to the TWC and post it to the website.
- Bill will look for historical unit operating data for Parr and FPS.

At the Water Quality TWC meeting on February 4, 2014, the TWC noted that the Parr Water Quality Report identified multiple dissolved oxygen (DO) levels below 4.0 mg/l in the Parr Shoals Dam tailrace. The TWC agreed that SCE&G would consolidate historic USGS data to examine those excursions and to provide any operations that might be associated with the data. SCE&G requested hourly DO, temperature and river flow data from 2004 through 2013 for the following USGS stations:

1. USGS 02160991 Broad River near Jenkinsville, SC
2. USGS 02156500 Broad River near Carlisle, SC
3. USGS 02160700 Enoree River at Whitmire, SC
4. USGS 02160105 Tyger River near Delta, SC

Our analysis of the data focused on the period from July through September of each year from 2004 through 2013. For this analysis, we plotted hourly readings of flow, temperature, and DO levels at each of the gage stations. Those plots and the raw data will be available to the TWC upon request. Included below are data from the Jenkinsville gage, located immediately downstream of the Parr Shoals Dam along the east bank of the tailrace (FIGURE 1 through FIGURE 10). Since flow data is not collected at the Jenkinsville gage, flow data from the Alston gage, USGS 02161000, was used.

FIGURE 1 2004 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

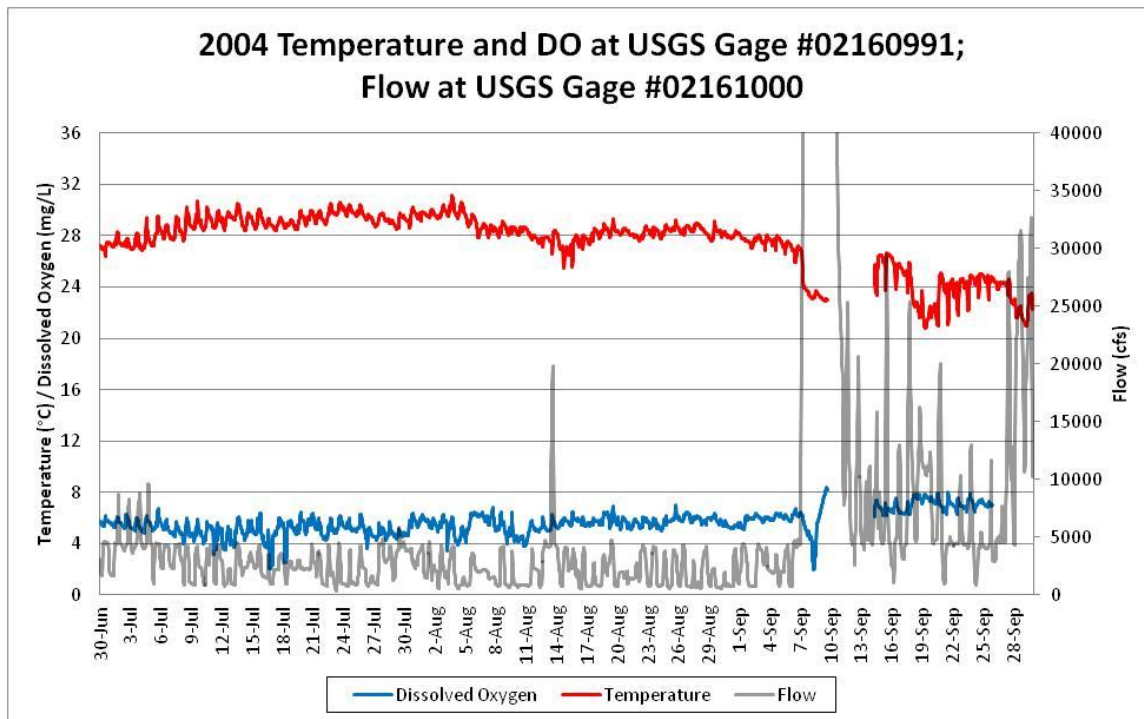


FIGURE 2 2005 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

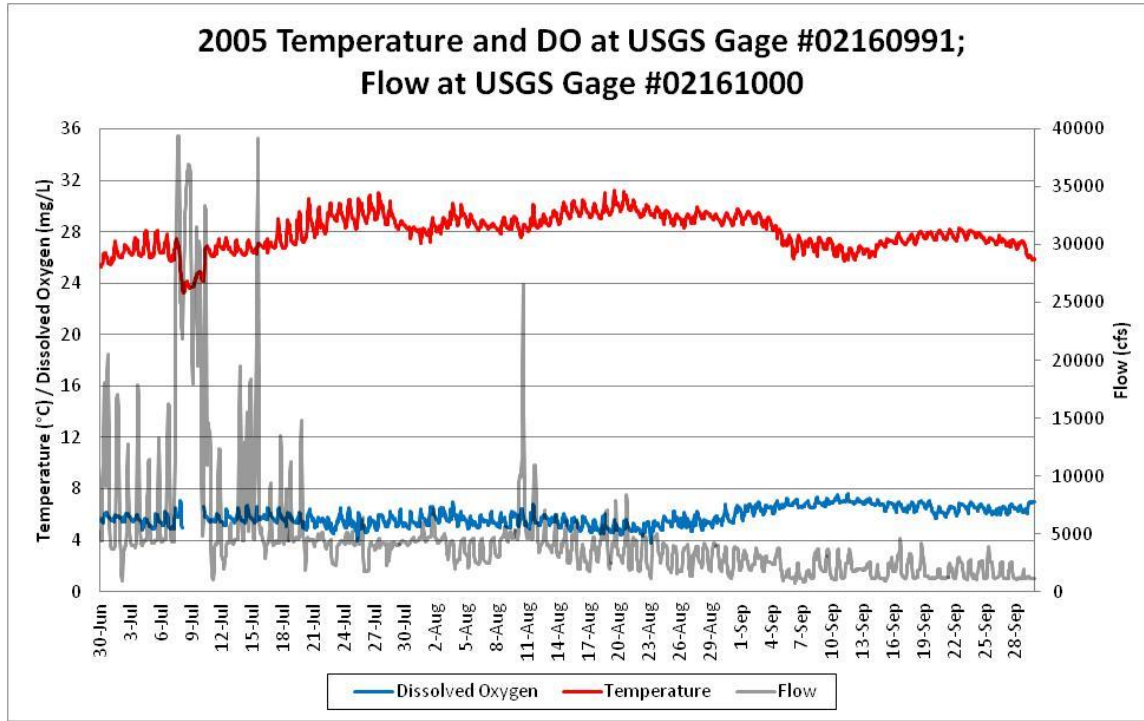


FIGURE 3 2006 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

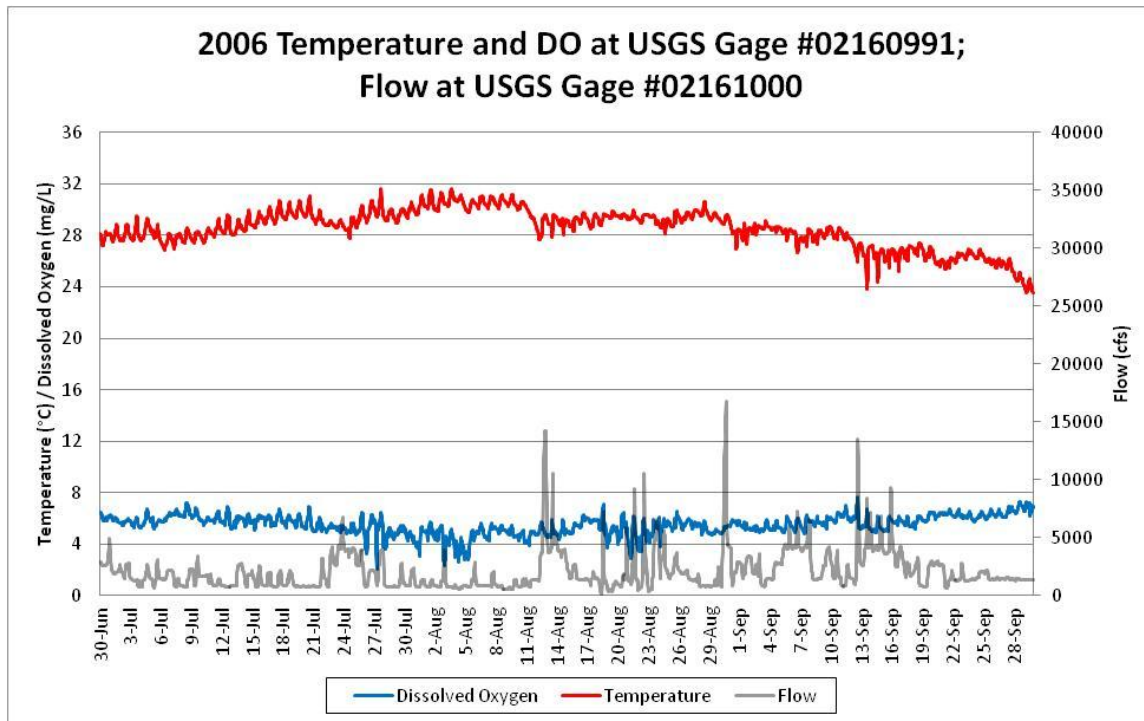


FIGURE 4 2007 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

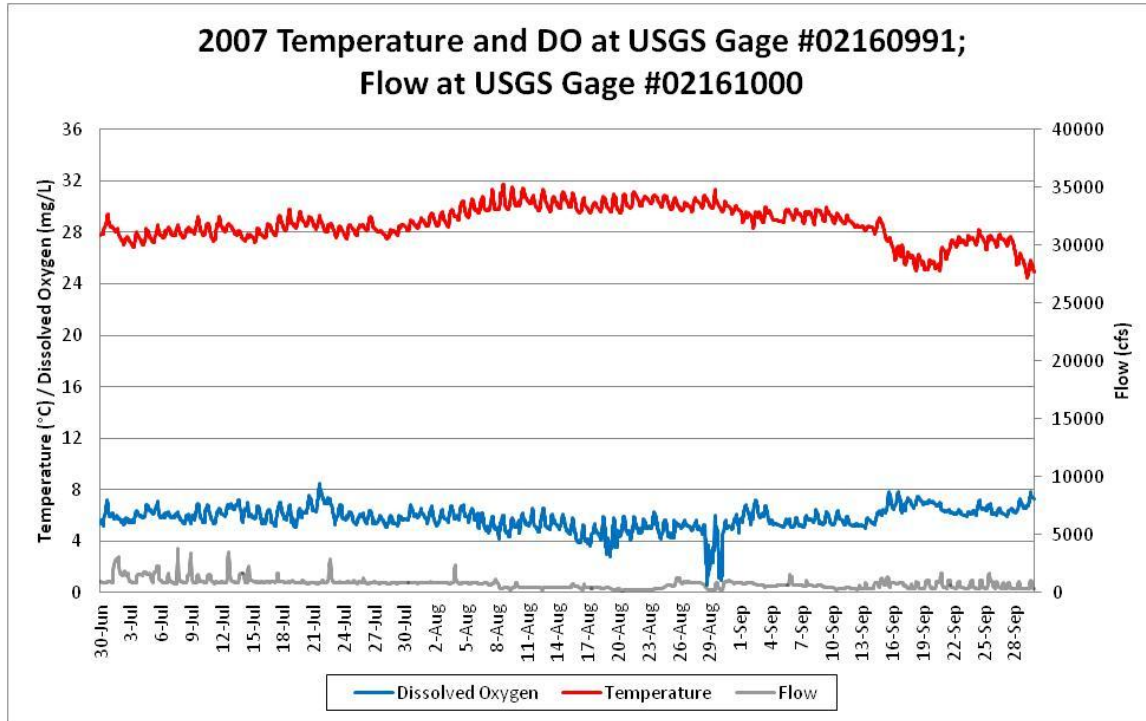


FIGURE 5 2008 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

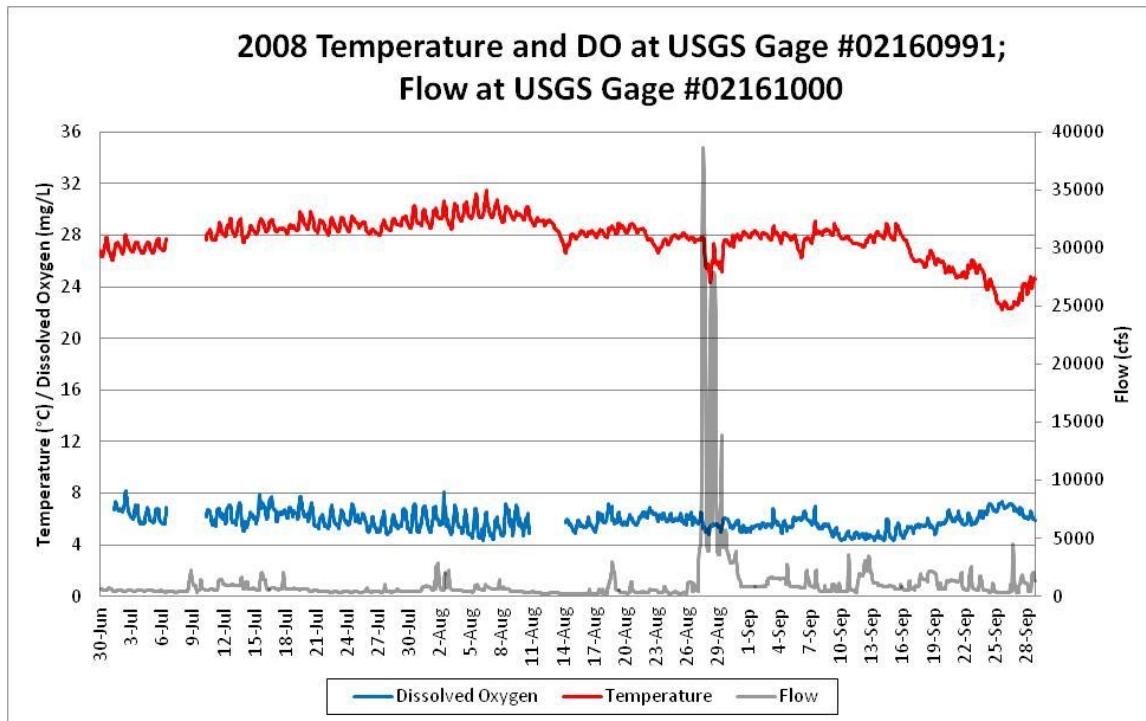


FIGURE 6 2009 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

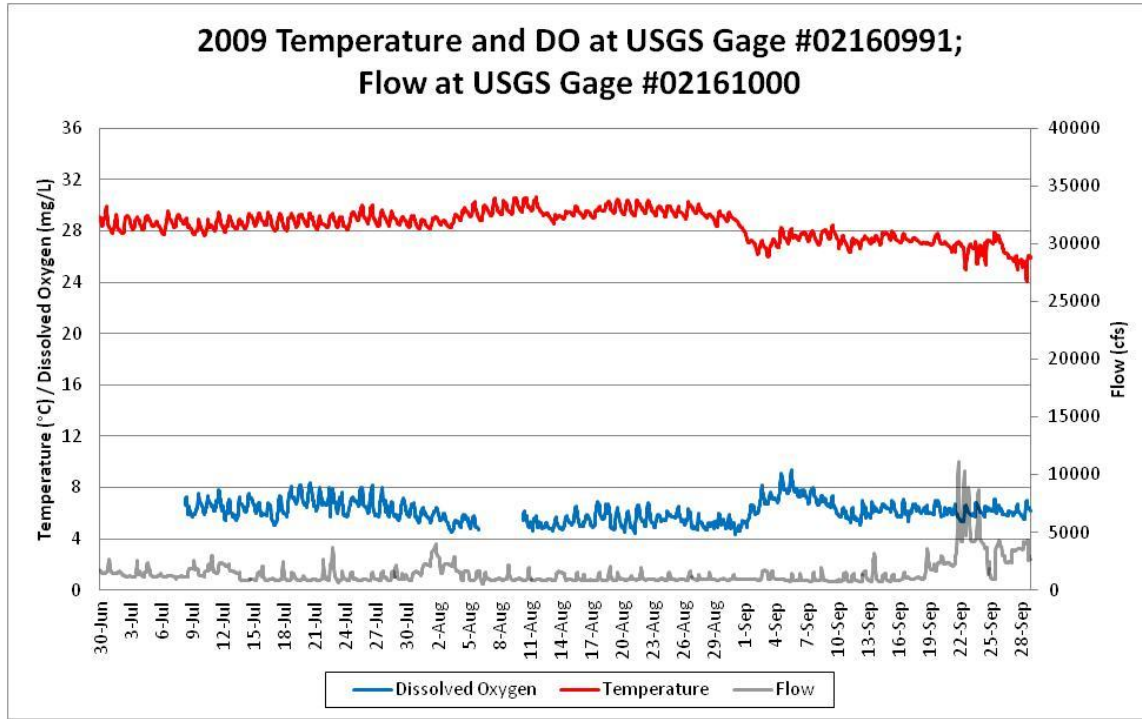


FIGURE 7 2010 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

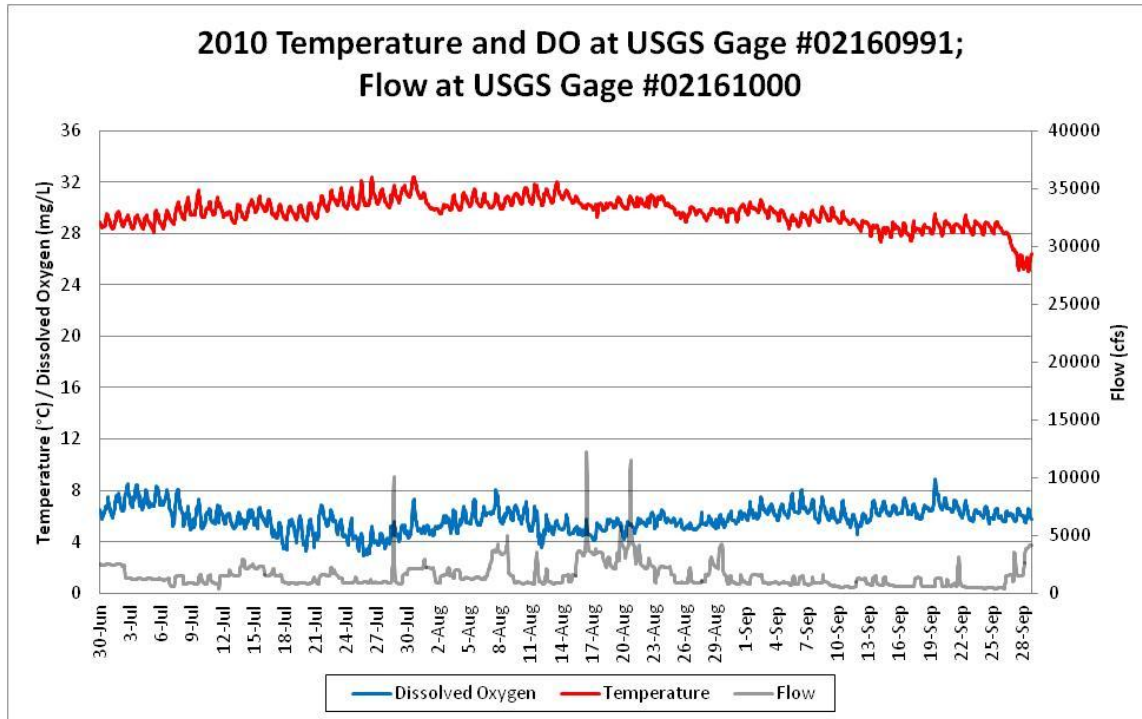


FIGURE 8 2011 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

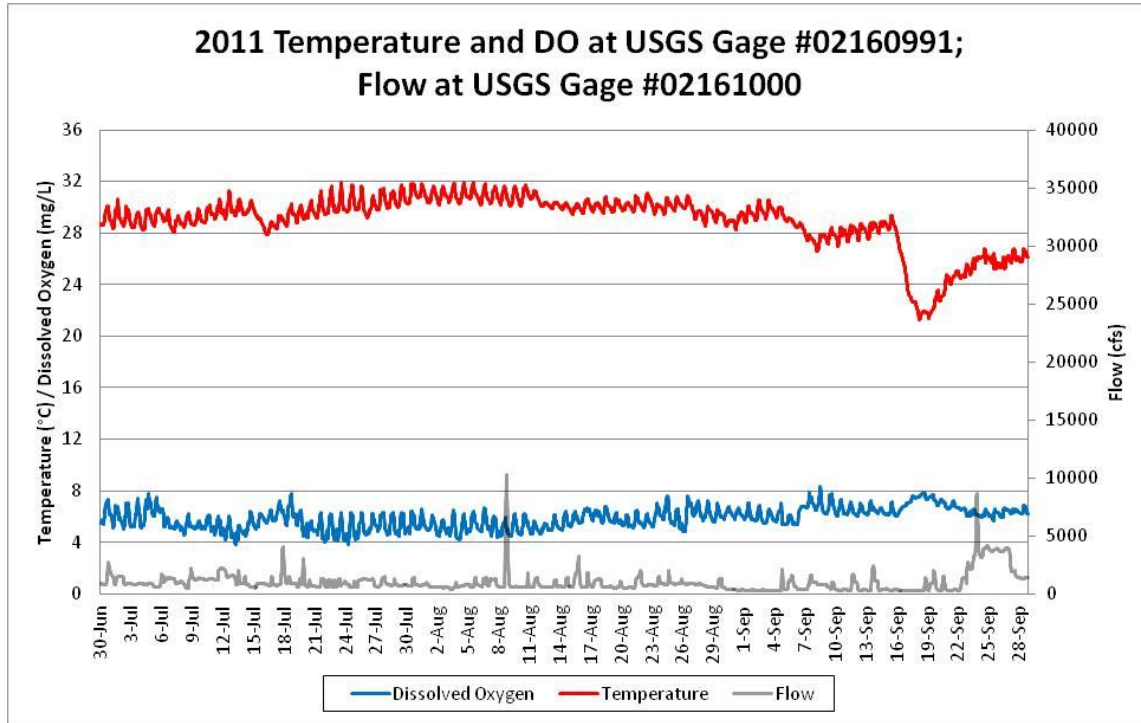


FIGURE 9 2012 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000

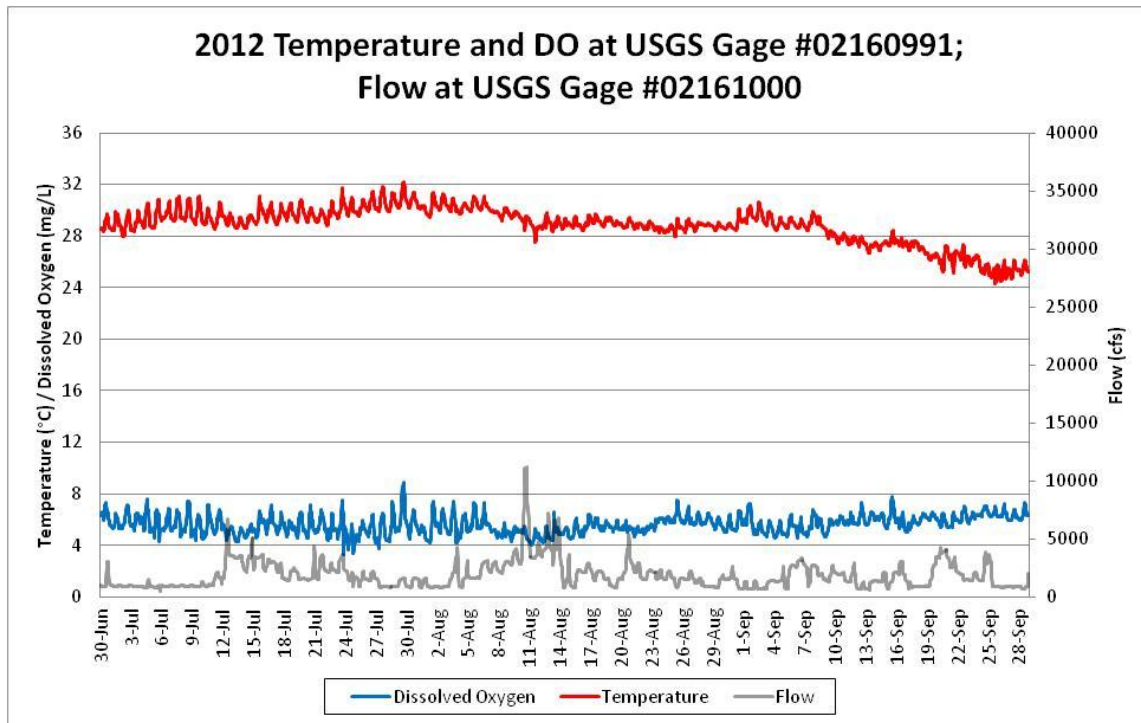
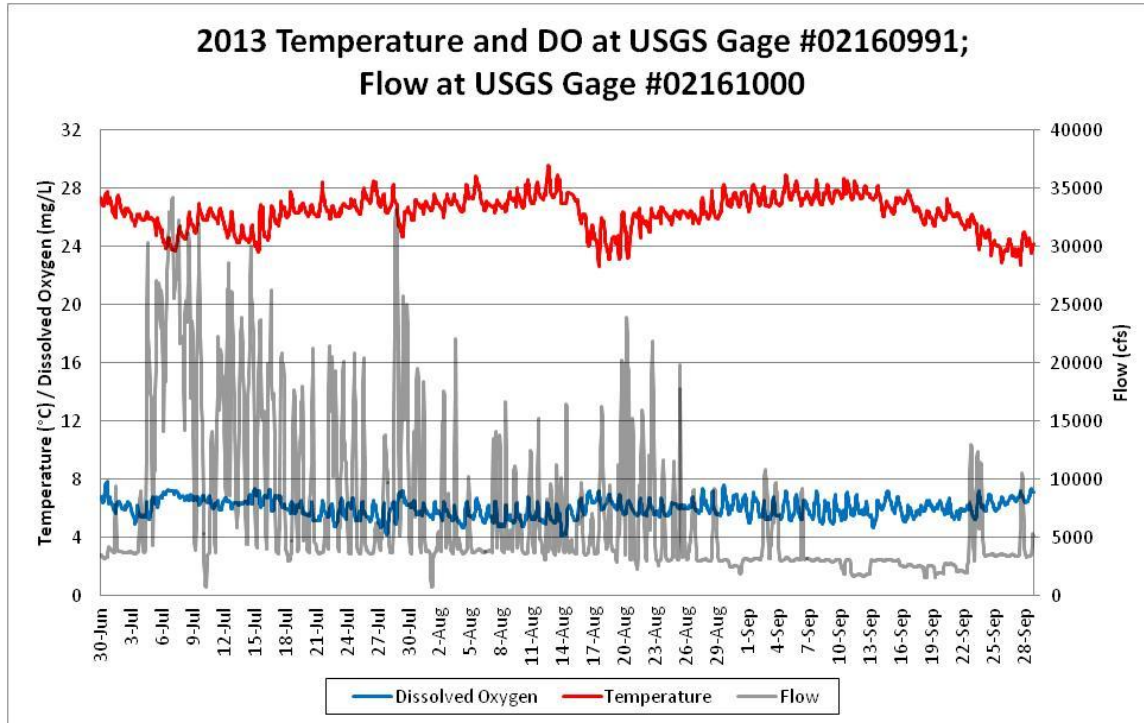


FIGURE 10 2013 TEMPERATURE AND DISSOLVED OXYGEN AT USGS 02160991; AND FLOW AT USGS 02161000



Review of the data verified that there are periodic excursions of DO levels less than 4.0 mg/l. These events are not consistent from year to year and do not typically have a long duration. We have presented representative excerpts of the raw data in TABLE 1 through TABLE 4 to demonstrate the month, flow, temperature, time of day, and DO level experienced.

TABLE 1 JULY 19-20, 2010: DO EXCURSION

Date	Time	DO (mg/L)	Temperature (°C)	Flow (cfs)
7/19/2010	9:00 pm	4.3	29.5	900.7
7/19/2010	10:00 pm	4.0	29.4	900.7
7/19/2010	11:00 pm	3.7	29.4	900.7
7/20/2010	12:00 am	3.9	29.3	900.7
7/20/2010	1:00 am	3.8	29.3	900.7
7/20/2010	2:00 am	3.8	29.2	888.0
7/20/2010	3:00 am	3.7	29.2	875.3
7/20/2010	4:00 am	3.6	29.1	862.7
7/20/2010	5:00 am	3.3	29.1	862.7
7/20/2010	6:00 am	3.7	29.0	837.7
7/20/2010	7:00 am	4.0	29.1	837.7
7/20/2010	8:00 am	4.5	29.2	825.3

Parr Hydroelectric Project - Water Quality Addendum - June 2014

TABLE 2 JULY 13, 2011: DO EXCURSION

Date	Time	DO (mg/L)	Temperature (°C)	Flow (cfs)
7/13/2011	5:00 am	4.6	29.7	1474.9
7/13/2011	6:00 am	3.9	29.3	1369.9
7/13/2011	7:00 am	3.8	29.3	939.3
7/13/2011	8:00 am	4.1	29.5	812.9

TABLE 3 JULY 24, 2012: DO EXCURSION

Date	Time	DO (mg/L)	Temperature (°C)	Flow (cfs)
7/24/2012	6:00 am	4.2	29.6	2107.6
7/24/2012	7:00 am	3.9	29.6	1789.4
7/24/2012	8:00 am	3.6	29.5	1536.0
7/24/2012	9:00 am	3.9	29.7	1459.7
7/24/2012	10:00 am	4.3	30.1	1429.5
7/24/2012	11:00 am	4.3	30.1	1429.5
7/24/2012	12:00 pm	4.4	30.2	1444.6
7/24/2012	1:00 pm	4.4	30.3	1444.6
7/24/2012	2:00 pm	4.7	30.6	1399.6
7/24/2012	3:00 pm	5.6	30.9	1444.6
7/24/2012	4:00 pm	5.7	31.0	1954.6
7/24/2012	5:00 pm	5.5	30.9	2124.8
7/24/2012	6:00 pm	4.8	30.8	1971.4
7/24/2012	7:00 pm	3.5	30.1	1154.4
7/24/2012	8:00 pm	3.4	29.9	875.3
7/24/2012	9:00 pm	3.6	29.9	1520.7
7/24/2012	10:00 pm	3.6	29.9	1676.9
7/24/2012	11:00 pm	4.1	29.9	1724.8

TABLE 4 JULY 27, 2012: DO EXCURSION

Date	Time	DO (mg/L)	Temperature (°C)	Flow (cfs)
7/27/2012	6:00 am	4.2	30.0	1490.1
7/27/2012	7:00 am	3.7	29.9	1196.5
7/27/2012	8:00 am	3.8	30.0	900.7
7/27/2012	9:00 am	4.3	30.0	837.7

Our review of this data lead us to the conclusion that the low DO levels frequently occur during the early morning hours when DO levels often begin to decline (diel fluctuation) and flows begin to decline. Based on this observation we reviewed the location of the USGS monitor which is located along the bank in a back eddy just downstream of the Parr Shoals Dam. We also asked the USGS to provide any information they had on the type of monitoring equipment used and how it had changed over time. The following is a consolidation of email excerpts that we received from Michael Hall of the USGS:

The current DO probe that the USGS uses at the Parr Dam monitoring site is a YSI 6150 ROX, which is an optical DO probe with a self cleaning wiper system. Looking back over the last year and a half, there have been no corrections needed to the sensor data for fouling or calibration drift. The sensors and sonde are cleaned at least monthly, but sometimes more often in the summer months if needed. The DO membrane itself rarely has any visible fouling because of the wiper system. Calibration is checked monthly and readings are also verified at each visit with a separate calibrated field meter. YSI states that the accuracy of the ROX DO is +/- 0.1 mg/L or 1% of reading, whichever is greater. The USGS applies corrections to the data if the combined fouling and drift differences exceed +/- 0.3 mg/L.

[USGS hasn't] noticed any issues with the quality of the readings and can't ever recall the water being stagnant where the sonde housing is placed. The flow at the sonde is mostly negative due to a swirling motion, but any debris or other trash that is floating in the pool gets "flushed" fairly quickly, so I would assume the water is constantly being refreshed. If you would like, we can arrange to be on site during different unit releases to better determine if there is a stagnant issue.

Prior to the ROX sensor [installation – June 2011], [USGS] used a YSI 5739 and YSI Rapid Pulse DO Probes. All three sensors have the same accuracy according to YSI. [USGS doesn't] have the exact dates that the ROX was installed, but [they] believe it was in the 2011 water year. The frequency of cleaning for the older probes was 2 to 4 weeks depending on season and flow events. Those probes didn't self clean, so during the summer months they usually needed more attention”

It is our suspicion that some, if not all, of these low DO events are related to low flows in the tailrace and backflow or stagnant flows at the USGS monitor. To test this theory, we have planned to collect additional data in the tailrace during July and August of 2014 and compare it with USGS data collected at the same time. We will focus on these warmer summer months when flows are lower and more likely for us to observe any deviations.

DO readings will be collected along a transect starting at the furthest turbine discharge on the west end of the Parr Shoals powerhouse and proceed to the east towards the USGS monitor using a Hydrolab Surveyor 4a with a Hydrolab MS 5 sonde or similar equipment. DO readings will be collected at the mid-depth of the water column from a maximum of 10 sample locations along the transect. Collections will be performed at one hour before sunrise, at sunrise, and one hour after sunrise. Collections will also be coordinated with lower flow events – possibly scheduled for each sampling. We will perform up to eight collections during July and August of 2014 to detect any differences in the transect DO measurements and the USGS data measurements.

The transect data will be compared to the USGS data. We will use figures and tables to display the collected data and patterns in the DO level will be described based on time, flow, and distance from the USGS monitor. We will consolidate this information into a letter report to share with the TWC for review and discussion.