March 17, 2016

Wilbur Mayorga
Chief
Environmental Monitoring and Restoration Division
701 NW 1st Court, 4th Floor
Miami, FL 33136-3912

Dear Mr. Mayorga:

Florida Power & Light Company (FPL) appreciates the effort extended by Miami-Dade County Department of Environmental Resource Management, the Miami-Dade Board of County Commissioners, and the University of Miami in collaborating on a review of the Turkey Point Cooling Canal System (CCS). As a technical organization, we are committed to the pursuit and application of thorough scientific analysis and welcome the observations of other like-minded individuals and organizations. As can be noted by a review of Dr. Chin's report, the CCS is a complex system whose comprehensive analysis involves a wide range of disciplines and is subject to many influencing factors. We note that Dr. Chin's review was limited by the lack of any direct interaction with FPL engineers and scientists, or the body of data that has been developed to characterize and understand the various forces in action within the system. Not unexpectedly some of the assumptions employed by Dr. Chin are not consistent with our observations or practical limitations. Moreover, we regret that Dr. Chin's work does not reflect the significant results of FPL's concerted efforts undertaken in 2014 and 2015 to address degraded water quality. We do find that the review provides confirmation of many of the activities FPL has initiated, or has attempted to initiate through appropriate regulatory channels, reflected in five recommended actions. Any necessary modification of the protocols will be guided by the lessons learned in 2015 and be accomplished in cooperation with the appropriate regulatory agencies. The following offers an updated commentary on the recommended actions, and discusses FPL's ongoing work to address the concerns these actions seek to address.

Recommendation 1: "Develop a calibrated heat balance model to simulate the thermal dynamics in the CCS, and collect the data necessary to calibrate and validate this model."

Heat balance models are a useful tool that have been used to inform the original design and subsequent changes to system operation and remain an important part of CCS management. It is important that these models be informed with actual system data and observations of the full range of system operations, and with an appreciation for the wide range of water quality, flow distribution, and ambient conditions that affect the heat balance. Importantly, these models have been the basis of regulatory review and direction provided for system operation. Review of the system operational experience through the summer of 2015 confirms that actions taken to restore water quality and system flow have stabilized the thermal operation of the system.

Recommendation 2: "Confirm and identify the causative factors for the decline in thermal efficiency of the CCS between the pre-uprate and post-uprate periods."

There have been multiple reviews over the past 18 months that have identified the causative factors for the decline in thermal efficiency of the CCS. Additionally, the factors have been reviewed in three related DOAH administrative hearings, and testimony before the NRC. These factors have been confirmed, as

identified by the recovery of system thermal efficiency and water quality through actions taken in late 2014 and 2015. Future actions are directed by continuing to validate and address these causative factors.
Recommendation 3: "Develop a quantitative relationship for estimating algae concentrations in the CCS as a function of temperature, salinity and nutrient levels."

FPL continues a detailed data monitoring program to characterize the status and behavior of the ecology of the CCS system. This information will enable development of a longer term solution, which may include re-establishing natural filtration through managed vegetation in the system.

Recommendation 4: "Develop a locally validated relationship between evaporation rate, water temperature, air temperature, wind speed, salinity, and algae concentrations in the CCS."

The salt/water balance model provides a serviceable and validated tool to address the salinity objective identified in this recommendation. The model has been reviewed through regulatory processes and accepted for use in developing predictions of CCS behavior under various future scenarios. Algae and nutrient concentrations are being monitored through the efforts described above, and are the focus of longer term efforts.

Recommendation 5: "Modify the operational protocol associated with the 2015-2016 permit for transferring up to 100 MGD from the L-31E Canal to the CCS."

The 2015 activities associated with the L-31E canal will be the subject of an After Action report by the SFWMD. This report will document the actual pumping history experienced through 2015 and make recommendations for modifications, as deemed necessary. FPL and Miami-Dade County Department of Environmental Resource Management will continue to review system operations to determine consistency with the objectives and requirements of the Consent Agreement. Any revisions to protocols warranted can be accommodated through this vehicle.

In addition to the above annotations, FPL would like to submit the attached addendum providing technical comments for consideration in Dr. Chin's final report.

Sincerely,

on behalf of

Matthew Raffenberg
Sr. Director, FPL Environmental Services

Attachment: Technical Addendum

Technical Addendum

#1 – Temperature in the CCS

Stated Conclusion (pg. 1) – "As a result of the increased heat addition to the CCS, the average temperature of the CCS has increased…"

The review apparently relies on a limited data set (2010 – 2014), and considers no other causative factors for an increase in average CCS temperature. FPL's observations have concluded that the temporal increase in average CCS temperature in 2014 was the result of a series of events that degraded CCS water quality and negatively affected the heat exchange capacity of the CCS. Key factors contributing to the CCS degradation were:

- Lower than average precipitation into the CCS during 2011 through early 2014 established a deficit of rainfall and reduced stage levels in the system. See Figure 1.

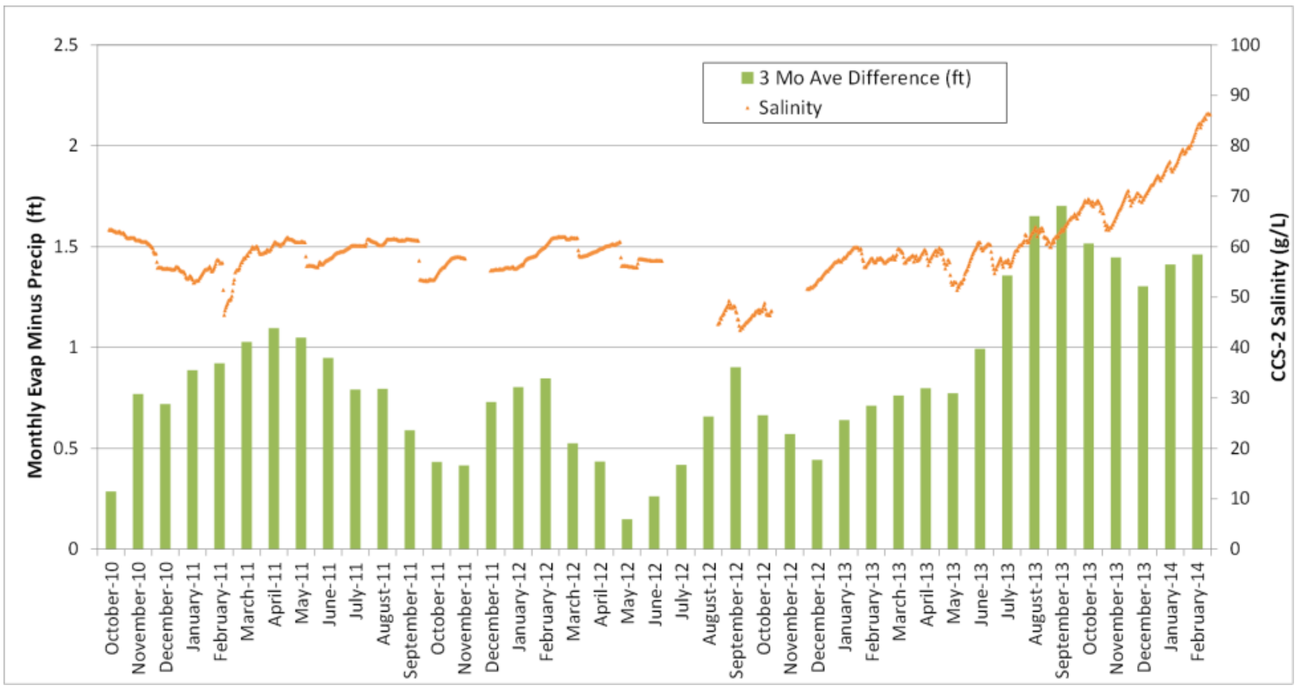

Figure 1. CCS Water balance deficit (Evaporation – Rainfall)

- Beginning in 2010 Unit 2 was secured, along with its circulation water pumps, which provided approximately 17% of design CCS flow. Uprate outages required securing circulating water pumps for Units 3 and 4, sequentially, over a 17 month period beginning in January 2012 and ending in May 2013. This reduced the circulation (and attendant canal flow velocities) to approximately 50% of design for a period of approximately 16 months. Reduction of flow had two affects; a) reduced flow velocities allowed increased deposition of sediments from the water column (preferentially, at the northern end of the system), and b) higher head levels in the eastern return canals inhibiting the historic inflow of saline groundwater into the CCS based on relative tidal fluctuations.

- Observations of CCS water quality during June 2012 noted a significant increase in turbidity and algae concentration, which was reduced upon receiving seasonal rainfall and cooler ambient temperatures in the fall of 2012. Following the dry season of 2013, CCS water quality was once again degraded, with observations of high turbidity. Below average rainfall throughout the remainder of the year contributed to increasing salinity in the CCS.

- In late 2013 and early 2014, salinity increased above historically observed peak levels. High turbidity and algae concentrations were observed out of the normal seasonal occurrences. Significant rainfall did not begin until mid-July 2014. Significant canal blockages in the upper segments of the CCS were observed, particularly during periods of low stage levels prior to rainfall. See Figure 2.

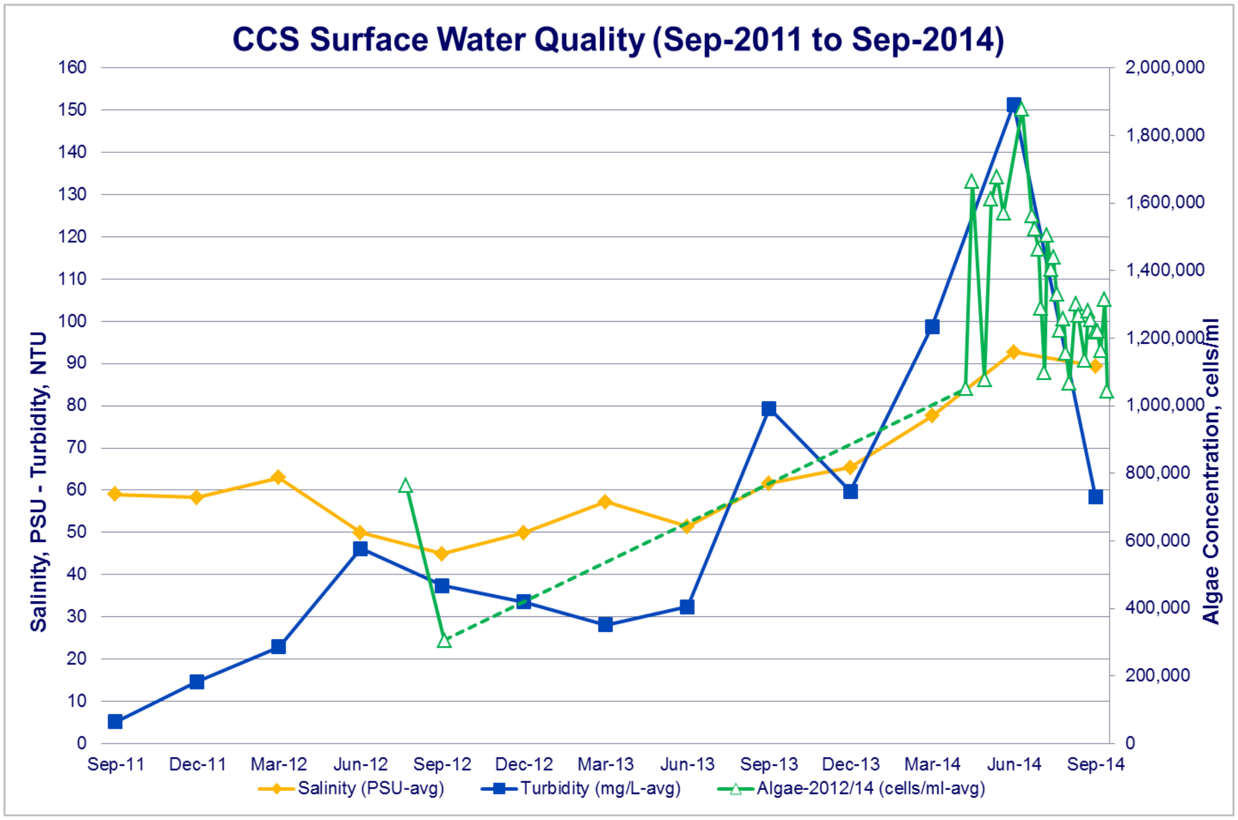

Figure 2. CCS Water quality observations

- A review of CCS heat exchange efficiency shows a decrease from a historic level of 75% efficiency to 65% in early 2013 followed by a decrease to 55% in early 2014. Significant blockages and sediment levels were noted, principally in the northern segments of the CCS. See Figure 3.

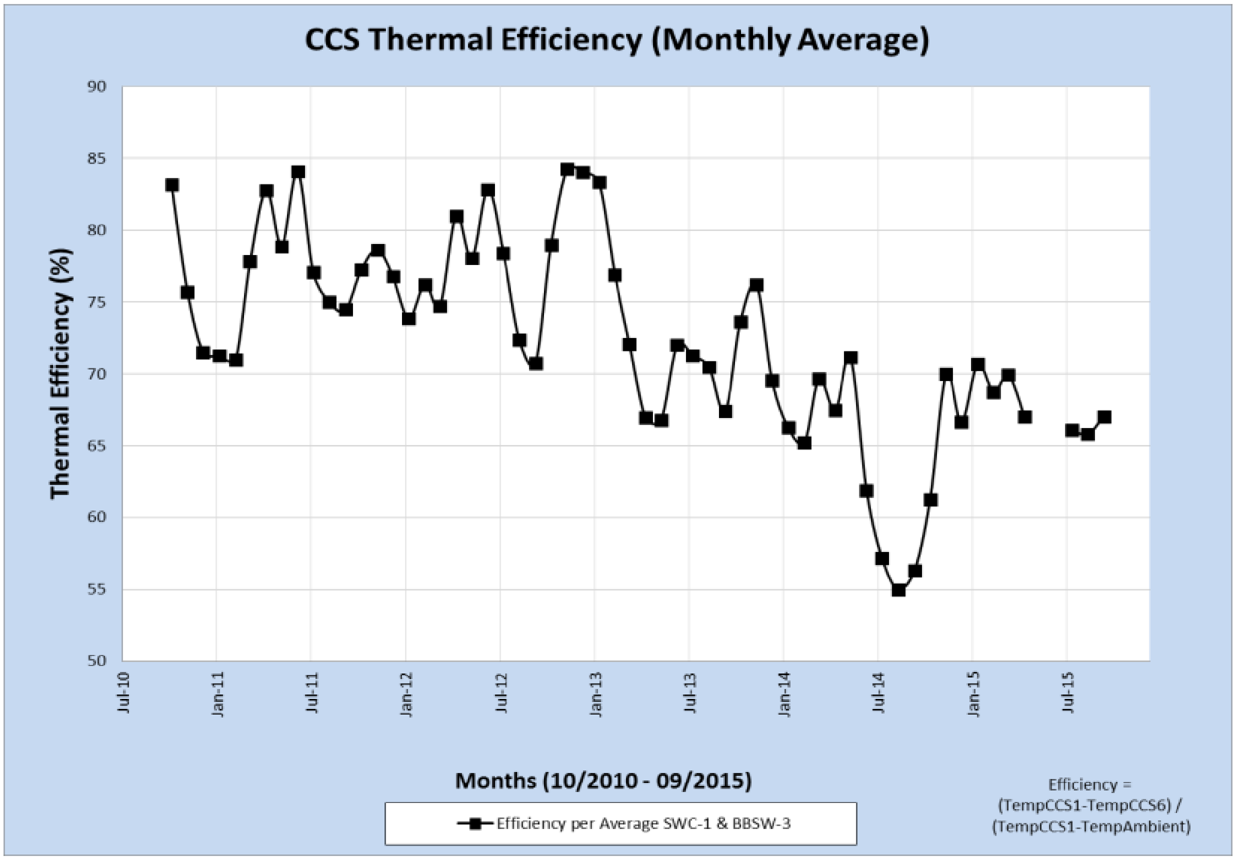

Figure 3. CCS Heat Exchange Efficiency history

- Elevated temperatures in the CCS approached the Ultimate Heat Sink (UHS) Technical Specification limit of 100°F, requiring multiple power reductions to maintain compliance in the summer of 2014. The UHS Technical Specification limit was subsequently amended to 104°F.

- Sediment removal was conducted March through October 2015 to redistribute flow and recover design depths in portions of Section 3 and Section 1. Aerial thermography comparing August 2014 vs August 2015 conditions confirm improved cooling and flow distribution in the system. CCS heat exchange efficiency improved to approximately 65% in August 2015. This is in spite of the fact that five of the canal segments were blocked for sediment maintenance activities during this period. See Figure 4.

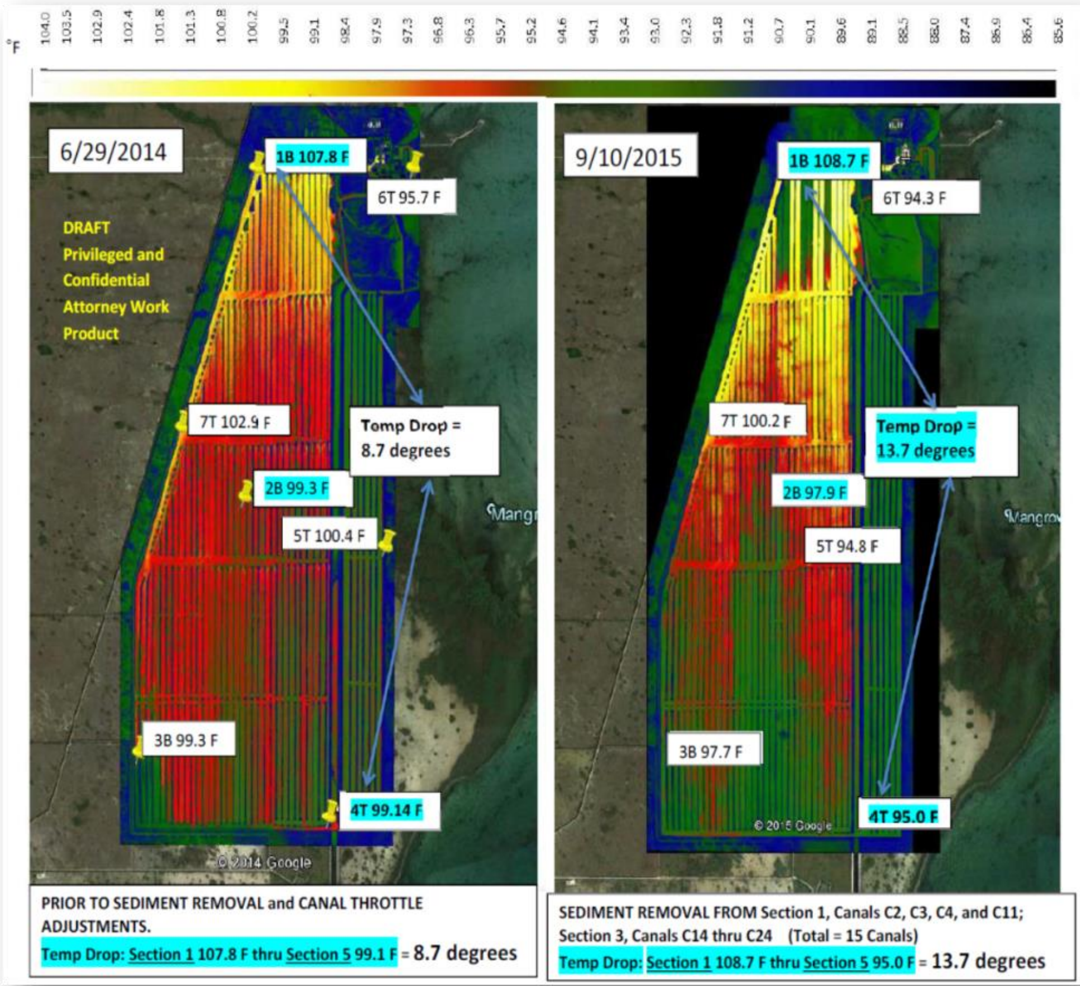

Figure 4. Aerial Thermography showing improved CCS heat rejection in 2015

Conclusion: The combined effect of multiple factors impacted water quality and heat exchange effectiveness to result in elevated CCS temperatures during the summer of 2014. Sediment removal activities in 2015 established improved heat exchange efficiency that reduced CCS temperatures during the summer of 2015, despite continued high salinity (average of 95 PSU) and degraded water quality. Units 3 and 4 operated continuously through the summer of 2015 with a maximum intake temperature of 98.5^{o}F.

#2 - Quantitative Effects of Water Input (Section 4.2)

The discussion of the impacts of L-31E water to temperature and salinity are based on unrealistic and incorrect assumptions that are inconsistent with the observations at site. For example:

- For the calculations, the focus is on the impacts of added L-31E canal water and disregards the variations that come from groundwater exchange and ambient weather conditions (rainfall, evaporation rates, etc.). These factors tend to be significant and more influential than the impacts being hypothetically calculated.

- The calculation assumes a 100 MGD rate of addition for over 170 days. The average daily volume during pumping operations was approximately 30 MGD. The period of active pumping began

August 27, 2015 and ceased November 30, 2015 – a period of 94 days. These events occurred during periods of significant rainfall, whose volumetric contributions were the predominant influence on CCS temperature and salinity during this period.

- In FPL's experience, L-31E water provided an input of approximately 28 MGD (or 0.6% of system volume per day) at an average temperature of 80^{o}F. The temperature impact of this water would be less than 0.2^{o}F degrees each day, calculable but likely not measurable.

- While FPL believes that a potential benefit of adding water is a reduction in CCS water temperature, as the report states, added water is significantly more effective at reducing CCS salinity. As the report later states, evaporation is a notably more effective means of cooling than added water. Whereas the report identifies occasions where water added to the CCS (i.e. L-31E, precipitation) has appeared to produce significant reductions in CCS water temperature, FPL wishes to identify potential inaccuracies in the cited events:

  - The report suggests that the water temperature of the CCS dropped by 6.5^{o}F during the fall 2014 pumping of L-31E water into the CCS. However, based on uprate monitoring data, the average CCS temperature decreased from 92.8°F (September 25) to 91.4^{o}F (October 15), a total reduction of 1.4^{o}F.
  - The report concludes that the average temperature of the CCS dropped from 98.2^{o}F on April 27, 2015 to 81.3^{o}F on April 28, 2015 (a reduction by 16.9^{o}F in one day) due to a rainfall event that occurred in that 2-day timeframe. Based on uprate monitoring data, the average temperatures for April 27 and 28, 2015 were 97.9^{o}F and 96.8^{o}F, respectively. The average water temperature on April 29 did drop to 90.0^{o}F, a reduction of 6.8 degrees in one day. This reduction is likely due to a number of factors, including an approximately 5-inch rainfall on April 29 and a drop in air temperature of a similar magnitude.

Conclusion: The discussion of quantitative effects of L-31E water fail to recognize the actual experience and environment, and therefore overstate the impacts of this activity.

- The report notes that pumping from the Interceptor Ditch (ID) has produced increases in the stage of the CCS. FPL is not cognizant of data that demonstrate a relationship between ID pumping and CCS stage in an absolute or relative sense. Due to the complex nature of inflows and outflows of water from the CCS, it is impossible to isolate the effect of water additions from water additions from the ID on CCS stage.

- The report notes that "In October 2015…FPL reached an agreement with Miami-Dade County which includes construction and operation of six wells that would pump water from the CCS into the Boulder Zone of the Floridan Aquifer so as to reduce the salinity in the CCS". The agreement between FPL and Miami-Dade County includes the design a system to pump low salinity Floridan Aquifer water into the CCS via six wells for the purpose of salinity reduction. In addition, FPL has agreed to remediate the hypersaline part of the plume to the west of the CCS, potentially by pumping water from the Biscayne Aquifer and injecting into the Boulder Zone.

- The report states that a unit volume of evaporated water would cause a 50 times greater temperature decrease than a unit volume of added water. This means that the average 39 MGD of evaporation reduces temperature approximately 50 times the 6.8^{o}F that is attributed (earlier in the report) to the average 43.5 MGD of L-31E water added during fall 2014. In theory, FPL agrees with the relative effectiveness of evaporation at cooling water. As such, FPL believes that comments elsewhere in the report pertaining to the cooling effects of added water to the CCS are overstated.

#3 - Application of Model Results (pg. 39)

The review improperly characterizes that "…the primary motivation for pumping from the L-31E is actually to reduce temperature." At best this statement is an oversimplification. The input of L-31E water was conducted primarily to reduce CCS salinity by making up for evaporative losses and diluting the existing CCS salinity. This allowed for improved water quality and therefore more efficient heat exchange operation. Input of L-31E water can only occur during periods of coincident rainfall.

With regard to the heat balance and unit operations, the following is noted.

- Following the approval of the uprate, but prior to its execution, FPL made the decision to decommission Unit 2. Calculations have been conducted to illustrate the pre- and post-uprate maximum thermal capacity provided by operating units at the Turkey Point site. While Unit 3 and 4 electric capacity was increased by 225 MW as a result of the uprates, Unit 2 was decommissioned removing 400 MW of electric capacity. The resultant net change in thermal heat rejection capacity to the CCS was a decrease of approximately 4%. (See FPL's NRC ASLB testimony, Exhibit FPL 008, November 11, 2015).

#4 - Impacts to Adjacent Water Bodies

- Between August 27 and November 30, 2015, FPL conducted near-sustained pumping from L-31E into the CCS (approximately 30 MGD). During this time, there was no evidence of increasing salinity within even the deepest portions of L-31E adjacent to the CCS. The figure below illustrates the daily averaged salinities in L-31E in the bottom sensors at stations TPSWC-1 and TPSWC-2. Inspection of this figure reveals that there is no notable increase in L-31E salinity (orange and blue lines) beyond the natural fluctuations over the prior year, between late-August and the end of November. See Figure 5.

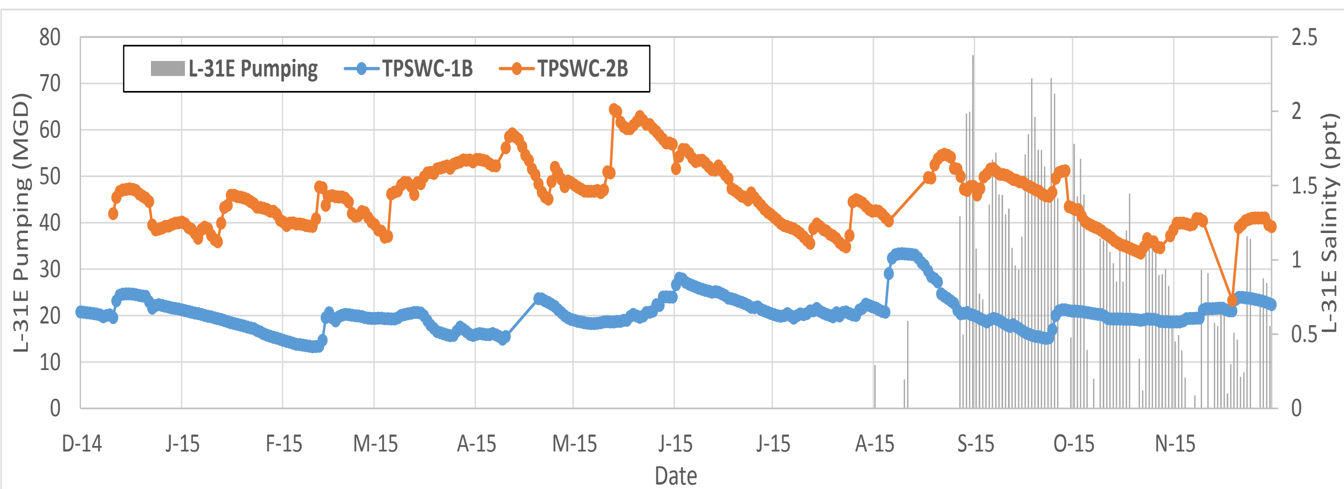

Figure 5. Daily average salinity in lower portion of L-31E (TPSWC-1 and TPSWC-2)

- The seasonal inland movement of saltwater noted in the report (7.5 miles during the dry season, 1 mile during the wet season for 0.5 ft increase in CCS water levels) suggests a maximum rate of migration of 7.5 miles per 180 days (220 ft per day). This rate is significantly higher than and inconsistent with tritium-based estimates of saltwater wedge movement (400 to 500 ft per year).

- While increased salinity in the CCS can contribute to increased saltwater intrusion within the Biscayne Aquifer, as the report concludes, it is also true that periods of increased CCS salinity are generally coupled with depressed water levels within the CCS. These periods of time are generally characterized by predominant groundwater inflow to (and reduced seepage to Biscayne Aquifer from) the CCS.

#5 - Algae in the CCS

- The statement by SFWMD that algaecide is ineffective at reducing algae concentrations in the CCS is contradicted by observed relationships between algaecide concentrations and algae concentrations. Dr. Chin's illustrates this conclusion reasonably well in his report.
- The report speculates on the application of a CuSO4-based algaecide between May 31, 2015 and November 13, 2015. FPL would like to clarify that no such algaecide was applied during this time. The decreasing trend in algae concentrations during this time are likely attributable to salinity concentrations exceeding 70 ppt. The particular algae observed in the CCS during this timeframe are not ideally suited to growing and surviving in water with salinity exceeding 70 ppt.

#6 - CCS Salinity

- While the differential between evaporation and precipitation is a cause for continuing increases in salinity, as the report states, data show that evaporation is greater than precipitation during periods of relatively steady and decreasing trends in salinity (See the 2004 to 2013 timeframe in report Figure 10). For example, between June 1 and August 31, 2012 (pre-Uprate period), cumulative evaporation exceeded cumulative precipitation by more than 200 MG; yet, average CCS salinity decreased by more than 6 ppt during this timeframe.
- In addition to evaporation and precipitation, there are other factors that affect the balance of salt in the CCS, as illustrated in the water and salt balance model. Salinity moderating factors include CCS water seepage to groundwater, inflow of lower salinity groundwater into the CCS, and additional water sources.
- According to the most recent calibrated water and salt balance model (which simulates from September 2010 through November 2015), evaporation is, on average, approximately twice precipitation. During this this timeframe, the CCS has experienced periods of increasing, decreasing and relatively steady salinity.

#7 - Inaccuracies Regarding the CCS

- Card Sound Canal is not a part of the Cooling Canal System. Perhaps the author is referring to the Grand Canal.

- The report notes that typical CCS stage elevations (NGVD 29) near the discharge, CCS southern canal, and intake locations are 2.04 ft, 0.76 ft, and -0.77 ft, respectively. Based on uprate monitoring data, the average stage elevations (NGVD 29) near the discharge, CCS southern canal, and intake locations during pre-Uprate, Interim, and post-Uprate periods are summarized in the table below. These values appear to be inconsistent with the stages stated in the report, and are indicative of a CCS with a lower stage at the discharge location (lower seepage rate to groundwater) and a more moderate hydraulic gradient across the CCS (lower canal flow rate, increased water travel time through the CCS, and increased opportunity for water cooling). See Table 1.

Location	pre-Uprate (ft, NGVD29)	Interim (ft, NGVD29)	post-Uprate (ft, NGVD29)
Discharge (TPSWCCS-1)	1.46	1.22	1.48
South (TPSWCCS-4)	0.78	0.50	0.95
Intake (TPSWCCS-6)	0.41	0.18	0.70

Table 1. Typical stage elevations (NGVD 29) at the discharge, southern end, and intake of the CCS