

MEETING NOTES

SOUTH CAROLINA ELECTRIC & GAS COMPANY
Water Quality TWC Meeting

December 14, 2016

Final KMK 1-23-17

ATTENDEES:

| | |
|--------------------------------------|-------------------------------------|
| Bill Argentieri (SCE&G) | Rusty Wenerick (SCDHEC) |
| Ray Ammarell (SCE&G) | Dick Christie (SCDNR) |
| Randy Mahan (SCE&G) | Bill Marshall (SCDNR) |
| Caleb Gaston (SCANA) | Ron Ahle (SCDNR) |
| Tom McCoy (USFWS) via conf. call | Alex Pellett (SCDNR) via conf. call |
| Melanie Olds (USFWS) via conf. call | Henry Mealing (Kleinschmidt) |
| Fritz Rohde (NOAA) via conf. call | Jason Moak (Kleinschmidt) |
| Bill Stangler (Congaree Riverkeeper) | Jordan Johnson (Kleinschmidt) |
| Gerrit Jobsis (American Rivers) | Kelly Kirven (Kleinschmidt) |

These notes are 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 reviewed the agenda. The purpose of this meeting was to discuss the results of the 2016 West Channel Water Quality Study, discuss any associated potential protection, mitigation and enhancement (PM&E) measures, and for SCE&G to give updates on the TWC request for downstream flow spawning stabilization periods.

2016 West Channel Water Quality Study Discussion

Henry gave a presentation to the TWC on the results from the 2016 West Channel Water Quality Study (PowerPoint is attached to these notes). Henry explained that Kleinschmidt did a field verification of pulse flows of approximately 24 acre-feet, which equates to a 3 hour spill. On August 6-7 and August 10-11, unplanned spill events also occurred during early August. Ron asked if randomized YSI samples were taken, using a method where a grid is overlaid on the study area and random sections are chosen for sampling. He said this is the only way to prevent bias when selecting sample sites. Henry said no, this method was not used. Kleinschmidt chose YSI sample locations in an attempt to best characterize the area while they were in the field.

Henry mentioned that Kleinschmidt noticed that large amounts of Hydrilla are located downstream of the Parr Shoals Dam now compared to the summer of 2015. Tom asked if SCE&G is going to try and do anything to get rid of the Hydrilla located downstream of the dam. Henry said he doesn't know how you can get rid of it. Tom noted that the USFWS is concerned about the potential for avian vacuolar myelinopathy (AVM), often associated with Hydrilla in the southeast, to impact local populations of bald eagles. Henry said although Hydrilla is located downstream of the dam now, he doesn't believe it is in Lake Monticello yet, although it likely will be in the future. Ron

said it would be extremely difficult to remove Hydrilla from the river and the only way to successfully do it (by introducing grass carp) would likely have catastrophic results to the river. Henry said he thinks the high flow events in October 2015 and January 2016 likely introduced Hydrilla to the area. He thinks it will move to Bookman Island and maybe Monticello Reservoir, but it probably won't become established in Parr Reservoir due in part to the fluctuations.

Henry noted that our observations did confirm that there is flow that moves from the tailrace into the West Channel. The amount varies based on tailwater elevation. Our study documented flows from 0 to approximately 100 cfs under the current conditions. Ron said that a higher minimum flow requirement combined with some channel excavation along the northern tip of Hampton Island might solve the water quality issue in the west channel and pulsing or continuous flows from the spillway gates may not be needed. Pulse flows might could be used only during a drought contingency plan, such as a low flow protocol. Gerrit asked what Ron means when he says channel excavation. Ron said SCE&G could deepen the natural channel or clean out debris to encourage water flow. Gerrit asked if we think a relatively small amount of flow would be enough. He thinks we would need a substantial opening in the channel to get flows high enough to keep the west channel area flushed out. Bill A. noted that whatever flows are diverted to the west channel will be subtracted from the east channel, which is currently functioning nicely. Ron said that he believes the new minimum flow requirement will be higher than it currently is today, so removing some of this flow from the east channel and diverting it to the west channel will likely make little to no impact on the east channel. He believes a small amount of flow to the west channel will make a vast improvement. Gerrit believes that we might need more flow in the West Channel to make a difference, but if it can be done, it would be better than using periodic pulse flows.

Bill S. asked if the channel modification will take place at the location of the YSI 8 sampling. Henry said yes, this is the area we should consider. Bill S. asked if this will help anything farther west past the middle rock ledge. Henry said no and Jordan explained that depending on tailwater elevations, the most western channel tends to have higher flows anyways, so improvements are needed to help the middle western channel. The most western area doesn't need as much additional flow because water runs along the face of the dam keeping this area flushed out.

Ron commented that the IFIM study could be really important to the decisions made about the west channel and transects will allow us to calculate additional flow coming into the area.

Dick said that he doesn't see how a 24 acre-feet pulse could affect DO over several days. Henry said that it could be flushing nutrients out and flushing spirogyra and phytoplankton out. Dick said that on a 95 degree day, hot water takes over pretty fast again. Flow from the tailrace coming across to the west channel could also be helping out. Dick said when he looks at the diurnal swings, he's having a hard time seeing the effect of the pulse and Gerrit agreed. Gerrit said he thinks it's questionable if we are seeing a benefit from the pulsing and if there is one, it's minor.

Ron said that vegetation plays a significant role in DO and having a large flushing flow might flush vegetation out. Ray pointed out that during the first week of the study, there was a high flushing pulse that didn't significantly move vegetation. Henry added that we are trying to move away from heavy downstream fluctuation flows, so the occurrence of heavy flushing flows downstream may be less in the new operating license.

Dick said that he believes DNR is open to keeping pulsing flows as an option, especially for use during critical periods of low inflow. He doesn't see pulsing flows as the "silver bullet" but it might help during specific times.

Henry noted that fouling was a big issue in 2015 and keeping the meters clean had a big effect in the 2016 study. Dissolved oxygen swings were still apparent in 2016, but to a much lesser degree. Jordan noted that fouling occurred during the first week at the middle west channel site. He will add this narrative to the report.

The group then began to discuss PM&E measures for the West Channel. Henry noted that there are two general TWC goals for that area: increase wetted habitat and meet state DO standards. The group agreed that implementing an Adaptive Management Plan (AMP) will likely be the best option for improving the West Channel. The following items were noted regarding the development of an AMP:

- 5 year plan, with framework included with the license application
- Encourage a continuous flow by expanding the notch already located at the northern tip of Hampton Island to increase flow from east channel
 - Check out flow from east to west channel during IFIM verification – see if increased minimum flow changes these natural flows prior to excavating a notch
 - Do a field test with a higher minimum flow, set up a transect, measure flow in two spots (test shoot WSEL)
- Incorporate pulsing during certain times (such as critical times of low inflow)
- Timing of monitoring – from late July into early September?
 - Do spot monitoring first to determine final timing of monitoring – May through September using YSI to collect temp/DO, morning/evening, once a week/every two weeks
 - Include stratified random sampling from grid – stratified toward upper portion of river, include some in middle area (Note – DNR will provide the stratified grid sites for TWC to consider for monitoring)
- Install a level logger to measure stage at “notch” area – leave in place – rated transect
- Conduct two meetings a year during the term of the AMP – include a spring meeting to determine what field work will be performed during the year, and a fall meeting to give a summary of what happened during the study – file meeting notes with FERC
- Identify what stakeholders will be involved in the process – SCDNR, SCDHEC, USFWS, Congaree Riverkeeper, American Rivers, etc.
- Timeline for developing the AMP –
 - Minimum flow range to be determined by February 2017
 - Strawman AMP – end of February 2017
 - IFIM verification of flow delivery with current channel (determine amount of flow available to go to west channel) – May-July 2017
 - Identify “east” and “west” flow split as part of IFIM verification – August 2017
- Ron/DNR may conduct baseline fish sampling for a few years, then do monitoring following the close of the AMP to determine success

Rusty noted that DHEC could overlook periodic state standard excursions if biological factors improve (such as fish species moving into the area).

Stabilization Flows Discussion

Ray offered the group a slideshow on downstream flow stabilization, which is attached to these notes. The TWC requested that SCE&G implement stabilization flows for shortnose sturgeon spawning (14 days during March 15-31) and striped bass, American shad, and robust redhorse spawning (two 7-day blocks sometime from April 1 through May 10). SCE&G cannot completely cease Fairfield Pumped Storage operations during these periods. SCE&G has proposed the following measures to reduce fluctuations, including generator upgrades, operators on site to control gates 24 hours a day, and modification of inventory management spills. During the four weeks of stabilization periods, SCE&G can manipulate the crest gates to track Parr Reservoir and maintain constant discharge when spilling while Fairfield operates. Ray looked at hourly inflow and outflow data during the months of March-May for years 2000-2016. He used historical deviations under the current license as a baseline to determine when fluctuations could be reduced. He suggested that annual target reductions in mean deviation be set in the new license. SCE&G could track mean inflow and mean deviation as a running measure each year to guide operations to reduce fluctuations below historical levels.

Ray noted that as inflow increases, backwater restrictions will limit how far gates can be raised as Parr Reservoir rises. Also, at some level of inflow, Fairfield operations will need to be curtailed, similar to the current 40,000 cfs limit but lower during the stabilization periods. Gerrit said that a 50 percent increase in flows is not a huge impact when overall river inflows are higher but it is a big impact when inflows are lower. Targeting efforts on lower river inflows will produce a greater impact.

The group agreed that an AMP could be developed for this issue since SCE&G is not quite sure how they will reduce the spikes in flow yet. Higher continuous minimum flows may cut down on inventory releases and may change operations in other ways that we don't know yet.

Henry asked how we will pull habitat data into the analysis. Should we look at WUA tables? Gerrit said one consideration to include is how these downstream flows affect sturgeon within the Congaree. Dick said that anything we do to address these spikes in flow in the Broad River will be observed downstream as well. Henry added that Bill Post may be able to help with this issue as well.

The group discussed the next steps for this issue. Dick said that someone will need to sit down and look at preferred flows for certain species. Gerrit suggested that this be included in the IFIM analysis. Henry said this will be added to the agenda for the January 24th Instream Flows TWC meeting.

With this, the meeting ended. Action items are included below.

ACTION ITEMS:

- Jordan will add narrative to the 2016 West Channel Water Quality Study regarding fouling that occurred during the first week at the middle west channel site.

- Kleinschmidt will begin to develop a strawman for the AMP and distribute to the WQ TWC for review.
- Ron will develop a stratified random sampling grid for inclusion in the AMP.
- TWC will include some of these discussions on preferred species flows at the January 24, 2017 IFIM TWC meeting.

West Channel Water Quality 2016 Second Year Study

Parr Hydro Project

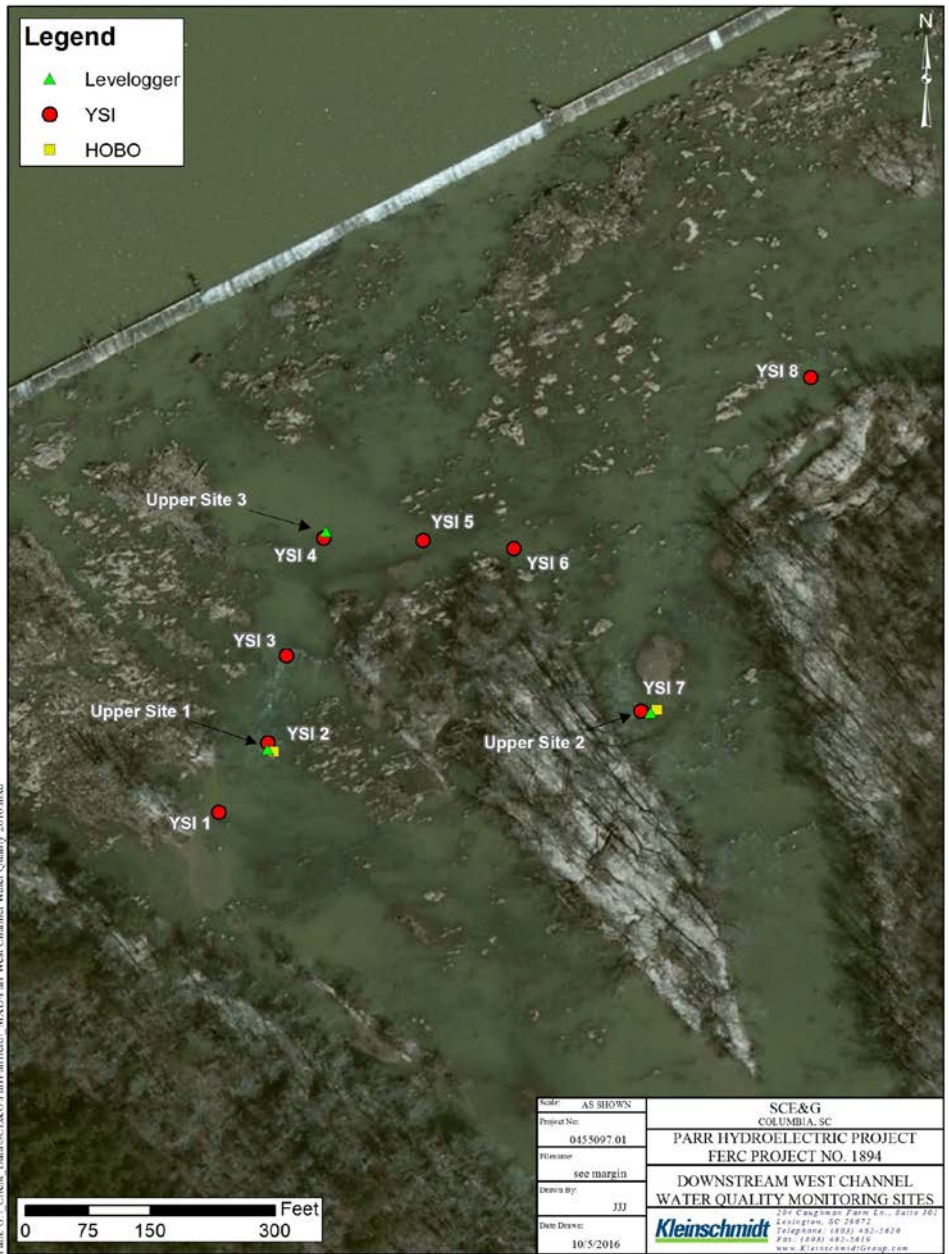
FERC No. 1894

Methods

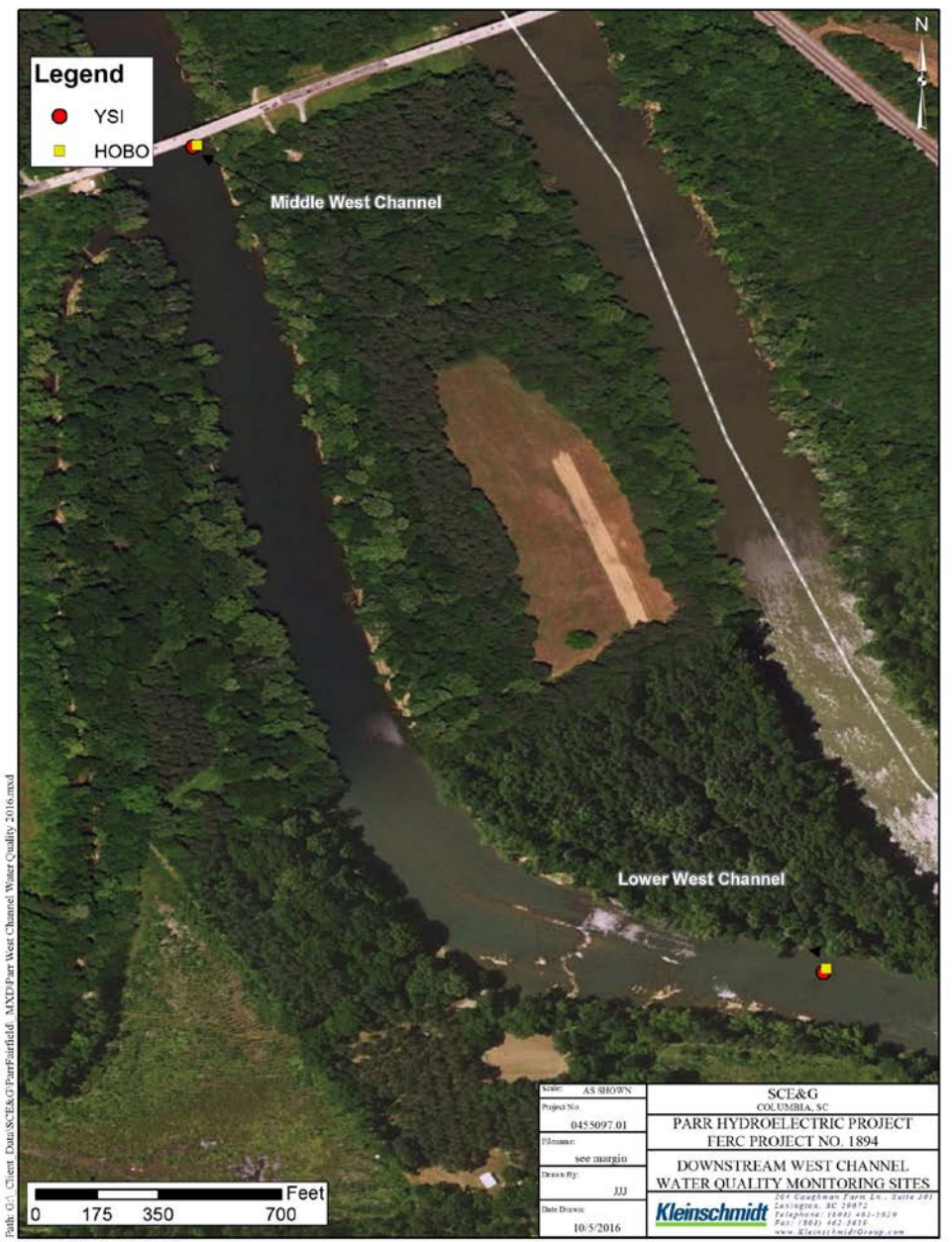
- Continuous temperature and DO data collected using HOBO U26 DO loggers
 - Meters serviced once per week
- Point temperature and DO data collected using handheld YSI DO logger
 - Additional sites in Upper West Channel
- Water level data collected using Levelloggers in Upper West Channel
 - Multiple sites for collection
- Discrete pulse flows released from Spillway gates 1 and 2
 - Approximately 3 hours & 24 acre-ft
- Streamflow collected using conventional USGS methods
 - Upper Site 1 and Upper Site 2

Study Schedule

- August 1, 2016 deploy monitors – baseline data, no pulse
- August 6, 2016 unplanned spill event, approximately 15,000 cfs peak flow
- August 7, 2016 unplanned spill event, approximately 7,500 cfs peak flow
- August 8, 2016 download data, clean, and redeploy monitors – pulse flow
- August 10, 2016 unplanned spill event, approximately 16,500 cfs peak flow
- August 11, 2016 unplanned spill event, approximately 9,000 cfs peak flow
- August 15, 2016 download data, clean, and redeploy monitors – pulse flow
- August 18, 2016 pulse flow
- August 22, 2016 download data, clean, and redeploy monitors – baseline data
no pulse
- August 29, 2016 download data – remove all monitors



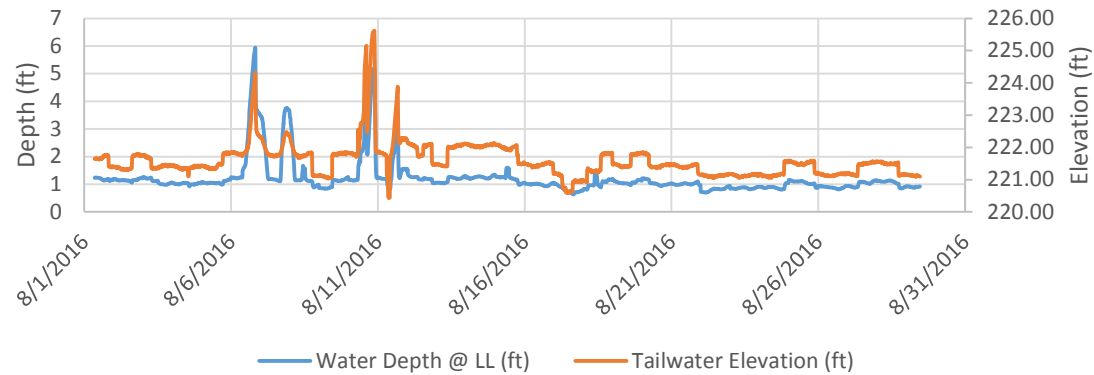
Source: Kleinschmidt, ESRI



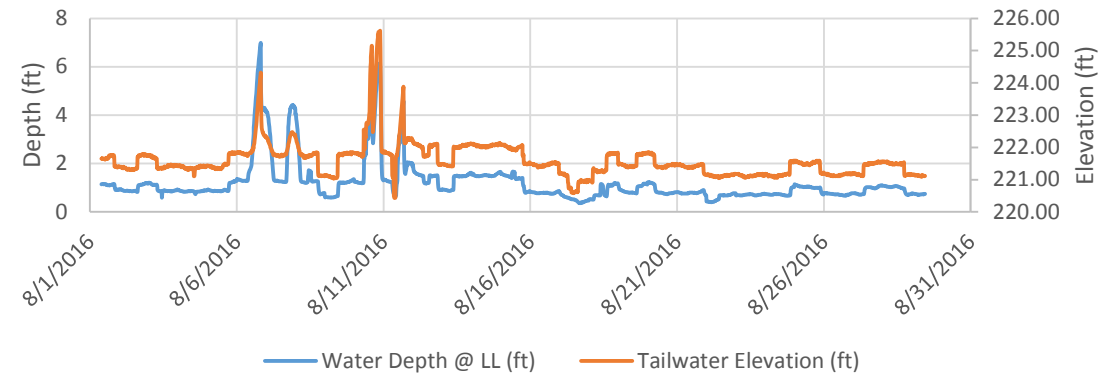
Source: Kleinschmidt, ESRI

Powerhouse Effect on West Channel

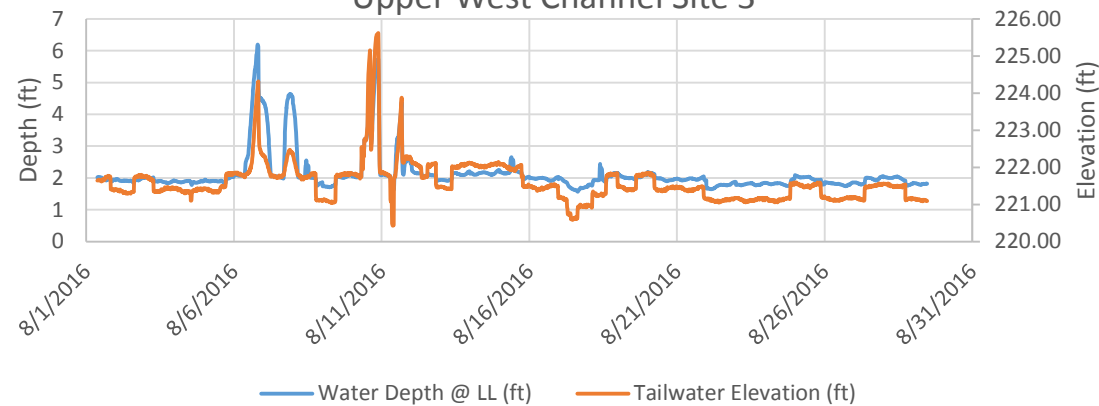
Upper West Channel Site 1



Upper West Channel Site 2



Upper West Channel Site 3



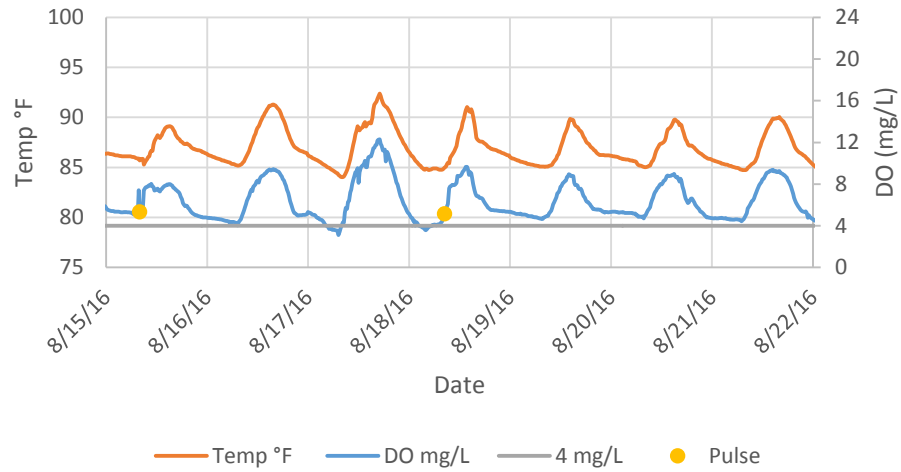
Streamflow Estimates

| UPPER SITE 1 | | |
|--------------|-------------------------|----------------------|
| FLOW (CFS) | LEVEL LOGGER DEPTH (FT) | TAILWATER ELEV. (FT) |
| 16 | 1.13 | 221.34 |
| 20 | 1.15 | 221.70 |
| 40 | 1.25 | 221.85 |
| 60 | 1.35 | 222.00 |
| 80 | 1.45 | 222.10 |
| 89 | 1.50 | 222.20 |

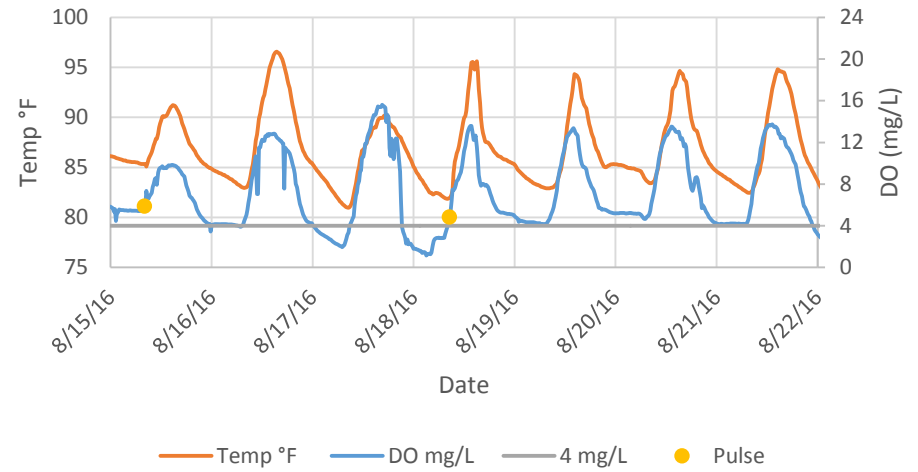
| UPPER SITE 2 | | |
|--------------|-------------------------|----------------------|
| FLOW (CFS) | LEVEL LOGGER DEPTH (FT) | TAILWATER ELEV. (FT) |
| 3 | 0.88 | 221.36 |
| 20 | 1.00 | 221.60 |
| 40 | 1.15 | 221.70 |
| 60 | 1.30 | 221.80 |
| 80 | 1.45 | 221.95 |
| 100 | 1.60 | 222.00 |

Pulse Flow Effect on DO

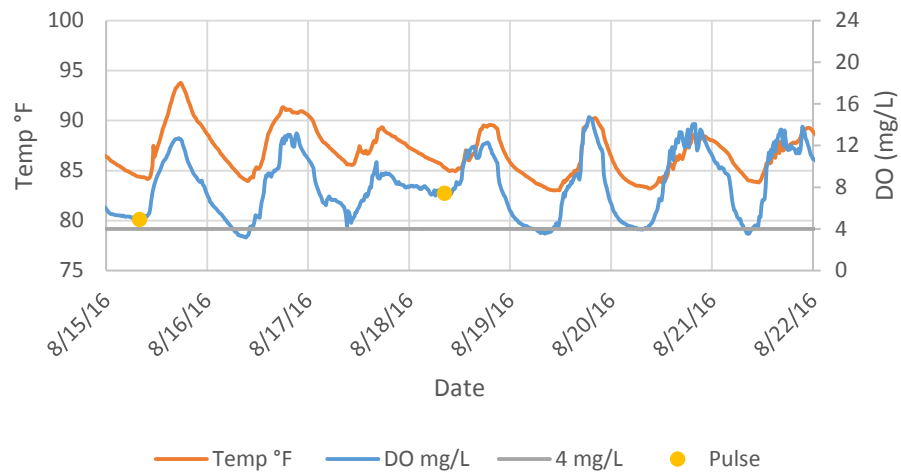
Upper West Channel Site 1: August 15-21



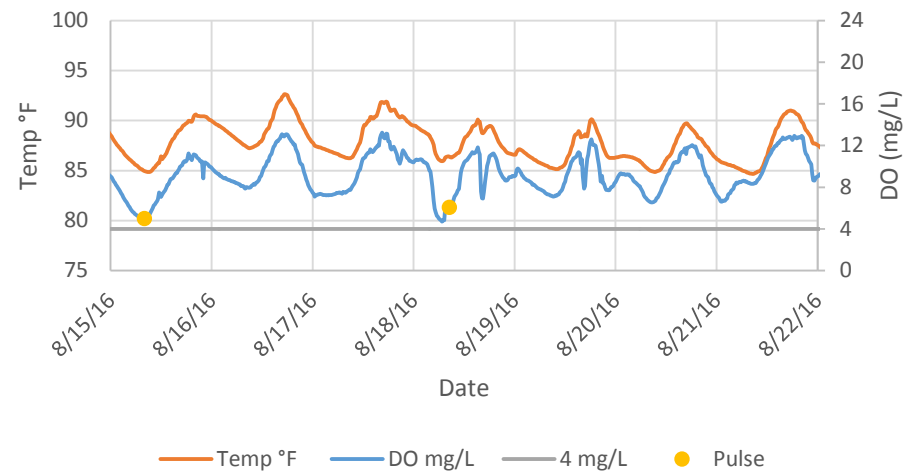
Upper West Channel Site 2: August 15-21



Middle West Channel: August 15-21

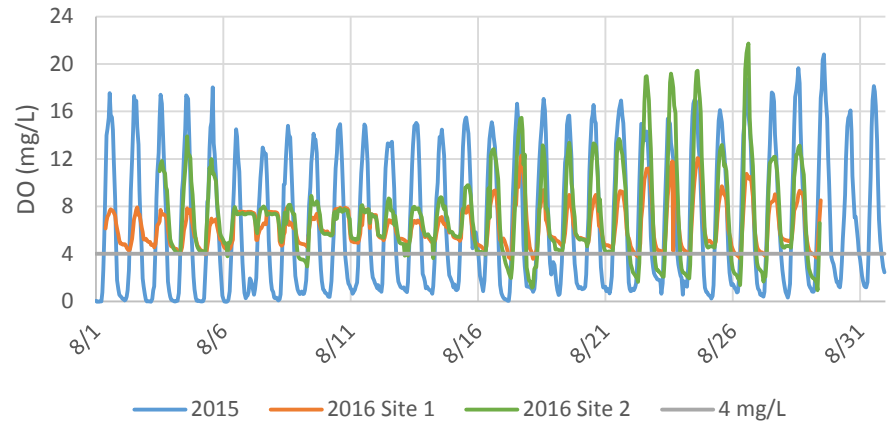


Lower West Channel: August 15-21

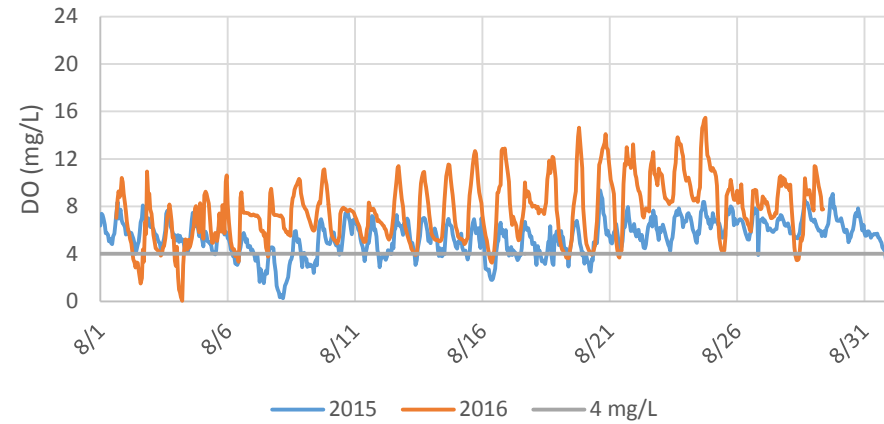


2015 and 2016 Comparison

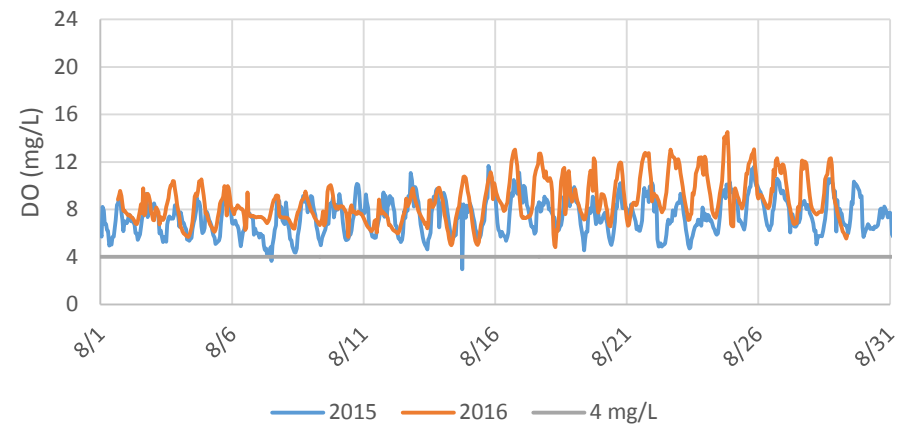
Upper West Channel: 2015 and 2016 DO Comparison



Middle West Channel: 2015 and 2016 DO Comparison



Lower West Channel: 2015 and 2016 DO Comparison



Upper West Channel Aquatic Vegetation



Parr Hydro Downstream Flow Fluctuations Update

December 14, 2016

Stakeholder Request

- Shortnose sturgeon spawning – for 14 days (March 15 – March 31);
- Striped bass, American shad, and Robust redhorse (and other species) spawning - Two 7 day blocks during April 1 – May 10:
- SCE&G is being asked to greatly regulate or remove effects of FFPS operations (generating and pumping) from Parr Shoals dam discharge.
- FFPS may be used for reserve purposes and when project inflow is less than hydraulic capacity of Parr Shoals powerhouse.

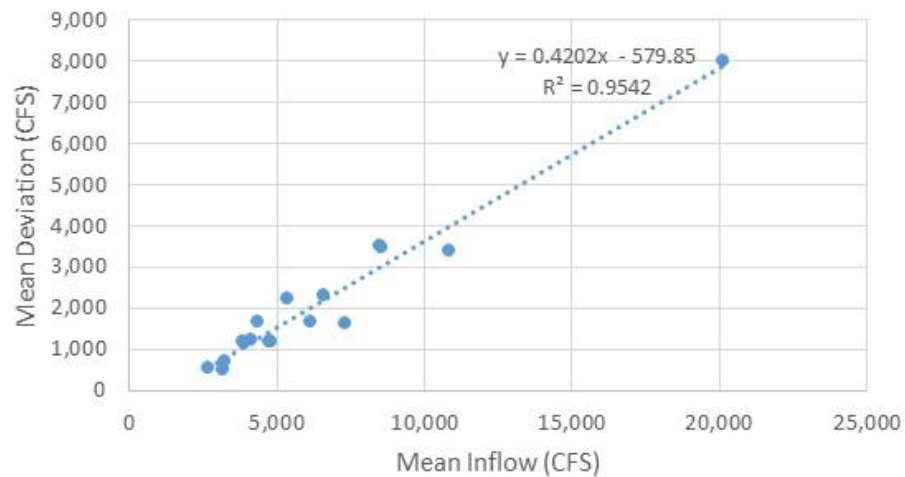
SCE&G Issues

- Having a total curtailment of FFPS operations for these periods is not practical.
- SCE&G has proposed measures to reduce fluctuations and spikes year round:
 - Generator upgrades at Parr Hydro
 - Give operators control of some crest gates 24/7
 - Modify inventory management spills
- In addition, during flow stabilization periods, will manipulate crest gates to track Parr Reservoir and maintain more constant discharge when spilling with FFPS operating.
- Have looked at inflow v. outflow under current license to see how to evaluate fluctuations.

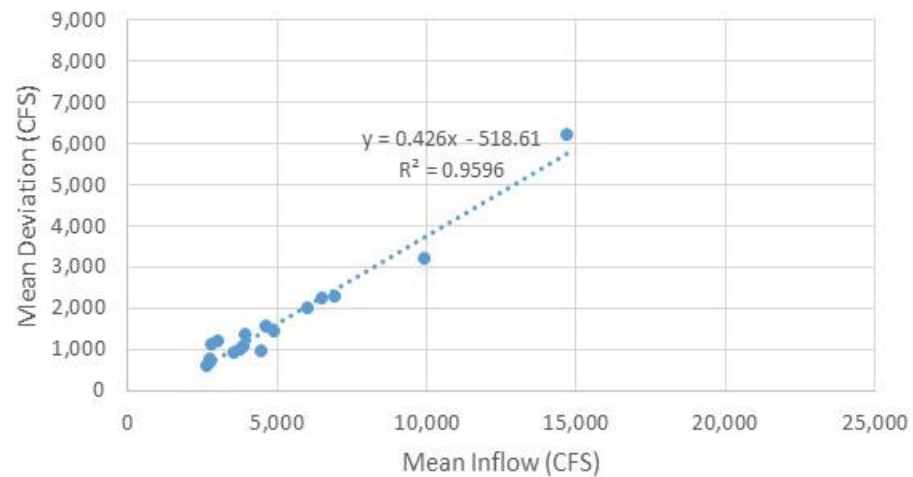
Baseline Data

- Looked at hourly inflow and outflow data for March – May period for years 2000 - 2016.
- Computed absolute value of hourly deviation of outflow from inflow:
 - Deviation = $\text{Abs}(\text{Outflow} - \text{Inflow})$.
- Plotted each year's mean inflow vs. mean deviation from inflow for March 15 – March 31 & April 1 – May 10.
- There is a fairly tight linear relationship between mean inflow and mean deviation from inflow.

Mean Deviation v. Inflow 3/15-3/31



Mean Deviation v. Inflow 4/1-5/10

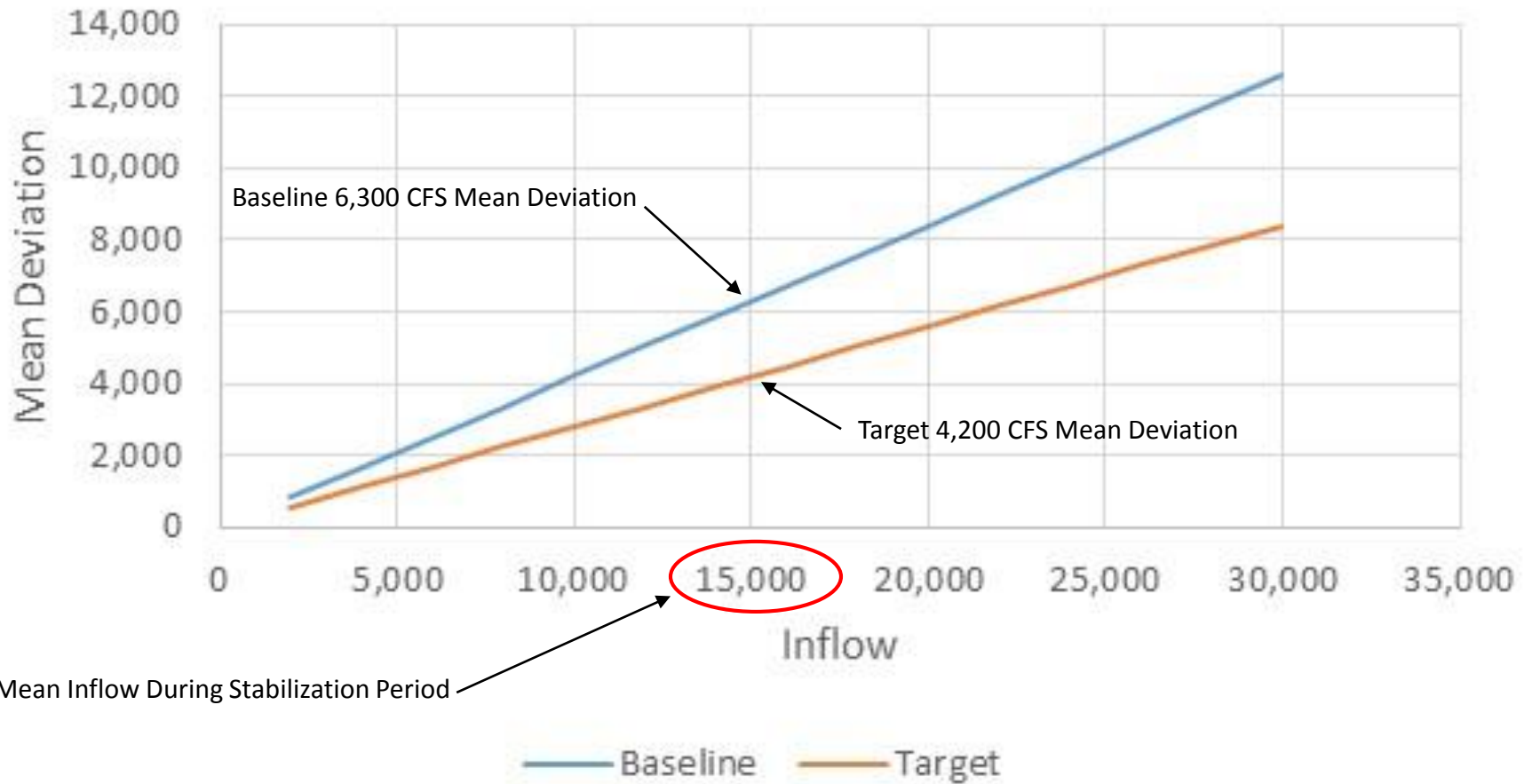


| Year | Mean Inflow 3/15-3/31 | Mean Deviation 3/15-3/31 | % of Inflow | Mean Inflow 4/1-5/10 | Mean Deviation 4/1-5/10 | % of Inflow |
|------|--------------------------|-----------------------------|-------------|-------------------------|----------------------------|-------------|
| 2000 | 8,553 | 3,483 | 41% | 3,943 | 1,343 | 34% |
| 2001 | 8,491 | 3,506 | 41% | 3,034 | 1,207 | 40% |
| 2002 | 4,127 | 1,215 | 29% | 2,817 | 1,091 | 39% |
| 2003 | 20,161 | 8,018 | 40% | 14,730 | 6,227 | 42% |
| 2004 | 3,240 | 720 | 22% | 3,808 | 994 | 26% |
| 2005 | 10,841 | 3,384 | 31% | 6,047 | 2,003 | 33% |
| 2006 | 3,146 | 494 | 16% | 2,777 | 678 | 24% |
| 2007 | 4,327 | 1,655 | 38% | 3,573 | 911 | 25% |
| 2008 | 3,917 | 1,154 | 29% | 2,789 | 753 | 27% |
| 2009 | 6,158 | 1,667 | 27% | 4,931 | 1,428 | 29% |
| 2010 | 7,307 | 1,641 | 22% | 4,465 | 931 | 21% |
| 2011 | 4,780 | 1,194 | 25% | 3,917 | 1,061 | 27% |
| 2012 | 2,667 | 567 | 21% | 2,647 | 595 | 22% |
| 2013 | 4,750 | 1,202 | 25% | 9,943 | 3,190 | 32% |
| 2014 | 6,588 | 2,326 | 35% | 6,936 | 2,274 | 33% |
| 2015 | 3,845 | 1,181 | 31% | 6,542 | 2,235 | 34% |
| 2016 | 5,334 | 2,215 | 42% | 4,630 | 1,557 | 34% |

Adaptive Management

- Use historical mean deviation under current license as a baseline.
- Set annual target reductions in mean deviation under new license.
- SCE&G could track mean inflow and mean deviation as a running measure each year to guide operations to reduce fluctuations below historical levels.
- Annual meeting to review results, set targets, develop operating guidelines.
- Adaptive management will allow SCE&G to develop operating guidelines and limits for different flow ranges, while keeping some FFPS availability.

Baseline and Target Example - 33% Reduction



Mean Inflow During Stabilization Period

Some Thoughts

- Some deviation is present even when gates are up, due to lag of outflow v. inflow – one is low when other is high. Present level of deviation when gates are up may be acceptable?
- Manipulation of crest gates to maintain a more constant outflow as Parr Reservoir fluctuates will require plant to be staffed 24/7 during flow stabilization periods.
- As inflow increases, backwater restrictions will limit how far gates can be raised as Parr Reservoir rises.
- At some level of inflow, FFPS will likely need to be curtailed, similar to current 40,000 CFS limit but lower during stabilization periods.