II. SOUTH FLORIDA WATER MANAGEMENT DISTRICT

II-1) Section 4.5 and Appendix 10.10 of the application address water supply use and sources. FPL proposes to use potable water from the City of Ft. Lauderdale for irrigation. Pursuant to Section 3.2 of the Basis of Review for Water Use Applications, which requires the consideration of the lowest quality water available and feasible, please elaborate on why potable water rather than onsite groundwater is proposed to be used for irrigation at the site.

RESPONSE:

A groundwater irrigation system for PEEC would require at least 15 to 20 shallow wells. Wells for irrigation are not considered feasible at the PEEC Site because of the shallow saltwater interface that is expected to exist. This conclusion is based on the following information: the average wet season water table elevation approximately 1 mile west of PEEC is about 2.0 feet (ft) National Geodetic Vertical Datum of 1929 (NGVD 29) based on water table maps published by Broward County. In the Port Everglades turning basin approximately ½ mile east of PEEC, mean sea level is about 0.7 ft NGVD 29 [National Oceanographic and Atmospheric Administration (NOAA) Tide Data]. Water level data from a U. S. Geological Survey (USGS) monitoring well (G-561_G) located in the Port northeast of PEEC, shows the dry season water table elevation to be approximately 1.3 to 1.5 ft NGVD 29. This elevation is consistent with water levels at the PEEC Site predicted by the groundwater model that was used for the dewatering analysis. If the dry season water table is only 0.7 ft above mean sea level, the Ghyben-Herzberg relationship would indicate that the saltwater interface should be approximately -27 ft NGVD 29 (0.7*40-0.7). Onsite geotechnical and nearby hydraulic data indicate that the surficial aquifer above -9 ft NGVD 29 consists of material that is not very conductive ($2 < Kh < 4$ ft/day). Between -9 and -27 ft NGVD 29, the boring data describe the material as fine sand. Based on this description, the horizontal hydraulic conductivity is estimated to be approximately 35 feet per day (ft/day). If the wells were screened above -9 ft NGVD 29, the drawdown in the well must be less than 0.45 ft to avoid entraining saltwater from below ((27 ft - 9 ft)/40 =0.45 ft). The transmissivity and the maximum specific capacity of the fresh water aquifer above the saltwater transition zone would be approximately 5,000 gpd/ft [(35 ft/day*(27 ft-9 ft) +10 ft * 3 ft/day)*7.48 gallons per cubic foot (gal/ft^3)]. If drawdown in the well is limited to 0.45 ft, a single well could produce only about 1.5 gallons per minute (gpm). This well capacity estimate may be optimistic.

In addition to the need for 15 to 20 shallow wells, the well field design would require detailed modeling because the intake and discharge canals are another source of salt water that could move laterally in the shallow aquifer toward the wells. The irrigation system would require continuous water quality monitoring and automated control at each well. The well field would have to operate almost continuously and a 100,000 gallon storage tank would be required for flow equalization. Finally, a separate water distribution system would be required for irrigation. The capital investment and the ongoing operating and maintenance costs for this irrigation system are not justified for two reasons. First, the city supply has been used previously; it has the required capacity and is available at a reasonable cost. Second, reclaimed water may become available in the future, possibly before an irrigation system of this cost and complexity would reach its useful life and be fully depreciated. This expenditure could limit FPL’s ability to accept reclaimed water for process and irrigation, if available, that otherwise might be environmentally, technically, and economically feasible.

II-2) In Section 4.5 and Appendix 10.10 of the Application, FPL indicates it would evaluate using reclaimed water for process and irrigation uses if the City of Hollywood or the City of Fort Lauderdale builds a pipeline to deliver reclaimed to the PEEC site and if the reclaimed

water meets FPL's water quantity and quality requirements. Please provide additional Information as to the water quality requirements in the SCA so that the potential reuse providers can determine if it is practical to expand their operations to serve PEEC. FPL should contact the utilities to understand their interest and ability to provide reclaimed water at this time.

RESPONSE: Please see SCA Appendix 10.10 Water Alternatives Study and Water Conservation Plan for information about the potential quantities of reclaimed water that PEEC may use for process and irrigation demands. See attached reclaimed water quality Table II-2-1 provided by FPL. FPL is in the process of arranging meetings with the two closest water utilities.

II-3) The following questions are regarding the Dewatering Plan (Appendix 10.9), and the hydrogeologic model used for dewatering analysis. Although a detailed dewatering plan will be provided as a post-certification submittal, FPL should provide reasonable assurances that the dewatering plan is technically feasible and will not impact offsite areas pursuant to Rule 2.5.2 of the Basis of Review for Water Use Permits.

RESPONSE:

Comment acknowledged. The preliminary Dewatering Plan has been revised to address comments provided by South Florida Water Management District (SFWMD) and to correct over-estimation of dewatering volumes discovered in preparing these responses. The revised Dewatering Plan is attached to this completeness response and designated as [SCA Appendix 10.9, Rev. 1 (Attachment I-C.13)], dated March 2012. The computational miscalculation in the original Dewatering Plan resulted in an over-estimation of the dewatering quantities. The error was not in the groundwater model, but in a spreadsheet used to calculate the integrated total flow from the model results. Specifically, Figure 1 and Tables 4 and 5 from the Dewatering Plan have been updated and revised. Additional scenarios were also added to incorporate the updated average and wet season recharge rates and to show the steady-state water levels before dewatering begins. The original scenarios used a number only designation; the new scenarios have a letter designation at the end.

Additional dewatering is expected associated with the installation of the Aquatic Organism Return System (AORS) and other associated linear facilities. When the final ROWs are defined for the associated linear facilities and detailed design is complete, a final Dewatering Plan will be submitted.

FPL is willing to accept a Condition of Certification requiring that FPL provide a final Dewatering Plan post-certification when detailed design is complete. Please also see FDEP-SED Responses I-C.7 and I-C.14 for reasonable assurances that there will be no offsite adverse impacts from dewatering.

II-3)a Please provide the depth of the sheet piles to justify the no flow boundaries.

RESPONSE:

Sheet piles in the model are considered no flow boundaries. Construction drawings for the existing power plant show that sheet piles along the discharge canal extend down to 23 ft below mean water level (mwl), which would be approximately -22 ft NGVD 29. On the intake side, the intake structure extends down to 33 ft below mwl (-32 ft NGVD 29). In the model, the sheet pile walls along the discharge canal were placed in model layers 1 and 2. The bottom of layer 2 is at -9 ft NGVD 29. The sheet pile walls along the intake bulkhead were placed in model layers 1, 2 and 3. The bottom of layer 3 is at -21.5 ft

NGVD 29. Therefore, the depth of the sheet pile walls used in the model are less than the actual depth in both cases (i.e., the model boundary conditions are conservative).

Along the Port Everglades bulkhead, the sheet pile walls, which also represent no flow boundaries, were estimated to extend down to the bottom of model layer 5 (-49 ft NGVD 29). Construction drawings recently obtained from Mr. Robert Musser with Broward County show the toe of the bulkhead piles at -53 ft below mean low water, which would be approximately -53.5 ft NGVD 29. The boundary conditions used in the model are consistent with actual conditions.

II-3)b The hydraulic parameters used in the model seem small. Please provide documentation to justify the parameters.

RESPONSE:

The hydraulic parameters used in the dewatering model are based on Site specific information. Geotechnical borings made at the PEEC Site show that from the ground surface (16 ft NGVD 29) to about -4 ft NGVD 29, the material is composed of fill. Below the fill there is an organics layer that is about 5 ft thick. Between -9 ft NGVD 29 and -49 ft NGVD 29, the material is described as fine sand with limestone fragments. Limestone is found below -49 ft NGVD 29. Hydraulic test data (two aquifer pumping tests (APTs) and 1 slug test) performed on three nearby wells (BEPD-124, BEPD-127 and BEPD-299) with total depths of 10 ft to 15 ft reported horizontal hydraulic conductivity values of 2.1 to 4.3 ft/day. This hydraulic data was obtained from the DBHYDRO database. The base case scenario used 2.0 ft/day in model layer 1. The sensitivity analysis (Scenario 2) evaluated a value of 4 ft/day. The organics layer below the fill material was assigned a base case K_h-value of 0.03 ft/day. The basis of this value is discussed further below. In model layers 3, 4 and 5, a K_h-value of 35 ft/day was used because these layers are described as fine sand with limestone fragments. In model layer 6 the K_h-value was set to 1,500 ft/day because this is representative of the Biscayne Aquifer. The vertical hydraulic conductivity for each model layer was estimated to be K_h /10 in all cases. These conductivity values are consistent with the Site specific hydraulic data and with the technical literature.

The vertical hydraulic conductivity value for model layer 2 (the confining organics layer) was determined by comparing low and high monthly average water levels in the USGS monitoring well G-561_G with model predicted water levels, using average and wet season recharge rates that were estimated from a water budget analysis. The water budget analysis used to estimate recharge rates is discussed below in Response II-3)d. Based on this procedure, the vertical hydraulic conductivity of model layer 2 must be 0.003(+/-33 percent) ft/day (i.e., the range must be between 0.002 ft/day to 0.004 ft/day). Outside this range, water levels and recharges rates cannot be reasonably matched. Within this range, they match very well.

II-3)c Please provide both dewater pumping rates and the volumes. The rates need to be the maximum rates under different conditions. What is the maximum rate during a storm or a storm season? For the volumes, please show at what period and how long the period is.

RESPONSE:

The total dewatering and maintenance volumes (millions of gallons) and the maximum dewatering rates (MGD) are shown in Table 5 (Rev. 1) for each scenario. As discussed in the footnote to the table, the dewatering volume will be pumped in three phases, over 1 to 5 days per phase. Each dewatering phase is separated by 60 to 90 days of maintenance pumping. The final pumping rate will be determined by the dewatering contractor before construction begins. The maximum dewatering rate shown in Table 5 is based on dewatering each phase in one day. The maximum maintenance dewatering rates for each scenario are calculated by dividing the maintenance volumes by 267 days.

II-3)d The assumption of surface recharge rate of 0.5 inches per year may be too small, especially during the wet season or a day with heavy rainfall.

RESPONSE:

Most of the areas surrounding PEEC have directly connected impervious surfaces (e.g., tank farms, parking lots, roads and buildings). Therefore, surface runoff is very high and recharge is very low. Based on a review of the Google Earth® aerial photograph (see Figure 1, Dewatering Plan), the estimated impervious surface area in the model domain is approximately 85 percent. Therefore, the pervious surface area would be approximately 15 percent. Based on this information and professional judgment, a base case of 0.5 inches per year was selected. Nevertheless, to address any concerns about the low net regional recharge rate that was applied to the entire model domain, the revised Dewatering Plan was updated to include additional scenarios with an average regional recharge rate of 1.5 inch per year (in/year) and a wet season regional recharge rate of 4.1 in/year as described below.

Annual average rainfall in the area of PEEC is approximately 64 in/year (SFWMD CUP BOR, Part B, 2003). For a grass-covered pervious surface, if rainfall is 64 in/year, surface runoff should be approximately 8 to 10 in/year. In Fort Lauderdale, pan evaporation is approximately 74 in/year (DBHYDRO Station S140) and reference crop evapotranspiration (ET) is approximately 60 in/year (SFWMD CUP BOR, Part B, 2003). Fernald and Patton (1984) estimate lake evaporation to be 51 in/year. Therefore, a reasonable estimate for actual ET from a non-irrigated grassed area would be 45 in/year (range: 40 to 50 in/year). This estimate is consistent with the regional ET estimate for Broward County provided by Fish (USGS, WRI Report 87-4034, 1988). Based on these values, a reasonable estimate of average net recharge (precipitation minus surface runoff minus ET) through a pervious surface would be 5 to 15 in/year. If pervious surfaces comprise 15 percent of the model domain, then the average net recharge in the model should be 0.75 in/year to 2.25 in/year; and the best estimate would be 1.5 in/year. During the wet season, when precipitation rates are 7 to 9 inches per month (annualized rate of 84 to 108 in/year) a reasonable estimate of the net surface recharge through a pervious surface is 20 to 40 in/year. Under these conditions, the wet season net recharge in the model domain would be 2.8 to 5.6 in/year, with the best estimate being 4.1 in/year.

In Scenarios 1 and 6 from the original Dewatering Plan, the net surface recharge (infiltration minus evapotranspiration) over the construction Site was specified as 50 in/year. Since ET is not subtracted from the infiltration rate in the model, this recharge rate is equivalent to about 95 inches of rainfall per year (50 in/year of recharge + 45 in/year of ET) with no surface runoff. This is equivalent to approximately 7.9 inches per month of rainfall, which reasonably represents wet season conditions.

The average and wet season net recharge rates estimated above are higher than the base case regional recharge rate (0.5 in/year) used in the original dewatering model, but they are much lower than the construction Site recharge rates used in Scenarios 1 and 6 (50 in/year).

Also, the worst-case assumption that was used in Scenarios 6, 7 & 8, that the organics layer is missing or highly permeable, is not justified by the neither the Site geotechnical data or by the results of the model calibration process. These scenarios were provided to envelope the most extreme conditions. These scenarios do not match Site-specific conditions and are very unlikely to develop. Therefore, Scenario 6C is the probable worst-case scenario.

References

Fernald, E. A. & Patton, D. J. (Eds.) (1984). Water resources atlas of Florida, Florida State University, Tallahassee, FL.

Fish, J. E. (1988). Hydrogeology, aquifer characteristics, and ground-water flow of the surficial aquifer system, Broward County, Florida. USGS Geological Survey Water-Resources Investigations Report 87-4034, prepared in cooperation with the South Florida Water Management District, Tallahassee, FL.

II-3)e Please provide the model data sets and base maps for each simulated scenario.

RESPONSE:

The model data sets including input and output files and the spreadsheets used to calculate the dewatering quantities and peak dewatering rates are included on the DVDs provided to the District and FDEP. Additional copies are available upon request.

II-4) Please provide additional information within the Water Conservation Plan (Section 5 of Appendix 10.10) on specific methods to conserve water at PEEC. Water saving devices such as low volume fixtures, automatic shutoff valves along with Florida Friendly landscaping should be specified. The following are staff's recommendations on ways the application could be modified to meet this request:

RESPONSE:

SCA Appendix 10.10, Section 5.0 Water Conservation Plan has been amended to incorporate the design recommendations noted below for new facilities and landscaping, and can be found on the attached CD. Heating, ventilation, and air conditioning (HVAC) cooling towers are not a part of the PEEC Project.

a) Indoor water use design recommendations

II-4)a-i Restroom fixtures meeting EPA WaterSense specifications will be used in all restrooms including High Efficiency Toilets using 1.28 gallons per flush, High Efficiency Urinals using 0.5 gallons per flush or less, High Efficiency Shower Heads using 2.0 gpm or less, and lavatory faucets using 0.5 gpm or less.

RESPONSE:

Restroom fixtures meeting Environmental Protection Agency (EPA) WaterSense® specifications will be used in all restrooms including high efficiency toilets using 1.28 gallons per flush, high efficiency urinals using 0.5 gallons per flush or less, high efficiency shower heads using 2.0 gpm or less, and lavatory faucets using 0.5 gpm or less. This applies to the new facilities only (control room, etc). The existing administration building is excluded from this requirement as no plumbing modifications are proposed for this building.

II-4)a-ii Automatic shutoff valves will be used on all hoses used for cleaning purposes.

RESPONSE:

Automatic shutoff valves will be used on all hoses used for cleaning purposes in the new facilities only. Existing facilities will not be modified.

II-4)a-iii Hot water lines will be insulated.

RESPONSE:

Hot water lines will be insulated in new facilities only. Existing facilities will not be modified.

b) HVAC Cooling Towers

II-4)b-i HVAC cooling towers will be installed with sub-meters for both makeup and blow-down water.

RESPONSE:

Comment acknowledged; HVAC cooling towers are not a part of the PEEC Project.

II-4)b-ii Conductivity Controllers will be installed on all HVAC cooling towers.

RESPONSE:

Comment acknowledged; HVAC cooling towers are not a part of the PEEC Project.

II-4)b-iii HVAC cooling tower will be operated at least five cycles of concentration.

RESPONSE:

Comment acknowledged; HVAC cooling towers are not a part of the PEEC Project.

c) Outdoor landscaping

II-4)c-i All outdoor landscaping will utilize recognized Florida Friendly landscaping principles.

RESPONSE:

Florida Friendly Landscaping principles will be used for new facilities. Existing facilities will not be modified.