Marion County Solar Project, LLC
Case No. 21-36-EL-BGN

Exhibit AA
Drain Tile Assessment and Construction Impact Report

MARION COUNTY
SOLAR PROJECT

Drain Tile Assessment & Construction Impact Report

By: Marion County Solar Project, LLC

Purpose Statement

Marion County Solar Project, LLC (Applicant) has worked with landowners, reviewed public records, and utilized available technology and engineering techniques to collect and create a data set identifying subsurface drain tile located within the Marion County Solar Project (Project) boundary. The purpose of this report is to demonstrate the Applicant's consideration of any potential impact and required mitigation to subsurface drainage systems during development of the 100-megawatt Project in Marion County, Ohio.

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Figure 1 – Marion County Solar Project Boundary Map

Methodology

Every project starts out as a blank canvas – a general area that is targeted based on potential transmission availability and general site suitability criteria, such as parcel size and housing density. As landowners decide to participate in the project by signing leases, the Development and Geographic Information Systems (GIS) teams work together to paint a picture of the Project to be used moving forward for environmental permitting and engineering design. Identifying subsurface features such as drainage tiles from aerial imagery is often a difficult task given the lack of available historic map documentation. Many times, landowners do not have tile maps available nor do they know specific details about drainage tiles on their own fields, such as how much, when or where a tile has been placed in their field over the years. The GIS team utilizes various technology to identify tiled farms and approximate spacing. Typically, when using aerial imagery, the analyst is looking for visible scars on the ground that indicate the presence of a subsurface installation. When the area in question is being farmed these scars are often not visible due to yearly farming activities and the passage of time. Under ideal conditions, imagery can be used to identify drainage tiles as shown in the example below.

Color-infrared orthophoto taken in spring of 2007, in Wright County, Iowa, a few days after a 3” rain event. Tile lines are indicated by a lighter pattern, where soils are draining faster because of buried tile lines.

Manually photo-interpreted and digitized GIS coverage of buried tile lines (blue) using 2007 CIR ortho as base map. Green lines are public drainage district tile lines obtained from County maps.

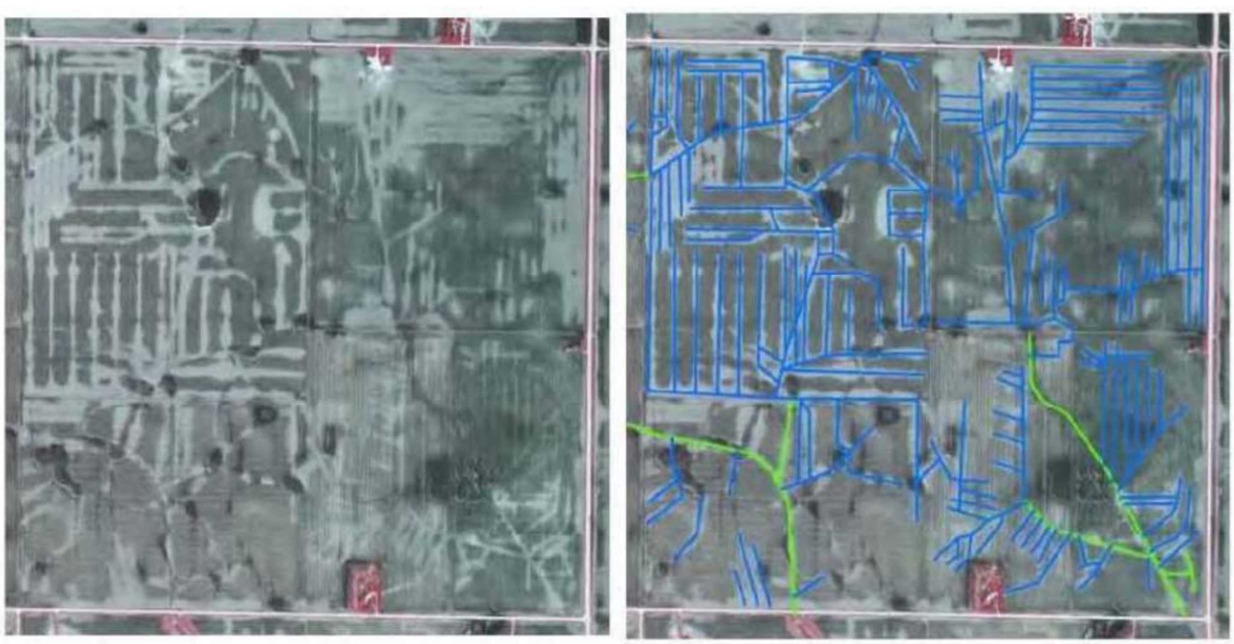

Figure 2 – Orthophotos Wright Co., Iowa (2007)

Unfortunately, conditions are not always ideal and satellite imagery from certain years are less useful. Yet, as illustrated throughout this report, even given the absence of ideal conditions, the Applicant was able to utilize several years of high quality imagery available from the Marion County GIS website (http://mcogis.co.marion.oh.us/mapping/) to provide quality insight into subsurface drainage tile locations within the Project boundary.

When available, the Applicant also used landowner drain tile layout maps that are georeferenced in order to digitize the layouts. The applicant also sought third-party, local expertise to discern typical layout patterns and tile spacing.

The figure below shows the overall picture the Applicant was able to build by digitizing the available data. The final version will be used to create the drainage tile overlay imagery that will be incorporated into the final Project design.

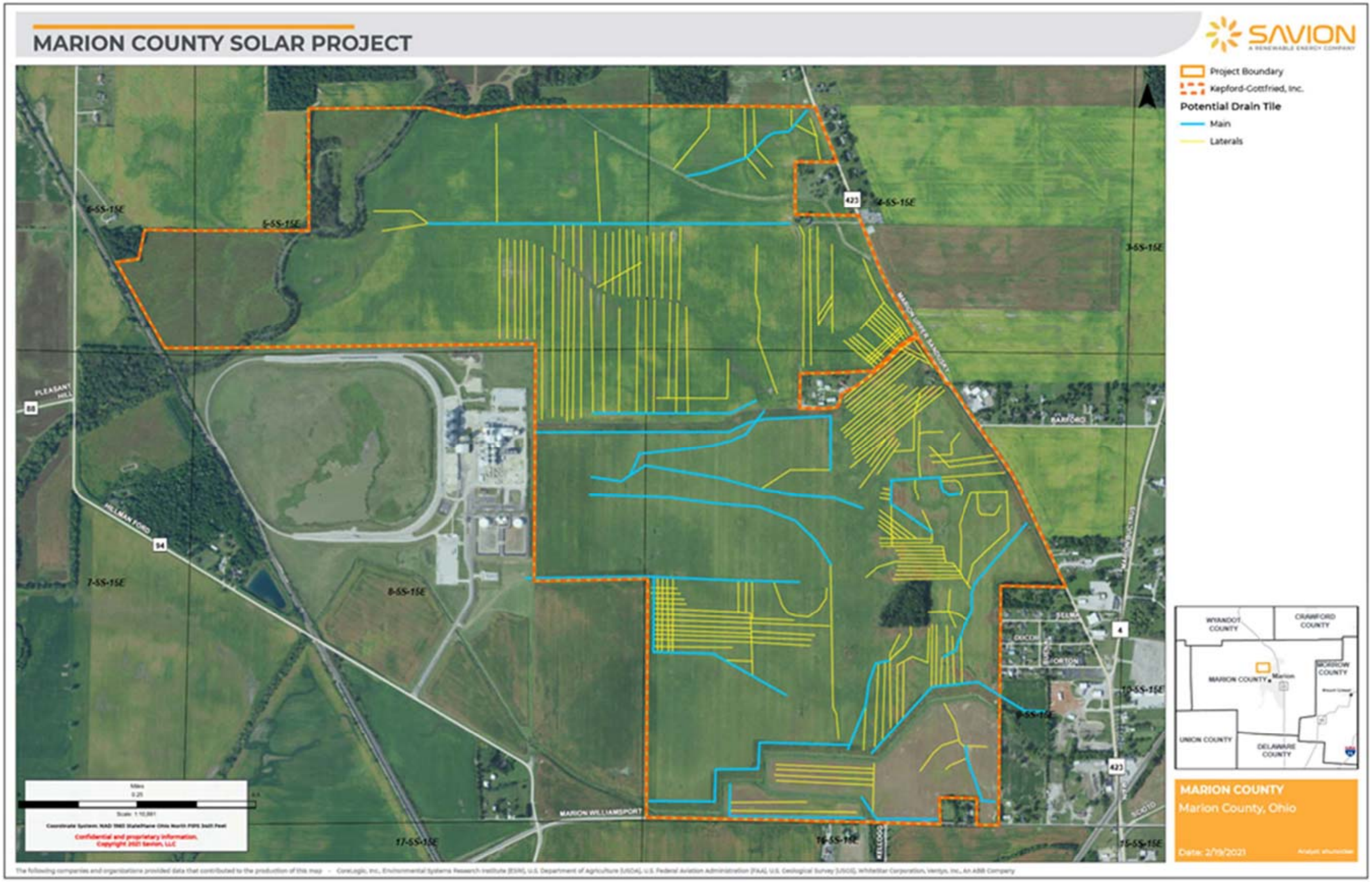

Figure 3 – Marion County Solar Project Boundary with tile layer

Applying the Data Set

Once a comprehensive drain tile layer is built, the Applicant can use the information moving forward to consider areas of interest during the design process. Knowing where tiles are located years before the Project is built allows for planning to reduce impact and cost under the consideration of subsurface drain tile systems.

Most drain tiles in an agricultural field are lateral ties and they only affect the area associated with that tile string. Lateral tiles feed into main tiles that drain entire fields and can impact adjacent property drainage. Figure 4 shows some typical tile patterns (main tiles highlighted blue) and Figure 3 illustrates the main tiles that have been identified within the Project boundary.

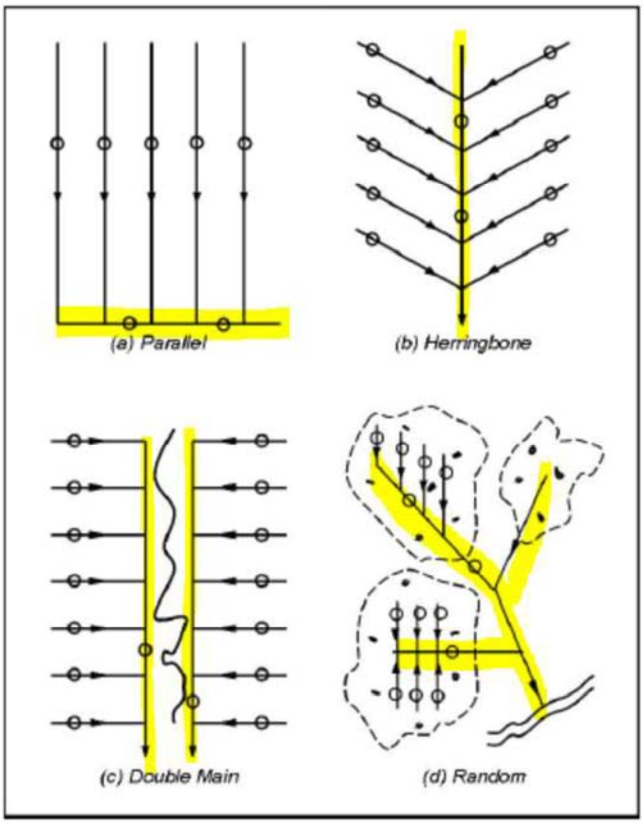

Figure 4 – Typical Subsurface Drainage System Patterns (Iowa State University Extension; July 2010)

Another important consideration is that, although the project appears to have heavy subsurface drainage, the typical lateral tile spacing is between 30 and 50 feet. In fact, looking at the Project layer map, because it is zoomed out to cover the entire boundary it may appear that tiles are closer than they are; however, in this particular project, there is not a farm with laterals spaced closer than 30 feet. This has been confirmed by Project landowners. Most of the lateral tiles are spaced at 30-foot intervals or are old clay tiles spaced at 50 feet and have not been systematically upgraded. Neither distance in tile spacing imposes a significant constraint on the Project and can usually be avoided during construction. The large tile row spacing reduces the impact of any inaccuracy by data derived from satellite imagery that cannot be perfectly accurate but is likely accurate within a few feet of where actual tile rows are in the ground.

Steel piers and transmission line poles driven into the ground and underground collection systems placed in trenches could impact drain tile systems. Row spacing of the panels allows these components of the solar energy system to be placed between tiles to avoid impact during construction. This allows the Project to maintain existing site drainage and minimizes the cost associated with tile repair.

Current Engineering Strategy/Practices

Current strategies/practices implemented by the Applicant to minimize drain tile impacts include the following:

1. Prepare drain tile GIS layer using available data from landowners and publicly available resources. Use the drain tile data as a constraint in Project design.
2. The Project will be designed to avoid impacts to all main tiles; and to the extent practicable, the Project will be designed to avoid lateral ties. Steel piles and overhead collection or transmission lines will be designed to avoid main tiles; and to the extent practicable, lateral tiles.
3. Develop construction procedures to identify locations where tiles have been damaged and perform repairs as necessary as part of the overall construction and site restoration (post-construction) process.
4. During operations, operations and maintenance crews will monitor the site for signs of damaged tile (i.e. saturated soils or areas of ponding) and perform repairs. The repairs are typically performed by a local contractor who specializes in the installation and repair of agricultural drain tiles.

Complaint Resolution

Per the Project's Complaint Resolution Plan, a 24-hour, 7-day a week "hot line" will be established to respond to emergencies and accept complaint notices. Complaints can also be submitted in-person to the construction trailer or operations and maintenance building or in writing or via electronic mail. During operations, site staff will be qualified to attend to requests and complaints with the necessary corporate support. Surrounding landowners will be provided with contact information for site staff. Additionally, emergency contact numbers will be posted on placards at the Project entrances that will allow anyone from the public to contact operations staff. No less than seven days prior to commencing construction, the Applicant will distribute this Complaint Resolution Plan to the affected property owner and tenants via first class mail.

Conclusion

This Project aims to maintain existing site drainage in part by avoiding impact to site drainage infrastructure during construction. In an effort to achieve this goal, the Applicant has digitized available subsurface drain tile system location data and created GIS layers to use during Project design. The Project will be designed to avoid all main tiles and to the extent practicable, all lateral tiles. Construction and Operations and Maintenance crews will be trained to identify areas where drain tiles have been damaged; and damaged tile will be repaired as necessary. In addition, a Complaint Resolution Plan will be in place during construction and operation to facilitate and manage landowner complaints regarding the Project.

References

Beck, M. W., Vondracek, B., & Vinje, J. (2013). Semi-automated analysis of high-resolution aerial images to quantify docks in glacial lakes. *ISPRS Journal of Photogrammetry and Remote Sensing*, 60-69.

Blaschke, T. (2009). Object Based Image Analysis for Remote Sensing. *ISPRS Journal of Photogrammetry and Remote Sensing*.

Brown, D. C. (2013). Applying a Model to Predict the Location of Land Drained by Subsurface Drainage Systems in Central Minnesota. *Papers in Resource Analysis at Saint Mary's University of Minnesota University Services*.

Campbell, J. B., & Wynne, R. H. (2011). *Introduction to Remote Sensing.* New York: The Guilford Press.

Corbane, C., Raclot, D., Jacob, F., Albergel, J., & Andieux, P. (2008). Remote Sensing of Soil Surface Characteristics from a Multiscale Classification Approach. *Catena 75*, 308-318.

Dezső , B., Fekete, I., Gera, D., Giachetta, R., & László, I. (2012). Object-Based Image Analysis in Remote Sensing Applications Using Various Segmentation Techniques. *Annales Univ. Sci. Budapest*, 103-120.

Fausey, N. R., Doering, E. J., & Palmer, M. L. (1987). Purposes and Benefits of Drainage. In U. ERS, *Farm Drainage in the United States; History, Status, and Prospects.* (pp. 48-51). Washington, D.C.

Flanders, D., Hall-Beyer, M., & Pereverzoff, J. (2003). Preliminary evaluation of eCognition object-based software for cut block delineation and feature extraction. *Can. Journal of Remote Sensing*, 441-452.

Fouss, J. L., & Reeve, R. C. (1987). Advances in Drainage Technology: 1955-85. In U. ERS, *Farm Drainage in the United States; History, Status, and Prospects.* (pp. 30-45). Washington, D.C.

Hay, G. J., & Castilla, G. (2006). *Object-Based Image Analysis.* Calgary, AB, Canada: Foothills Facility for Remote Sensing and GIScience.

Jaynes, D. B., & James, D. E. (1987). *The Extent of Farm Drainage in the United States.* Ames, IA: US Department of Agriculture Economic Research Service.

Naz, B. S., & Bowling, L. C. (2008). Automated Identification of Tile Lines from Remotely Sensed Data. *Transactions of the ASABE*, 1937-1950.

Naz, B. S., Ale, S., & Bowling, L. C. (2009). Detecting subsurface drainage systems and estimating drain spacing in intensively managed agricultural landscapes.

Agricultural Water Management, 627-637.

Niagara Block. (2014). *Drain Tile.* Retrieved from Niagara Block: http://www.niagarablock.com/application/webroot/userfiles/image/F-DrainTile%201001.JPG

Northcott, W. J., Verma, A. K., & Cooke, R. A. (2000). Mapping Subsurface Drainage Systems using Remote Sensing and GIS. Milwaukee, WI: ASAE/CSAE-SCGR Annual International Meeting.

Ohio Geographically Reference Information Program. (2011). *OSIP Data for Ohio by County.* Retrieved from OSIP Data: http://gis3.oit.ohio.gov/geodatadownload/osip.aspx

Reynolds, E. (2014, August). An Automated Method of Identifying the Location of Agricultural Field Drainage Tiles. Toledo, Ohio.

Schopfer, E., & Moller, M. S. (2006). Comparing metropolitan areas - Transferable object-based image analysis approach. *Photogrammetrie, Fernerkundung, Geoinformation*, 277-286.

Sugg, Z. (2007). *Can GIS Lead to Better Estimates of Subsurface Drainage Extent?* Washington, DC: World Resources Institute.

The Black Swamp Conservancy. (2014). *Historic Map*. Retrieved from The Black Swamp Conservancy: http://www.blackswamp.org/clientuploads/historic_map.jpg

Thompson, J. (2010). Identifying Subsurface Tile Drainage Systems Utilizing Remote Sensing Techniques. https://etd.ohiolink.edu/ap/10?206094541742112::NO:10:P10_ETD_SUBID:781 84.

United States Department of Agriculture Economic Research Service. (1987). *Farm Drainage in the United States; History, Status, and Prospects.* Washington, DC.

Verma, A. K., Cooke, R. A., & Wendte, L. (1996). Mapping subsurface drainage systems with color infrared aerial photographs. *GIS and Water Resources.* Ft. Lauderdale, FL: American Water Resource Association's 32nd Annual Conference and Symposium.

Weaver, M. M. (1964). *History of Tile Drainage.* Waterloo, New York: M. M. Weaver.