BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of Kingwood Solar I LLC for a Certificate of Environmental Compatibility and Public Need	))))	**Case No. 21-0117-EL-BGN**

REBUTTAL TESTIMONY OF DR. JOHN S. NEALON

Q.1. Please state your name, title and business address.

A.1. My name is John Nealon. I am a Senior Consultant for Geotechnology, LLC, whose business address is 1398 Cox Avenue, Erlanger, Kentucky 41018-1002.

Q.2. Did you previously present direct testimony in this proceeding?

A.2. Yes.

Q.3. What is the purpose of your rebuttal testimony?

A.3. I am filing rebuttal testimony on behalf of the Applicant, Kingwood Solar I LLC, in response to testimony by Susan Jennings and Andrew Conway.

Q.4. Have you reviewed Ms. Jennings's testimony?

A.4. Yes. I reviewed Ms. Jennings's testimony marked as Citizens Exhibit 7.

Q.5. What portion of Ms. Jennings's testimony will you address?

A.5. I will address Ms. Jennings's testimony that the pile foundations for the solar array "will provide preferential pathways for rainwater to enter into groundwater."

Q.6. Are you familiar with the process for installing driven piles, such as those that will be used in this Project?

A.6. Yes.

Q.7. Can you describe the process for installing driven piles, such as those that will be used in this Project?

A.7. The wide-flange, W6X9 piles to be installed for this project are to be driven using a Vermier PD-10 pile driver. Once a pile is lifted into the rig mast, the PD-10's GPS and autoplumb features position the pile at the desired location and automatically plumb the pile. The pile is then quickly driven into the ground to the desired depth using a high-frequency hammer. Once in place, the PD-10 is moved to the next pile location and the process is repeated.

Q.8. Can you explain how the soil surrounding the piles reacts after pile installation?

A.8. Piles driven into subsurface soils will displace a certain volume of soil immediately around the pile as they penetrate to their terminal depth. In clayey soils, the displacement process causes some soil compression and soil porewater pressures to increase in the immediate vicinity of the pile. In the first few to several days after driving, these excess pore pressures dissipate into the surrounding soils, and as they do the soil consolidates around the cross-sectional area of the pile and grips it. The soil is able to consolidate around the pile because the soil weight generates horizontal as well as vertical stresses at depth. This process is known as "pile set". In granular soils, the process of pore pressure generation and dissipation occurs instantaneously, causing pile set to occur more quickly than in clayey soils. The greatest evidence that pile set occurs is that the capacity of the pile to support axial loads in skin friction increases with time following the completion of pile driving, which would not occur if the subsurface soils were not consolidating around the installed piles.

Q.9. Is there a difference in how the soils react when the piles are installed into an area with shallow groundwater?

A.9. There is no difference in how the clayey soils react when piles are installed below the water table. Excess pore water pressures are still generated, and pile set still occurs following excess pore pressure dissipation.

Q.10. Do you agree with Ms. Jennings's statement in her testimony that the pilings for the solar array will provide "preferential pathways for rainwater to enter into groundwater"?

A.10. I disagree with this statement, which I also note was not supported by any other documentation. If the pile driving process were to result in the formation of any permanent annular space between the piles and the surrounding soils that would allow for "preferential pathways for rainwater to enter into groundwater", the driven piles would not be capable of supporting axial compressive or tensile loads in skin friction. The process of pile set is well documented in geotechnical engineering.

Q.11. After construction, can water migrate to the ground surface around a pile if a drain tile is broken by the pile?

A.11. Yes, water can migrate to the ground surface around a pile if a drain tile is broken by the pile. Drain tile is typically comprised of either a sectional clay pipe or a slotted or perforated PVC pipe that allows entry of runoff water or snowmelt that has infiltrated below the ground surface. The pipe interior provides a highly-permeable space in which infiltrating water can be collected and then discharged from the outlet end of the pipe. If a driven pile encounters the drain tile and blocks or crushes it, thus preventing the collected water from draining freely, the water will back up in the upstream section of the pipe until it finds either an outlet to the ground surface or another permeable medium in which to dissipate. The outlet from the drain tile to the ground surface could be along the perimeter of the driven pile itself, along cracks in the relatively-permeable, disturbed plow zone, or along near-surface cracks that develop seasonally due to freezing and thawing. The other permeable medium in which collected water could dissipate could be shallow sand and gravel zones through which the drain tile passes. Regarding the potential for the backed-up water to migrate down the pile shaft, instead of upwards to the ground surface, it is my opinion that pile set will largely preclude this from occurring. Pile set is less likely to occur within the frost zone 1) because of the effects of seasonal freeze and thaw, and 2) because the majority of the frost zone is expected to be comprised of disturbed, plow zone soils.

Q.12. Have you reviewed Mr. Conway's testimony?

A.12. Yes. I reviewed Mr. Conway's testimony marked as Staff Exhibit 9.

Q.13. What portion of Mr. Conway's testimony will you address?

A.13. I will address Mr. Conway's testimony related to the Clifton Day Camp source water protection area and Staff's recommended Condition 26.

Q.14. In your opinion, do you think the placement of piles used to support solar arrays within the inner management zone of the Clifton Day Camp source water protection area represents a threat to the Camp's drinking water supply?

A.14. No. In my opinion, the placement of piles to support solar arrays within the inner management zone of the 4-H Camp Clifton source water protection area would not represent a threat to the Camp's drinking water supply, for the reasons discussed in my answers to Questions 8, 9, and 10. Additionally, Borings B-19 and B-24 indicated that this portion of the site is underlain by clayey, glacial till soils to depths of at least 13 to 14 feet.

Piles driven south of Clifton Road and within the limits of the 4-H Camp Clifton source water protection area are not expected to penetrate the clayey, glacial till soils, which are expected to exhibit low permeability that will further mitigate transmission of infiltrating runoff water (which should not occur) to the bedrock aquifer serving the Camp Clifton wells.

Q.15. Is there potential for a preferential pathway for infiltrating water to be set up along the driven pile shafts, caused by below-ground corrosion of the steel piles at their soil-pile interfaces, that could lead to eventual introduction of contaminants to the bedrock aquifer?

A.15. Not in my opinion. The National Bureau of Standards has studied corrosion of driven steel piles[1]. As part of their study, steel piles that had been in service in various underground structures for periods of up to 40 years were inspected by either extracting driven piles or by making excavations to expose buried pile sections. Soil types ranged from well-drained sands to impervious clays. Soil resistivities ranged from 300 to 50,200 ohm-cm, and soil pH ranged from 2.3 to 8.6. The study concluded that "soil environments which are severely corrosive to iron and steel buried under disturbed conditions [i.e., in backfill soils]…were not corrosive to steel pilings driven in the undisturbed [i.e., native] soil…The data indicate that undisturbed [i.e., native] soils are so deficient in oxygen at levels a few feet below the ground line or below the water table zone, that steel pilings are not appreciably affected by corrosion, regardless of the soil types or the soil properties." I also note that the three public water supply (PWS) wells at Camp Clifton were completed

[1] Romanoff, M. (1962). Corrosion of Steel Pilings in Soils. National Bureau of Standards Monograph 58. Reprinted from the *Journal of Research of the National Bureau of Standards-C. Engineering and Instrumentation* Vol. 66C, No. 3, July-September 1962.

in 1952, 1963, and 1967. These wells included casings, likely of steel, that extended through the overburden soils and into the bedrock, and which varied in length from 11.8 to 32 feet.

A 1982 study[2] of 126 driven steel piles that had been extracted in thirds at intervals of 2, 5, and 10 years concluded that 1) most of the withdrawn piles were almost in an as-new condition even at 10 years after driving, except the portion in the aerated zone near the ground surface; 2) the mean corrosion rate per year per both faces averaged over 10 years was 0. 0106 mm/yr; and 3) the corrosion rate definitely decreases with time after driving, and would have decreased further below 0.0106 mm/yr had the study been extended.

Finally, a 2018 posting to the SME website[3] states that "steel piles driven vertically into the ground typically experience little corrosion. Factors that cause severe corrosion of metals placed in the ground in horizontal trenches are much less impactful for vertical steel piles. The main reason? The presence or absence of oxygen…In soil backfill, the soil is aerated and therefore corrosion occurs. However for steel piling, the natural soil (below any fill) normally contains limited amounts of oxygen resulting in only limited corrosion."

If corrosion of steel in the subsurface is to be raised as a concern in terms of the potential for transmission of surface contaminants to the Camp Clifton PWS wells, I would be far more concerned by the potential for surface contaminant transmission via corroded steel casings in the 55- to 70-year-old wells themselves, than in the potential for transmission of contaminants via 10-foot-long steel piles that 1) are not expected to penetrate the clayey

[2] Ohsaki, Y. (1982). Corrosion of steel piles driven in soil deposits. *Japanese Society of Soil Mechanics and Soil Engineering, Soils and Foundations*, Vol. 22, No. 3, September.
[3] https://www.sme-usa.com/blog/underground-corrosion-metallic-utilities-vs-steel-piling.

glacial till; 2) will experience pile setup after driving; and 3) will be driven no closer than about 300 feet from the nearest PWS well.

Q.16. Does this conclude your testimony?

A.16. Yes, it does.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing was served upon the following via email on this 14th day of April 2022.

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