


United States Nuclear Regulatory Commission Official Hearing Exhibit	
In the Matter of:	Progress Energy Florida, Inc. (Levy County Nuclear Power Plant, Units 1 and 2)
	ASLBP #: 09-879-04-COL-BD01
	Docket #: 05200029 05200030
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DESCRIPTION OF FIGURES FOR PROPOSED LNP SITE AND SURROUNDING VICINITY

Figure 1A shows the boundaries of the proposed site for PEF’s LNP Units 1 and 2, based on shapefiles provided by PEF. The location for the proposed LNP supply wells (solid white circles), also based on shapefiles provided by PEF, are in the northeast corner of the proposed LNP site, adjacent to the southern boundary of Goethe State Forest. This location is not consistent with the location of the proposed LNP supply wells permitted by the Southwest Florida Water Management District (SWFWMD) in Water Use Permit (WUP) 13262.000 issued on June 2, 2008 (solid yellow circles), with an expiration date of August 26, 2059.

The base map for Figure 1 A is color infrared (CIR) aerial imagery, acquired during December 2003 to March 2004 by USGS and orthorectified as digital orthophoto quarter quadrangles (“DOQQ”). That CIR imagery was obtained online from the United States Department of Agriculture (“USDA”), Geospatial Data Gateway (USDA, 2009) and has a pixel ground resolution of 1 m (3.3 ft). The boundaries of the 2011 “Badlands” wildfire in Goethe State Forest (black outline) were determined by a shapefile provided by the Florida Division of Forestry. The approximate boundaries of the proposed Knight Farm sand mine were georeferenced from figures included in the SWFWMD Environmental Resource Management (ERP) application file for the stormwater management system of the proposed Knight Farm sand mine.

Figure 1A also includes numerous lineaments oriented primarily northeast to southwest and northwest to southeast. The red and orange lines in Figure 1A are lineaments indicative of the fractures and faults mapped by Vernon (1951) respectively and also based on Faulkner (1973). The light blue lines are similar but more extensive lineaments mapped by the Florida Department of Transportation (“FDOT”, 1973). The lineaments were georeferenced using the lineaments maps by Vernon (1951) and FDOT (1973), respectively, according to National Map Accuracy Standards (<http://egsc.usgs.gov/isb/pubs/factsheets/fs17199.html>) and using 114 and 42 control points, respectively, that were distributed over the maps that were identified using similar analog features represented on the raster maps and on reference vectors layers. Raster maps are digital maps composed of individual pixels. Each point must be represented on the map with a pixel and color to provide sufficient detail. The georeferenced lineaments then were digitized using ArcMap™ 10 Geographic Information System (GIS) mapping software. The lineaments from Vernon (1951) were compared to the georeferenced map of the lineaments for Levy and Citrus counties included in Faulkner (1973) and were comparable to those lineaments.

Three of the georeferenced lineaments mapped by Vernon (1951) traverse the proposed LNP site (Figure 1A). Those lineaments are located in the immediate vicinity of four proposed LNP supply wells permitted by SWFWMD in conjunction with the State Site Certification of the proposed LNP. Three of those proposed supply wells (solid yellow circles) are in the southern half of the proposed LNP site, in proximity to the Withlacoochee Canal. Those wells are associated with two lineaments extending southeast through the dammed stretch of the lower Withlacoochee River that is known as “Lake Rousseau” at the junction of the Withlacoochee Canal. These lineaments extend to the southeast into Citrus County, through a cluster of sinkholes (solid blue circles) mapped using coordinates from the Florida Sinkhole Maps database at the following link:

http://fcit.usf.edu/florida/maps/galleries/sinkholes/index.php?pageNum_Recordset1=1&totalRows_Recordset1=52
The locations of the mapped sinkholes were consistent with the locations of sinkholes in the sinkhole shapefile provided by PEF.

These lineaments also extend to the northwest through the Gulf Hammock Wildlife Management Area and the site of the proposed Tarmac mine and intersect with a northeast trending lineament that extends through the existing Lebanon Station Mine. That lineament intersects two additional lineaments mapped by Vernon (1951) that are oriented northwest to southeast and extend through Goethe State Forest. One of those lineaments, identified by Faulkner (1973) as a fault (bold orange line), extends through the approximately 3,000-acre area in Goethe State Forest burned by a destructive wildfire (outlined in black in Figure 1A) that began in April 2011 and continued to smolder and burn for approximately two months.

An additional five lineaments mapped by FDOT (1973) also traverse the proposed LNP site, as shown by the light blue lines in (Figure 1A). The lineament in the southwest corner of the south parcel of the proposed LNP site intersects the southwest supply well (yellow dot), which is designated supply well #1 on the SWFWMD permit. The lineament intersecting supply well #1 also intersects a second lineament northwest of supply well #1, which extends through the eastern stormwater pond (outlined in blue) that is proposed to be excavated in the north parcel of the proposed LNP site. That lineament continues through that proposed stormwater pond into Goethe State Forest, where it intersects with a network of additional lineaments, including the fractures and faults mapped by Vernon (1951).

Southeast of the 2011 “Badlands” wildfire area in Goethe State Forest, north of the proposed LNP and east of the Lebanon Station Mine, the fault described previously intersects with the lineament trending northeast to southwest that is the third lineament mapped by FDOT (1973). That lineament extends through the proposed LNP site, in the immediate vicinity of the fourth proposed supply well permitted by SWFWMD (solid yellow circles) that is associated with these lineaments. This lineament also is in the immediate vicinity of the proposed well locations identified by the shapefiles provided by PEF (solid white circles). All of these proposed supply wells associated with this lineament are located in the northern half of the proposed LNP site. That same lineament also extends southwest through another cluster of sinkholes in Levy and Citrus Counties and the existing Cemex Mine in Citrus County.

The lineaments mapped by FDOT (1973) that are located in the northeast corner of the north parcel of the proposed LNP site intersect the site where the proposed Knight Farm sand mine would be excavated and the vicinity of the proposed Tarmac limestone mine, extending into the Gulf Hammock Wildlife Management Area. The southern lineament of that pair also intersects the fracture (red line) mapped by Vernon (1951) that extends through the proposed Tarmac mine site to the northwest, then through proposed supply well #2, located in the southeast corner of the south parcel of the proposed LNP, and through Lake Rousseau.

The second related figure, Figure 1B, uses the same CIR base map, PEF shapefiles, lineaments indicative of fractures and faults and other symbols as I described for Figure 1A. This figure also includes additional symbols of construction and operation components from the PEF shapefiles I described previously.

Figure 1B is an enlarged view of the proposed LNP site and vicinity. This figure illustrates that the proposed LNP “site access road” (bold brown lines) to the west-central part of north parcel of the proposed LNP coincides with the intersection of two of the lineaments indicative of fractures mapped by Vernon (1951) and extending through the north and south LNP parcels.

Figure 1B also provides an enlargement of the permitted locations of the five supply wells (#1 through #5, solid yellow circles) and five monitor wells (#6 through #10) that are clustered in the southeast corner of the north parcel of the proposed LNP site. This figure shows that the proposed “site access road” also is associated with proposed supply well #5 (yellow dot) that was permitted by the SWFWMD in the north LNP parcel. Other proposed LNP facilities in the immediate vicinity of that lineament and with proposed supply well #5 include the largest of the three proposed stormwater ponds, the two proposed cooling towers and proposed nuclear Units 1 and 2.

Figure 1 B indicates that the five proposed monitor wells permitted by the SWFWMD in the north LNP parcel (#6 through #10) are not located in the vicinity of lineaments either within or outside the proposed LNP site. Those permitted monitor wells also are not located within the wetlands beyond the LNP site boundaries.

Figures 1A and B also show multiple locations of seepage springs (blue triangles) that I documented discharging fresh water along the Withlacoochee Canal and in Bennett Creek (western blue triangle in Figure 1A). Note that the lineament mapped by FDOT (1973) that extends through the location of the proposed supply well #1 in the southwest corner of the south parcel of the proposed LNP site also extends south, through the cluster of seepage springs along the Withlacoochee canal.

Figure 1B also illustrates that the proposed pipeline (bold bright pink) to the debilitated Crystal River nuclear plant in adjacent Citrus County would be constructed in the immediate vicinity and on top of the seepage springs documented as discharging into the Withlacoochee Canal on November 17, 2009. The eastern cluster of these seepage springs in the Withlacoochee Canal is immediately south of proposed LNP supply wells #1 and #3.

Figure 1B also illustrates that the proposed location of the “heavy haul road” (bold light pink lines) crosses all of the lineaments that extend through the south LNP parcel. The proposed location for the “heavy haul road” also coincides with the locations of the proposed supply wells #2, #3 and #4 that were permitted by the SWFWMD in the south LNP parcel.

The black cross-hatching in Figure 1C illustrates the extensive jurisdictional “Waters of the United States” wetlands throughout the proposed LNP site, as determined by the U.S. Army Corps of Engineers and based on the shapefile provided by PEF. This figure also uses the same CIR base map, PEF shapefiles, lineaments indicative of fractures and faults and other symbols as I described for Figures 1A and 1B.

The extent of wetlands mapped by the U.S. Fish and Wildlife Service (USFWS) in its National Wetlands Inventory (NWI) maps throughout the proposed LNP site, Goethe State Forest and remaining immediate vicinity of the proposed LNP site is shown in blue in Figure 2. This figure also uses the same shapefiles, lineaments indicative of fractures and faults and other symbols as I described for Figures 1A through 1C, but the lineaments mapped by the FDOT (1973) are shown in lavender in this figure, instead of in light blue. Figure 2 also shows the proximity of the four permitted supply wells in the south LNP parcel and the fifth permitted supply well in the north LNP, in proximity to the lineaments from Vernon (1951) and FDOT (1973) extending through the proposed LNP site and for more than 30 km from the proposed LNP site.

Figure 1D also uses the same CIR base map, shapefiles, lineaments indicative of fractures and faults and other symbols as I described for Figures 1A through 1C. This figure also illustrates lineaments extending through permitted supply wells #1, #2 and #3, Lake Rousseau, the Withlacoochee Canal and the Cemex Mine.

Figure 1E shows that all of the boreholes taken by PEF were clustered closely in the center of the north LNP parcel, rather than distributed widely throughout the entire proposed LNP site and surrounding vicinity or along the lineaments indicative of fractures and faults. The locations of the boreholes in Figure 1E were determined from the borehole shapefile provided by PEF. The same CIR base map, shapefiles, lineaments indicative of fractures and faults and other symbols as described for Figures 1A through 1D were used in Figure 1E.

Because Figure 1E is an enlargement of the north LNP parcel, the location of the three proposed stormwater ponds (perimeters outlined in blue) shown in Figure 1D, are more easily seen. In addition to the lineaments that intersect these three proposed stormwater ponds, these proposed ponds also located over multiple depressional pond-cypress wetlands that appear as dark gray-green areas on the DOQQ CIR

imagery layer. The locations of the stormwater ponds in Figure 1E also were determined from shapefiles provided by PEF.

Figures 3A and B incorporate the computer raster file for the Integrated Wildlife Habitat Ranking System developed by the Florida Fish and Wildlife Conservation Commission (“FFWCC”) in 2009 as the base map. The legend in these figures was generated by the FFWCC raster file. The lineaments for these maps are the same as for the previous maps, with the Vernon (1951) lineaments in orange and the FDOT (1973) lineaments in white. The boundaries of the proposed LNP site and the Goethe State Forest were created using the same shape files as for the previous figures.

Figure 4 was created using the same DOQQ CIR as the base map and all of the other symbols referenced previously. The additional information provided in Figure 4 includes the white triangles at the locations of thermal infrared signatures indicative of groundwater discharges in the vicinity of the proposed LNP that were identified by Raabe and Bialkowska-Jelinska (2010) during a period of low ambient temperatures in March 2009, based on shapefiles provided by the U.S. Geological Survey (USGS) office that conducted that study. This figure illustrates that the majority of these individual points form an “S” shape that coincides with the boundary between the coastal forested hammock habitat and the coastal marsh, suggesting that these groundwater discharges play an important role in maintaining both habitats.

This figure also provides related locations where I collected surface water salinity measurements in January 2012 (diamonds) and March 2012 (crosses). Salinity levels ranged from fresh to saline (0.01-5 ppt = dark blue; 5.01-14 ppt = light blue; 14.01-21 ppt = green; 21.01-24 ppt = orange; 24.01-30 ppt = red, respectively). Several inferences can be made from the pattern of these ranges in salinities:

The multiple dark blue crosses located in the center of the Gulf Hammock Wildlife Management Area west of the location of the proposed Tarmac aggregate mine represent several small mines where excavated limestone from the carbonate aquifer system have resulted in large areas of fresh groundwater discharge. The cluster of blue diamonds approximately 8 km north of those small mines and coinciding with the lineament (diagonal red line) extending from the proposed supply well in the southeast corner of the south LNP parcel represents additional small mines. Limestone was excavated from the carbonate aquifer system at these locations, diverting a larger volume of ground water into these pits and exposing the ground water, now as surface water, to high evaporation rates and resulting in irreversible adverse impacts to the natural hydroperiod.