June 26, 2012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)		
	)	Docket Nos.	52-029-COL
Progress Energy Florida, Inc.	)		52-030-COL
(Combined License Application for	)		
Levy Nuclear Plant, Units 1 and 2)	)	ASLBP No.	09-879-04-COL

PRE-FILED DIRECT TESTIMONY OF MITCHELL L. GRIFFIN, PH.D.
REGARDING PASSIVE DEWATERING AND ACTIVE DEWATERING DURING CONSTRUCTION

Please state your name, address and provide your qualifications.

1. I am Mitchell Lee Griffin, 3011 S.W. Williston Road, Gainesville, Florida. This is my office address.
2. I am a Principal Technologist in Water Resources with CH2M HILL, Inc., an engineering company providing consulting services to Progress Energy Florida, Inc. (PEF) for the proposed Levy Nuclear Plant, Units 1 and 2 (LNP).[1]
3. My professional and educational experience is summarized in the curriculum vitae included as Exhibit PEF003. I hold a Doctorate of Philosophy degree from Purdue University (through the Agricultural Engineering program) and a Bachelor of Science degree in Civil Engineering and a Master of Science degree in Agricultural Engineering from the University of Kentucky. I am a registered Professional Engineer (P.E.) in the States of Florida, Georgia, and Louisiana.

What has been your personal experience with the LNP project?

4. I have been involved in addressing water resource issues relating to the LNP for about six years. In my capacity as the surface water resources engineer for the LNP project, I am responsible for providing technical support on the National Pollutant Discharge Elimination System (NPDES) permit application and conducting senior review of surface water hydrologic evaluations. I am

[1] Exhibit PEF002 defines select acronyms used in my testimony as a convenient reference.

knowledgeable of passive and active dewatering issues related to LNP, stormwater, and the effects of dewatering on surface waters, including Outstanding Florida Waters (OFWs). I have reviewed the analysis and provided advice and input for preparation of the LNP Environmental Report (ER) submitted to the NRC as part of the combined license application (COLA). Specifically, I am knowledgeable of, and have provided advice and input on formulating portions of, the ER, the Site Certification Application (SCA), and the NPDES permit application. I provided testimony during the SCA hearings on water quality issues, effects of the LNP project on the Cross Florida Barge Canal (CFBC) and portions of the Withlacoochee River, and also the groundwater impacts near the CFBC. I am familiar with and have reviewed carefully certain sections of the Draft Environmental Impact Statement (DEIS) published on August 5, 2010, and the Final Environmental Impact Statement (FEIS) published on April 27, 2012 (NRC001).

5. I am familiar with Joint Intervenors' (Intervenors) Contention 4A, which was admitted by the Atomic Safety and Licensing Board (Board) in the U.S. Nuclear Regulatory Commission (NRC) combined license proceeding for LNP. Contention 4A asserts that the FEIS is deficient, in part, because it fails to adequately address, and inappropriately characterizes as SMALL, certain specific environmental impacts to wetlands, floodplains, special aquatic sites, and other waters, associated with dewatering.

6. For the LNP project, I prepared or conducted senior oversight of the sections of the SCA that dealt with surface water impacts, including the preparation of the NPDES and Environmental Resource Permit (ERP) applications. I was responsible for preparing the NPDES permit application and responses to follow-up information requests with the Florida Department of Environmental Protection (FDEP) on that Federal permit, which FDEP issues with approval from the U.S. Environmental Protection Agency (EPA). I provided senior review and advice to the LNP plant designers, Sargent & Lundy and Shaw Group, Inc., on compliance with Florida stormwater regulations. As part of the Section 316 Clean Water Act (CWA) studies, I led the evaluation of the flows into the CFBC from Lake Rousseau, the water quality data from the CFBC and the Gulf of Mexico (Gulf), potential flow and water quality of the LNP discharge, and flows from Lake Rousseau into the lower Withlacoochee

River. The SCA heavily referenced the ER, which I also reviewed during its development. The ER was submitted as Appendix 10.11 to the SCA. The ERP application was Appendix 10.4 of the SCA. As part of the administrative hearing for the SCA, I provided testimony on the NPDES permitting issues and potential changes to groundwater salinity near the CFBC. I was accepted in the Florida SCA proceeding as an expert on impacts to surface water and groundwater resources in the vicinity of the CFBC. After the State's Conditions of Certification (COC) were issued by the State Siting Board, I performed senior review of additional floodplain evaluations that were conducted to assess the effect of fill in wetlands and changes to the 100-year flood levels (for the Section 404 CWA permit to be issued by the U.S. Army Corps of Engineers (USACE)). I have also helped to prepare plans of study to conduct monitoring of water quality in the Gulf prior to and after LNP operations.

What will your testimony address specifically?

7. My testimony specifically addresses Intervenors' claims in Contention 4A of LARGE[2] environmental impacts resulting from "passive dewatering" alleged to result from the stormwater control and "active dewatering" during construction. I will address the impacts onsite and offsite, direct or indirect, including wetlands, floodplains, special aquatic sites, and other waters, including specifically the Withlacoochee and Waccasassa Rivers, and the surficial and Floridan Aquifers underlying the LNP site and the surrounding area. LNP was designed to avoid and minimize offsite impacts to the greatest degree possible on surface waters and my testimony will explain how this is accomplished with respect to passive dewatering. In addition, my testimony will explain that active dewatering during construction is of short duration and will have minimal impacts onsite or offsite. My testimony will demonstrate that the onsite and offsite environmental impacts, direct or indirect,

[2] "LARGE" is defined by the NRC as "Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resources." (FEIS, NRC001, p. 1-4).

including cumulative impacts, from passive dewatering and active dewatering during construction will be nonexistent to SMALL.[3]

To place your testimony in context, please describe the LNP site and related waters.

8. Contention 4A broadly challenges the FEIS's analysis of impacts, associated with dewatering onsite and offsite, to the following: "wetlands, floodplains, special aquatic sites and other waters;" the "Floridan aquifer system;" and "Outstanding Florida Waters such as the Withlacoochee and Waccasassa Rivers." It is my understanding that the FEIS need only analyze those waters where impacts from the LNP are reasonably foreseeable. Accordingly, a description at the outset of the LNP site, site waters, and waters that are in the vicinity of the LNP site will help put Contention 4A in the proper context for my testimony.

9. The LNP site lies in a rural portion of Levy County, Florida. The Board visited the LNP site January 11, 2012, and I will refer to BRD001, p. 3, for the main components that I will be discussing. The LNP main power generation facilities will be located in the middle of what is now a pine plantation. The parcel is 3,105 acres and is sometimes referred to as the north property, because PEF also owns the parcel to the south (a.k.a. the South Property, an additional 2,114 acres). In general, when the ER and FEIS refer to the "LNP site" it is to the north property only, and I will continue with that convention in my testimony.[4] However, the freshwater supply will be from wells located in the South Property and the heavy haul road, pipelines, and transmission corridors will pass through the South Property. No other construction or disturbance will occur in the South Property as a result of the LNP project. Other locations in BRD001, p. 3, that I will refer to include the CFBC (where the intake is

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[3] "SMALL" is defined by the NRC as "Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource." (FEIS, NRC001, p. 1-3).

[4] While my testimony adopts the ER and FEIS convention for the meaning of the phrase "LNP site," its references more generally to "site," "onsite," "offsite," or "property" will be intended to take into account *both* parcels of PEF property: the north property in which the LNP will be located, as well as the South Property.

located), the lower Withlacoochee River (by the label on the figure for the "Blowdown Pipeline"), and U.S. Highway 19 (US 19) west of the LNP site.

10. The LNP main power generation facilities, including buildings and cooling towers, are shown on BRD001, p. 4. The main power generation facilities will be elevated above the natural ground surface by approximately 8 feet, creating a higher "island" that raises the powerblock, cooling towers, and associated service buildings above the 100-year floodplain (FEIS, NRC001, p. 4-4). The switchyard area adjacent to the main power generation facilities will also be raised about 5 feet (FEIS, NRC001, p. 3-23). There will be three stormwater ponds around the raised power plant to collect stormwater runoff for treatment, some retention, and attenuation prior to release back to the ground (FEIS, NRC001, p. 3-30).

11. Ecologists categorize habitats into community types for discussion and assessment purposes, and the U.S. Department of Agriculture Natural Resources Conservation Service has developed 26 types of natural ecological communities for use in Florida. The LNP site and South Property currently are considered a flatwoods ecological community altered by many years of silviculture, specifically the cultivation of pine trees for harvesting. This landscape is mostly flat and surface water moves from the LNP site and South Property by overland flow. Technically, the western half of the LNP site is historically more of a wetland hardwood hammock ecological community and it transitioned to a North Florida flatwoods ecological community to the north and east. However, the silviculture has eliminated most of the distinctive characteristics of these two historical ecological communities. About 54 percent of the landscape of the LNP site and South Property is considered wetlands, and runoff gathers in the lower shallow wetlands and overflows this landscape during wet weather. More wetlands exist to the west of the LNP site and South Property at the lower elevations and in remnant forested wetland ecological communities. There are no creeks, streams, ditches, or channels that lead offsite; therefore, only stormwater runoff by overland flow is pertinent to the discussion of surface water impacts from the LNP. Roads (existing and future) onsite are elevated somewhat, which is a customary practice on flat landscapes in Florida, and stormwater primary flow paths will be

maintained by culverts located at existing low areas. I will discuss the stormwater on the LNP site and South Property in greater detail later in this testimony.

12. I will now describe the regulatory status of wetlands, floodplains, special aquatic sites, and other waters in relation to the LNP site and South Property. Only a few named surface water bodies are in proximity to the LNP site and South Property. Only the surface waters in immediate proximity to the LNP site and South Property are relevant, and the waters farther away to the north and east of the LNP site and South Property, or south of Lake Rousseau, are not relevant.

13. These comments explain the special regulatory meaning of certain surface waters. The EPA identifies six categories of "special aquatic sites" in EPA's Section 404(b)(1)-Subpart E guidelines (45 Fed. Reg. 85,336, 85,344, Dec. 24, 1980), including the following:

- Sanctuaries and refuges
- Wetlands
- Mudflats
- Vegetated shallows
- Coral reefs
- Riffle and pool complexes

14. Of EPA's categories of special aquatic sites listed above, only wetlands are present at the LNP site and South Property; the LNP site and the South Property are located inland, and there are no lakes or streams onsite. Both the LNP site and South Property's ecology are north Florida flatwoods with mostly level landscape scattered with both hydrologically-interconnected and isolated wetlands with slightly lower elevations than the surrounding woods. The landscape has been modified heavily from past silviculture activities. The LNP site's and South Property's wetlands are all freshwater wetlands.

15. The classification of surface waters by their designated use is delegated to States in the CWA, and surface water classifications are included in Section 62-302.400, Florida Administrative Code (F.A.C.). There are five use classifications recognized in Florida: Class I (Potable Water Supply), Class II (Shellfish Propagation or Harvesting), Class III (Recreation, Fish, and Wildlife), Class IV (Agricultural Water Supply), and Class V (Navigation, Utility, and Industrial). There currently are no Class V designated surface waters in Florida. All surface waters not designated otherwise are considered Class III surface waters. All wetlands on the LNP site and South Property are Class III surface waters and, therefore, are not considered special aquatic sites under State surface water quality standards. That is not to say that wetlands are not afforded regulatory considerations, but none of the wetlands on the LNP site or South Property have more than ordinary regulatory status.

16. As described in FEIS Section 2.3.1.2 (NRC001, pp. 2-22 and 2-25), there is an interconnection between the wetlands, near-surface groundwater levels, and the Upper Floridan Aquifer in the area surrounding the LNP site and South Property. Flow through the Upper Floridan Aquifer is mostly west by southwest, directly to the Gulf or toward the lower Withlacoochee River or Lake Rousseau (NRC001, p. 2-27).

What are Outstanding Florida Waters and are there any in the vicinity of the LNP site?

17. Florida has a category of surface waters called OFWs that do have special regulatory considerations. OFWs are defined explicitly in Section 62-302.700 F.A.C., “Special Protection, Outstanding Florida Waters, Outstanding National Resource Waters.” Generally, all water bodies under this Section are called OFWs and these include waters located in State or national parks, refuges, recreational areas, and preserves, or that are specifically designated as special aquatic sites. I developed a figure showing all of the OFWs and lands containing OFWs in the vicinity of the LNP site that FDEP has published in a Geographic Information System (GIS) database (*see* BRD002). This Exhibit is a combination of figures available in the FEIS, including Figure 2-8 that shows three sub-basins, and Figure 2-18 that shows the local preserves published in the State of Florida’s GIS database (NRC001, pp. 2-18 and 2-84). There are many shaded areas included in BRD002 but many are State-owned

lands that have a preservation function. For example, the Levy County Forest/sandhill polygon adjacent to the northeast section of the LNP site (also known as Goethe State Forest) identifies waters within its boundaries that have OFW protection, but does not imply that the entire shaded area is water or an OFW. This information combined on one map serves as an aid to readily show all OFWs in proximity of the LNP site. This Exhibit can be used as a reference for the following discussion.

18. Most of the LNP site and South Property drain into three sub-basins defined by FDEP as Spring Run Creek, Direct Runoff to Gulf, and the Withlacoochee River (BRD002; FEIS Figure 2-8, NRC001, p. 2-18). The Waccasassa River is north of the Spring Run Creek sub-basin, so surface water from the LNP site and South Property could not reach that river, or any other OFW that may lie outside of these three drainage sub-basins. Surface water will not flow back to the east either, so the waters in Goethe State Forest (located north and east) would not be affected.

19. The only relevant OFW in the vicinity of the LNP site is the lower Withlacoochee River, from the Inglis Lock Bypass Channel to the Gulf, but not including the isolated segment of the river between Lake Rousseau and the CFBC (the CFBC bisects the Withlacoochee River) (*see* FEIS Figures 2-6 and 2-9, NRC001, pp. 2-15 and 2-20). FEIS Figure 5-3 (NRC001, p. 5-10) is an excellent schematic of the relationships between the water bodies in this area. The components of the CFBC project that have been re-designated by Florida as the Cross Florida Greenway Recreation and Conservation Area (including Lake Rousseau, the CFBC, and the remnant of the Withlacoochee River below Inglis Dam) are not OFWs except within portions of the lands around Lake Rousseau that lie in a State park. Only the lower Withlacoochee River downstream of the Bypass Channel is relevant, because the Withlacoochee River upstream and east of Lake Rousseau is not in proximity to the LNP site, and drainage from the LNP site flows mostly westward and thus does not affect the portion of Lake Rousseau that is designated an OFW.

20. The LNP power generation facilities will be located approximately 3.4 miles from the lower Withlacoochee River, 3.0 miles from Lake Rousseau, and 7.9 miles from the Gulf (BRD002). Surface water derived from the northern portion of the LNP site is eventually intercepted by an offsite

creek called Spring Run Creek after stormwater flows through the flatwoods (both onsite and offsite) into the US 19 drainage system, and then toward the Gulf (BRD002; FEIS Figure 2-8, NRC001, p. 2-18). The portions of the LNP site draining to Spring Run lie north of the raised LNP powerblock. Little activity will be conducted in this sub-basin; portions will be used as material laydown and parking areas during construction and the permanent transmission switchyard. Spring Run Creek is a Class III water body and only some of the Waccasassa Bay Preserve State Park near the coast lies in this sub-basin. Because the preserve is in the salt marsh along the Gulf, there will be little influence of freshwater on this area and the LNP site is located more than 7 miles away (about 7 miles in a straight line, but the flow path is more winding and lengthy).

21. Portions of the LNP site, where the raised powerblock and stormwater ponds will be located, drain southwest, through flatwoods both onsite and offsite, into the US 19 drainage system and then directly to the Gulf through a series of interconnected wetlands (BRD002). There are no named streams or creeks in this sub-basin and there are preserves only in the salt marshes along the Gulf. Again, the flow path is indirect and far away from the salt marshes with special concern.

22. A small portion of the LNP site that will contain the transmission line lies in the lower Withlacoochee River basin (BRD002). The South Property draining west and southward only contains the freshwater well field, haul road and an onsite pipeline and transmission line corridor (FEIS Figure 2-3, NRC001, p. 2-4). After a careful review of the floodplain flow and detailed topography, I determined that the surface water runoff from the South Property is intercepted by ditches on offsite western properties that drain mostly south toward County Road 40 (CR 40) and is intercepted by the Bypass Channel. Stormwater overflows through the interconnected wetlands located offsite and move further west to the lower Withlacoochee River. The Bypass Channel is a Class III water body, but it does flow directly into the lower Withlacoochee River.

How should "passive dewatering" and "active dewatering" be defined?

23. The terms "passive dewatering" and "active dewatering" are not terms normally used by water resource engineers. In trying to address Contention 4A issues, the scientists and engineers at

CH2M HILL needed to interpret what the Intervenors may have meant, because most experts in the field would divide issues into technical disciplines, such as stormwater management or groundwater hydraulics. To better address the technical issues raised by the Intervenors, we have defined passive dewatering as the removal of water through non-mechanical means (no pumping involved). Active dewatering would therefore involve pumping or other mechanical methods. Since stormwater will not be pumped to be removed from the LNP site, it is the primary focus of passive dewatering. Dewatering during LNP construction would be considered active and pumping groundwater for water supply during LNP operation will be addressed as active dewatering during operations by other testimony. This division is not arbitrary as Dr. Bacchus claims in her November 15, 2010 affidavit,[5] because breaking water resource issues into surface and groundwater hydrology components is a well-established approach from university to professional settings. Dr. Bacchus used the terminology "mechanical" and "non-mechanical" in her 2006 paper[6] and also referred there to pumping as active dewatering. It is a conventional scientific approach to parse big questions into smaller questions so that relationships can be defined and examined, and then consolidate the relationships back into the larger analysis, often with the use of computer simulation programs. Subsequently, the tools that the surface water hydrologist and groundwater hydrologists use have evolved into different technical specialties; so it naturally directs us to evaluate and defend our work along those same disciplines. Linkages between technical disciplines are incorporated into the analyses and are used to evaluate the larger ecosystem. So the passive dewatering at LNP examined in my testimony includes the natural water cycle on the surface and the interaction with the near-surface groundwater. In this testimony, LNP site water may include surface water, stormwater, and runoff (another term for excess stormwater) that are often used synonymously. Passive dewatering most often occurs from man-

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[5] Bacchus, S. November 12, 2010. Attachment 2, Affidavit of Sydney T. Bacchus in Support of Joint Interveners' Responses to Environmental Impacts of Proposed Levy Nuclear Plant Units 1 and 2. (Bacchus 2010) (Submitted in support of a Motion for an Amended Contention 4 (November 15, 2010), page 5, paragraphs D.1 and D.2).

[6] Bacchus, S. 2006. Nonmechanical Dewatering of the Regional Florida Aquifer System. Geological Society of America Special Paper 404, pp. 219-234. (Bacchus 2006).

made drainage infrastructure (*e.g.*, ditches and pipes) designed to remove water to facilitate a new land use.

24. There are periods of time during the year when the groundwater table is very near the ground surface in the flatwoods (autumn is the typical seasonal high water table level) surrounding the LNP site, so we have, for design purposes, assumed the conservative condition with the groundwater table being at the surface (using seasonal high water table levels is a bounding assumption commonly used in Florida because that would produce the most runoff volume). Some rural lands and developments (such as subdivisions) attempt to "dry-up" wet conditions through lowering near-surface groundwater levels by underground drain tiles, pipes, or ditching. Another potential passive dewatering impact could be observed downstream when small creeks or flow-ways are mechanically altered (i.e., made larger by excavation) to remove water from the land quickly without careful planning and engineering. None of these activities are proposed as part of the LNP project.

Will passive dewatering have environmental impacts onsite or offsite?

25. In my professional opinion, any passive dewatering resulting from the LNP project will have inconsequential impacts because design features of the LNP project were selected in part to avoid the type of activities that could cause passive dewatering. I base this statement, in part, on conditions that will exist at the boundary of the 3,105 acre LNP site and the 2,114 acre South Property. There are no existing ditches, creeks or streams that leave the perimeter of the property now, and no new ditches will lead offsite, as proposed. New power plant facilities are being built on a raised "island" above ground, and drainage facilities around the new buildings and roads are designed to manage stormwater. Stormwater ponds, often required by the State of Florida to control stormwater and runoff rates, will overflow in a controlled manner onsite to the natural landscape. The LNP project, as proposed, avoids impacts because surface water will not be ditched offsite through channels and, therefore, will not cause rapid runoff. Open mine pits will not occur at the LNP site or South Property; therefore, there is no profile modification that could cause passive dewatering contrary to the Intervenors' postulation in Bacchus 2006. The LNP will generally sit on top of the natural

landscape, collect and treat stormwater from the new buildings and roads, release stormwater from the new facilities in a controlled manner onto the natural ground (onsite), and let any runoff occurring from "uphill" to flow through the property in a manner that will not increase peak runoff flow rates. The only stormwater related component of the system that will permanently be created lower than the natural landscape are portions of the stormwater ponds. The runoff from the raised LNP powerblock will be captured by the stormwater ponds and will replenish the near-surface groundwater under normal and dry conditions. The limited depth of the ponds will minimize passive dewatering during dry conditions. These specific items are described further in the following paragraphs. During normal (or wet) conditions, the ponds may be full at the time of a storm event and they will not capture a lot of additional water, but the storage within the ponds will keep more water onsite and available for percolation. During dry conditions, if the water level in the ponds is low because of the naturally lower groundwater table, the ponds will capture much more runoff and retain it for percolation. Under both normal and dry weather conditions, the ponds will capture and detain more stormwater runoff for groundwater recharge through percolation than the existing shallow wetlands would.

26. Dr. Bacchus claimed that just having new infrastructure onsite to manage stormwater is proof that dewatering is occurring and that the raised island alters the path of stormwater (Bacchus 2010, paragraph D.2). Again, changes in flow patterns around the new power plant and associated facilities will occur, but not to a point where it affects offsite conditions. Further, the changes to the onsite drainage patterns are more accurately described as resulting from the LNP project's earth fill and required stormwater management activities, not from dewatering.

Please describe the proposed onsite stormwater facilities.

27. Drainage from the elevated LNP powerblock will be piped or ditched to collect in three large stormwater ponds surrounding the raised landscape, which will hold water at or above the natural ground level (FEIS Figure 3-4, NRC001, p. 3-8; BRD001, p. 4). The ponds will have raised dikes surrounding them to keep the collected stormwater staged above ground level. These ponds are

called "wet ponds" in Florida because the pond bottoms will be below the natural seasonal high groundwater level; so there will be some open water in the ponds most of the year. The depth of the ponds will be consistent with FDEP guidelines that will limit the average depth of the ponds (about 6 to 8 feet average depth below the ground). At least 35 percent of the ponds' bottoms will be shallow and planted with wetland plants in front of the ponds' outfall. Over the last three decades, wet ponds have emerged as the preferred stormwater treatment method in Florida in locations with high groundwater conditions, like the LNP site, because they have a proven track record of nutrient and sediment removal as well as mitigating the peak runoff rates. The stormwater collected in the wet ponds will be detained to allow sediment and solids to settle and be trapped in lower portion of the ponds. The stormwater will be exposed to sunlight and vegetation that will allow for natural processes to treat nutrients and other pollutants. The surrounding dike will have a spillway that releases high levels of stormwater down to the natural ground, which will be dispersed on the downstream side to prevent erosion or scouring and allowed to flow into the onsite landscape. All of these features will minimize the offsite stormwater effects from the LNP project and constitute the current standard of best practices for stormwater management in Florida.

28. The roadways to the LNP site and South Property will also be elevated above natural grade, and stormwater from the roadways will be treated in adjacent swales that will discharge to surrounding wetlands. Swales are wide, shallow, grassy areas that will treat the stormwater from the roadways by filtering (shallow flow across grassy area) and percolation that will reduce solids and sediment in the runoff. These swales will be incorporated into the fill section and will not be excavated below natural landscape grades. Some culverts will be installed under the roads at natural flow-path locations to allow stormwater to drain from higher-ground elevations from the east to lower ground elevations on the west to preserve the natural flow patterns of the overall landscape. There are no onsite ditches now and there will be no ditches leading offsite in the future. Water passing through the culverts will be dispersed on the downstream side and allowed to flow into the onsite landscape in areas that maintain the existing flow paths of the property prior to the LNP project. These equalizer culverts are

necessary to avoid redirecting the water to other locations and will avoid changing the volume of runoff to existing downstream wetlands before they drain offsite, thus minimizing any effects from the roads.

29. Dr. Bacchus's affidavit (Bacchus 2010, paragraph D.4) claims that neither the DEIS, PEF, nor I addressed the excavation of the canal permitted by FDEP for the cooling water tower water supply. There is no cooling tower water supply canal proposed to be constructed as part of the LNP project. The cooling tower water supply will come from the existing CFBC. An intake structure, with pumping station, and pipeline will be constructed on the north bank of the CFBC to move water to the cooling towers. The FEIS does include an analysis of the impacts of the pipelines and intake structure (FEIS Chapter 4, NRC001, addresses the construction impacts from all LNP facilities). These facilities were also addressed by PEF in the SCA and CWA Section 404 permitting activities. The cumulative impacts of these activities are also subject to the CWA NPDES permitting system and provisions included in the State's COC. I will present testimony later that will discuss active dewatering during construction of the pipelines leading to the canal.

30. There will be no landscape profile modifications for stormwater management that will alter the subsurface soils or water levels to depths that would be considered significant from a geologic standpoint. The stormwater facilities are being designed to account for the natural seasonal high-water table that is near the ground surface (FEIS, NRC001, p. 2-28). Stormwater will flow from the wet ponds over the crest of the main spillways (approximately 1-foot above the natural ground) and through small 12-inch pipes that slowly drain the ponds with their bottom flow elevation set at natural ground level. Dikes will surround the ponds because the water levels in the ponds will fluctuate between natural ground level and the raised powerblock. There will be no construction for stormwater management that will modify the soil profiles so deeply that it may induce indirect drainage, because new facilities will be above grade and the primary water control features (stormwater ponds) will maintain water levels at or above the seasonal high-water table during the wet season, such that the near-surface groundwater levels will not be artificially lowered. There are

some periods of time when the groundwater levels will fluctuate below the ground surface level resulting from the natural seasonal fluctuation of the groundwater table. The available groundwater onsite monitoring well data indicate that surficial aquifer water levels naturally varied about 5 feet during 2007 to 2008. A review of a longer period of record (30 to 40 years) of nearby regional observation wells indicates a natural groundwater fluctuation of up to 7 to 8 feet (FEIS, NRC001, p. 2-28).

31. The FDEP is the State of Florida's lead review agency for power plants and their stormwater management. On August 26, 2009, the State of Florida Siting Board issued its Final Order Approving Certification of the LNP site (PEF004). That order was issued subject to the LNP's compliance with the COC set forth in Exhibit B to the Final Order. The most recent version of the COC was issued on January 25, 2011 (PEF005). One of the State's requirements is to protect adjacent property owners from increased flood stages and to prevent adverse water quality and quantity impacts associated with stormwater from new property developments. The COC included the floodplain requirements of the Levy County Code of Ordinances, *Chapter 50 Article VI Flood Damage Protection* (Levy County, 1991), and of the Southwest Florida Water Management District (SWFWMD) by reference (PEF005, pp. 4-5, and 40-41).

32. Florida has been proactive in regulating stormwater since the early 1980s. No new development that may alter stormwater, use sovereign land, or conduct dredge and fill in waters of the State can be built without State approval, which is commonly addressed by meeting ERP requirements. ERP requirements are established by the local water management district, SWFWMD in this case, and are incorporated into the COC. When engineers design stormwater management facilities in Florida, they rely on the water management district's guidelines and rules. Specifically, the LNP drainage facilities must meet the criteria shown in the SWFWMD ERP Basis of Review (BOR) as adopted by the FDEP in 2006 (BOR (Adopted by FDEP Rule 62-330.200(3), F.A.C.), PEF006). The BOR contains the pertinent criteria that the LNP project must meet so that this project will have no adverse offsite impacts or indirect passive dewatering. Pertinent BOR criteria can be summarized as follows:

- It is permissible to allow onsite wetlands to receive stormwater and to consider the compensating storage effect when estimating impacts (BOR 4.9, PEF006, Chapter 4, p. 2).
- No offsite impacts can result during a 100-year storm (BOR 4.4, PEF006, Chapter 4, p. 1), which is 11.3 inches of rainfall in 24 hours at the LNP site.
- If fill is placed in low lands, including wetlands, the stormwater volume that would have stayed onsite prior to development must be replaced by new retention storage onsite (BOR 4.7, PEF006, Chapter 4, p. 2).

33. The fact that the LNP project meets Florida's stringent floodplain and water quality treatment criteria in the BOR provides increased confidence that no adverse offsite impacts will occur and the recharge of stormwater into the underlying aquifer systems will not be reduced. I will discuss in more detail the reasons why these provisions mitigate potential flooding impacts.
34. The SWFWMD BOR 4.2 (PEF006, Chapter 4, p. 1) requires that the quantity of stormwater runoff be regulated to prevent offsite impacts by controlling peak stormwater runoff rates from a 25-year, 24-hour storm (8.5 inches of rainfall at the LNP site). The post-development peak runoff rate must be less than or equal to the pre-development rates to prevent an increase in offsite flooding. This requirement will be satisfied on the LNP site by directing the stormwater from the new facilities to the wet ponds that surround the raised powerblock or the swales by the roads. The three large stormwater ponds at the LNP site were designed to collect and detain the entire runoff from the 25-year, 24-hour storm (8.5 inches), and prevent erosion from the runoff associated with a 100-year storm (11.3 inches) (FEIS, NRC001, p. 3-30). Stormwater will be stored in the three wet ponds and released more slowly to meet the pre-development peak rate (*see* SCA Appendix 10.4, Attachment A.3, Drawing LNG-G100-X3-014-01, PEF007). From the proposed roadways for the LNP, the shallow, broad, grassy swales will slow down the stormwater runoff and cause some ponding by detention prior to release to the natural landscape (SCA Appendix 10.4, Attachment A.3, Drawing LNG-G1-X0-043, PEF008). The peak runoff rate from the centrally located LNP site facilities will

be further attenuated as stormwater flows into the undisturbed landscape and wetlands that surround the new facilities. Because of the stormwater detention ponds, roadside swales, and the central location of the developed area compared to the property boundaries, it is my professional opinion that runoff flow rates at the LNP site and South Property boundary will not exceed existing runoff rates.

35. Stormwater quality is also regulated by the FDEP and is addressed by the SWFWMD BOR (Exhibit PEF006, Chapter 5, pp. 1-4). Florida has some of the most stringent stormwater quality treatment requirements in the nation. Projects designed to meet the SWFWMD criteria provide reasonable assurance of compliance with the State water quality standards. On average at any given location in Florida there are about 100 to 120 storms per year, with about 70 of them resulting in greater than 0.1 inch of rainfall. Driscoll *et al.*, 1989[7] lists the average number of storms with 0.1 inch or more precipitation in Florida at about 70 events per year, and the average event size to be about 0.8 inches. Data reviewed from multiple sites in north Florida show about 115 storms greater than 0.01 inches (*see* ER Table 2.7-2, PEF010,pp. 2-646 to 2-648). Stormwater treatment of 1 inch of rainfall will treat about 85 percent of the average annual rainfall event volume because most of the storms are small. The wet ponds surrounding the powerblock will collect and slowly discharge the runoff volume from 1 inch of rain. While all of the runoff is treated from larger storms, the runoff volume roughly equivalent to the permanent pool volume will be subject to a longer detention time, which enhances treatment, including removing sediment. Wet ponds provide superior sediment capture rates from large areas when compared to other stormwater treatment practices. The ponds will have wetland plants across at least 35 percent of the shallow areas to filter and use nutrients. The open water areas are exposed to sunlight (ultraviolet radiation) that will reduce some pollutants and allow algae to remove more nutrients. A moderately deep permanent pool will prevent scouring and allow longer detention time for settling between storm events. The small pipe at natural ground level in the

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[7] Driscoll, E.D., G.E. Palhegyi, E.W. Strecker, and P.E. Shelley. 1989. Analysis of Storm Event Characteristics for Selected Rainfall Gages Throughout the United States. Prepared for the U.S. Environmental Protection Agency, Washington, D.C. (PEF009, p. 32).

spillway will be sized to restore the treatment volume in about 5 days; because it rains on average every 3 to 5 days in Florida (*e.g.*, 365 days per year/70 events equals 5.2 days between events greater than 0.1 inches; 365/115 equals 3.2 days between events with greater than 0.01 inches of rain). SWFWMD's BOR requires that the runoff from a 1-inch storm be available again within 72 hours after the storm, and only that volume discharged within 36 hours of the storm can be used to store the design event (BOR 5.2.a.5, PEF006, Chapter 5, p. 1). Consequently, these three wet ponds are the best alternative for treating the runoff from the LNP powerblock and meeting the SWFWMD BOR requirements.

36. Swales are designed for shallow flow that will provide treatment benefits from filtration through grass. Swales are required in Florida to be at least 12 feet wide at the top and about 1 foot deep. A typical design cross section provided in the SCA shows the swales along the haul road to be approximately 46 feet wide from the road to outer edge, on each side, to allow ample storage in the LNP's swales to collect and treat runoff from the road (SCA Appendix 10.4, Attachment A.3, Drawing LNG-G1-X0-043, PEF008). Again, all of these swales will have their bottom elevations near the natural landscape elevation.

How will the proposed LNP project affect the floodplain and wetlands?

37. Any direct filling of wetlands will be addressed as required by the USACE as part of the Federal dredge and fill permitting. The State dredge and fill permitting has been addressed in the SCA and is covered by the COC. I can testify to the evaluation of the potential for impacts on floodplains and wetlands related to stormwater runoff. The floodplain 100-year flood water levels were evaluated in two separate efforts by CH2M HILL personnel. I provided senior quality control reviews for both evaluations, which were performed under my direction. The first evaluation was an estimate of the amount of fill that would be placed in the delineated 100-year floodplain as defined by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRMs). This floodplain map was constructed by FEMA using aerial photographs and Soil Conservation Service soil mapping and it delineated low and apparent wet areas as the 100-year floodplain. This qualitative approach is

often used by FEMA in rural areas typically to construct FIRMs where no detailed flood level evaluations are available. BRD001, p. 5, and FEIS Figure 2-10, NRC001, p. 2-23, show the 100-year floodplain as mapped in the current FIRM. The first CH2M HILL evaluation quantified the fill volume that could displace stormwater volume on the property within the mapped 100-year flood boundaries. The results of the first evaluation demonstrated that there would be enough land available onsite to compensate for the loss of floodplain storage if upland soil had to be removed to provide compensation. These results were provided to the NRC and USACE for their consideration of the total land area that may be impacted by the LNP project. CH2M HILL and PEF called this the "Floodplain Bounding Analysis" because it represented a worst-case scenario if more land were needed to mitigate fill effects on stormwater (FEIS, NRC001, pp. 4-19 to 4-20).

38. The USACE, FEMA, and FDEP will rely on the results of a more detailed analysis (the second evaluation) for their final reviews. The second CH2M HILL evaluation of the 100-year floodplain for the LNP site was conducted using EPA's Storm Water Management Model (SWMM Version 5, 2009) computer program, a FEMA-approved software used to determine the elevation of the 100-year floodplain. The SWMM modeling estimated the stormwater runoff volume; flow rates and water depths considering storage in wetlands; the severity of water backing up as it flows through culverts; and flow across broad shallow flow ways, which are critical for flood modeling in flat landscapes. The existing ground elevations were available with 1-foot contours from detailed topographic mapping obtained by PEF. Existing and future water levels were predicted using the computer model and then compared to see how the LNP project would affect offsite flood conditions. The evaluation included offsite lands up-gradient (specifically, the higher ground to the north and east, or uphill) and down-gradient (south and west, or downhill) of the LNP project. As noted in the SWFWMD BOR criteria 4.4 and 4.9 (PEF006, Chapter 4, pp. 1-2), the LNP project cannot cause offsite impacts, but water may pool in wetlands onsite. This kind of evaluation could only be done with detailed computer simulations, which were completed in February 2010. This detailed evaluation was

required in the COC to address ERP requirements BOR 4.4 and will be updated prior to final ERP design and review activity, as needed.

39. The topographic mapping indicates that drainage within the modeled area generally flows from the northeast to the southwest toward existing culverts under US 19 and CR 40. The model predicts that some land immediately uphill of the LNP powerblock and haul road (that is, east and north of the powerblock) will experience, after construction of the LNP, somewhat greater backing-up of water levels during the 100-year flood event than would be experienced absent construction of LNP; however, all increases in the flood levels remain onsite. The ground slopes enough uphill of the new facilities such that all increases in flood elevations remain on PEF-owned property. The LNP power plant facilities will occupy only about 20 percent of the 3,105 acres of the LNP site (*see* FEIS, NRC001, p. 4-4), so there is a sufficient buffer to contain localized increases in stormwater stages. The model predicts that some downhill (that is, west and south of the property) offsite sub-basins will have either a slight reduction or a slight increase to flood stages (rise or decrease of 1 inch or less). This model prediction may reflect a calculation that the new facilities will create slight changes in the timing of the peak storm, or it may simply be an artifact of the way the numerical model estimates water levels using iterative techniques to solve the equations. I do not consider that these downstream changes would be detectable even if they exist. They are not significant because they do not exceed the acceptable tolerance in the variation in modeling results, considering the accuracy of the modeling approach and the accuracy of the topographic data. There will be no need to mitigate impacts to the floodplain by extra excavation to offset the predicted change in water levels because there will be no offsite impacts.

40. The LNP project's effect on stormwater storage onsite, both in the floodplain and historic basin storage, were evaluated together by using the detailed dynamic modeling that takes the existing and proposed ground contours into account. For stormwater evaluations, detention is temporary storage that occurs when water is staged up in a pond or wetland and is slowed down by a restriction like a pond outlet, culvert, or just a narrow spot in the flow way (overland flow). Retention is when water

fills up a low spot and cannot leave except by percolation, including water that may percolate during the storm while flow is occurring, or by evaporation. SWFWMD defines floodplain storage as the detention volume above the elevation where stormwater runoff occurs by sheet flow from natural low areas. The detailed computer simulations include this temporary detention volume when we compare the total flood elevation between pre- and post-project conditions. As described in the preceding paragraph, stormwater will back up temporarily behind the raised facilities, which replaces the detention volume that may be lost from within the LNP project footprint. Since this backup will remain onsite, there will be no offsite impact from loss of detention storage.

41. The SWFWMD defines historic basin storage as the available retention volume below the discharge elevation of the floodplain storage. The historic basin storage volume remains onsite and percolates to recharge the surficial aquifer after the storm is complete and overland flow ceases. The SWFWMD BOR requires that historic basin storage lost by filling be replaced so that groundwater recharge opportunities are maintained with site development. The three proposed wet stormwater ponds, covering approximately 105 acres (FEIS, NRC001, p. 4-21), will have an average depth of about 6 to 8 feet. The permanent pools will generate approximately 630 acre-feet of compensating storage. The results of the Floodplain Bounding Analysis estimated the potential loss of historic storage at 74 acre-feet. Because the wet ponds provide much more than 74 acre-feet storage, the wet ponds more than compensate for the historic storage loss. The LNP project will not decrease the amount of stormwater reaching the near-surface groundwater under the property because excess water will be captured and stored when the levels in the ponds allow it. If anything, the LNP project increases recharge capacity of the property and thus recharge to the surficial and Upper Floridan Aquifers. Furthermore, additional upland soil removal for floodplain mitigation purposes discussed in the Floodplain Bounding Analysis will not be required, but will remain available if needed.

What is the basis of your professional opinion that the wet ponds will recharge the surficial and Upper Floridan Aquifers onsite in light of Dr. Bacchus's contention that they will passively dewater the surficial and Upper Floridan Aquifers?

42. The stormwater ponds will generally recharge the surficial groundwater system and on occasion they may lose more water to atmosphere than natural ground cover would. It depends on the season, the timing of the rainfall relative to the season, and the nature of the events (big storm, frequent smaller storms, or drought conditions). Dr. Bacchus notes that there are times of drought when evaporation from the open water surface of the stormwater ponds will exceed natural evapotranspiration[8] (ET) of the pre-development conditions ("natural" in this case is a managed pine plantation), which is correct. However, when looking at long-term cumulative effects it is customary to look at average conditions given the high amount of variability in environmental inputs. Pre-Filed Direct Testimony by Dr. William Dunn describes how the wetland impacts are evaluated relative to long-term average groundwater levels (PEF300). As I discussed previously, we assumed that the groundwater table is at or very near the natural ground surface for stormwater control design purposes. This is true only for the seasonal high level, which normally occurs at the end of the rainy season in October, and groundwater levels normally would drop as the dry season continues through June (the rainy season is normally July through mid-October). Observed data from regional observation groundwater wells over a 30- to 40-year period showed a variation in the surficial aquifer levels of about 7 to 8 feet[9] (FEIS, NRC001, p. 2-28). Consequently, the groundwater levels are naturally several feet below natural grade during much of the year. The stormwater ponds will average about 6 to 8 feet deep to comply with FDEP and SWFWMD design criteria. Since about 35 percent of the pond area must be shallow for littoral zone plantings, there are long periods of time during the year where about 37 acres

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[8] Transport of water into the atmosphere from surfaces, including soil (soil evaporation), and from vegetation (transpiration).

[9] The FEIS refers to the "phreatic" surface, which is synonymous with "groundwater table" in the surface soils. Basically, if you dig a hole into saturated soil and let it rest for a while, water in the hole will equalize to a constant level and this is called the groundwater table. FEIS, NRC001, p. 2-27.

of the ponds will not be open water. That means about 68 acres (65% of 105 acres) would be deep enough to be open water when the water levels are more than about 2 feet lower than the outfall (i.e., natural grade). If the groundwater is very low resulting from drought conditions (*e.g.*, 7 to 8 feet deep as observed in the regional wells), then only a portion of the stormwater ponds will be open water. The rest of the ponds (35% of the area) will have the same ET rates as marsh wetlands.

43. As discussed earlier concerning historical basin storage, the SWFWMD BOR considers a permanent pool as the preferred replacement for filled depressions that would have retained stormwater (in this case the permanent pool is the entire volume under the natural ground surface since that is the level of the lowest pipe). SWFWMD considers this retained water as recharge. The deeper that the groundwater table is below natural landscape grade the more runoff from the power plant is captured in the stormwater ponds' permanent pool and is available for percolation. The groundwater table level reduces during spring and early summer. At least some of this period experiences lower ET rates than the annual average, so rainfall runoff captured during this period would go mostly toward recharge.

44. Much of the passive dewatering discussion by Intervenors in this proceeding depends on the ET or evaporation from the ponds; therefore, I am providing the Board more background information here. The rate of loss to the atmosphere through evaporation is not an exact science because it is not an easy value to directly measure from large water areas when considering all of the factors that affect the results. These factors include the amount of radiation from the sun reaching the water body, heat storage in the pond water, cloud cover or shading from plants (including from algal or macrophytic growth in the pond), rainfall, relative humidity, wind, and potential heat exchange with the groundwater and earth. Often ET is estimated by equations or back-calculated from water budget analyses (including lysimeters[10]). Potential ET is a maximum computed value and is normally related

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[10] A lysimeter is best described as a controlled and extensively monitored box of soil with growing vegetation where the water budget is measured in detail. These are normally only found at universities or similar research institutions.

to a reference crop like grass. Pan evaporation is a common observation method (a type of actual measurement that tends to be high). Lake evaporation is normally an estimated value based on water balance computations and is expected to be closer to the long-term average evaporation from a natural waterbody (and varies by location). I conducted a literature review searching for lake evaporation rates in Florida, and the USGS conducted a study for the Rainbow Springs and Silver Springs basins in the next county east of Levy County (Rainbow Springs is about 20 miles east of LNP and Silver Springs is further east). Knowles (1996)[11] evaluated ET and lake evaporation between 1965 and 1994 and concluded that lake evaporation is about the same as direct precipitation on the ponds at 53.2 inches per year, plus or minus 7 percent (PEF011, p. 34).

45. The stormwater ponds will be a source of recharge for the surficial aquifer rather than a source of passive dewatering because the lake evaporation is about the same as direct precipitation on the ponds and the ponds will capture extra water as discussed in Paragraph 42. I have assumed that lake evaporation will be canceled out by direct precipitation after evaluating reservoir water supply yields obtained from previous studies in Florida. The NRC concluded that annual precipitation at the LNP site is 53 inches per year (FEIS, NRC001, p. 2-21) which is essentially the same average precipitation reported by Knowles (i.e., 52 inches per year, PEF011, p. 33). Direct precipitation on the ponds will offset lake evaporation on average, and additional runoff from the approximately 175 acre raised powerblock will provide stormwater runoff volume available for additional percolation volume, especially when the groundwater levels are below natural landscape grade. Therefore, in my professional opinion, directing stormwater from the LNP power plant to the three stormwater ponds will be a source of net recharge to the aquifer and cannot reasonably be foreseen to cause net passive dewatering.

[11] Knowles, L., Estimation of Evapotranspiration in the Rainbow Springs and Silver Springs Basins in North-Central Florida, U.S. Geological Survey, Water-Resources Investigations Report 96-4024 (1996) (PEF011).

46. The Intervenors also stated that the Application did not consider climate change in evaluating the LNP design's impacts on aquifer systems. The effects of long-term climate change on rainfall are speculative. The FEIS noted that global climate change may induce drier springs and wetter falls (NRC001, pp. 2-181, 5-22 to 5-24).[12] In general, researchers tend to opine that the long-term average precipitation would continue to change only slightly in Florida with climate change; perhaps a slightly lower average annual rainfall will result from higher temperatures, but precipitation could become more variable with an increase in storm intensity (Fernald and Purdum, 1998; Karl, Melillo, and Peterson, 2009).[13] The inclusion of more storage onsite from the use of stormwater ponds should mitigate changes to offsite runoff rates from more intense storms better than the natural wetlands would, and could provide more capture of runoff during droughts. I consider attempting to quantify climate change impacts on rainfall as too speculative to be included in the analysis in the FEIS because there is inadequate agreement to support any one hypothesis. Regardless, the LNP stormwater ponds will not exacerbate any passive dewatering during dry periods because the ponds are relatively shallow, are located well away from property boundaries, and mitigate the impact of passive dewatering when it does rain following dry spells.

Will there be any consequential effects of the LNP project to offsite surface waters?

47. No. Potential mechanisms by which active or passive dewatering could potentially impact special aquatic sites or other waters are generally through a reduction of water levels or by secondary effects caused by the lowering of the groundwater table. I examined whether active dewatering by withdrawing water for the cooling tower makeup would affect water levels surrounding the intake. The intake will be located in the CFBC that is connected directly to the Gulf by a wide channel (about

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[12] Karl, T. R., Melillo, J. M., and Peterson, T. C. 2009. Global Climate Change Impacts in the United States. Cambridge University Press. (Same reference as in FEIS as GCRP 2009.) This reference also notes that the trend between 1958 and 2008 (50 years) has been a 10 to 15 percent decline in average annual precipitation throughout the Southeast U.S. and in this area. However, recent work by SWFWMD demonstrated that this trend in Florida is mostly attributed to shifts up and down in annual precipitation caused by natural ocean current changes and not necessarily a long-term climate change.

[13] Fernald, E.A. and E.D. Purdum, Eds. 1998. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee, FL.

150 feet wide at the bottom, and 12 feet deep). Withdrawing makeup water will not lower any water levels in the vicinity of the intake because the withdrawal rate for the LNP cooling water system relative to the tidal flow in the canal is small (FEIS, NRC001, p. 5-12).

48. No net passive dewatering will occur at the LNP site or South Property. Even if passive dewatering did occur during certain drought conditions, it would not affect the volume of surface water reaching the lower Withlacoochee River, because most of the LNP site to be developed with new buildings and facilities drains directly toward the Gulf and not into another named water body. Even though some of the LNP site is generally situated in the Waccasassa River watershed as defined by FDEP for area accounting purposes, no drainage in the "Direct Runoff to Gulf" sub-basin, where most development would occur, reaches the Waccasassa River. In addition, the LNP site and South Property combined comprise only a small portion of the entire sub-basin labeled as Direct Runoff to the Gulf in BRD002 (also in FEIS Figure 2-8, NRC001, p. 2-18). The OFWs in this Direct Runoff to the Gulf sub-basin are either preserves in the Gulf or in the adjacent salt marshes. The amount of freshwater flowing overland toward the Gulf from the 3,105-acre (4.9-square-mile (mi^2)) LNP site is very small in comparison to the amount of freshwater being introduced to the Gulf through the Withlacoochee River watershed (approximately 2,100 mi^2) and the Waccasassa River basin (approximately 936 mi^2). Freshwater flow from the LNP site is small because it is less than 0.2 percent of the area of these two rivers' watersheds. *See* FEIS Figure 2-7, NRC001, p. 2-17, for a graphic depiction of the size of the two rivers' watersheds relative to the LNP site. FEIS Figure 2-8, NRC001, p. 2-18, is a close-up view of the three sub-basins where the LNP site lies that total 72 mi^2 (Spring Run sub-basin is 25.4 mi^2, Direct Runoff to the Gulf sub-basin is 33.1 mi^2, and the Withlacoochee River sub-basin is 13.5 mi^2). The 3,105-acre LNP site is less than 7 percent of these local drainage sub-basins. Any extra net indirect passive dewatering from the 105 acre stormwater ponds would have an undetectable impact on surface water flow water balance to the lower Withlacoochee River and Gulf because it would affect only about 0.2 percent of the contributing drainage area to the local sub-basins.

49. The lower Withlacoochee River is the only flowing OFW water body in proximity to the LNP site that could be possibly affected by changes in surface water discharges. However, the LNP project was carefully planned to make sure that the lower Withlacoochee River will not be affected, and this includes using Gulf water from the CFBC for cooling water. Pipelines to the CFBC intake will bridge over the Bypass Channel to avoid restricting any flow to the lower Withlacoochee River. The spillway located at the end of the Bypass Channel near the lower Withlacoochee River controls the amount of surface water reaching the river (*see* FEIS Figure 2-9, NRC001, p. 2-20). Lake Rousseau is maintained at a nearly constant water level by the State of Florida. Flow has nearly always passed through the Bypass spillway control structure to the lower Withlacoochee River to maintain a constant supply of water. The contributing watershed to Lake Rousseau is about 2,000 square miles, which provides baseflow during drought periods. The minimum annual 7-day low flow over the Bypass spillway during 40 years of record keeping was reported by the U.S. Geological Survey (USGS) to be about 56 million gallons per day (mgd) (86 cubic feet per second (cfs)), flow of at least 365 mgd (564 cfs) 90 percent of the time, and flow in excess of 643 mgd (994 cfs) more than half of the time (PEF012 presents the USGS Water-Data Report 2011 for Gauge 02313250 Withlacoochee River Bypass Channel Near Inglis, FL, a recent data summary). By maintaining the Lake at a nearly constant water level, Lake Rousseau provides a large source of water to keep the groundwater levels near the lower Withlacoochee River at nearly the same steady levels. Therefore, even if there were passive dewatering at the LNP site, it would not have a noticeable effect on the flow to the lower Withlacoochee River because the contributing watershed is about 400 times larger than the LNP site and groundwater levels near the river are controlled by the lake elevation.

What will be the effects of the LNP reactor foundations on the surficial aquifer?

50. The soils at the LNP site contain fine sand and sandy silt about 67 feet deep at the proposed reactor locations. There is not a well-defined confinement layer between the surficial aquifer and the Upper Floridan Aquifer, so the 400-plus feet deep Avon Park limestone formation below the LNP site also conveys groundwater. The potentiometric surface of the two layers was measured to be about the

same level, which confirms that the two layers are connected. The LNP reactors will have foundations extending down to the rock, about 75 feet deep, and below that, the limestone will be grouted to an elevation of about -99 feet (about 140 to 145 feet total depth). Each LNP reactor will have its own foundation of approximately 0.88 acres (or 1.8 acres total). The FEIS noted that the final dewatering depth for the reactors is about 100 feet deep (approximate diaphragm wall depth), but that does not include the grouted depth below the outer diaphragm walls (FEIS, NRC001, p. 3-13).

51. Paul C. Rizzo Associates conducted groundwater modeling to examine how the diaphragm wall and low-permeability grouted foundation would affect the groundwater velocities around the grouted material.[14] Of primary concern was the increase in potential soil scouring that could lead to forming cavities that ultimately form solution channels. Rizzo conducted a MODFLOW groundwater model around the reactors for pre-construction and post-construction (with the reactor foundations). The simulation predicted the groundwater levels and velocities that flowed around and under the foundation in the three-dimensional model. The simulated groundwater levels in selected regional observation wells on all four sides of each foundation showed no change in groundwater elevations. That is, there was no blocking that would cause mounding behind the foundations. (However, significant mounding would not likely occur in any event in the slow-moving groundwater system, unlike the stormwater system.) A change in velocities would be of higher concern. The model results predicted a change of only 0.105 feet per day after construction. The maximum velocity predicted around the nuclear islands was 0.162 feet per day. This maximum velocity was well below a level that would be expected to scour out even small particles (about 0.26 feet per day for a 1 micron clay particle). This change in velocity is insignificant; so the effect of the foundation on groundwater flow

[14] Paul C. Rizzo Associates. Effect of Grouting on Groundwater Flow Regime, Prepared for Progress Energy Florida, Reference document LNG-0000-XDC-001, Rev. 2. November 19, 2008 (Rizzo, 2008b) (PEF013).

would be considered small, if any at all, because groundwater will be able to flow freely around the foundations.

Please describe any active dewatering of the LNP reactor foundations and cooling water pipelines during construction.

52. During construction, active dewatering (that is, mechanical pumping) will occur on a temporary basis to construct the new facilities. The pipelines will need moderately deep (about 15 feet deep) excavations to be dewatered, and the foundations of the reactors will be the deepest areas to be dewatered (about 140 feet deep). Most of the other buildings and roads will require only very shallow and short-term dewatering, if any at all. These other areas will be dewatered most likely using shallow well points (small diameter pipes hooked to a vacuum pump) and then discharged to nearby land. Most of this water would percolate back into the ground or keep the local wetlands hydrated. Impacts from very shallow dewatering will be negligible and will not be discussed here further. I will discuss the pipeline and reactor foundation dewatering separately.

53. The pipeline corridor will extend from the raised powerblock to the CFBC as shown in BRD001, p. 3. The corridor will have multiple pipes installed in one open trench. These pipes are for supplying cooling water to the cooling towers (4 pipes) and for the discharge of the blowdown from the cooling towers (2 pipes) to the Crystal River Energy Center discharge canal. The trench required to install these pipes in the South Property will be about 40 feet wide at the bottom and approximately 12-feet deep. The top width is assumed to be about 80 feet wide with 1.5-feet horizontal to 1-foot vertical side slopes. The pipelines will be constructed in segments about 400 to 500 feet long. Dewatering will commence under each segment for about 8 weeks, and the water table must be about 14 to 15 feet deep during construction. Water pumped out of the trench, or more likely from well points, will be discharged in nearby infiltration trenches, protected to reduce turbidity prior to discharge to local uplands. Sargent & Lundy conducted MODFLOW modeling, which estimated that the dewatering rate will need to be about 2 gallons per minute per linear foot of trench, or about 1,000 gallons per minute (gpm, or 2.2 cfs) per 500 feet of trench. Each segment will take about 8 weeks for trench

dewatering, excavation, pipe installation, and backfill. The model results demonstrated that the drawdown will recover quickly once pumping under each segment stops.[15] The groundwater table will recover to within 6 inches of the original surface near the trench within two or three months, under very conservative assumptions of no recharge (i.e., no rain and no return of the dewatering fluid from the next segment). This change in groundwater level will not have any long-term cumulative effects on wetlands because:

- The drawdown is relatively short term and the groundwater levels will recover quickly.
- The period of drawdown is within a normal range of seasonal variability.
- The wetlands are not isolated, but are part of a large complex of similar systems. The extent of the drawdown greater than 6 inches is only about 300 feet wide and 500 feet long at a time. There is an abundance of similar habitat on the property that will reduce potential impacts to wildlife utilizing the area.
- Groundwater monitoring and local infiltration trenches will be used to allow adaptive management during construction, as needed.

54. Paul C. Rizzo Associates also conducted groundwater modeling to examine the degree to which the low-permeability grouted diaphragm walls will allow seepage into the foundation excavation during construction.[16] The grouting will create conditions similar to a "bathtub" to restrict groundwater from flowing into foundation hole from the sides and underneath. However, the grout walls are not completely impermeable, just much less permeable than the native sand material (about 0.003 foot per day versus 9 to 14 feet per day in the surficial and Upper Floridan Aquifers, respectively). Three scenarios are discussed for seepage rates into a foundation excavation. Note that construction will

[15] CH2M HILL. Effects of Temporary Dewatering on Wetlands for the Construction of the Levy Nuclear Plant, Levy County, Florida, Prepared for Progress Energy Florida, Reference document 338884-TMEM-131, September 7, 2011. (PEF014).

[16] Paul C. Rizzo Associates. Design of Excavation Dewatering System, Prepared for Progress Energy Florida. Reference document LNG-0000-XEC-001, Rev. 1, June 26, 2008. (Rizzo, 2008a) (PEF015).

last about two to four years for the two reactors, roughly two to three years for each foundation, with schedules overlap occurring. The dewatering rates discussed are the maximum rates and the dewatering from seepage would be reduced as the foundation is filled back in. The first scenario identifies how much water needs to be removed from the soil inside the bathtub after the grout wall is constructed. The maximum volume of water to be removed is about 7.72 million gallons. Some of this soil water would just be included with the soil as it is excavated and spread onsite rather than having been removed by pumping. The second scenario estimated groundwater flow into a completely empty hole to be about 67 gpm (0.14 cfs, or 0.10 mgd). Direct rainfall into the hole was expected to require an average of 4.4 gpm averaged over a four month period between June and September, the wet season. For the third scenario, Rizzo simulated the amount of flow that may enter the foundation hole, if there were a rupture of the grout wall (about 3-feet wide), and estimated a flow rate of 94 gpm (0.21 cfs, or 0.14 mgd). Any rupture in the diaphragm wall would be temporary until repaired. Additional simulations were conducted varying the modeling input permeability parameters, and the maximum seepage into the excavation was estimated to be 452 gpm (1.01 cfs, or 0.65 mgd). Regardless of the actual rate of flow, water pumped out of the foundation excavation will be placed into holding ponds and allowed to percolate back into the groundwater system. Thus, in my professional opinion, this temporary construction active dewatering would have at most a very small net reduction in groundwater levels or volumes onsite and on a wider regional perspective. In comparison to active dewatering during operations, the maximum amount of water withdrawn during construction will be considerably smaller and of a relatively short duration. The Pre-Filed Direct Testimony of Dr. William Dunn (PEF300) addresses the impacts of active dewatering during operations and shows that the impacts on the environment will be SMALL. The impacts of active dewatering during construction will necessarily be considerably less than the SMALL impacts of dewatering during operations.

You have discussed a number of Florida proceedings for permits relating to water usage and impacts on water bodies required for LNP. Please describe the various proceedings and the degree of scrutiny given to potential impacts of dewatering to onsite and offsite waters.

55. There have been three major parallel efforts in permitting the LNP project: NRC licensing, State of Florida certification (transmission siting is included in overall State certification), and the USACE Section 404 permitting. The LNP project has received extensive review by a number of Federal, State, and local agencies. I will not review the NRC efforts because they are described in the FEIS. The NRC has coordinated with State and Federal agencies (*see* FEIS, NRC001, Appendix B) and has reviewed the conditions and permits with which the LNP will need to comply (*see* FEIS, NRC001, Appendix H). A summary of some the agencies that have reviewed the potential impacts on water resources, which are the subject of Contention 4A, are described briefly here.

56. In Florida, the FDEP is the lead agency for power plant regulation and reviews, and FDEP is responsible for oversight in connection with the following approvals, conditions, and requirements:

- The COC, which includes extensive conditions to ensure compliance with State and local regulations (PEF005).
- An ERP, a combined State stormwater and wetland permit, which includes conditions to address impacts to State-regulated wetlands and for management of stormwater.
- Sovereign land use authorizations, such as easements to use or cross Waters of the State for works in water such as the pipeline crossing and intake structure (an easement has already been obtained for the haul road bridge and barge slip).
- Air construction permit (has been obtained).
- NPDES discharge permit.

- Potable water treatment system and sanitary wastewater system design approval pursuant to the COC.

57. The LNP project has been approved by the Florida Department of Transportation and Levy County for ingress and egress on the highways, subject to submittal of final design details. Levy County has also issued a comprehensive plan amendment and a special use zoning permit for the LNP, with limiting conditions. The Florida Department of State required cultural resource surveys before construction (all surveys of the LNP site have been completed). The SWFWMD regulates the water use (withdrawals from the surficial and Upper Floridan Aquifers) and will review the FEMA mapping and stormwater runoff modeling. The Withlacoochee Regional Planning Council has reviewed the LNP project's consistency with the Council's regional plan. The Florida Fish and Wildlife Conservation Commission has reviewed and recommended conditions of the site certification that require three monitoring plans to establish baseline and operational monitoring in the CFBC and in the near-shore Gulf environment (into the surrounding marine preserves) for: nekton (fish and invertebrates like shrimp) and plankton, benthic organisms (organisms living at the seabed), sea grasses, oysters, hard bottom habitats (*e.g.*, coral), impingement and entrainment, flow currents, and water quality. This Commission also has reviewed the threatened species issues for the State.
58. The permitting effort with the USACE for wetlands has been extensive. Both the USACE and FDEP have delineated wetlands to determine wetland boundaries, and PEF prepared a detailed wetland mitigation plan to address the LNP project's impacts to wetlands, including impacts across the multiple watersheds that the transmission corridors traverse. PEF's final wetland mitigation plan must be suitable and approved by both the USACE and FDEP. The USACE has also required that an Environmental Monitoring Plan (PEF305), similar to what SWFWMD requires for groundwater use, be developed and approved by the USACE in advance of permitting. On June 4, 2012, PEF submitted its final version of the Environmental Monitoring Plan to the USACE for its review.

59. The environmental impacts have been carefully reviewed and evaluated by all local, regional, and State agencies affected by the LNP project. Monitoring and mitigation measures and the COC imposed ensure that the Florida waters and environment will be protected. It should be noted that there is a very significant record of these other reviews available to the NRC to assist the NRC in identifying and quantifying the environmental impacts. Having been personally involved in the LNP project for six years as a professional advising on water-related issues, I can testify with personal assurance that the impacts on the environment, especially those relating to Florida waters, have been given a very hard look by multiple local, State and Federal agencies, have been characterized in great detail, and have been carefully evaluated and disclosed to the public and to decision makers.

Please summarize your testimony about the LNP project environmental assessment relative to passive dewatering and active dewatering during construction.

60. The 3,105 acre LNP site and 2,114 acre South Property currently comprise a highly modified pine plantation. The proposed new power plant facilities will be located in the center of the LNP site and only about 620 acres (about 20 percent of the LNP site) will be cleared for the new plant. This will leave a buffer around all sides. The new facilities will be located primarily above the natural ground surface; the powerblock will be constructed about 8-feet above the natural grade. The powerblock will be surrounded by three stormwater ponds that will capture and treat stormwater from the new facilities before it is released. The ponds will overflow into spreading areas that will drain into the natural wetlands and pine plantation downhill of the LNP site and into the same systems where the natural drainage moved prior to the LNP project. This above-ground construction avoids having to artificially reduce the groundwater table (either by passive or active means) to provide drier working conditions. The ponds provide water quality treatment of the stormwater from the powerblock and attenuate peak runoff rates. The roads will have broad grassy swales to also treat and mitigate stormwater runoff, again avoiding modifying the groundwater table. These types of best management practices (swales and ponds) are required by the State of Florida to mitigate the impacts of the new construction. Consequently, the treatment and attenuation located near the new facilities will keep

potential stormwater impacts local and no offsite impacts of any consequence are anticipated. No permanent adverse impact to nearby wetlands will occur as a result of temporary construction active dewatering for the LNP project and no additional wetland mitigation is required for temporary changes resulting from construction dewatering. The new foundations for the reactor buildings will still allow groundwater to flow through the Upper Floridan Aquifer with minimal restriction at the LNP powerblock and no restrictions beyond the immediate footprint because the Upper Floridan Aquifer is much deeper than the foundation.

61. The Intervenors have expressed concern about passive dewatering on the direct, indirect and cumulative environmental impacts of the LNP project. Surface water storage on the LNP site lost to the earth fill will be mitigated within the large stormwater ponds that provide stormwater control and preclude consequential impacts on the surficial aquifer. These ponds will capture stormwater runoff that would otherwise be captured in the filled floodplain to replenish the groundwater. The stormwater from a 100-year flood can be passed through and around the new facilities without affecting any offsite flood levels. Again, mitigation of these types of impacts is required by the State of Florida and must be included as part of the LNP design criteria.

62. My testimony also addressed additional issues raised by the Intervenors concerning potential offsite environmental impacts from passive dewatering. Since there are no existing direct connections to OFWs, including the Withlacoochee and Waccasassa Rivers, and no new ditches or canals from the project will be constructed, the surface water runoff from LNP will not directly affect any sensitive water bodies. The intake structure and cooling water will be taken from an existing channel directly connected to the Gulf, so no freshwater resources will be impacted.

63. The Intervenors' witness has emphasized that the main issue relative to passive dewatering is the impacts during the extreme drought conditions. Wetlands and other water resources naturally experience changes to water levels due to changes in rainfall. The LNP project will not exacerbate the impacts of drought; if anything, the stormwater ponds will more effectively recharge the aquifer once the drought conditions are broken by extended rain. An analysis of long-term cumulative effects

on wetlands would normally be assessed in terms of the mean or median conditions. While there will be local impacts resulting from the new facilities immediately under or around the new power plant, impacts away from the new plant facilities will be avoided and mitigated.

64. After working on this project since 2006, essentially from the initial site selection, it is my professional opinion that any impacts related to non-mechanical or "passive" dewatering, or to the limited active dewatering during construction, will be negligible and would be properly characterized as SMALL in the context of the FEIS. There will be no measurable offsite environmental impacts, direct or indirect, including cumulative impacts, from passive and active dewatering to wetlands, floodplains, special aquatic sites, and other waters. The reactor foundations will have no measurable impact to the underlying Upper Floridan Aquifer on groundwater movement. During construction, the amount of water to be removed from these foundation areas will be minimized through the containment system – a "bathtub" formed by grout – and dewatering flow rates were evaluated to be small. Water removed from the foundation and pipeline trenches will be placed back into infiltration basins near the work so that there will be negligible effect on the surficial aquifer groundwater during that construction as well. The FEIS has correctly characterized the impacts as SMALL and the LNP project has been thoroughly evaluated by the NRC Staff and multiple local, regional, State, and Federal agencies that have issued a variety of design, monitoring, and permitting requirements to ensure that all potential impacts have been avoided or mitigated as needed.

I, Mitchell Lee Griffin, swear under penalties of perjury that the foregoing testimony is true and correct to the best of my knowledge and belief.

Mitchell Lee Griffin
Signature

June 26, 2012
Date