Kimley»Horn

MEMORANDUM

To: Pine Gate Renewables

Mikala Newsom

From: Marcus Rubenstein, CPESC

Kimley-Horn and Associates

Date: December 1, 2022

Re: Morven Solar Energy Project – FAQ Sheet

Hydrology - Commentors have expressed concerns related to water flowing onto their property from the project site

- Solar farms that use traditional elevated solar panels, like those proposed at Morven Solar contain an impervious surface (elevated solar panel) with a pervious surface (vegetation) underneath the panel. It is a common and acceptable practice across utility scale solar farms to manage stormwater by disconnecting rows of solar panels and directing runoff over the vegetated areas between the rows.
- Currently, the State allows solar panels associated with ground-mounted solar farms to be considered pervious if configured such that they promote sheet flow of stormwater from the panels and natural infiltration of stormwater into the ground beneath the panels.
- The Morven Solar Project proposes to design and install solar arrays in a way that will allow growth of vegetation under and between the solar arrays. Each row of panels will be installed with sufficient distance between rows to allow for capture and infiltration of rainfall
- In accordance with Georgia stormwater management regulations, stormwater runoff in the developed condition will not increase in flow volume or velocity from that of the pre-developed condition.
- During construction, the site will contain sediment barriers (silt fence) on the downstream side of any disturbed land. These barriers will be designed to store sediment on-site and filter/treat runoff before stormwater leaves the site. In some areas, the site may also contain sediment basins, which will also be designed to capture and store 67 cubic yards per acre of sediment and filter/treat runoff before stormwater leaves the site.
- In areas where topography gradients increase and localized runoff may flow off site across these steep slopes, sediment basins will be retrofitted after construction and converted to permanent stormwater detention ponds. This will ensure that post construction stormwater flows are detained and released at a rate equal to or less than that of the pre-construction condition.
- The Journal of Hydrologic Engineering published a peer reviewed article in May 2013 by Cook and McCuen, called *Hydrologic Response of Solar Farms.* Cook and McCuen studied and determined the effects that various factors would have on runoff from a site with solar panels and a site without solar panels. The article analyzed storm duration, soil type, ground slope, panel angle, and ground cover and provided an assessment of the factors that would most influences stormwater runoff from leaving a given site.
- Of the factors considered, ground cover was determined to be the single most important factor in slowing down and managing stormwater runoff from a solar site.

Ground Cover

- The runoff curve number (CN) is **an empirical parameter used in hydrology for predicting direct runoff or infiltration from rainfall excess**. Different ground cover or land types are assigned different CN's. The lower the CN, the higher the infiltration ability of the ground cover
- Based on the Runoff Curve Number table (Table 3.1.5-1) from the Georgia Stormwater Management Manual, the following are curve numbers (CN) applicable to Morven:
  - Wooded or forest land: ~60.5
  - Cultivated/agricultural land: ~76
  - Impervious areas: 98
  - Meadows: 58
- In the Cook and McCuen paper, ground cover type had the most significant hydrologic response change. A site with grassy fields beneath the solar panels had 7% less storm runoff rate compared to a site with gravel/bare ground underneath.

  Grassy/meadows have a lower CN as they have greater infiltration rates and produce less stormwater runoff. Land beneath the panels will consist of mainly grassy/meadows for the proposed Morven Solar Project.

Soil Type

- Soil type had slight significance on hydrologic response change. Four groups of soils were examined in the peer reviewed article: Groups A – D. Group A soils have high infiltration rate when thoroughly wet and have a high rate of water transmission. Group B soils have a moderate infiltration rate and moderately well drained soils. Group C soils have a slow infiltration rate and consists of a layer that impedes the downward movement of water. Group D soils have a very slow infiltration rate and consist of clay that have a high shrink-swell potential. Based on the article, runoff volume increased by 7.5% for Group C soils compared to Group B.

  - Based on the Morven Solar Soil Survey Report, the proposed site consists of mainly Groups A and B soils. Group B soils have higher infiltration and drainage rates compared to Groups C and D, which leads to slower runoff rates and better infiltration rates of stormwater across the site.

Summary – Based on the proposed ground cover (meadow) and soil types (Group B) of the site, stormwater runoff that may drain onto neighboring properties will drain at the same or slower rate than that of existing conditions.

Contamination – Commentors have expressed concerns related to soil contamination if a panel breaks and rainfall runs off the panel and onto the ground

To prevent any leakage or corrosion from occurring, solar panels are constructed with a protective layer of tempered glass on the rear of the panel. Beneath this glass, plastic ethylene-vinyl acetate (EVA) is placed to encapsulate the cell from any air or moisture. This EVA layer in PV panels keep broken panels intact. They are commonly used as layers of tempered glass in car windshields and hurricane windows to give them that extra strength.

- NC State University published a white paper in May 2017 by Tommy Cleveland called *Health and Safety Impacts of Solar Photovoltaics*. Cleveland described two PV technologies currently used in PV panels at utility-scale solar facilities: Crystalline Silicon and Cadmium Telluride (CdTe) PV Panels.

  Crystalline Silicon

  - 90% of solar PV panels installed today are crystalline silicon PV panels
  - Over 80% of the content of these panels is the tempered glass front and an aluminum frame, both common building materials
  - Small traces of lead are present in these PV panels. However, as stated in the *Health and Safety Impacts of Solar Photovoltaics*, "*very limited amount of lead involved and its strong*

physical and chemical attachment to other components of the PV panel means that even in worst-case scenarios, the health hazard it poses is insignificant. Lead in operating PV modules is not at risk of release to the environment".

Cadmium Telluride (CdTe)

- CdTe panels are constructed with a tempered glass front, an EVA layer, and a rear heat strengthened glass backing, ensuring tight protection from any possible breaks/leakages.
- EPA's Toxic Characteristics Leaching Procedure (TLCP) test is a procedure used to determine whether hazardous elements are present in a waste and leachable into the soil and groundwater. EPA has determined maximum concentration limits for various contaminants that if surpassed, would be deemed as hazardous. Based on the TLCP test limit, CdTe panels passed EPA's TLCP test. Cases of crushed panels in a landfill would not result in hazardous contaminants leaching into the groundwater.
- Only 7 grams of cadmium in one CdTe panel is in the form of a chemical compound cadmium telluride, which has 1/100th the toxicity of free cadmium
    - Cadmium telluride is non-volatile and non-soluble in water

Summary – Based on the information provided above, PV panels have been designed to efficiently encapsulate and keep intact potential hazardous components from leaking out and into groundwater. Additionally, these potentially hazardous metals in PV panels are below the EPA's hazardous threshold and do not pose a threat to impact groundwater runoff.

Contamination – Commentors have expressed concerns related to soil contamination around the places where steel and concrete will be installed in the ground

There is no study or supporting documentation that steel or concrete placed in the ground would have any effect on the health of soil or groundwater. Steel and concrete are used in all kinds of construction projects, and the claim that their placement into the ground could contaminate soil or groundwater is baseless and illogical.

Certain soils may cause steel and concrete to corrode over long periods of time, and the design of the arrays at Morven will consider these corrosivity factors. However, this will be assessed to ensure the long-term integrity of the arrays themselves and will have nothing to do with the question of soil or groundwater contamination. There are no scientific data that we are aware of that presents any correlation between the corrosivity of steel and concrete and soil or groundwater contamination.