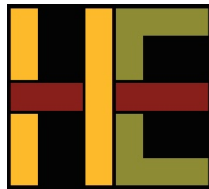


# **Review and Evaluation of the Caldwell Solar, LLC Site Assessment Report**

**Kentucky Public Service Commission and  
Kentucky State Board on Electrical Generation and  
Transmission Siting**

**January 21, 2022**





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January 21, 2022

Ms. Linda Gosnell  
Kentucky Public Service Commission  
211 Sower Blvd.  
Frankfort, KY 40601

**Re: Harvey Economics' Review of Caldwell Solar, LLC's Site Assessment  
Report for Solar Facilities in Caldwell County, Kentucky**

Dear Ms. Gosnell,

Harvey Economics is pleased to provide you with our final report, *Review and Evaluation of the Caldwell Solar, LLC Site Assessment Report*.

Yours truly,

Edward F. Harvey  
Principal

Report

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January 21, 2022

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**Prepared for**

Kentucky Public Service Commission and  
Kentucky State Board on Electrical Generation and Transmission Siting  
211 Sower Boulevard  
Frankfort, Kentucky 40602

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Harvey Economics

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# **SECTION 1**

## **Introduction**

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This document provides a review of the Site Assessment Report (SAR) for the proposed Caldwell Solar, LLC solar facility (Project or Solar Project) submitted to the Kentucky State Board on Electric Generation and Transmission Siting (Siting Board). Caldwell Solar, LLC submitted the SAR to the Siting Board on October 12, 2021. Siting Board staff retained Harvey Economics (HE) to perform a review of the SAR. Caldwell Solar, LLC (Caldwell Solar or Applicant) submitted the SAR as part of its application for a construction certificate to construct a merchant electric generating facility under KRS 278.706 and 807 KAR 5:110. Requirements specific to the SAR are defined under KRS 278.708, detailed below.

### **Statutes Applicable to the SAR Review**

KRS 278.706 outlines the requirements for an application to receive a certificate to construct a merchant electric generating facility. Section (2)(l) of that statute requires the Applicant to prepare a SAR, as specified under KRS 278.708. The Caldwell Solar SAR is the main focus of HE's review. However, the Siting Board also requested that HE review the economic impact report prepared by the Applicant. The economic impact report is a requirement of the application under KRS 278.706(2)(j), separate from the SAR.

KRS 278.708(3) states the following:

A completed site assessment report shall include:

- (a) A description of the proposed facility that shall include a proposed site development plan that describes:
  - 1. Surrounding land uses for residential, commercial, agricultural, and recreational purposes;
  - 2. The legal boundaries of the proposed site;
  - 3. Proposed access control to the site;
  - 4. The location of facility buildings, transmission lines, and other structures;
  - 5. Location and use of access ways, internal roads, and railways;
  - 6. Existing or proposed utilities to service facility;
  - 7. Compliance with applicable setback requirements as provided under KRS 278.704(2), (3), (4), or (5); and
  - 8. Evaluation of the noise levels expected to be produced by the facility.
- (b) An evaluation of the compatibility of the facility with scenic surroundings;

- (c) The potential changes in property values and land use resulting from the siting, construction, and operation of the proposed facility for property owners adjacent to the facility;
- (d) Evaluation of anticipated peak and average noise levels associated with the facility's construction and operation at the property boundary; and
- (e) The impact of the facility's operation on road and rail traffic to and within the facility, including anticipated levels of fugitive dust created by the traffic and any anticipated degradation of roads and lands in the vicinity of the facility.

KRS 278.708(4) states that “the site assessment report shall also suggest any mitigating measures to be implemented by the applicant to minimize or avoid adverse effects identified in the site assessment report.”

KRS 278.706(2)(j) states that a completed application shall include “an analysis of the proposed facility's economic impact on the affected region and the state.”

KRS 278.706(2)(d) addresses specific setback requirements, as related to distances from adjacent property owners of various types (i.e., residential neighborhoods, schools, hospitals, nursing homes).

## **SAR Review Process and Methodology**

HE completed the following tasks as part of the review of the Caldwell Solar SAR and certain other components of the Caldwell Solar application:

- Review of the contents and information provided in the site assessment report, application and other documents provided by the Applicant;
- Brief review of secondary data sources to obtain background information and geographic setting for the Caldwell Solar Project;
- Limited review of relevant evaluation criteria to identify potential issues and assessment approaches to serve as benchmarks for the adequacy review;
- Identification of additional information we deemed useful for a thorough review, and submittal of questions to the Applicant via Kentucky Public Service Commission General Counsel;
- Review of additional information supplied by the Applicant in response to first submitted HE questions, and discussion of responses with the Siting Board staff;
- Completion of interviews and data collection with outside sources as identified in this document;

- Review of additional information supplied by the Applicant in response to a second set of questions submitted by HE, and discussion of responses with the Siting Board staff;
- Participation in a site visit, including a tour of the Project site with the Applicant and in-person meetings with local officials;
- Completion of analyses and evaluation of the impacts upon each of the previous identified resources; and
- Preparation of this report, which provides HE’s conclusions as to potential Project impacts and mitigation recommendations.

## **Components of the Caldwell Solar Facility Application**

Caldwell Solar, LLC’s application package to the Siting Board (Application) consists of multiple documents, including several appendices:

- The main Application document provides a summary overview of the Caldwell Solar Project and the Applicant’s responses to applicable KRS.
- Exhibits A through J include, but are not limited to, the following:
  - Description of the proposed site, including maps of the project area
  - Public notice evidence and report
  - Compliance with local ordinances, regulations and setback requirements
  - Effect on Kentucky electricity transmission system
  - Economic Impact Analysis report
  - Cumulative Environmental Assessment report
  - Site Assessment Report (SAR), including Noise Assessment, Glare Report, Property Value Impact Report, Decommissioning Methodology and Traffic Study. The SAR is Exhibit H.

## **Additional Information Provided by the Applicant**

Once HE reviewed the contents of the Application, including the SAR, HE and the Siting Board staff independently developed a first list of detailed questions, either requesting additional information or asking for clarification about items in the SAR. The Siting Board staff submitted the first request for information, including questions from HE, on November 19, 2021; Caldwell Solar provided written responses on December 3, 2021, and December 10, 2021.

After HE and the Siting Board staff reviewed Caldwell Solar’s responses to the first request for information, HE and the Siting Board staff independently developed a second list of detailed questions. The Siting Board staff submitted the second request for information,

including questions from HE, on December 21, 2021. Caldwell Solar provided written responses to the second request for information on January 7, 2021.

HE and certain representatives from the Siting Board also met with the Applicant for an in-person meeting on December 8, 2021, to conduct a site visit and discuss remaining issues.

## **Report Format**

This report is intended to support the Siting Board in its decision-making process pertaining to a construction certificate for Caldwell Solar, LLC. The report is structured to respond to the requirements for a SAR as outlined in KRS 278.708, the economic analysis described in KRS 278.706(j) and to our contract:

- This section of the report, Section 1, introduces the purpose and process of the SAR review and HE's work;
- Section 2 offers a summary and conclusions of HE's SAR evaluation;
- Section 3 describes the Caldwell Solar Project and proposed site development plan;
- Section 4 provides a brief profile of Caldwell County's economic and demographic characteristics as context for the Project setting;
- Section 5 offers detailed findings and conclusions for each resource area; and
- Section 6 presents recommendations concerning mitigation measures and future Siting Board actions.

## **Caveats and Limitations**

**Review limited to resource areas/issues enumerated in the statutes.** HE's evaluation of the Caldwell Solar Project is contractually limited to a review of the SAR and associated materials, as well as the economic impact analysis. Statutes dictate the issues to be covered in the SAR; HE focused on those specific topic areas, which are addressed in this report. The Siting Board might have additional interests or concerns related to the construction, siting, or operation of the Project; those may be addressed in other documents or by other parties.

**Level of review detail determined by expert judgement.** KRS 278.708 identifies the required components of an SAR; however, the level of scrutiny and detail of the evaluation depends upon expert judgement as to what information is relevant and what level of detail is appropriate. This level of review generally relates to the assessment methodologies, geographic extent of impacts and the degree of detailed information about the Project as requested by the consultant in follow-up inquiries. Given our experience related to project impact assessments and evaluation of impacts on various socioeconomic and natural resource components, HE believes that we have performed a thorough and comprehensive review of the Caldwell Solar SAR, which will meet the needs of the Siting Board.

**Assumption of accurate Applicant data.** HE reviewed all the data and information provided by the Applicant as part of the SAR and associated documents, including responses to two sets of inquiries. Although we evaluated Applicant data for consistency and clarity as part of our review, we did not perform any type of audit to confirm the accuracy of the provided information. We assume that the Applicant has provided an honest representation of the Project, based on the best data available at the time.

In instances where the Applicant was unsure about certain aspects of the Project, such as exactly where the solar panels would be placed, HE assumed a “worst case” for the purposes of the impact analysis. Should the actual Project development deviate in a manner that materially changes the Project magnitude or location of impacts, or affected parties, the Applicant can be required to notify the Siting Board for it to evaluate such a deviation and take appropriate action as deemed necessary. See mitigation recommendations in Section 6.

**Cumulative impacts not evaluated.** During its review process, HE became aware of two other solar energy generation facilities whose construction or operational activities could potentially result in cumulative impacts in combination with the Caldwell Solar Project:

- The Ashwood Solar I Project is an 86-megawatt facility to be located on approximately 1,500 acres in eastern Lyon County, several miles south of the City of Fredonia along the east and west sides of US 641.<sup>1</sup> At the closest point, the Ashwood Solar I Project would be about one mile west of the Caldwell Solar Project site. The Ashwood Solar I Project’s Certificate to Construct was issued on June 21, 2021, and the case was closed on October 22, 2021. As of the date of this report, no construction activities have commenced.
- The Golden Solar Project is a proposed 150-megawatt facility on approximately 2,400 acres in Caldwell County, immediately to the east of the Caldwell Solar Project.<sup>2</sup> On July 23, 2021, that Applicant submitted a Renewed and Revised Notice of Intent to file an application for a construction certificate. As of the date of this report, that application has not been filed.

In the interest of full disclosure to the Siting Board and public, we have identified these facilities and noted the potential for cumulative impacts on the local area in Section 5, but we have not performed any analyses to quantify or address the full scope of cumulative impacts.

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<sup>1</sup> <https://psc.ky.gov/Case/ViewCaseFilings/2020-00280>.

<sup>2</sup> <https://psc.ky.gov/Case/ViewCaseFilings/2020-00243>.



## **SECTION 2**

# **Summary and Conclusions**

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On October 12, 2021, Caldwell Solar, LLC (Caldwell Solar or Applicant) applied to the Kentucky State Board on Electric Generation and Transmission Siting (Siting Board) for a construction certificate to construct a merchant electric generation facility. Caldwell Solar's application (Application) responded to the statutory requirements set forth by the State of Kentucky in KRS 278.706 and 278.708.

The Siting Board retained Harvey Economics (HE) to review and evaluate the Site Assessment Report (SAR) included in the Application, as well as other supporting information provided by the Applicant. In addition to the topic areas included in the SAR, HE also addressed the Applicant's economic impact analysis and the topic of decommissioning. The results and conclusions from HE's review and evaluation are provided below. Recommended mitigation measures are offered in Section 6 of this report.

### **Facility Description and Site Development Plan**

Caldwell Solar proposes to construct an up to 200-megawatt (MW) alternating current photovoltaic electricity generation facility (Project or Solar Project) in western Caldwell County, KY, northwest of the City of Princeton. The Project site encompasses a total of about 3,000 acres of rural agricultural land. Solar infrastructure will include over 541,750 solar panels, associated ground-mounted racking structures, 265 inverters, and overhead and underground electrical collection systems. A Project substation and switchyard will connect the Project to the existing Barkley 161-kilovolt (kV) transmission line owned by Big Rivers Electric Corporation.

- ***Surrounding land uses*** – The area around the Project site can be generally described as rural agricultural. Some vegetation does exist; however, much of the area is comprised of open fields. Acreage surrounding the Project site is largely residential agriculture or purely agricultural land; few commercial properties are located adjacent to the Project site. A Lafarge gravel quarry is located immediately to the north of the Project site and two churches are located to the east of the Project site. The cities of Princeton to the south and Fredonia to the north offer a mix of residential, commercial and public uses.
- ***Proximity to homes and other structures*** – A total of 45 residential structures and 88 “other” structures (including barns, warehouses, and similar ancillary structures) would be located within 1,200 feet of a Project solar panel. Eight residential structures would be located within 300 feet of a solar panel.<sup>3</sup> Four businesses are located within 1,500 feet of a solar panel.

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<sup>3</sup> Two of those residences are owned by participating landowners.

- **Locations of structures** – Solar panels, inverters and the racking system will be located throughout the property. The substation and switchyard will be located in the northern portion of the Project site, west of KY 91 (Marion Road). An operations and maintenance (O&M) building will be located on-site, likely near the substation and switchyard. Eight weather stations will be located within the interior of the site, likely near inverters. Overhead collection lines will run in a north-south direction through the center of the site. The existing Big Rivers Electric Corporation 161-kV transmission line runs in an east-west direction through the northern portion of the Project site; the Project substation will connect to that transmission line.
- **Locations of access ways** – 15 proposed entrances will allow access to different areas of the property during construction and operations. Those access points include two on the northern side of the Project site (Fredonia Quarry Road), two on the southern side (Craig Cemetery Road) and 11 others located along local roads throughout the Project site on various roads, including Craig Cemetery Road, Bobby Gill Road, Skinframe Creek Road and Pleasant Valley Road. The Fredonia Valley Railroad line runs in a north-south direction on the east side of the Project site; the Paducah and Louisville Railroad rail line runs in an east-west direction to the south of the Project site. The Project may use those railways for delivery of heavy equipment.
- **Access control** – All site entrances will be gated and locked when not in use; additionally, security lighting and cameras will be in place during operations. Security fencing (six-foot high chain-link fencing) will enclose the solar arrays. The substation and switchyard will have their own separate security fencing (seven-foot high chain-link fencing). All fencing will meet National Electric Safety Code requirements. Site entrances and boundaries will have signage. The Applicant will coordinate with local law enforcement regarding security prior to construction.
- **Utility service** – Electrical services will be needed for construction and operational activities. Caldwell Solar anticipates electrical services will be provided by Louisville Gas & Electric and by Kentucky Utilities. Water and wastewater services may be needed for the O&M building; Caldwell Solar anticipates that the Caldwell County Water District will provide those services. Portable toilets will be provided during construction.
- **Project life**—The Applicant anticipates a 20-to-25-year Project life for the Caldwell Solar facility.

Project construction is expected to last approximately 12 to 16 months. Between 60 and 225 workers will be on-site throughout the construction period, depending on the types of activities occurring at any particular time. The peak construction period is expected to last approximately six months. The Project construction schedule and description of construction activities is provided in Section 3.

**Setback requirements and requested deviation.** The Applicant has entered a motion for a deviation from the existing setback requirements. HE reviewed this motion and

believes that the Project meets the specific statutes of a setback deviation. The Siting Board must determine if these measures are sufficient.

**Conclusions and recommendations.** HE believes that the Applicant has generally complied with the legislative requirements for describing the Caldwell Solar facility and the site development plan, as required by KRS 278.708.

## **Project Setting**

Caldwell County had a 2020 population of about 12,650 people. Population levels have been slowly declining over the past 20 years and levels are projected to continue that decline into the future. The City of Princeton, southeast of the Project site, has an estimated 6,300 residents. The area around the Project site can be generally described as rural and agricultural; more than half of the County's acreage is agricultural, with crop production accounting for the majority of agricultural activity. Several manufacturing facilities currently operate in the County. Residents' income levels are low, as compared to other areas of Kentucky or the U.S. About 15 percent of County residents live in poverty.

## **Compatibility with Scenic Surroundings**

The area surrounding the Project is largely agricultural, with scattered rural residential properties. Existing vegetation is sparse in some areas of the Project site and open spaces would allow the solar panels or other infrastructure to be visible from different viewpoints. The Project site is located to the northwest of the City of Princeton and southeast of the City of Fredonia, both of which offer a mix of commercial activities. A Lafarge gravel quarry is located immediately to the north of the Project site.

Scenic compatibility focuses largely on the solar panels; inverter/transformer stations; the Project substation and switchyard area; and the overhead collection system. Solar panels will be in view of several nearby homes without any type of visual barrier. The substation/switchyard is located in a remote area, about 3,700 feet from the nearest residence. Portions of the Project will be visible from local roads, including Old Fredonia Road, Skinframe Creek Road, Pleasant Valley Road, Adamson Road, and others. The Applicant's proposed vegetative buffering plan would largely shield the Project from local residences and drivers. The Applicant has stated they will work with neighboring homeowners and business owners to address concerns related to the Project.

The Project will use anti-glare solar panels. The Applicant's glare study stated that modeling indicated no glare from the Project would be detected at any of the nearby roadway or residential observer locations (zero minutes of any type of glare over the course of a year at any location.)

Given its rural location, the sparse population in the Project area, and the distances between Project components and nearby residences, HE believes the Caldwell Solar facility can be considered compatible with the existing scenic surroundings, assuming the addition of vegetative buffers in certain, strategic areas.

## **Potential Changes in Property Values and Land Use**

The Applicant's consultant, CohnReznick LLP, provided an extensive database and analysis of property values, transactions, and estimated impacts of solar facilities in diverse locations, concluding that the Project would have no effect on property values during construction or once in operation. To further assess potential property value impacts, HE: (1) reviewed existing literature related to solar facility impacts; (2) interviewed the Caldwell County Property Valuation Administrator; (3) requested additional information from CohnReznick; and (4) examined the potential for impacts to residential and other properties closest to the Project.

Most recent studies indicate no impacts to property values related to solar facilities. The Caldwell County Property Valuation Administrator stated that he does not expect to see any changes in property values (increases or decreases) due to the Project, mainly due to its rural country setting, but that residents adjacent to the Project site would appreciate vegetative buffers. Additionally, HE's evaluation of the data provided by CohnReznick also suggests that property values are unlikely to be affected by solar facilities. Therefore, HE concludes that negative impacts to property values from this Project are unlikely as a general rule. This conclusion is predicated on the assumption that the mitigation strategies discussed in Section 6 are adopted by Caldwell Solar and the Siting Board. Mitigation of visual and other effects, with close property owner coordination, can minimize uncertainties related to property values.

## **Anticipated Peak and Average Noise Levels**

Neither the Commonwealth of Kentucky nor Caldwell County have noise ordinances applicable to this Project. As such, HE adopted the noise recommendations generated by the Environmental Protection Agency and the World Health Organization to gauge acceptable levels of sound. Natural vegetation is sparse in some areas surrounding the Project site; vegetative buffers would help mitigate noise emissions that may be caused by the Project.

Construction activities are expected to generate noise emissions greater than 55 decibels (dBA) throughout the 16-month construction period. This level is above standards for annoyance, but the noise will be sporadic and decrease with distance from nearby residences. The pile driving process is the loudest part of the construction process. Road construction, substation construction and trenching may also be loud activities. Those activities will only occur in any one location for a short period of time, moving around the Project site until construction is complete. Since these construction activities are not sustained, no hearing loss or long-term annoyance to residents is expected.

Noise from Project components during operations (inverters, motors, transformer) is anticipated to result in only a small increase, if any, to the local sound environment. Operational components would emit relatively low sounds during daylight hours and little sound at night. For all nearby residences, operational sound levels would be less than the 50.0 dBA noted by the World Health Organization (WHO) as potentially causing moderate annoyance. Noise from the Project's operational components is not likely to be annoying and may not be noticeable.

Existing vegetation is sparse in some areas surrounding the Project site. Vegetative buffers developed by the Applicant would help mitigate noise for nearby homeowners.

## **Road and Rail Traffic, Fugitive Dust and Road Degradation**

Major roads providing access to the Project site include KY 91 (Marion Road) and US 641. These feed into numerous local roads that will access the Project site. Road and traffic impacts during operation will be minimal, but clearly evident during construction.

Construction activities will cause noticeable increases in traffic volumes on local roads, given light existing traffic volumes in the area. Local roads are generally narrow and passing may be an issue in some areas. These impacts will be temporary, occurring over the 16-month construction period, but may be annoying to local residents. Vehicle traffic, including commuting workers and deliveries, may also have the potential to cause road degradation. The Applicant has committed to paying for or fully fixing any damage.

Given the few employees and deliveries required for Project operations, traffic impacts during the operational phase will be minimal.

The Fredonia Valley Railroad (FVRR) and the Paducah and Louisville Railroad (PAL) rail lines are located in the Project area. The Applicant may use one or both of the railroads for the delivery of heavy Project components, including the substation transformers. Additionally, construction or operational vehicles may travel over FVRR or PAL road crossings to access the site. The Applicant will coordinate with the railroads directly if a crossing agreement is necessary.

Fugitive dust should not be an issue given the Applicant's commitment to best practices for construction and operational activities, including the application of water for dust suppression.

## **Economic Impact Analysis**

Construction and operation of the Caldwell Solar facility will provide some limited economic benefits to the region and the Commonwealth. Construction employment and income opportunities will be temporary, but local hires will increase employment and incomes in an area that needs it. The bulk of construction purchases will be made outside Kentucky, limiting opportunities for local business activity or generation of additional sales tax.

Operational economic benefits will be confined mostly to property taxes. Annual property tax payments will be made to Caldwell County taxing authorities, including the Caldwell County School District; however, those payments will likely amount to a small percentage of total tax revenues. The Applicant has pledged annual monetary contributions to a local charitable organization, which will offer additional local benefits. Operational employment will be minimal, and purchases of materials or supplies will be small on an annual basis.

Socioeconomic impacts of the Caldwell Solar facility represent a positive, albeit small, contribution to the region.

## **Decommissioning**

The Applicant assumes a 20-to-25-year useful life for the Caldwell Solar facility. The Applicant's Decommissioning Methodology document includes information about the removal of solar facility components, site restoration commitments and an approach to developing decommissioning cost estimates. The Applicant states that they will post a financial surety with Caldwell County as the obligee, if requested.

All above- and below-ground Project facilities will be removed from the Project site, unless the landowner requests that internal access roads or other structures remain on-site. After site restoration, the land would return to pre-Project productive uses and property values, thereby eliminating long-term Project-related impacts, compared with simply shuttering the solar facility. This process will also add a modest, temporary positive economic stimulus to the region.

Additionally, lease agreements with participating landowners commit the Applicant to removing any construction debris and restoring the portions of the land not occupied by the solar facilities to substantially the same conditions as prior to construction of the Project.

## **Public Outreach and Communication**

The Applicant has engaged in public outreach in Caldwell County and in the Project area since early 2020, including hosting a public meeting, mailing informational letters to adjacent landowners, meeting with County officials and creating a Project website. However, the public meeting was not well attended, and public awareness of the Project is limited.

## **Complaint Resolution**

The Applicant has stated that they will notify local landowners prior to construction and provide contact information to the public so that residents can raise concerns with Project representatives. The Applicant will work with landowners to resolve any issues. HE encourages the development of a formal complaint resolution process, applicable to both the construction and operational periods.

## **Conclusions and Recommendations**

Based on our findings related to the specific siting considerations in the statutes and as addressed in this report, HE recommends that the Siting Board approve Caldwell Solar, LLC's application for a certificate to construct a merchant electric generating facility. This finding assumes that the Project is developed as described in the SAR and the supplemental information, and the mitigation measures set forth in Section 6 of this report are adopted.

# **SECTION 3**

## **Project Overview and Proposed Site Development Plan**

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### **Project Overview**

The Caldwell Solar, LLC SAR describes the Caldwell Solar Project as follows:

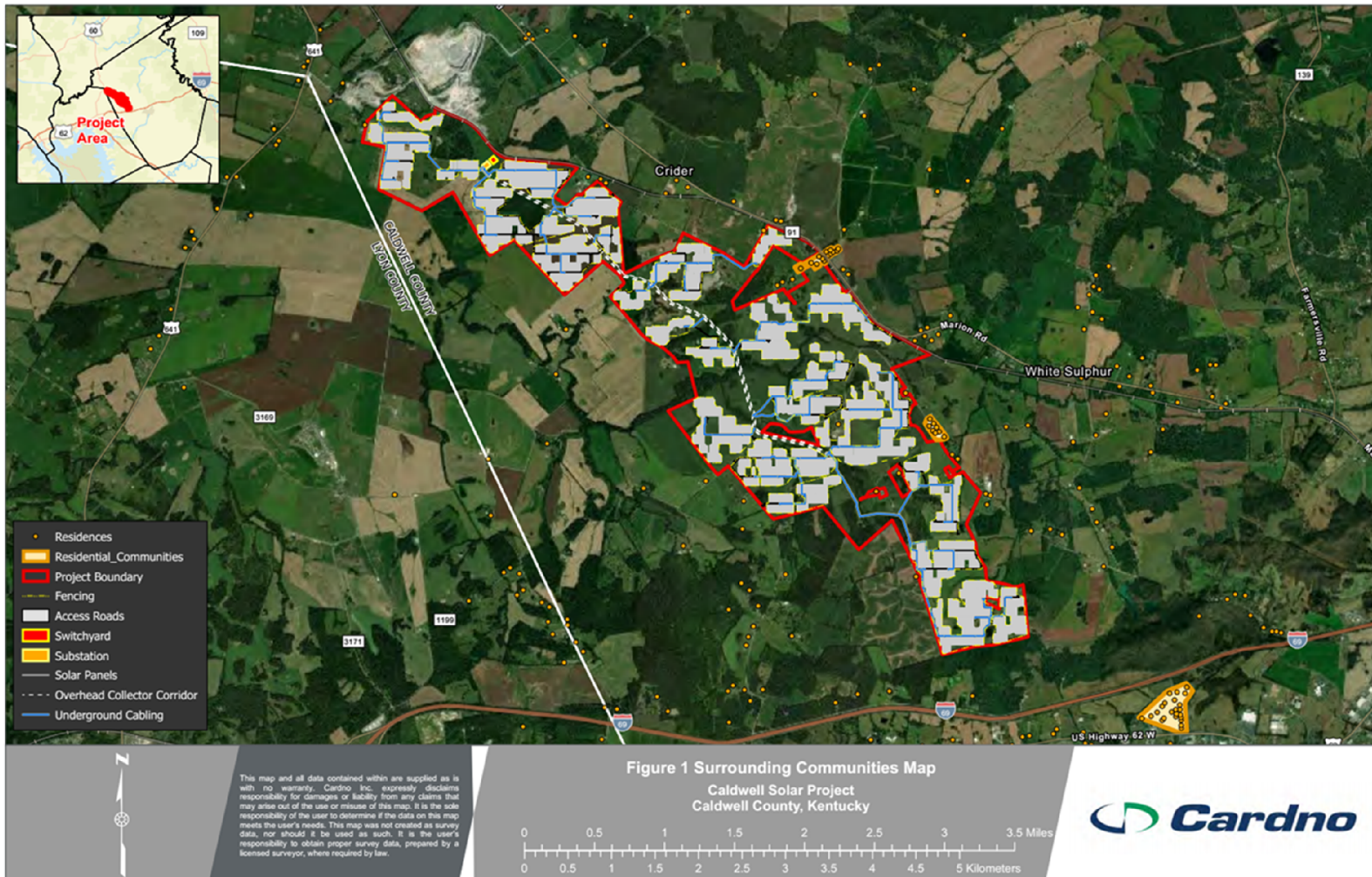
“The proposed Caldwell Solar Facility will be an up to 200-megawatt alternating current (MW) photovoltaic electricity generation facility. Project facilities will include solar modules, inverters, tracking racking, fencing, access roads, a Project substation and switchyard, an operations and maintenance (O&M) building, a parking lot, below-and/or above-ground electrical collection lines, up to eight weather stations (up to 20 feet tall), and temporary construction laydown yards. The Project will be located on approximately 3,000 combined acres of connected properties in Caldwell County. No street address has been established at this time for the Project; the coordinates for the location are 37.085563°N and 87.592701°W. For interconnection, Caldwell Solar, LLC will construct a Project substation to connect to the Caldwell County to Barkley 161-kV transmission line owned by Big Rivers Electric Corporation. The interconnection point and switchyard will be located within the Project Area.

The solar panels will be mounted on a racking system, which provides a foundation for the panels and supports them above the ground on pile-driven piers. This racking system has a minor footprint, and concrete foundations are unlikely to be required, resulting in low impact to the area beneath the panels. Final geotechnical studies will identify any possible deviations from standard pile driving conditions. Rainfall will run off the panels onto the ground surrounding the panels, which will be vegetated with herbaceous plants and provide infiltration into the ground water.

The electricity generation facility will be surrounded by a 6-foot-tall fence topped with barbed and/or smooth wire for security that meets National Electrical Code (NEC) Article 110. Outside of the fence, trees and shrubs will be planted as screens in areas where the panels are adjacent to residences or other sensitive areas that could experience visual impacts from the panels and associated infrastructure. Vegetative buffers will consist of deciduous and evergreen trees and shrubs.”

Exhibit 3-1 illustrates the Project boundaries and identifies locations of Project components, as provided by the Applicant in the SAR. Additional detailed maps of the Project were provided in Exhibit I and Exhibit J of the Application. Due to the number of figures and very detailed information provided in those exhibits, they have not been included in this report.

**Exhibit 3-1.  
Location, Overview and Project Facilities Map for the Proposed Caldwell Solar Project**



Source: Caldwell Solar, LLC, October 2021.



The Project site is located approximately 100 miles west of the City of Bowling Green and about 45 miles north of the border with Tennessee. The southernmost portion of the Project site is approximately two miles west of the City of Princeton.

## **Construction Activities**

Construction of the Caldwell Solar facility is expected to occur over a period of about 12 to 16 months, as shown in Exhibit 3-2.<sup>4</sup> Peak construction activity is anticipated to occur during delivery and installation of the structural piles, trackers, modules and inverters and will last approximately six months.

Certain construction activities may occur sequentially across the entire Project site; however, the Applicant anticipates that most activities will overlap, with different activities taking place in different areas of the Project site at the same time. According to the Applicant, pile driving activities and any activities that require pile driving as a precursor will flow like a wave, sequentially, across individual areas within the Project site. That action may not apply to the entire site but will be true within individual sections of the site. Caldwell Solar has not yet determined the geographic starting point of construction activities.

General construction activities and anticipated timelines include the following:

- Site preparation: 60 days
- Pile installation: 150 days
- Racking installation: 150 days
- Module installation: 170 days
- Project substation: 270 days
- Transmission line: 45 days
- Operations building/parking lots: 120 days
- Mechanical completion: 100 days
- Commissioning: 120 days

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<sup>4</sup> Due to circumstances, such as weather delays, construction may last up to 18 months.

**Exhibit 3-2.**  
**Preliminary Construction Schedule for the Proposed Caldwell Solar Project**

TASK	MONTH															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Start of Construction	X															
Site preparation	X	X														
Pile Installation			X	X	X	X	X									
Racking Installation					X	X	X	X	X							
Module Installation						X	X	X	X	X	X					
Project Substation			X	X	X	X	X	X	X	X	X					
Transmission line											X	X				
Operations building/parking lot							X	X	X	X						
Mechanical Completion											X	X	X	X		
Commissioning													X	X	X	X

Source: Caldwell Solar, LLC, December 2021.

Between 60 and 225 workers will be on-site at any particular time, depending on the specific tasks and activities occurring at the time. Exhibit 3-3 provides the estimated number of construction workers on the Project site, by quarter, for the duration of the construction period.

**Exhibit 3-3.**  
**Estimated Construction Workforce for the Proposed Caldwell Solar Project**

<u>Quarter of Construction</u>	<u>Estimated Workers On-site</u>
Quarter 1	60
Quarter 2	100
Quarter 3	180
Quarter 4	225
Quarter 5	100
Quarter 6	60

Source: Caldwell Solar, LLC, December 2021.

The Applicant is proposing that “noise-creating” construction activity occur between the hours of 7:00 am and 7:00 pm, Monday through Saturday. In the case of inclement weather, the Applicant proposes that Sundays may be used as make-up days. Non-noise creating on-site activities are proposed to be limited to the hours of 6:00 am and 10:00 pm, Monday through Sunday. Those activities would include field visits, arrival, departure, planning meetings, mowing, surveying, etc.

**Life of the Project**

The Caldwell Solar facility is anticipated to operate for approximately 20 to 25 years. Project decommissioning (the process of closing the facility to retire it from service) is discussed in Section 5 of this report.

## Proposed Site Development Plan

The following discussion addresses each of the SAR requirements for a proposed site development plan, as laid out in KRS 278.708(3)(a).

**Surrounding land uses.** Caldwell County in general, and particularly areas outside the cities of Princeton and Fredonia, is rural in nature, with low population density and an agricultural emphasis. The Project site and surrounding properties can be described as rural and agricultural; however, the site is also located several miles north of I-69 and State Highway 62, which run through the center of the County. Section 4 of this report provides a general overview of the County's demographic and economic characteristics.

The SAR states that about 80 percent of the land within the Project site is currently used for agricultural purposes, including cultivated crops (630.2 acres) and pasture/hay (1,328.3 acres). About another 16 percent (409.6 acres) is forested and approximately three percent of the acreage within the Project site is described as developed, including less than one acre of medium to high density development.

The Applicant also provided information describing the distances between nearby residences, businesses or other structures and Project solar panels. That information is provided in Exhibit 3-4.

### Exhibit 3-4. Distances between Nearby Structures and the Proposed Caldwell Solar Project Solar Panels

Distance from Solar Panels (ft)	Residential Structures	Commercial Structures	Other Structures
0 - 300	8	0	24
301 - 600	9	0	16
601 - 900	13	0	22
901 - 1,200	15	0	26
1,201 - 1,500	8	4	12
1,501 - 1,800	4	0	6
1,801 - 2,100	5	0	8
2,100 - 2,400	5	0	5
2,401 >	<u>1</u>	<u>0</u>	<u>5</u>
Total Structures:	68	4	124

- Notes: (1) Structures include those within 2,000 feet of the Project boundary line.  
(2) Residences include seven homes owned by participating landowners.  
(3) Other structures include barns, warehouses and similar types of ancillary structures.

Source: Caldwell Solar, LLC, December 2021.

A total of 30 residences will be located within 900 feet of a solar panel and 62 residences within 2,100 feet of a solar panel.<sup>5</sup> Three of the four commercial structures located within 1,500 feet of a solar panel are associated with the Lafarge Quarry; the fourth is associated with a welding business.

A Lafarge gravel quarry is located immediately to the north of the Project site, along Fredonia Quarry Road. The quarry is currently operational; however, the specific operations of the facility, including level of production and traffic volumes, are unknown.

**Legal boundaries.** The legal boundaries of the proposed site are illustrated in Exhibit I, Figure 3 of the Application. According to the Applicant, the Project will be constructed on privately-owned land comprised of 18 separate parcels. Six separate lease agreements with property owners represent those 18 parcels.

Five small areas, generally located within the southern half of the Project boundary, have been identified as “Project Exclusion Areas” and are excluded from the Project activities.<sup>6</sup> Each of the excluded areas is owned by a participating landowner. One of the excluded areas includes a residential structure; one includes a residential structure and outbuildings; two include outbuildings only; and one excluded area is a forested area that includes no structures of any type.

**Access control.** According to supplemental information provided by the Applicant, the preliminary site plan includes 15 separate construction entrances.<sup>7</sup> The Applicant or its contractor will control access to the site during construction and operation. All entrances will be gated and locked when not in use. The Applicant will ensure that site entrances and boundaries have adequate signage, particularly in areas visible to the public.

Security fencing (transparent, chain-link) will be placed around the solar arrays and other generation equipment. The substation and switchyard will each have their own separate security fencing installed. The substation fencing will be seven feet high; fencing in other areas of the Project will be six feet in height.

Security lighting, cameras and locked gates will be used throughout the Project site during operations. The Applicant will coordinate with local law enforcement regarding security and emergency protocols prior to construction. Emergency contact information will be provided on the security fencing near the site entrances.

**Location of buildings, transmission lines and other structures.** Approximately 541,750 solar panels and 265 inverters will be located on about 1,450 acres within the Project site. Inverters will be clustered on 65 inverter skids, which will provide the foundation for the inverters, transformers and the Supervisory Control and Data Acquisition systems. The

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<sup>5</sup> Section 5 of this report provides additional information about distances between residential and non-residential structures and other Project facilities, including inverters and the substation.

<sup>6</sup> Caldwell Amended Exhibit I, Figure 2, provided to the Siting Board in December 2021 in response to Data Request 1.

<sup>7</sup> Caldwell Site Entrances Figure, provided to the Siting Board in December 2021 in response to Data Request 1.

substation and switchyard area (about three acres) will be located in the northern section of the Project site, south and west of KY 91 (Marion Road), along the existing Barkley 161-kV transmission line route owned by Big Rivers Electric Corporation (BREC). The Project will connect to that transmission line.<sup>8</sup> The Project will include a below-ground electrical collection system as well as an above-ground collection system. The below-ground system includes cabling installed in trenches or ploughed into place at a depth of at least three feet below grade. Underground collector lines will be located across the Project site. The overhead collector line(s) will generally run in a north-south direction through the center of the Project site and will include approximately 76 poles within the overhead collection corridor. The preliminary locations of the panels, substation and switchyard, underground cabling and the overhead collection corridor can be seen in Exhibit 3-1 of this report and in the Amended Figure 2.1 Project Layout Map provided by the Applicant as part of supplemental materials.

Between one and three laydown yards are anticipated to be developed within the Project site, to include parking areas for construction workers and staging areas for Project components during construction. The locations of those areas have not been finalized but are anticipated to be located in areas accessible from main roads and near site entrances. Laydown yards may be graveled. In total, the laydown yards will cover about 15 acres of the Project site. Temporary laydown yards located in areas that will not eventually include solar modules will be returned to their original conditions after construction.

An operations and maintenance (O&M) building will provide access and storage for Project O&M equipment; that building will include an office for the onsite Plant Manager; break rooms, restrooms and technician rooms; and equipment storage. The location of the O&M building has not been finalized. O&M buildings are often located near substation/switchyard areas; however, due to the secluded nature of the proposed location of the substation in this case, Caldwell Solar may elect to locate the O&M building in a more accessible location. A gravel or paved parking lot will be located adjacent to the building.

The Project will also include up to eight weather stations. The locations of those stations have not been determined, but they are likely to be located within the interior of the Project site; they would typically be positioned near an inverter.

Existing structures within the Project site (barns or other unoccupied structures) may be demolished or removed, if necessary and in coordination with participating landowners.

**Location and use of access ways, internal roads and railways.** As noted previously, 15 entrance locations will allow access to different sections of the Project site during construction. Those entrances are located across the Project site, including two at the northern end of the site (along Fredonia Quarry Road), two at the southern end of the site (along Craig Cemetery Road) and 11 along other roads within the Project boundary, including Bobby Gill Road, Old Fredonia Road, Skinframe Creek Road, Pleasant Valley Road, Henry Jones Road and Crider-Dulaney Road. It is uncertain whether all 15 entrances will be utilized during operations; however, all entrances may be needed to access the full site for maintenance.

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<sup>8</sup> In addition to the BREC transmission line, a Kentucky Utilities (KU) 161-kV transmission line also runs across the Project site; the Caldwell Solar Project will not utilize the KU line.

During operations, the main site entrance(s) will be near the O&M building and the substation /switchyard area.

Approximately 97,400 feet (18.46 miles) of graveled access roads will be installed across the Project site. Approximately 16 segments of roadway between 500 and 1,000 feet in length will be developed for Project use.

The Fredonia Valley Railroad (FVRR) rail line (a Class III short freight line) runs in a north-south direction immediately east of the proposed Project site. That rail line is currently operated by Martin Marietta Aggregates and runs between the cities of Princeton and Fredonia. The Paducah and Louisville Railroad (PAL) (Class II freight line) is a longer rail line which generally runs in an east-west direction across western Kentucky; that rail line is located to the south of the Project site. Either or both of those railways may be used for the delivery of large equipment, such as the main power transformers. Project vehicles (including worker commuter vehicles and delivery trucks) may need to drive over FVRR or PAL crossings to access the site; impacts related to use of those railroad crossings are discussed in Chapter 5.

**Existing or proposed utilities to service facility.** Electrical services will be needed for construction and operational activities. Caldwell Solar anticipates electrical services will be provided by Louisville Gas & Electric and by Kentucky Utilities. Water and wastewater services may be needed for the O&M building; Caldwell Solar anticipates that the Caldwell County Water District will provide those services. Portable toilets will be provided during construction.

**Compliance with applicable setback requirements.** Applicable portions of the setback statute (KRS 278.706(2)(e)) state that “all proposed structures or facilities used for generation of electricity be 2,000 feet from any residential neighborhood, school, hospital, or nursing home facility”.<sup>9</sup> Caldwell County has no planning and zoning ordinances governing relevant setback requirements; therefore, the State statutory setback requirements apply to the Caldwell Solar facility. Two residential “groupings” are located within 2,000 feet of Project facilities; there are no schools, hospitals or nursing homes within 2,000 feet of the Applicant’s proposed location of Project structures or facilities.

The Applicant has submitted a document titled Motion for Deviation from Setback Requirements (Motion for Deviation). The Motion for Deviation poses some questions as to whether the two identified residential groupings meet the criteria of a “residential neighborhood.” Therefore, Caldwell Solar is requesting “two alternative forms of relief”: (1) an approval of a deviation from the statutory setback requirements or (2) a determination that no deviation is necessary because neither of the groupings is a “residential neighborhood”. This report and evaluation of the Caldwell Solar Project assumes that the Project will require an approval for deviation from the Siting Board. The Applicant has stated that without the deviation, the Project would lose approximately 337 acres of Project area and 127 acres of solar panel area, resulting in an estimated loss of 15 MW of generation capacity. According to the Applicant, the existing number of solar panels and other structures cannot be re-configured

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<sup>9</sup> According to KRS 278.700(6), a residential neighborhood is a populated area of five or more acres containing at least one residential structure per acre.

within the Project site boundaries to meet the statutory requirements and meet the planned 200 MW generation capacity.

KRS 278.704(4) states that deviations from the setback requirements may be granted “on a finding that the proposed facility is designed to, and as located, would meet the goals of KRS 224.10-280, 278.010, 278.212, 278.214, 278.216, 278,218, and 278.700 to 278.716 at a distance closer than those outlined in the setback statute.

The Motion for Deviation addresses each of the statutes listed above, describing the Applicant’s or facility’s compliance with each. That document also provides descriptions of the two residential groupings/ neighborhoods within 2,000 feet of Project facilities.

**Residential neighborhoods.** The two residential neighborhoods identified in the Motion for Deviation are described as follows:

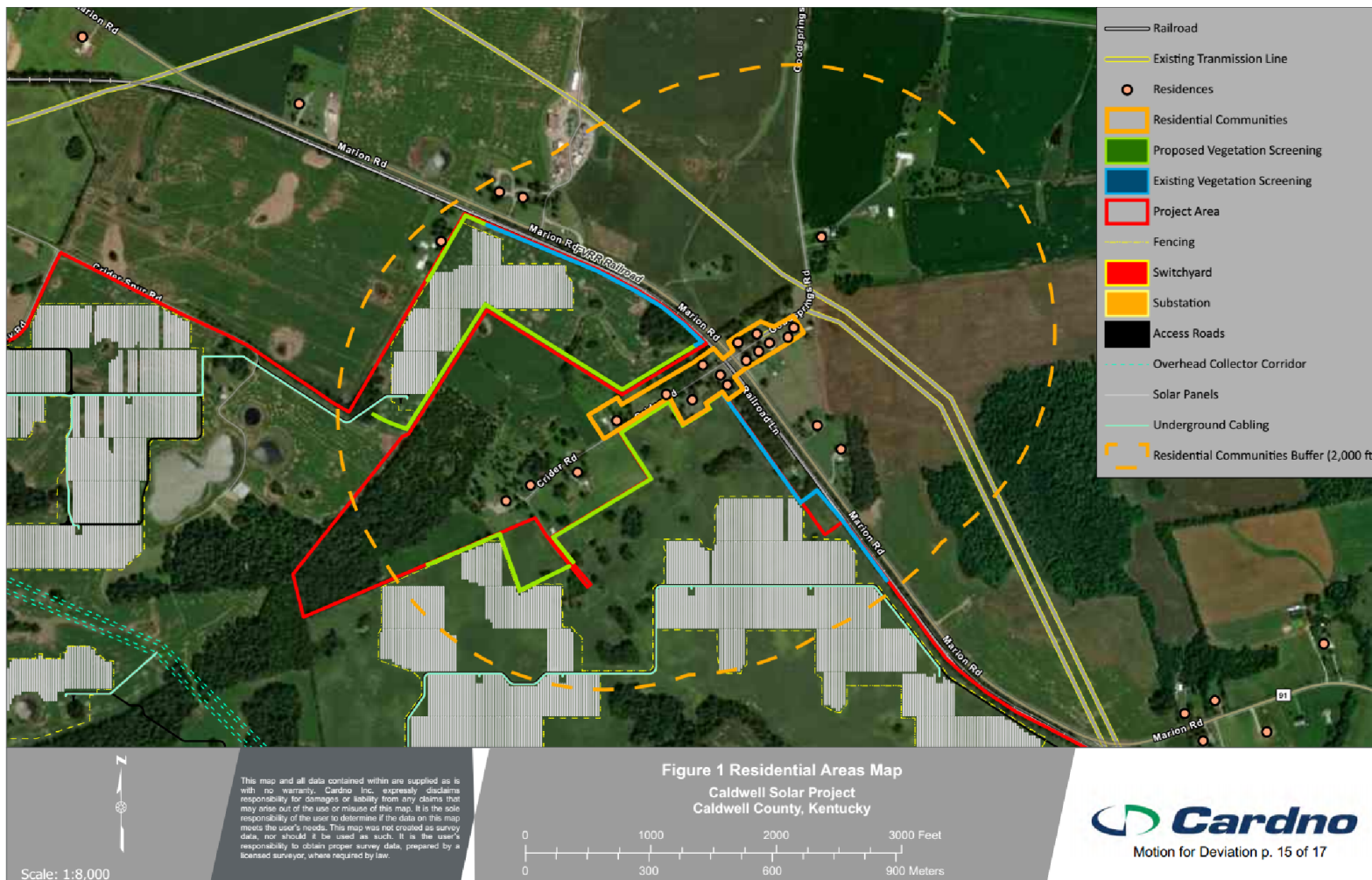
- Residential Group 1 is located in the north-central portion of the Project, at the intersection of Marion Road with Crider-Dulaney and Goodsprings Roads. The boundary shown around the residences encompasses approximately ten acres and includes 13 residences. The nearest proposed structures or facilities used for the generation of electricity (specifically, solar panel arrays) are at least 300 feet from the closest residence.
- Residential Group 2 is located near the Project boundary, along Old Fredonia Road. The boundary shown around the residences encompasses approximately seven acres and includes eight residential structures. The nearest proposed structures or facilities used for the generation of electricity (specifically, solar panel arrays) are at least 300 feet from the closest residence.

Exhibits 3-5 and 3-6 show the Project boundary, Residential Group 1 and Residential Group 2, and nearby Project infrastructure. Both residential neighborhoods are located along the eastern side of the Project boundary. Photos of select homes in those areas are provided in Appendix B of this report.<sup>10</sup>

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<sup>10</sup> Photos were taken by HE staff as part of the Project site visit.

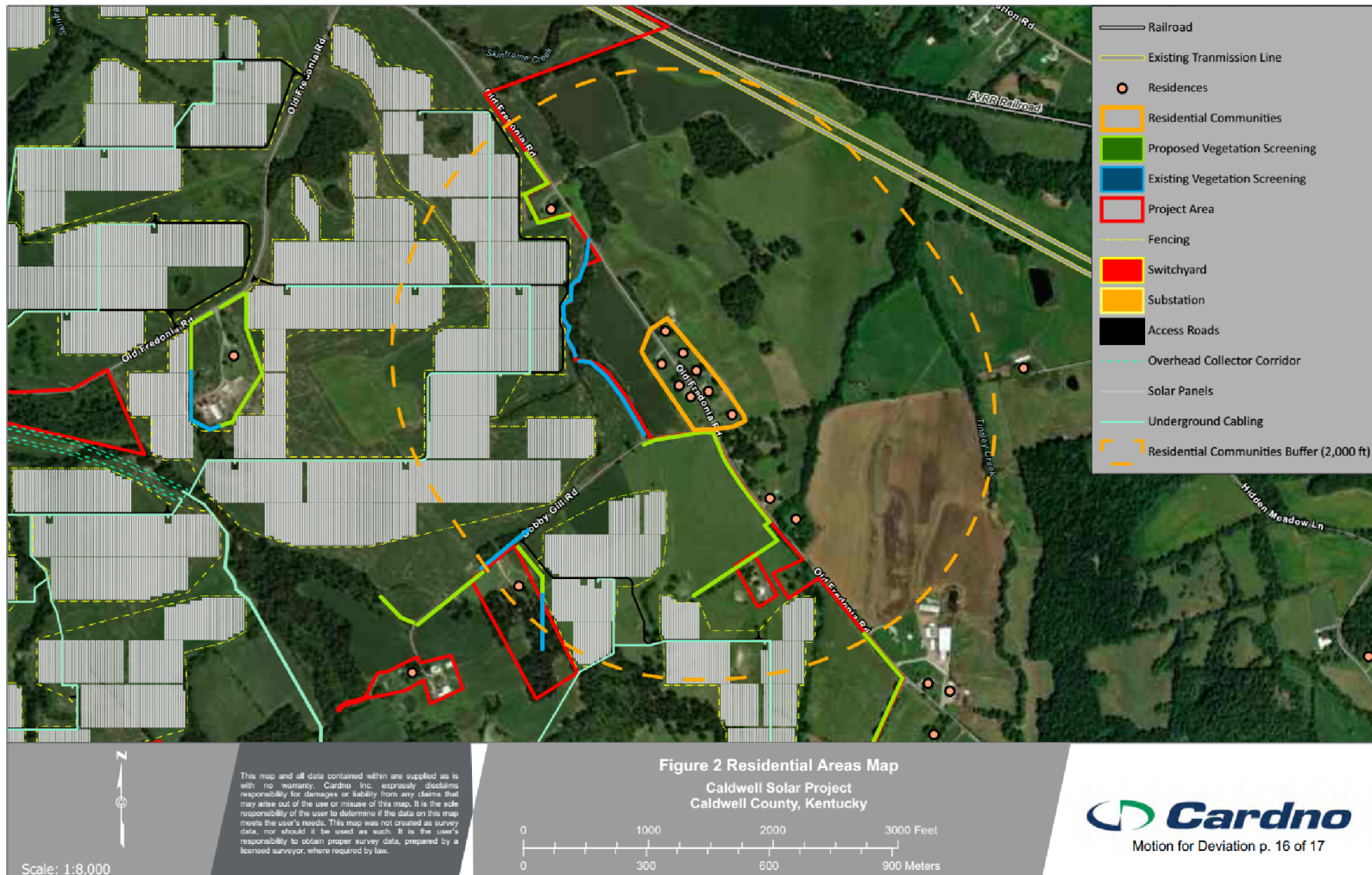
**Exhibit 3-5.  
Caldwell Solar Project Boundary, Project Infrastructure and Location of Residential Group 1**



Source: Caldwell Solar, LLC, October 2021.



**Exhibit 3-6.  
Caldwell Solar Project Boundary, Project Infrastructure and Location of Residential Group 2**



Source: Caldwell Solar, LLC, October 2021.

**Compliance with statutory requirements.** The Motion for Deviation described the Applicant's or facility's compliance with applicable requirements as follows:

- ***KRS 224.10-280: Cumulative Environmental Assessment (CEA)***: The Applicant has provided a CEA that addresses air pollutants, water pollutants, waste, and water withdrawal. That report (included as part of Exhibit G) provides a detailed discussion of each topic area and concludes the following:

- ***Air pollutants*** – Construction and operation of the completed facility would produce air pollutants. Emissions will predominantly come from the construction and personnel vehicles, operating equipment, and supplies. The anticipated emissions generated by construction are expected to be minor due to the scale and duration of operations. Construction activities would also generate dust and other suspended particulates. Best management practices (BMPs) will be implemented onsite, requiring measures such as covering loads and applying water for dust suppression. With the use of appropriate BMPs, ambient air quality standards would not be exceeded, and construction activities would result in temporary, negligible impacts to air quality.

Any emissions from the operation of the Project would be generated by worker vehicles and maintenance equipment. Facility operations would generate negligible levels of air pollutants.

- ***Water pollutants*** – Wetlands, ponds, and streams are present within the proposed Project boundary. These bodies of water could be impacted by erosion and sedimentation generated by ground-disturbing construction activities. The Project will follow BMPs to limit surface water pollution from dust and sediment. In compliance with Kentucky Division of Water (KDOW), Caldwell Solar will design and implement a stormwater pollution prevention plan. Furthermore, the Project will comply with the KDOW Construction Storm Water Discharge General Permit on actions that will influence one or more acres of land.

The Project is not expected to generate adverse impacts to groundwater. Hazardous materials, including but not limited to fuel, lubricants, hydraulic fluids, herbicides, and fertilizers, will be limited to essential use only, properly stored and used following proper techniques.

- ***Wastes*** – Project construction will generate very small quantities of hazardous waste, such as used oil, diesel fuel, gasoline, hydraulic fluid, and other lubricants. To avoid any on- and offsite impacts, all waste will be stored, handled, and disposed of in accordance with local, state, and federal regulations. Solid construction waste will be recycled, if possible. Non-recyclable solid materials will be removed from the Project site and disposed of at an appropriate regulated landfill. Anticipated solid waste includes construction debris, recyclables, and garbage, including packaging materials,

storage boxes, wooden pallets, and building materials. Facility construction and operations will generate hazardous and non-hazardous waste; however, due to their limited quantities and the implementation of spill prevention measures, they are not expected to negatively impact onsite or offsite resources.

- ***Water withdrawal*** – Construction and operation of solar electricity generating facilities are not anticipated to be water intensive. Water withdrawal for the Project is not expected to create negative effects on regional water resources.
- ***KRS 278.010: Definitions applicable to associated statutes:*** The Motion for Deviation states that to the extent relevant, Caldwell Solar has satisfied any goals of KRS 278.010 by preparing and presenting its Project proposal and Application in terms consistent with the statutory definitions.
- ***KRS 278.212: Filing of plans for electrical interconnection with merchant electric generation facility; costs of upgrading existing grid:*** The Motion for Deviation states that Caldwell Solar has an interconnection agreement with Big Rivers Electric Corporation (BREC) to connect to the transmission grid at the BREC Barkley Substation and pay the related costs.
- ***KRS 278.214: Curtailment of service or generation and transmission cooperative:*** The Motion for Deviation states that, to the extent this section applies to the operation of Caldwell’s proposed generation or the Project, the Applicant commits to following all appropriate and legally binding operating procedures.
- ***KRS 278.216: Site compatibility certificate; site assessment report; commission action on application:*** The Motion for Deviation states that Caldwell’s filing of a site assessment report as part of its Application in the present proceeding satisfies the goals of KRS 278.216.
- ***KRS 278.218: Approval of commission for change in ownership or control of assets owned by utility:*** Caldwell Solar is not a utility as defined by the applicable statute; therefore, the Motion for Deviation states that this statute does not apply to the Applicant. However, the Motion for Deviation also states that “to the extent Board approval may at some time be required for change of ownership or control of assets owned by Caldwell or its parent company, Caldwell will comply with the applicable rules and regulations which govern its operation.”
- ***KRS 278.700 – 278.716: Electric Generation and Transmission Siting:*** The Motion for Deviation states that Caldwell’s Application and timely participation in the present proceeding demonstrates that the Applicant’s proposed facility is designed to, and as located, would meet the goals of KRS 278.700 *et seq.*, including the allowance for deviation from setback requirements in KRS 278.704(4).

**Evaluation of noise levels produced by facility.** Noise levels related to facility construction and operations are discussed in detail in Section 5 of this report.

## **Results of SAR Review – Proposed Site Development Plan**

**Conclusions.** Based on HE’s review of the Caldwell Solar SAR, the subsequent information provided by the Applicant in response to two rounds of inquiries, direct discussions with the Applicant, and other secondary area research, HE offers the following conclusions regarding the proposed site development plan:

- We believe that the Applicant has generally complied with the legislative requirements for describing the facility and a site development plan, as required by KRS 278.708.
- Security and access control measures appear to be adequate, given the type of facility and its location in a rural area.
- The Caldwell Solar Project does not meet the existing setback requirements, so the Applicant has submitted a motion for a deviation from those requirements. HE believes that the Project, as proposed, does meet the specific statutes noted for consideration in a setback deviation, assuming the mitigation HE proposes is adopted. The Siting Board will need to judge the quality of the Applicant responses in the setback deviation request.

**Need for mitigation.** Mitigation measures described in the SAR, or recommended by HE, which are related to the description of the facility and the proposed site development plan include:

1. A final site layout plan should be submitted to the Siting Board upon completion of the final site design. Deviations from the preliminary site layout plan, which formed the basis for HE’s review, should be clearly indicated on the revised graphic. Those changes could include, but are not limited to, location of solar panels, inverters, transformers, substation, operations and maintenance building or other Project facilities or infrastructure.
2. Any change in Project boundaries from the information which formed this evaluation should be submitted to the Siting Board for review.
3. The Siting Board will determine if any deviation in the boundaries or site layout plan is likely to create a materially different pattern or magnitude of impacts. If not, no further action is required, but if yes, the Applicant will support the Siting Board’s effort to revise its assessment of impact and mitigation requirements.
4. A final, Project-specific, construction schedule, including revised estimates of on-site workers and commuter vehicle traffic, should be submitted to the Siting Board. Deviations from the preliminary construction schedule should be clearly indicated.
5. The Siting Board will determine whether any deviation to the construction schedule or workforce estimates is likely to create a materially different pattern or magnitude of impacts. If not, no further action is required. If so, the Applicant will support the Siting Board’s effort to revise its assessment of impacts and mitigation requirements.

6. The Applicant or its contractor will control access to the site during construction and operation. All construction entrances will be gated and locked when not in use.
7. The Applicant's access control strategy will include appropriate signage to warn potential trespassers. The Applicant will ensure that all site entrances and boundaries have adequate signage, particularly in locations visible to the public, local residents and business owners.
8. According to National Electrical Safety Code regulations, the security fence must be installed prior to any electrical installation work. The substation will have its own separate security fence and locked access installed.

# SECTION 4

## Project Setting

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### Description of the Area

This section provides a description of the area surrounding the proposed Project site. The Project site is located to the northwest of the City of Princeton in Caldwell County, in far western Kentucky. The topography of the area is diverse. Southern and western portions of the County lie on a sinkhole plain with creeks and springs throughout. Northeastern areas include hills and ridges. The northern and eastern portions of the County are the most rugged and have the County's highest elevations; that area also includes bluffs and some waterfalls.<sup>11</sup>

**Population and housing density.** As of mid-2020, approximately 12,650 people resided in Caldwell County.<sup>12</sup> The County's population has decreased slightly over the past 20 years; in 2000 the population was 13,060 and in 2010 the population was 13,000.<sup>13</sup> About 95 percent of the population is white and the median age of residents is 44.<sup>14</sup> Caldwell County is predicted to continue to slowly decline in population; the Kentucky State Data Center estimates 12,150 people will reside in the County in 2040, a loss of about four percent as compared to the current population.<sup>15</sup> Currently, there are about 5,200 households in Caldwell County, with an average of about 2.4 persons per household.<sup>16</sup> There are 38 people per square mile, which makes Caldwell County more sparsely populated than most other counties in Kentucky.<sup>17</sup>

Caldwell County is located about 100 miles west of Bowling Green, Kentucky. Princeton, the county seat of Caldwell County, is a small city located generally in the middle of the County; that city has a population of about 6,300 people.<sup>18</sup> Nashville, Tennessee, located about 100 miles southeast of Princeton, is the nearest metropolitan area. Nashville has a population of

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<sup>11</sup> Kentucky Geological Survey. Topography Caldwell County, Kentucky.

<https://www.uky.edu/KGS/water/library/gwatlas/Caldwell/Topography.htm>

<sup>12</sup> U.S. Census Bureau. Caldwell County QuickFacts.

<https://www.census.gov/quickfacts/caldwellcountykentucky>

<sup>13</sup> U.S. Census Bureau. Caldwell County, Kentucky, Profile of General Demographic Characteristics.

<https://data.census.gov/cedsci/table?q=caldwell%20county%20kentucky&y=2000&tid=DECENNIALDPSF42000.DP1&hidePreview=false>

<sup>14</sup> U.S. Census Bureau. Caldwell County, Kentucky, Age and Sex.

<https://data.census.gov/cedsci/table?q=caldwell%20county%20kentucky&tid=ACSST5Y2019.S0101&hidePreview=false>

<sup>15</sup> Kentucky State Data Center, Projections of Population and Households, State of Kentucky, Kentucky Counties, and Area Development Districts 2015 – 2040.

<http://www.ksdc.louisville.edu/wp-content/uploads/2016/10/projection-report-v16.pdf>

<sup>16</sup> U.S. Census Bureau. Caldwell County QuickFacts.

<https://www.census.gov/quickfacts/caldwellcountykentucky>

<sup>17</sup> Statistical Atlas. Caldwell County, Kentucky.

<https://statisticalatlas.com/county/Kentucky/Caldwell-County/Population>

<sup>18</sup> U.S. Census Bureau. Princeton QuickFacts.

<https://www.census.gov/quickfacts/fact/table/princetoncitykentucky/PST045221>

about 680,000.<sup>19</sup> The Greater Nashville metropolitan statistical area has a population of about two million.<sup>20</sup>

**Income.** In 2020, per capita personal income in Caldwell County was \$40,364.<sup>21</sup> This was 10 percent less than the average per capital personal income of the Commonwealth of Kentucky, and 29 percent less than the average in the United States.<sup>22</sup> As of mid-2020, about 15 percent of the Caldwell County population lives in poverty.<sup>23</sup>

**Business and industry.** In 2019, there were about 6,100 jobs in Caldwell County, with 74 percent classified as wage and salary jobs and 26 percent being proprietors' employment.<sup>24</sup>

- Manufacturing is the largest employment sector in Caldwell County, with 1,020 jobs.<sup>25</sup> Major manufacturers in the area include Hydro-Gear (makers of drivetrain solutions for lawn and garden markets), Bodycote (provider of heat treatment pressing for supply chains), Lafarge (constructions solutions such as cement, asphalt, aggregates), and TreeHouse Foods (private label packaged crackers).<sup>26</sup>
- Retail trade is the second largest sector with roughly 860 jobs. Government is the next largest sector in the County, with about 700 jobs. Farm employment is at 570 jobs. As of 2017, 130,000 acres were in farms, which equates to roughly 58 percent of the total acreage in Caldwell County.<sup>27</sup> Cropland is 66 percent of the farmland. Soybeans for beans, corn and wheat for grain, as well as tobacco account for most of the cropland.

**Major and minor roads and railways.** The Project site is mostly bounded on the south by I-69, on the east and north by KR 91 (Marion Road) and on the west by US 641. Interstate 24 runs through the southern portion of the County, traveling northwest to Illinois and southeast

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<sup>19</sup> U.S. Census Bureau. Nashville-Davidson QuickFacts.

<https://www.census.gov/quickfacts/fact/table/nashvilledavidsonmetropolitangovernmentbalancetennessee/PST045221>

<sup>20</sup> Population U. Nashville Population.

<https://www.populationu.com/cities/nashville-tn-population>

<sup>21</sup> U.S. Bureau of Economic Analysis. Caldwell County, GDP and Personal Income.

<https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&acrdn=6>

<sup>22</sup> U.S. Bureau of Economic Analysis. United States and Kentucky, GDP and Personal Income.

<https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&acrdn=2>

<sup>23</sup> U.S. Census Bureau. Caldwell County QuickFacts.

<https://www.census.gov/quickfacts/fact/table/caldwellcountykentucky/PST045221>

<sup>24</sup> U.S. Bureau of Economic Analysis. Caldwell County, Total Full-Time and Part-Time Employment.

<https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&acrdn=6>

<sup>25</sup> U.S. Bureau of Economic Analysis. Caldwell County, Total Full-Time and Part-Time Employment.

<https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&acrdn=6>

<sup>26</sup> Princeton Kentucky Chamber of Commerce. Business Directory.

<https://www.princetonkychamber.org/business-directory>

<sup>27</sup> U.S. Census of Agriculture. Caldwell County, Kentucky Profile.

[https://www.nass.usda.gov/Publications/AgCensus/2017/Online\\_Resources/County\\_Profiles/Kentucky/cp21033.pdf](https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Kentucky/cp21033.pdf)

to Georgia, passing through Nashville, Tennessee. A class II railroad from Paducah to Louisville runs through the County and near the Project site.<sup>28</sup>

**Overall area description.** Based on HE's research, the area around the Project site can be generally described as rural and agricultural. The County is experiencing a slow decline in population and residents are older than the average Kentucky resident. Residents' income levels are relatively low, and they experience higher than average rates of poverty than Kentucky as a whole and the U.S.<sup>29</sup>

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<sup>28</sup> Kentucky Transportation Cabinet. Railroad Map.

<https://transportation.ky.gov/MultimodalFreight/PublishingImages/RAIL/RailroadMap1.jpg>

<sup>29</sup> U.S. Census Bureau. Kentucky Quickfacts.

<https://www.census.gov/quickfacts/fact/table/US,KY,caldwellcountykentucky/PST045221>



# SECTION 5

## Description of Impacts

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This section of the report addresses impacts to the following resource topics, as enumerated in KRS 278.708 and KRS 278.706(j):

- Compatibility of the facility with scenic surroundings;
- Potential changes in property values and land use for adjacent property owners;
- Anticipated peak and average noise levels;
- Road and rail traffic, fugitive dust and anticipated degradation of roads and lands; and
- Economic impacts on the region and the state.

The statutes require that the SAR provides information about impacts to the above resources resulting from short-term construction activities and longer-term operational activities. The Siting Board also directed HE to address the potential effects of decommissioning activities, and that discussion is included in this section.

For each resource topic, HE describes generally accepted assessment criteria or methodology necessary to evaluate impacts of a project of this nature. We then summarize the relevant information included in the SAR, as well as supplemental information about the Caldwell Solar Project provided by the Applicant in response to data inquiries. HE also provides additional information gathered about the Project and its potential impacts on the region through secondary source research, including interviews. Finally, HE draws conclusions about Project impacts as well as recommended mitigation measures.

HE is also aware of the Ashwood Solar I project, an 86-megawatt facility to be located on approximately 1,500 acres in eastern Lyon County, about one mile west of the Caldwell Project site at their closest points. That project has been granted a Certificate to Construct but has not yet begun construction.<sup>30</sup> Construction of the Caldwell Solar and Ashwood Solar I projects may or may not overlap, but both projects would be simultaneously operational for many years.<sup>31,32</sup> Additionally, the Golden Solar project may also be proposed for location within Caldwell County. The applicant for that project (same parent company as for Caldwell Solar –

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<sup>30</sup> The Siting Board granted Ashwood Solar I a Certificate to Construct, with conditions on June 21, 2021.

<sup>31</sup> The topic of cumulative effects is not called out in the KRS and the Siting Board has not directed HE to consider cumulative impacts in this case.

<sup>32</sup> The Applicant has not considered the potential for any types of cumulative effects between the Caldwell Solar Project and the Ashwood Solar I project.

National Grid Renewables) submitted a Renewed and Revised Notice of Intent to file an application in July 2021, but as of the date of this report, no application has been filed.<sup>33</sup>

## **Facility Compatibility with Scenic Surroundings**

This component of the statute relates to how well the proposed facility will “blend-in” or is compatible with its physical surroundings and associated land uses. For example, certain industrial facilities can be unsightly, visually unappealing, and generally incongruous with the surrounding area. Coal-fired electric generating plants often have large smokestacks that can be seen from far away. Wind turbines are tall, and their blades can be seen spinning from miles away, etc. Generally, solar farms are considered to be less visually intrusive, as they are relatively short in stature, and can be effectively visually blocked naturally with topographic variation or intervening vegetation, or through strategic means utilized by an applicant.

**General methods of assessment.** Visual impacts of solar facilities are highly dependent on the characteristics of the surrounding area, i.e., industrial, suburban residential, rural/agricultural. As a result, different methods may be used to assess the visual impacts of solar facilities, depending on location. The Argonne National Laboratory’s Environmental Science Division and the National Park Service jointly developed the *Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects*; that document is a guide designed to help planners evaluate the quality and completeness of visual impact assessments for solar and wind facilities.<sup>34</sup> Additional reports have been published from public agencies and private firms on visual impact assessments for solar facilities.

Most visual impact assessments focus on visualization of the appearance of the project from key observation points (KOPs). Since it is impossible to visualize proposed projects from every observation point, it is common for planners to utilize a “worst-case” potential visual impact, i.e., locations where perceived change may be greatest. The overarching goal of visual impact assessments is to determine potential visual impacts that may result from construction, operations, and decommissioning of a project, in a manner that is logical, repeatable, and defensible.<sup>35</sup>

A standard visual analysis generally proceeds in this sequence:<sup>36</sup>

- Description of the project’s visual setting;
- Identification of KOPs. KOPs are locations near the project site where there is potential for solar facility components to be seen from ground-level vantage points, i.e., a nearby residence or a passing vehicle;

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<sup>33</sup> Caldwell Solar acknowledges that the construction periods for the Caldwell Solar Project and the Golden Solar project could overlap and if so, National Grid Renewables would strive to mitigate traffic and noise impacts by creating construction schedules that optimize efficiency and flow across the two project sites.

<sup>34</sup> National Park Service, U.S. Department of the Interior. *Guide to Evaluating Visual Impact Assessments for Renewable Energy Projects*. August 2014. <http://visualimpact.anl.gov/npsguidance/>.

<sup>35</sup> Dean Apostol, James Palmer, Martin Pasqualetti, Richard Smardon, Robert Sullivan. (2016). *The Renewable Energy Landscape: Preserving Scenic Values in our Sustainable Future*. September 2016.

<sup>36</sup> Environmental Design & Research. *Visual Impact Analysis*. May 2019.

- Analysis of the visual characteristics of the project, i.e., height of solar panels, descriptions of other facility components; and
- Evaluation of impacts from KOPs.

Glare from sun shining off of solar panels can also be a potential issue in certain locations (i.e., along roadways, near airports, or close to residential properties) or at specific times of the day (generally in the early morning or later in the afternoon as the panels rotate to capture the light). Glare analyses evaluate the potential for different types of glare (red, which is the most severe; yellow, which is less severe; and green, which has the lowest severity rating) at different locations around a project site and the duration of potential glare, if applicable, at different times of the day. Measures can be implemented to reduce the potential for glare impacts, including the use of anti-glare panels, appropriate panel location and growth of vegetative buffers.

**Summary of information provided by the Applicant.** The existing scenic setting of the area, potential visual impacts associated with the Project and proposed mitigation are addressed in several portions of the Application.

**Scenic surroundings.** As described in Section 3, current uses of the land within the Project boundaries and surrounding the Project site are identified as largely agricultural and residential. A Lafarge gravel quarry is located immediately to the north of the Project site. Applicant provided maps (see Exhibit 3-1 of this report) also show the Fredonia Valley Railroad (FVRR) rail line running in a northwest-southeast direction along the eastern edge of the Project site. I-69 runs in an east-west direction to the south of the Project site.

**Potential visual impacts from Project construction.** The SAR does not address the potential for visual impacts to adjacent landowners, local visitors or drivers during the construction phase.

**Potential visual impacts from Project operations.** During operations, different Project components may result in visual impacts to local residents and drivers. Exhibit B of the Application describes the look of various components:

- *Solar panels:* The Project would include approximately 541,750 solar panels. Each panel would be approximately four to seven feet long by two to four feet wide. On the tracking rack system, the panels would be approximately 15 to 20 feet in height from the ground to the top of the panel when at a 45 degree angle.
- *Inverter skids:* 65 inverter skids will accommodate 265 inverters and Project transformers. The skids will be placed atop a concrete slab or other foundation and typically measure 10 feet wide by 25 feet long, with a structure height of approximately 12 feet above grade. The skids will be located at various points throughout the site, as shown in Exhibits 5-10 and 5-11 included in HE's noise analysis.
- *Project substation and switchyard:* This area (covering about three acres) would be located in the northern portion of the Project site west of KY 91 (Marion Road).

- *O&M building*: This building would be approximately 3,200 square feet in size. A parking lot would be adjacent.
- *Weather stations*: Eight weather stations will be located throughout the interior of the Project site. Each weather station would be approximately 20 feet in height.
- *Overhead collection system*: The overhead system will include 76 wood or steel poles, approximately 12 to 18 inches in diameter, up to 90 feet in height and spaced approximately 200 to 300 feet apart. Final engineering will determine the need for one or two collection lines. If two collection lines are required, they would run in parallel, spaced approximately 60 feet apart. The location of the overhead collector corridor is shown in Exhibit 3-1 of this report; that corridor generally runs through the center of the Project site.
- *Fencing*: Security fencing surrounding the solar panels will be six feet in height; fencing surrounding the substation and switchyard will be seven feet in height and topped with one foot of barbed wire. All fencing will be transparent chain-link material.

**Proposed setbacks and vegetative buffers.** The SAR states that sections of the proposed Project boundary will be adjacent to roadways and other properties. Minimum setback requirements between residential structures and non-residential structures and proposed vegetative buffering aim to reduce the visual impacts of the Project. The Applicant’s proposed setbacks are shown in Exhibit 5-1.

**Exhibit 5-1.  
Caldwell Solar Minimum Setbacks between Residential and Non-Residential Structures and Project Components**

<u>Project Components</u>	<u>Residential Structures</u>	<u>Non-Residential Structures</u>
Solar Panel	≥ 200 feet	≥ 50 feet
Inverter Skid	≥ 200 feet	≥ 50 feet
Substation	≥ 1,000 feet	≥ 50 feet
Overhead Collection Line	≥ 200 feet	≥ 50 feet

Source: Caldwell Solar, LLC, December 2021.

Exhibit 3-4 provides information regarding the proximity of residences, commercial buildings and other structures, in relation to the closest solar panels; that table is also shown below in Exhibit 5-2 for ease of reference. A total of 68 residential structures and 128 non-residential structures are located within 2,000 feet of the Project boundary. Four commercial buildings are located within 1,500 feet of Project panels.

**Exhibit 5-2.**  
**Distances between Nearby Structures and the Proposed Caldwell Solar Project Solar Panels**

<b>Distance from Solar Panels (ft)</b>	<b>Residential Structures</b>	<b>Commercial Structures</b>	<b>Other Structures</b>
0 - 300	8	0	24
301 - 600	9	0	16
601 - 900	13	0	22
901 - 1,200	15	0	26
1,201 - 1,500	8	4	12
1,501 - 1,800	4	0	6
1,801 - 2,100	5	0	8
2,100 - 2,400	5	0	5
2,401 >	<u>1</u>	<u>0</u>	<u>5</u>
<b>Total Structures:</b>	<b>68</b>	<b>4</b>	<b>124</b>

Notes: (1) Structures include those within 2,000 feet of the Project boundary line.  
(2) Residences include seven homes owned by participating landowners.  
(3) The closest residence is 216 feet from a solar panel.  
(4) Other structures include barns, warehouses and similar types of ancillary structures.

Source: Caldwell Solar, LLC, December 2021.

- Eight residential structures are within 300 feet of the solar panels; the closest residence would be 216 feet from a panel. Of those eight residences, two are owned by participating landowners.
- 17 residential structures would be located within 1,200 feet of an inverter - the closest home would be 391 feet from an inverter. An additional 40 residences would be located between 1,200 feet and 2,400 feet from an inverter.
- All residential structures are more than 2,000 feet from the substation and switchyard. The closest residence is 3,699 feet from the substation and only five residences are within a mile of the substation.
- The closest residence to an overhead collection line is 1,128 feet from the line; that home is on property owned by a participating landowner. All other residences are more than a quarter mile from the overhead lines and the majority are a half mile or more from any overhead line.

The Applicant has prepared a screening plan (Exhibit I, Figure 2) to mitigate potential visual impacts.<sup>37</sup> According to the SAR, if a vegetation buffer is not already present between the Project boundary and adjacent residential structures, one will be planted. An estimated 19 buffers are planned, each ranging from 450 feet to 4,780 feet in length (total length of proposed screening is 26,426 feet). The majority of buffers will be planted along the Project perimeter,

<sup>37</sup> Caldwell Amended Exhibit I, Figure 2, was provided to the Siting Board in December 2021 in response to Data Request 1. That Exhibit was not included in this report due to its large size and level of detail.

with a smaller proportion within the Project area. The locations of proposed buffers were determined by the Applicant using aerial imagery to identify homes adjacent to the Project and determine whether those homes' line of sight would include a view of the Project equipment (no existing vegetation or inadequate existing vegetation).<sup>38</sup>

Designs for vegetation buffers include deciduous and evergreen trees and shrubs. The trees will be planted at a height of three feet and reach a height of 15-25 feet at maturity (about 20 years after planting); after five years, the trees are anticipated to be between eight and eleven feet in height, which would be greater than the height of the security fencing. The shrubs will be planted at a height of two feet and reach a height of 10-12 feet at maturity (also about 20 years after planting); after five years, the shrubs are anticipated to be approximately seven feet in height, which would be higher than security fencing.

**Potential for glare from Project panels.** The Project's solar panels will be constructed of dark, light-absorbing materials with anti-reflective coatings. According to the Applicant, the solar panels can reflect as little as two percent of the incoming sunlight depending on the angle of the sun.

The Applicant provided an initial Glare Study prepared by the firm HMMH (Attachment C of the SAR) and an amended Glare Study in response to HE inquiries. The amended Glare Study evaluated potential glare from the Project on sensitive roadway observer locations on KY 91, US 641, I-69, as well as on nearby residences (39 residential locations were included in the analysis). Using the GlareGauge solar glare modeling tool, no glare from the Project was detected at any of the nearby roadway or residential observer locations (zero minutes of any type of glare over the course of a year at any location).

**HE's evaluation of impacts.** HE reviewed maps and Google Earth satellite imagery of the site and used Google Maps to "drive" around the area to assess viewpoints of the Project from a vehicle commuter's point of view. In addition, HE staff made a visit to the Project site on December 8, 2021. During this site visit, we visited all proposed access points, drove around the property to gain line-of-sight to various viewpoints, and compiled a photo log of the Property boundary at different areas. The photo log index map and site photos can be found in Appendices A and B of this report, respectively.

**Visual setting.** HE's site visit confirmed information provided by the Applicant and gathered as part of the Project evaluation, with regards to the rural nature and "look" of the area. The area surrounding the Project is largely agricultural, but there are several homes in close proximity to the Project boundary, including two areas identified as residential neighborhoods.<sup>39</sup> Additionally, the Lafarge Quarry is located immediately to the north of the Project site. Traffic in the Project area is generally light, especially on smaller, local roads; KY 91 (Marion Road) and US 641 are more heavily traveled. The Fredonia Valley Railroad (FVRR) rail line runs along the east side of the Project site.

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<sup>38</sup> Prior to construction, existing vegetation will be confirmed with on-site surveys. Elevation will also be considered when finalizing the site design and vegetative screening plan.

<sup>39</sup> Section 3 of this report described the residential neighborhoods.

Most local roads surrounding or traversing the Project site are paved, while a small number are gravel; all local roads are relatively narrow. Existing vegetation includes trees, bushes and grasses, but vegetation is relatively sparse in some areas surrounding the Project site. Open agricultural fields occur throughout the area.

**Construction activities.** Some adjacent landowners and commuters driving along surrounding roads, including Old Fredonia Road, Marion Road, Skinframe Creek Road, Pleasant Valley Road and other local roads, will be able to see construction equipment and activity as it occurs.

- There are relatively few homes surrounding the Project site, but some residences are very close to the site and would be able to see trucks and other equipment during construction. These include homes along Old Fredonia Road, Marion Road, Skinframe Creek Road, Pleasant Valley Road, Adamson Road and smaller local roads.
- Drivers on surrounding roadways, including local roads near the Project site, would be able to see construction activities occurring on the Project site since little vegetation exists in certain areas.
- The Adamson Cemetery is located at the edge of a field at the intersection of Henry Jones Road and Pleasant Valley Road. Construction activity will occur near the cemetery for some portion of the 16-month construction phase. During that time, the cemetery will have a view of construction vehicles, equipment and activity.
- As described in Section 3 of this report, some construction activities would occur in a “wave” fashion across portions of the Project site. That could reduce the presence of construction workers, equipment and vehicles in any one location to a smaller portion of the 16-month construction timeline.
- The Applicant has committed to working with local landowners and the public to resolve any potential issues during construction.

Because of the rural nature of the area, the small number of homes in close proximity to the Project site and the fact that construction will be temporary, occurring over about a 12-to-16-month period, with construction activities moving around the Project site, HE expects the visual impacts from construction activities to be minimal.

**Project facilities.** HE’s focus of the scenic compatibility evaluation is upon the above-ground Project components, including the solar panels, inverters, substation/switchyard, overhead collection lines and other structures as those components may be visible from local residences and roads.

- Existing vegetation in some areas surrounding the Project is sparse and the Project site has been largely cleared for agricultural purposes. Without the development of some type of visual barrier, the Project could be visible from many viewpoints (homes, roadways and the Adamson Cemetery).

- The Applicant’s proposed buffering plan includes planting of trees and shrubs to mitigate potential viewshed impacts. As proposed, vegetative buffers appear to generally surround nearby residences, potentially shielding them from view of the Project. However, site specific circumstances (i.e., elevation) or time of year conditions (i.e., leafless trees in winter) may render portions of certain Project components visible in some locations at some point of the year.
- The overhead collection lines may be visible from nearby homes due to their 70 foot above-ground height. In general, vegetative buffers would not shield the overhead collection lines from view. However, no home would be closer than a quarter mile from any overhead lines and most homes would be more than half a mile from the lines. At that distance, the lines themselves would be barely visible and the visual impact of the individual poles would also be lessened. Depending on the distance, angle of view and growth of vegetation, planted trees and shrubs may block some of the poles from full view. Existing overhead transmission poles are located throughout the region; the Caldwell poles may be consistent with that existing view.
- The Applicant has committed to working with local landowners and the public to resolve any potential issues related to operation of the Project.

Interviews with the Caldwell County Judge Executive and the Caldwell County Property Value Administrator indicated that some residents close to the Project site have voiced concerns about the Project and stated opposition to the Project.<sup>40</sup> To the extent that opposition is due to visual concerns, the Applicant’s buffering plan and willingness to work with landowners to mitigate potential impacts should allay at least some of the concern of homeowners. Many residences in the area are scattered; however, two neighborhoods have been identified adjacent to the Project site.<sup>41</sup> All homes within Residential Group 1 would be at least 822 feet from any solar panels; homes within Residential Group 2 would be at least 707 feet from Project panels.

Without a vegetative buffer, the Project would be highly visible from surrounding homes and roadways. However, if buffers are planted according to the Applicant’s proposed buffering plan, HE would expect the visual impacts associated with the presence of Project facilities to be minimal.

**Conclusions and recommendations.** Based on our review of the SAR, supplemental information provided by the Applicant, and additional research conducted by HE, we offer the following conclusions and recommendations regarding scenic compatibility:

- Construction vehicles and activity may be visible from local roadways and at multiple vantage points around the Project site, but these effects will be temporary as construction work moves around the site. Existing vegetation left in place along the Project boundary line may reduce visibility of construction activities occurring on-site in some areas, but natural vegetation surrounding the Project site is relatively sparse.

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<sup>40</sup> Interviews with Mr. Larry Curling, the County Judge Executive, and Mr. Ronald Wood, the Property Valuation Administrator, were conducted during the site visit trip on December 8, 2021.

<sup>41</sup> Section 3 of this report defines and describes those neighborhoods.



However, the area is relatively remote, with few residents or drivers along local roads, reducing the extent of visual impacts.

- Operational infrastructure, including the solar panels and inverter skids, will be largely visible to drivers along local roads, including KY 91 (Marion Road), Old Fredonia Road, Skinframe Creek Road and others, as well as to local residents surrounding the Project site. The existence of relatively few homes in close proximity to the Project will reduce the extent of visual effects.
- The substation/switchyard area will be located in the northern portion of the Project site, to the west of KY 91 (Marion Road). That area is remote, located far from any homes or roadways; visibility of those components will be quite low.
- HE believes that the vegetative buffers proposed by the Applicant would largely shield Project components from view of local residents. Overhead collection lines will remain visible from certain locations, but homes will be relatively far from those structures.
- The use of anti-glare panels will reduce, or eliminate, the potential for glare from solar panels for local residents and drivers. A glare study was performed by the Applicant's consultants and glare is not expected to be an issue.
- Based on our understanding of the Project area in Caldwell County, HE believes that the Caldwell Solar facility would not be incompatible with existing scenic conditions with appropriate buffering. Development of vegetative buffers would support scenic compatibility between the Project and adjacent properties and land uses.

**Need for mitigation.** The visual impacts are likely to be such that the Applicant should consider certain mitigation:

1. Existing vegetation between the solar arrays and nearby roadways and homes shall be left in place, to the extent feasible, to help minimize visual impacts and screen the Project from nearby homeowners and travelers.
2. The Applicant will not remove any existing vegetation except to the extent it must remove such vegetation for the construction and operation of Project components.
3. The Applicant shall implement planting of native evergreen species as a visual buffer to mitigate viewshed impacts, particularly in areas directly adjacent to the Project without existing vegetation.
4. The Applicant shall carry out visual screening consistent with the plans proposed in its Application, Site Assessment Report and Exhibits included as attachments to Caldwell Solar's responses to Siting Board data requests, and ensure proposed new vegetative buffers are successfully established and develop as expected over time. Should vegetation used as buffers die over time, the Applicant shall replace them as appropriate.

5. Any changes to the vegetative buffering plan or site infrastructure layout (i.e., panels, inverters, etc.) included in the Application materials will be submitted to the Siting Board for review. If the Siting Board deems those changes to be significant, the Siting Board may require the Applicant to further modify the buffering plan.
6. The Applicant shall provide a visual buffer between Project infrastructure and residences or other occupied structures with a line of sight to the facility to the reasonable satisfaction of the affected adjacent property owners. If vegetation is used, plantings should reach eight feet high within four years. To the extent that an affected property owner indicates to the Applicant that a visual barrier or vegetative buffer is not necessary, Caldwell Solar will obtain that property owner's written consent and submit such consent in writing to the Siting Board.
7. The Applicant should plant vegetative buffers along the Project boundary near the Adamson Cemetery to reduce or eliminate views of solar panels or other Project infrastructure from that location.
8. Landscape screening will extend and connect to existing site vegetation, if any, to help create a more natural transition between existing vegetation and Applicant developed vegetation.
9. The Applicant will develop a vegetation management plan that describes the approach and procedures for maintaining or replacing vegetative buffers as needed.
10. The Applicant shall cultivate at least two acres of native pollinator-friendly species on-site.
11. The Applicant will use anti-glare panels and operate the panels in such a way that glare from the panels is minimized or eliminated. The Applicant will immediately adjust solar panel operations upon any complaint about glare from those living, working, or traveling in proximity to the Project. Failing this, the Applicant will cease operations until the glare is rectified.
12. The Applicant will work with homeowners and business owners to address concerns related to the visual impact of the Project on its neighbors.

## **Potential Changes in Property Values and Land Use**

The construction and operation of industrial facilities has the potential to negatively affect property values and/or land uses of those properties adjacent to, or even in the general vicinity of, the facility in question. The magnitude, timing, and duration of increased traffic volume, noise, odor, visual impairments, or other emissions associated with the facility can influence the marketability and value of nearby properties. Each of those factors are addressed in this report and are considered here in examining property value impacts.

**General methods of assessment.** The value of a residential property is based on several factors, including characteristics of the home and the land on which it is situated, the uses and

values of the surrounding property, among other attributes. The value of a residential property will take into account things such as lot size, age of home, size of home, number of bedrooms and bathrooms, etc. A residential property located near public lands or open spaces may be more highly valued, whereas the same property located near a heavy industry facility might have a lower value. Residential properties will be assessed differently than agricultural or industrial properties.

Several methods are available to assess the impacts of a new development on nearby property values. A technique known as hedonic pricing analysis can be used to determine the impacts of a specific characteristic on the price or value of a property. However, this method of valuation requires large amounts of data, statistical experience, and careful evaluation. Formal appraisal is a technique which uses the concept of specific property characteristics in comparing different properties. Matched pair analysis is another technique. A matched pair analysis makes a comparison between similarly situated properties that sold before and after a new industrial facility is constructed. This approach is described in more detail below.

**Summary of information provided by the Applicant.** The Applicant’s consultants, Ms. Patricia McGarr and Mr. Andrew Lines of CohnReznick LLP, completed the Adjacent Property Value Impact Report (Attachment D of the SAR). Referred to here as the CohnReznick report, that document, along with additional follow-up information from the consultant, provides the following relevant information:

- ***Academic reports, valuation expert reports and real estate assessor reports*** – The CohnReznick report provides summaries of three academic reports addressing property value impacts of solar facilities. Several property value impact studies and real estate assessor reports prepared by other experts were also reviewed. The CohnReznick report states that “based on these published studies and other valuation expert opinions, all appear to conclude similarly that there is no impact to property adjacent to established solar farms.”
- ***Interview with Grant County, Kentucky Property Valuation Administrator (PVA)*** – The CohnReznick report describes an interview with the Grant County PVA, Mr. Elliot Anderson, regarding the impacts of a Duke Energy solar facility near Crittenden.<sup>42</sup> Based on completed and upcoming property sales subsequent to the commencement of project operations, Mr. Anderson concluded that “the solar farm had no impact either on adjoining home values or on marketability or desirability of those homes adjacent to the solar farm”.<sup>43</sup>
- ***Discussion of the paired sale analysis approach*** – The CohnReznick report employs an analytical approach described as a paired sale analysis, which “can be utilized to

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<sup>42</sup> It is unclear from the report whether the CohnReznick staff conducted the interview. The date of that interview is not cited.

<sup>43</sup> The Crittenden Solar Power Plant is a 2.7 MW facility on about 110 acres. It includes about 11,500 solar panels. At that scale, it is much smaller than the Caldwell Solar Project.

extract the effect of a single characteristic on value.” The report provides the following description of this approach:

*“One of the most useful applications of the sales comparison approach is paired sale analysis. This type of analysis may compare the subject property or similarity impacted properties called **Test Areas** with unimpaired properties called **Control Areas**. A comparison may also be made between the unimpaired value of the subject property before and after the discovery of a detrimental condition. If a legitimate detrimental condition exists, there will likely be a measurable and consistent difference between the two sets of market data; if not, there will likely be no significant difference between the two sets of data. This process involves the study of a group of sales with a detrimental condition, which are then compared to a group of otherwise similar sales without the detrimental condition.”<sup>44</sup>*

Essentially, assuming that the presence of a solar facility might constitute a “detrimental condition,” the CohnReznick analysts compare sales prices of properties adjacent to (Test Areas) and further from (Control Areas) solar facility properties. The report provides detailed information for ten different solar facilities, including project data (acreage, generation, date of operation) and property sales data.

- **Local home values compared to the paired sales data** – CohnReznick provided the following information regarding local home values: In the 12-month period from July 2020 to August 2021, there were 23 home sale transactions of improved property in the area surrounding the proposed Caldwell Solar Project. Of those transactions, one was a very large tract of land with one improved home; that transaction was excluded from the analysis. Exhibit 5-3 presents a summary of recent local sales in Caldwell County.

**Exhibit 5-3.  
Home Sales Surrounding the Proposed Caldwell Solar Project Site, July 2020 – August 2021**

	<u>Sales Price</u>	<u>Total Square Footage</u>	<u>Price per Square Foot</u>	<u>Lot Size (Acres)</u>
Median	\$100,000	1,439	\$75.41	0.72
Average	\$108,418	1,573	\$71.29	1.16
Min	\$27,000	984	\$16.27	0.22
Max	\$305,000	4,100	\$159.33	4.36

Source: Caldwell Solar, LLC, December 2021.

Two thirds of the homes sold were on lots of less than one acre and only three homes were on lots of more than two acres. The homes sold were either in the City of Fredonia or along KY 91 (Marion Road) towards the City of Princeton. The area immediately surrounding the Project

<sup>44</sup> The CohnReznick report cites Randall Bell, PhD, MAI. Real Estate Damages. Third ed. Chicago, IL: Appraisal Institute, 2016. (Page 33).

site is considered very rural with very few homes. The home values surrounding the Project site are roughly similar to the average home value of the Control Area properties analyzed in CohnReznick's paired sale analysis, as seen in Exhibit 5-4, below.

- ***Construction related impacts to property values*** – CohnReznick states that construction activities are temporary in nature and not consistent with the long-term proposed passive use of the Project site; therefore, the focus of the impact analysis is on the operational period. However, according to CohnReznick, a review of transactions occurring during construction did not identify any measurable impact to property prices at that time.

**CohnReznick conclusions.** As noted, above, the CohnReznick analysis focuses on data associated with ten separate solar farms. The report states that “overall, the vast majority of the surrounding acreage for each comparable solar farm is made up of agricultural land, some of which have homesteads. There are also smaller single-family home sites that adjoin the solar farms analyzed in this report. Generally, these solar farms are sound comparables to National Grid Renewables’ proposed solar project [Caldwell Solar] in terms of adjoining uses, location and size.”

The CohnReznick report provides the following conclusions:

- The solar farms analyzed reflected sales of property adjoining an existing solar farm (Test Area Sales) in which the unit sale prices were effectively the same or higher, except for one, than the comparable Control Area Sales that were not near a solar farm. The report’s conclusion is that there is no negative impact on improved residential homes adjacent to solar, nor agricultural acreage. This was confirmed with market participants interviews, which provided additional insight as to how the market evaluates farmland and single-family homes with views of the solar farm.
- CohnReznick concluded that since the Adjoining Property Sales (Test Area Sales) were not adversely affected by their proximity to the solar farm, that properties surrounding other proposed solar farms operating in compliance with all regulatory standards will similarly not be adversely affected, in either the short or long term periods.
- Based upon the examination, research, and analyses of the existing solar farm uses, the surrounding areas, and an extensive market database, CohnReznick concluded that ***no consistent negative impact has occurred to adjacent property that could be attributed to proximity to the adjacent solar farm***, with regard to unit sale prices or other influential market indicators.

Together, Exhibits 5-4 and 5-5 provide a summary of the CohnReznick analysis and conclusions. Exhibit 5-4 focuses on residential sales, while Exhibit 5-5 focuses on land sales.

**Exhibit 5-4.  
CohnReznick Paired Sale Analysis Conclusions – Single Family Residential Properties**

Solar Farm	Number of Test Area Sales	Number of Control Area Sales	Median Price per Sq Ft (Test Area)	Median Price per Sq Ft (Control Area)	% Diff	Impact Found
<b>Single-Family Residential</b>						
North Star Solar	4	11	\$139.13	\$138.54	0.43%	No Impact
Indy Solar III Group 2	4	8	\$59.10	\$57.84	2.18%	No Impact
Indy Solar III Group 3	7	11	\$72.15	\$71.69	0.65%	No Impact
Dougherty Solar	1	5	\$74.55	\$76.23	-2.21%	No Impact
Barefoot Bay Solar Group 2	5	126	\$95.90	\$93.95	2.07%	No Impact
Innovative Solar 42 Group 1	1	7	\$107.09	\$100.18	6.91%	No Impact
Innovative Solar 42 Group 2	1	7	\$111.71	\$105.34	6.10%	No Impact
Rutherford Farm	1	6	\$53.46	\$52.49	1.85%	No Impact
Elm City Solar	1	8	\$56.60	\$55.57	1.85%	No Impact
Woodland Solar	1	5	\$144.63	\$137.76	4.99%	No Impact
DTE Lapeer Solar Group 1	3	7	\$86.12	\$85.92	0.24%	No Impact
DTE Lapeer Solar Group 2	1	4	\$94.84	\$91.80	3.31%	No Impact
<b>Average Variance in Sale Price for Test to Control Areas - Residential</b>					<b>2.36%</b>	

Note: Each solar facility included in the CohnReznick analysis is described in detail in the CohnReznick report included in the SAR.

Source: Caldwell Solar, LLC, October 2021.

**Exhibit 5-5  
CohnReznick Paired Sale Analysis Conclusions – Land Sales**

Solar Farm	Number of Test Area Sales	Number of Control Area Sales	Median Price per Acre (Test Area)	Median Price per Acre (Control Area)	% Diff	Impact Found
<b>Land (Agricultural / Single Family Lots)</b>						
Indy Solar III Group 1	1	4	\$8,210	\$8,091	1.47%	No Impact
Miami-Dade Solar	3	6	\$82,491	\$81,686	0.76%	No Impact
Barefoot Bay Solar Group	2	7	\$54,500	\$51,000	6.86%	No Impact
<b>Average Variance in Sale Price for Test to Control Areas - Land</b>					<b>3.03%</b>	

Note: Each solar facility included in the CohnReznick analysis is described in detail in the CohnReznick report included in the SAR.

Source: Caldwell Solar, LLC, October 2021.

**HE's evaluation of impacts.** To assess the topic of impacts to property values, HE: (1) reviewed relevant existing literature related to solar facility impacts; (2) conducted an interview with the Caldwell County Property Valuation Administrator; (3) requested additional information from CohnReznick regarding their analyses and conclusions; and (4) examined the potential for impacts to residential and other properties closest to the Project.

**Literature review.** HE reviewed the existing literature related to the relationship between property values and utility – scale solar facilities. Overall, there are not many studies available that address the issue of changes in property values specifically related to solar facilities; the few that are available include the following:

- A 2020 study completed by economists at the University of Rhode Island found that in areas of high population density, houses within a one-mile radius depreciate by about 1.7 percent following construction of a solar array. The study found “substantially larger negative effects for properties within 0.1 miles and properties surrounding solar sites built on farm and forest lands in non-rural areas.” However, additional analysis focused on impacts in more rural areas found that the “effect in rural areas is effectively zero (a statistically insignificant 0.1%) and that the negative externalities of solar arrays are only occurring in non-rural areas.” The researchers note that this may be due to solar facilities being less visible in rural areas (due to land abundance for vegetative buffers).<sup>45</sup>
- A 2020 study focusing on the property value effects of wind turbines and solar facilities in the Netherlands states evidence suggesting that the negative effects of solar facilities (including noise (buzzing sounds), glare and visibility) results in decreased residential housing prices (2-3%). They found these effects to be localized (within 1km of the facility, or a little more than half a mile). However, the researchers also note that the relatively small number of solar facilities in the Netherlands makes the results less precise (as compared to the wind farm analysis).<sup>46</sup>
- A 2019 article produced by the American Planning Association (APA) indicates that the “impact of utility-scale solar facilities is typically negligible on neighboring property values.” The issue of property value impacts “can be a significant concern of adjacent residents, but negative impacts to property values are rarely demonstrated.”<sup>47</sup>
- A 2018 University of Texas study included a geospatial analysis and a survey of residential property assessors to determine the potential for property value impacts. The results show “that while a majority of survey respondents estimated a value impact of zero, some estimated a negative impact associated with close distance between the home and the facility, and large facility size. Regardless of these

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<sup>45</sup> Gaur, V., and C. Lang. *Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island*. University of Rhode Island, Department of Environmental and Natural Resource Economics, September 2020. <https://web.uri.edu/coopext/files/PropertyValueImpactsOfSolar.pdf>

<sup>46</sup> Koster, H. and M. Drees. *Wind turbines and solar farms drive down house prices*. VoxEU, September 2020. <https://voxeu.org/article/wind-turbines-and-solar-farms-drive-down-house-prices>. Mr. Koster is Professor of Urban Economics and Real Estate at Vrije University in Amsterdam; Mr. Drees is Assistant Professor of real Estate Finance at the University of Amsterdam.

<sup>47</sup> Coffey, Darren. *Planning for Utility-Scale Soar Energy Facilities*. American Planning Association, PAS Memo, September – October 2019. <https://www.planning.org/pas/memo/2019/sep/>.

perceptions, geospatial analysis shows that relatively few homes would be impacted.”<sup>48</sup>

- Independent appraisers are often hired to conduct analyses related to property value impacts for solar companies, as is the case here for the Caldwell solar facility. Those analyses focus on property value trends of lands adjacent to existing solar farms across the country, using a paired sales or matching pair approach. HE reviewed several appraisal reports; those appraisals indicate differences in property values ranging from about -3.2% to as much as +27%, although generally in cases with positive impacts, property values increased by about 5% or less. Overall, the conclusions were that solar facilities do not negatively impact property values.<sup>49</sup>

It is interesting to note that although the few existing studies related to this issue generally indicate no impacts to property values, local residents often bring up concerns about property values during public hearings or open houses related to specific solar facilities. In many cases, as evidenced by newspaper articles or other media, residents believe that property values will be reduced by nearby solar farms. So, there may at least be a perception of negative effects on property values that permeates communities.

**Interview with the Caldwell County Property Valuation Administrator (PVA).** HE spoke with Mr. Ronald Wood on January 13, 2022; he has been the PVA for Caldwell County since 2006. Mr. Wood was aware of the Project in general but has not had much recent interaction with Caldwell Solar representatives and was unaware of Project specifics. He stated that he believes County residents are largely unaware of the Project. He has not heard much in the way of support or opposition to the Project, but what he has heard has focused on concerns surrounding decommissioning, site clean-up after the operational period and the potential for environmental damage.

Mr. Wood does not expect the Caldwell Solar facility to have any impact on local property values, positive or negative. The Project would be located in a very rural country setting; Mr. Wood indicated that residents of those areas are generally used to adjacent land uses that residents of more developed areas might find objectionable, such as agricultural uses. He did not think the presence of the solar facility would result in any different effects. Mr. Wood stated that he did not know whether residents would find the panels unattractive, but that they would

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<sup>48</sup> Al-Hamoodah, Leila, et al. *An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations*. Policy Research Project, LBJ School of Public Affairs, The University of Texas at Austin, May 2018. [https://emp.lbj.gov/sites/default/files/property-value\\_impacts\\_near\\_utility-scale\\_solar\\_installations.pdf](https://emp.lbj.gov/sites/default/files/property-value_impacts_near_utility-scale_solar_installations.pdf).

<sup>49</sup> McGarr, P. and A. Lines, CohnReznick, Property Value Impact Study, Proposed Soar Farm, McLean County, IL, 2018; McGarr, P. and A. Lines, CohnReznick, Property Value Impact Study, Proposed Soar Farm, Kane County, IL, 2018; McGarr, P., CohnReznick, Property Value Impact Study, Adjacent Property Values Solar Impact Study: A Study of Nine Existing Solar Farms Located in Champaign, LaSalle, and Winnebago Counties, Illinois; and Lake, Porter, Madison, Marion, And Elkhart Counties, Indiana, 2018; McGarr, P., CohnReznick, Property Value Impact Study, Adjacent Property Values Solar Impact Study: A Study of Eight Existing Solar Farms Located in Lapeer County, Michigan; Chisago County, Minnesota; Marion County, Indiana; LaSalle County, Illinois; Bladen, Cumberland, Rutherford and Wilson Counties, North Carolina; and Isle of Wight County, Virginia, 2020.



appreciate the vegetative buffers. He described the real estate market in Caldwell County as stable, in terms of number of transactions and home prices.

**Evaluation of the CohnReznick report and conclusions.** The CohnReznick report concludes that there are no impacts on property values associated with proximity to a solar facility (Exhibits 5-4 and 5-5). HE closely examined the solar projects, data and conclusions provided in the CohnReznick report and we offer the following observations and comments:

- For the ten solar facilities analyzed, the average distance between a residence and a solar panel ranged from 180 feet to 750 feet. For the Caldwell Project, homes are located between 216 feet and 3,264 feet from solar panels, with an average of distance between residence and panel of about 1,080 feet.<sup>50</sup> Therefore, the CohnReznick analysis and conclusions may also reflect outcomes related to the Caldwell Solar Project in Caldwell County.
- For the ten solar facilities analyzed, the size of the solar facilities evaluated ranged from about 8.6 MW up to 120 MW and from an overall property size of 129 acres (8.6 MW facility) up to 1,037 acres (120 MW facility). All of those are smaller than the proposed Caldwell Solar Project. When asked whether the completed analyses of the ten facilities were also applicable to larger solar projects, CohnReznick responded that the research conducted indicated “no evidence of a differential of impacts due to the installation’s size.” They are also pointed out that adjacent homes may view a portion of the total facility, but not the entire site at once.
- The one solar project included in the analysis that indicated a small negative difference in sales price (Dougherty Solar) was also the largest facility in the set and the closest in size to the Caldwell Project at 120 MW and 1,037 acres. However, one data point is not enough to confirm a relationship or trend.
- The presence of vegetative buffers could be a factor in the sales prices of homes near solar facilities. Vegetative buffering surrounding the solar farms included in the CohnReznick analyses varied from existing vegetative buffering to vegetation planted by the developer to no buffering at all. CohnReznick stated that there appears to be no consistent difference in the paired sale analyses associated with the existence or extent of vegetative buffering around a solar facility.

**Residential properties in close proximity to the Project site.** Information obtained in HE’s literature search indicates that impacts to the values of adjacent or surrounding properties may be related to the ability to see or hear the Project and that vegetation or other visual barriers may reduce the potential for adverse impacts to property values. Therefore, HE more closely examined the locations and situations of nearby residential properties in terms of distance to the Project and potential viewshed impacts when considering potential impacts to property values.

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<sup>50</sup> This includes all 68 residences within 2,000 feet of the Project boundary.

- Some homes along Old Fredonia Road and KY 91 (Marion Road) would be located very close to the Project – several within 300 feet of the panels and more homes within 600 feet of the panels (Exhibit 5-2). The closest home would be 216 feet from a Project solar panel. The closest home to an inverter would be 391 feet from that component. The sensation/switchyard and overhead power lines are much further from any home.
- If vegetative buffers are developed as proposed by the Applicant to shield the Project from view, residential property owners may not be able to see the solar panels or other infrastructure (other than some of the overhead collection lines) from their homes.
- Additionally, as described in the next section of this report (noise evaluation), operational noise levels are expected to be low, and Project generated noise level may not be noticeable to nearby residents.
- Homes located at further distances from the Project panels may also benefit from vegetative buffers, in terms of alleviating any concerns related to property value impacts in general.

**Conclusions and recommendations.** Based upon review of the CohnReznick report and our additional research efforts and interviews, HE offers the following conclusions related to potential impacts to property values or land uses for adjacent property owners:

- Certain literature and our interviews suggest that concerns surrounding impacts to property values from solar facilities stems from visibility of panels and other infrastructure. If that is the case, the creation of vegetative or other buffers may go a long way to reducing concerns or mitigating potential reductions in property values.<sup>51</sup>
- Current research suggests that the existence of solar facilities does not, in general, measurably result in negative influences on property values for adjacent landowners in rural areas. HE’s data analyses also generally point to a conclusion of no discernible impacts to property values, although there is a small risk of negative impacts.
- Construction activities will be temporary, occurring over a period of about 12 to 16 months. Those activities will result in increased traffic and noise in the vicinity of the Project; however, homebuyers and those interested in buying other types of properties often have a longer-term mindset when deliberating a purchase.
- Existing vegetation is sparse in some areas surrounding the Project site; the Project will be in full view from some nearby locations, including homes and roads. The Applicant’s vegetative buffering plan will reduce impacts related to the change in viewshed.

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<sup>51</sup> Community & Environmental Defense Services, located in Maryland supports coordination between solar companies and landowners related to screening measures to protect the view. Community & Environmental Defense Services, Solar Farms: Protecting Homes, Property Value, Views & the Environment While Reaping Solar Energy Benefits. <https://ceds.org/solar/>

- Operational noise levels are estimated to be below the World Health Organization’s estimates of moderate or annoying noise levels for all nearby residences.
- The Caldwell County Property Valuation Administrator believes that property values will be unaffected by the presence of the solar facility, mainly due to the very rural nature of the Project area.
- HE concludes that property values in the Project area and in Caldwell County are unlikely to be affected by the siting of the Caldwell Solar facility. This conclusion assumes that the mitigation strategies discussed in Section 6 are adopted by Caldwell Solar.

**Need for mitigation.** No unique mitigation measures are recommended related to potential impacts to property values or adjacent land uses because other mitigation can accomplish this. However, close coordination by the Applicant with impacted and concerned homeowners regarding potential visual impacts and impacts from noise, traffic or other Project activities should be initiated.

## **Anticipated Peak and Average Noise Levels**

Noise issues stem from construction activities and operational components of the solar facility. During construction, noise will include graders, bulldozers, excavators, dozers, dump trucks, pile drivers, and other equipment. During operations, noise will be emitted from transformers, inverters, and the tracking motors that tilt the panels to track the sun throughout the day. Distance from noise emitters to noise receptors is important since noise levels decrease the further a noise receptor from a noise emitter. Caldwell County does not have a noise ordinance.

**General methods of assessment.** Sound levels are measured in decibel units (dB). Decibels are measured on a logarithmic scale that quantifies sound intensity. Sound levels are typically described as dBA, which is the measure of the overall noise level of sound across the audible spectrum to compensate for the varying sensitivity of the human ear to sound at different frequencies. The impacts of noise are not strictly related to loudness – the time of day when noise occurs, the duration of the noise, and baseline or background noise levels are also important factors in determining the “loudness” of a noise.

Generally speaking, an increase in 10 dBA is perceived as a doubling of loudness, which is to say, 70 dBA is perceived as twice as loud as is a level of 60 dBA.<sup>52</sup> A change of three decibels is barely noticeable, but a change of five decibels is typically noticeable. Once sounds reach 90 dBA humans can experience pain from the noise and sounds above 150 dBA can cause permanent hearing damage.<sup>53</sup> For additional context, 30 dBA is the sound emitted by a whisper, 55 dBA are emitted from a percolating coffee-maker, and 90 dBA would be the sound emitted by an individual’s yell.

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<sup>52</sup> RECON Environmental, Inc. *Noise Analysis for the Drew Solar Project, Imperial County, California*. July 24, 2018. <http://www.icpds.com/CMS/Media/Drew-Solar---Appendix-G.pdf>

<sup>53</sup> Alpine Hearing Protection website, <https://www.alpinehearingprotection.co.uk/5-sound-levels-in-decibels/#:~:text=0%20decibel%20is%20the%20so,permanent%20damage%20to%20your%20hearing.>

A standard noise impact assessment focuses on several key factors:<sup>54</sup>

- Measurement of existing ambient noise levels;
- Identification of noise-sensitive receptor sites;
- Calculation of distances between noise sources and sensitive receptors;
- Estimation of project-related (construction or operational) noise production and exposure, including cumulative noise effects.

**Summary of information provided by the Applicant.** Attachment B of the SAR is the Operational Sound Emissions Mapping Assessment prepared by Hessler Associates, Inc. (Hessler). That technical memorandum provides an assessment of sound emissions during the operational phase of the Project but does not address construction phase noise. Additional data on baseline ambient conditions and expected noise conditions during construction were provided in response to the two Siting Board data requests.

**Baseline (ambient) noise levels.** Existing land uses in the Project area are mainly agricultural, including cultivation of crops and grazing; undeveloped forest land is also present in the area. The Applicant indicated that baseline noise levels from farming activities would result in daytime sound levels of 35 to 45 DBA, although windy conditions would increase noise levels. In addition to farming activities, the area surrounding the Project site includes a Lafarge quarry, a railway, secondary roads, and residential structures. The Applicant speculates that noise from quarry operations would include rock crushers, sorting screens and heavy equipment. The Fredonia Valley Railroad (FVRR) connects the quarry to a larger railroad network to the south. That rail line is generally located to the east and north of the Project site. The Applicant expects that freight trains traveling to and from the quarry, along with shunting and moving rail cars, contributes to ambient noise in the Project area. Traffic noise from KY 91 (Marion Road) also contributes to the existing ambient noise profile of the area.

**Noise sensitive receptors.** Noise sensitive receptors are generally defined as locations where people reside or where the presence of unwanted sound may adversely affect the existing land use. Typically, sound sensitive locations include residences, places of worship, hotels, auditoriums, athletic fields, day care centers, hospitals, offices, schools, parks and recreational areas. Noise is generally described as unwanted sound, which can be based either on objective effects (hearing loss, damage to structures, etc.) or subjective judgments (such as community annoyance). Local conditions such as traffic, topography, and wind characteristics of the region can alter background sound conditions.

As noted previously and described in Exhibit 5-2, there are 68 residences and four commercial/business structures located within 2,000 feet of the Project boundary; all of those structures are

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<sup>54</sup> Department of Energy. Noise and Vibration Impact Assessment Methodology. [https://www.energy.gov/sites/prod/files/edg/media/EIS0250F-S2\\_0369\\_Volume\\_V\\_Part\\_3.pdf](https://www.energy.gov/sites/prod/files/edg/media/EIS0250F-S2_0369_Volume_V_Part_3.pdf);

considered sensitive noise receptors.<sup>55</sup> Other structures in the Project area are outbuildings, described as barns, warehouses and other ancillary structures.

**Construction noise emitters.** During the construction phase, a variety of heavy equipment will be utilized. Peak construction noise will be created by pile drivers, graders, front end loaders, backhoes, flatbed trucks, forklifts, and additional road traffic. At a distance of 50 feet, maximum noise levels for that equipment may range from about 73 dBA for forklifts to 89 dBA for a pile driver.

The Applicant utilized the Federal Highway Administration (FHWA) Construction Guide to develop estimate sound pressure levels at various distances. Sound levels are organized by construction activity, reflecting the equipment likely to be used for that activity. For each activity, both the single equipment sound pressure level and the cumulative level (multiple types of equipment used simultaneously) are provided by distance. Average construction equipment sound pressure levels are provided in Exhibit 5-6.

**Exhibit 5-6.**

**Average Construction Equipment Sound Pressure Levels at 50, 100 and 300 Feet**

<u>Phase</u>	<u>Equipment and Model Designation</u>	<u>Max. Sound Pressure Level (LpAmax) at 50 ft. dBA<sup>1</sup></u>	<u>Usage Factor, %<sup>1</sup></u>	<u>Average Sound Pressure Level at 50 ft. (LAeq), dBA</u>	<u>Average Sound Pressure Level at 100 ft. (LAeq), dBA</u>	<u>Average Sound Pressure Level at 300 ft. (LAeq), dBA</u>
Road/Substation Construction	2 Graders	88	40	84	78	67
	1 Front End Loader	80	40	76	70	59
	Cumulative			85	79	69
Trenching	1 Backhoe	80	40	76	70	59
Laydown Yard Activity	2 Forklifts	73	40	69	63	52
	2 Flatbed Trucks	83	40	79	73	62
	Cumulative			79	73	62
Piling	3 Vermeer PD10 Pile Drivers	89	75	88	82	71
Material Distribution, Installation	2 Flatbed Trucks	83	40	79	73	62
	2 Forklifts	73	40	69	63	52
	Cumulative			79	73	62

Note: (1) The Usage Factor indicates the percentage of the day that a piece of equipment is expected to be in use.

Source: Caldwell Solar, LLC, January 2022.

The usage factor, also from FHWA, indicates the percentage of time that a given piece of equipment is expected to be in use. Caldwell Solar has indicated that they will employ a 12-hour workday, which suggests that most of the equipment would be in use for about five hours

<sup>55</sup> Residential and commercial structures are illustrated on the Amended Exhibit I, Figure 2, provided to the Siting Board in December 2021 in response to Data Request 1. That Exhibit was not included in this report due to its large size and level of detail. They can be seen generally in Exhibit 3-1 of this report.

per day, or 40 percent of the time. However, pile driving, one of the loudest activities, would occur for about nine hours per day (75 percent of the time).

The Applicant provided additional information regarding expected noise levels for the substation construction, which is anticipated to take about nine months. Equipment required for this may include concrete mixer trucks, a concrete pump truck, dump trucks for gravel delivery, and a crane. The Applicant noted that this equipment will be in use for a relatively short period of time as compared to the other construction phases. Additionally, the Applicant has stated that no non-participating residences will be located within 1,000 feet of the substation. As the distance from the source of noise increases, the sound level attenuates, or decreases. A doubling of distance results in a decreased noise level of approximately six dBA.<sup>56</sup> Therefore, residences more than 1,000 feet from the substation would experience relatively low levels of noise from the construction of the substation. The Applicant used FHWA data to estimate substation construction equipment sound levels at a distance of 1,000 feet, as shown in Exhibit 5-7.

**Exhibit 5-7.**

**Substation Construction Equipment Sound Power Levels at 1,000 Feet**

<b>Equipment Type</b>	<b>Max. Sound Pressure Level (LpAmax) at 1,000 ft (dBA)</b>	<b>Usage Factor, %</b>	<b>Average Sound Pressure Level at 1,000 ft. (LAeq) (dBA)</b>
Grader	59	40	55
Front End Loader	54	40	50
Dump Truck	50	40	46
Concrete Mixer Truck	53	40	49
Concrete Pump Truck	55	20	48
Flatbed Truck	55	16	47
Crane	48	40	44

Note: The Usage Factor indicates the percentage of the day that a piece of equipment is expected to be in use.

Source: Caldwell Solar, LLC, January 2022 and <http://hyperphysics.phy-astr.gsu.edu/hbase/Acoustic/isprob2.html#c1>.

Trenching activities will occur for approximately three to four months, beginning during the site preparation phase and continuing into the pile installation phase. Trenches will be dug to a depth of about four feet and a width of one to two feet. The locations of the underground cabling across the Project site can be seen in Exhibit 3-1 of this report.

Construction of the laydown yards will take approximately two months, occurring during site preparation. The locations of the laydown yards have not been determined.

Caldwell Solar has indicated that non-participating residences will be located at least 200 feet from any solar panel, which is also the location of pile driving during construction. Pile driving

<sup>56</sup> <http://hyperphysics.phy-astr.gsu.edu/hbase/Acoustic/isprob2.html#c1>

activities are expected to occur over a period of about five months; however, this activity will move across the Project area such that noise impacts to individual residences will not occur for the full five months. Exhibit 5-8 provides estimated sound levels at non-participating residences within 500 feet of any panel array.

**Exhibit 5-8.  
Estimated Sound Levels Due to Pile Driving for Residences within 500 Feet of Construction Activity**

<u>Distance from Edge of Any Panel Array (ft)</u>	<u>Estimated Sound Level (dBA)</u>
216	68
229	68
230	68
245	67
267	66
277	66
346	63
347	63
425	61
439	61

Source: Caldwell Solar, LLC, December 2021.

**Operational noise emitters.** According to the Hessler memo, during the Project’s operational phase, the primary sources for noise will be (1) the two main step-up transformers in the substation; and (2) the inverters, which will be distributed throughout the Project on the inverter skids. As noted previously in this report, 65 inverter skids will hold a total of 265 inverters, with each skid supporting between three and six inverters, as shown in Exhibit 5-9.

**Exhibit 5-9.  
Distribution of Inverters on Multi-Inverter Skids**

<u># of Inverters per Skid</u>	<u># of Skids</u>	<u># of Inverters</u>
3	19	57
4	25	100
5	18	90
6	<u>3</u>	<u>18</u>
<b>Total</b>	<b>65</b>	<b>265</b>

Source: Caldwell Solar, LLC, December 2021

According to Hessler, the “brief and intermittent sound from the tracking motors is only barely perceptible within the panel arrays themselves.” Most of the operational noise will occur during daylight hours, however, the substation transformer remains energized at night, which may

produce some sound. The nearest residence is located about 3,700 feet from the substation location. The nearest business is about 4,300 feet from the substation. Caldwell Solar has stated that no residence will be closer than 1,000 feet to the substation.

Hessler modeled operational noise from the Project using software designed for power generation applications to calculate the sum of individual sources of sound. Using the EPA standard of a day/night sound level ( $L_{dn}$ ) of 55 dBA for daytime and 45 dBA for night as a starting point, Hessler adopted a design goal of 45 dBA for daytime operations to be conservative.

Modeling results are illustrated in Exhibits 5-10 and 5-11, which show the distance from each inverter skid and from the substation at which sound levels are 55 dBA (purple circles), 50 dBA (red circles) and 45 dBA (orange contour lines) during daytime and nighttime operations.<sup>57</sup>

Focusing on daytime operations and noise levels, Exhibit 5-10 shows that all residences are outside of the 45 dBA sound contour. Among non-participating residences, the highest predicted sound level is about 44 dBA.<sup>58</sup> The Hessler memo concludes that “any adverse noise impact from the Project is unlikely, since what is normally a nighttime noise limit is being met here during the day.” Modeling of nighttime noise was related to the operation of the substation; the 45 dBA sound contour occurred about 440 feet from the substation. As discussed above, this is well within the 1,000 foot setback anticipated for residences.

In addition to the inverters and the substation transformers, routine maintenance and repair activities will occur during operations but will not materially impact noise levels in the area. Mowing will occur during daylight hours and will be similar to other farm-related noise in the area.

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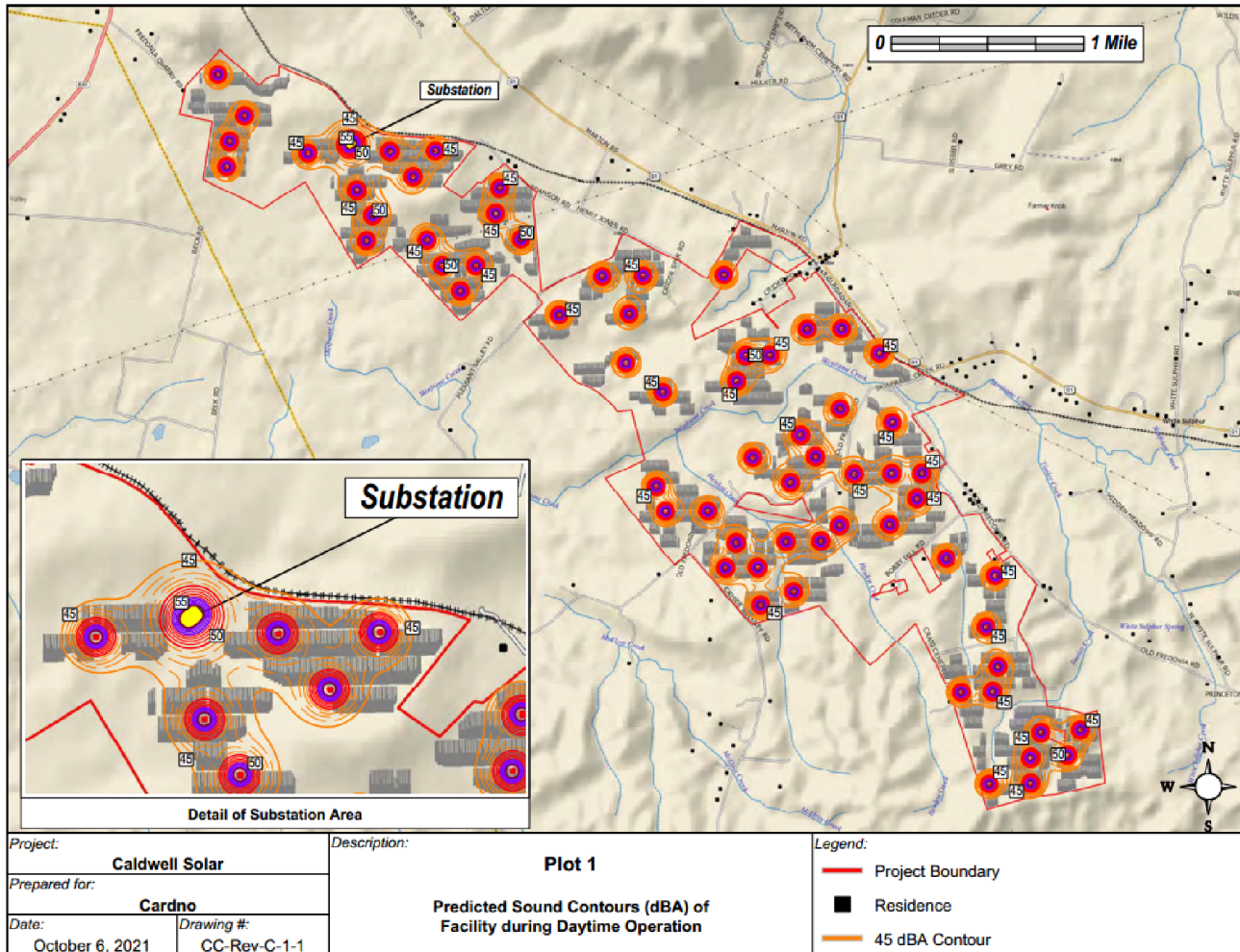
<sup>57</sup> Noise modeling assumes five inverters per skid. This assumption overestimates the sound from skids with fewer inverters. Only three of the 65 skids would include six inverters.

<sup>58</sup> This is also true for all participating residences, except one, which appears to be predicted to experience operational sounds of about 45 dBA.



**Exhibit 5-10.**

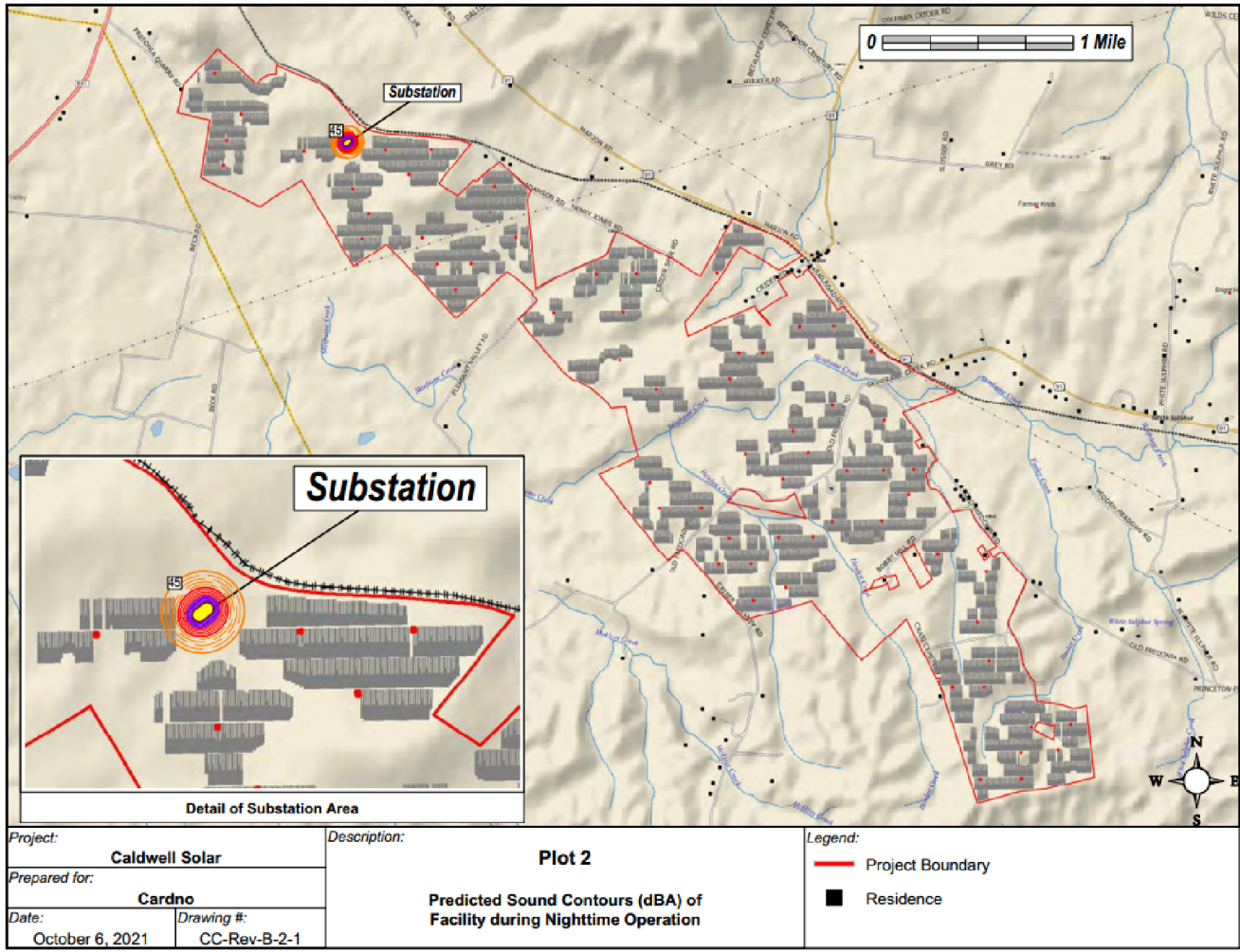
**Predicted Sound Contours of the Caldwell Solar Facility during Daytime Operation, dBA**



Source: Caldwell Solar, LLC, October 2021.

**Exhibit 5-11.**

**Predicted Sound Contours of the Caldwell Solar Facility during Nighttime Operation, dBA**



Source: Caldwell Solar, LLC, October 2021.

**HE's evaluation of impacts.** Neither the Commonwealth of Kentucky nor Caldwell County have a noise ordinance that is applicable to the Project. As such, HE utilized the noise limit recommendations generated by the Environmental Protection Agency (EPA) and the World Health Organization (WHO) to gauge acceptable levels of sound.

- The EPA determined that a constant sound of 70 dBA over a 24-hour period is enough to start causing permanent hearing loss for individuals, and a sound of 55 dBA outdoors is enough to cause activity interference and annoyance.<sup>59</sup>
- The WHO determined that daytime noise emissions greater than 55 dBA over a 16-hour period can cause serious annoyance, and noise emissions greater than 50 dBA over a 16-hour period can cause moderate annoyance. The WHO recommends limits of 45 dBA over an 8-hour period during the night.<sup>60</sup>

**Construction noise.** Construction activities will produce sporadic noise that will exceed 55 dBA during daytime hours. Residential noise sensitive receptors less than 500 feet from pile driving locations will experience estimated sound levels of 61–68 dBA during pile driving. Trenching activity, road construction and other construction activities will also generate noise greater than 55 dBA at 300 feet. However, the nature of the Project, which requires that construction activities move around the site as each task is completed, will minimize some of the annoyance created by loud, though sporadic, noise.

The Project has the potential for a number of loud activities to occur simultaneously, but the timing of activities is such that it is not realistic to predict which sources of noise will contribute to these periods of cumulative sounds. The anticipated construction timeframe provided by the Applicant indicates a two-month site preparation period and many subsequent construction activities will overlap. The Applicant did provide some data on cumulative noise for different construction activities; however, it is unlikely that construction noise would be limited to that shown in Exhibit 5-6. For example, the equipment listed as necessary for substation construction in Exhibit 5-7 is more extensive than that listed for the same activity in Exhibit 5-6. Therefore, HE examined methods for calculating cumulative sound levels.

As a reference, one decibel is the “just noticeable difference” in sound intensity for the human ear.<sup>61</sup> However, the frequencies of different sounds will affect the perceived loudness of cumulative noise. “Compared with dB, A-weighted measurements underestimate the perceived loudness, annoyance factor, and stress-inducing capability of noises with low frequency components, especially at moderate and high volumes of noise.”<sup>62</sup> This means that very different types of noises could have a greater cumulative impact than expected. Cumulative

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<sup>59</sup> United States Environmental Protection Agency. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. March 1974. <https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF>

<sup>60</sup> World Health Organization. *Guidelines for Community Noise*. April 1999. <https://www.who.int/docstore/peh/noise/Comnoise-1.pdf>

<sup>61</sup> <http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/db.html#c3>

<sup>62</sup> <https://www.softdb.com/difference-between-db-dba/>

impacts from two noise sources can be calculated based on the difference in the sound levels as shown in Exhibit 5-12.

**Exhibit 5-12.**

**Calculation of Additional Sound Power, in Decibels**

Signal Level Difference between Two Sources (dB)	Decibels to Add to the Highest Signal Level (dB)
0	3
1	2.5
2	2
3	2
4	1.5
5	1
6	1
7	1
8	0.5
9	0.5
10	0.5
>10	0

Source: [https://www.engineeringtoolbox.com/adding-decibel-d\\_63.html](https://www.engineeringtoolbox.com/adding-decibel-d_63.html).

This suggests that even multiple sources of loud noise will produce only modest increases to overall sound levels, providing the sources of noise are not of very different frequencies.

Although residents near the Project site will experience noise at levels expected to cause annoyance (55 dBA or greater), the sporadic nature of the noise will not be sufficient to cause damage to residents’ hearing.

**Operational noise.** The nature of solar projects dictates that noise from operations will occur mainly during daylight hours. During operations, the closest residential receptor will experience predicted noise levels of about 44 dBA. This is within the WHO’s recommended maximum noise level of 50.0 dBA. HE concludes that, overall, noise impacts from Project operations will be minimal.

**Conclusions and recommendations.** Based on our review of the SAR, supplemental information provided by the Applicant, and additional research conducted by HE, we offer the following conclusions and recommendations regarding noise emissions:

- Construction phase noise may be annoying for residents surrounding the Project area for short periods of time. The intermittent nature of the noise might ameliorate the impacts, but residents close to the Project site might find construction noise to be troublesome even if it does not present actual damages to hearing.
- Caldwell Solar has stated that during the construction phase, only work that doesn’t produce noise will be done during the hours of 6:00 am to 7:00 am and 7:00 pm to

10:00 pm; however, it is likely that some noise, for example from worker vehicles, would occur during those hours. Noise occurring in the early hours of the morning and later hours of the evening should be minimized.

- The current trend of employees working from home could make daytime noise more of an issue than it would have been previously.
- Noise from Project components during operations (inverters, motors, transformer) is anticipated to result in small, if any, increases to the local sound environment, depending on location. In most locations, those increases would be unnoticeable to residents or drivers in the area.
- The topography and existing vegetation in some areas might help mitigate noise emissions that may be caused by construction or operational components of the Project. Vegetative buffering proposed by the Applicant would also help to reduce noise impacts.

**Need for mitigation.** The Applicant should consider certain mitigation to reduce noise impacts:

1. The Applicant shall notify residents and businesses within 2,400 feet of the Project boundary about the construction plan, the noise potential, and the mitigation plans at least one month prior to the start of construction.
2. The Applicant shall respond to any complaints related to noise levels or noise causing activities occurring during construction or operations via a formal and clearly developed complaint resolution program.
3. If pile driving activity occurs within 1,500 feet of a noise sensitive receptor, the Applicant shall implement a construction method that will suppress the noise generated during the pile driving process (i.e., semi-tractor and canvas method; sound blankets on fencing surrounding the Project site; or any other comparably effective method).
4. The Applicant should limit the construction activity, process and deliveries to the hours of 8:00 am to 6:00 pm, Monday through Saturday. No construction work should be conducted on Sundays.
5. The Applicant shall place panels, inverters and substation equipment consistent with the distances to noise receptors indicated in the Applicant's noise study and with the Applicant's proposed setbacks. Nevertheless, the Applicant shall not place solar panels or string inverters, if used, closer than 150 feet from a residence, church or school, 25 feet from non-participating adjoining parcels, and 50 feet from adjacent roadways. The Applicant shall not place a central inverter, and, if used, energy storage systems closer than 450 feet from a residence, church, or school. These setbacks shall not be required for residences owned by landowners involved in the Project that explicitly agree to lesser setbacks and have done so in writing. All agreements by participating



landowners to lesser setbacks must be filed with the Siting Board prior to commencement of construction of the Project.

## **Road and Rail Traffic, Fugitive Dust and Road Degradation**

Traffic concerns related to the development of the Caldwell Solar facility during the construction or operational phases are addressed in this section. The 16-month long construction phase would include commuting construction workers, vehicles, and equipment on-site, plus the delivery of heavy loads of solar components, infrastructure, and other equipment. Increased traffic during operations will occur as employees travel to and from the property to monitor and maintain the site.

**General methods of assessment.** A typical evaluation of traffic-related impacts includes:

- Establishing existing traffic conditions in the area;
- Identifying primary access points that will be used by the project;
- Estimating changes in traffic due to construction and operations; and
- Assessing the impacts of project-related traffic on local areas. This includes determining whether additional traffic will lead to congestion, changes in service levels of existing road networks and identifying any potential degradation to existing roadways.

**Summary of information provided by the Applicant.** Attachment F of the SAR is a Traffic Study prepared by Cardno. That brief document provided a short narrative on existing road and traffic conditions; average daily traffic statistics for select roads; estimates of the Project's construction and operational traffic; and an opinion on potential impacts to road infrastructure. More detailed and updated information was provided in the Applicant's subsequent responses to the Siting Board's data requests. HE assumes that responses to the second data request are the best available information; that information was used if it conflicted with previous information.

**Site access, vehicle parking and internal roadways.** Vehicles traveling to the Project site will use US 641 and KY 91 (Marion Road) to reach local roads accessing the site. Local roads used to reach the 15 separate access points proposed for the Project are shown in Exhibit 5-13.<sup>63</sup>

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<sup>63</sup> The Caldwell Site Entrances Figure, provided to the Siting Board in December 2021 in response to Data Request 1 illustrates the location of each proposed entrance. That figure was not included in this report due to its size and level of detail.

**Exhibit 5-13.**

**Local Roads Leading to Proposed Access Points for the Caldwell Solar Project**

<b>Entrance Number</b>	<b>Local Roads to Reach Access Points</b>
1 and 2	Fredonia Quarry Road Private Drive
3	Henry Jones Road Pleasant Valley Road
4	Henry Jones Road
5	Henry Jones Road Pleasant Valley Road
6	Old Fredonia Road
7	Old Fredonia Road Skinframe Creek Road
8 and 9	Old Fredonia Road Skinframe Creek Road
10	Skinframe Creek Road
11	Skinframe Creek Road Crider-Dulaney Road
12	Bobby Gill Road
13	Crider-Dulaney Road
14 and 15	Craig Cemetary Road

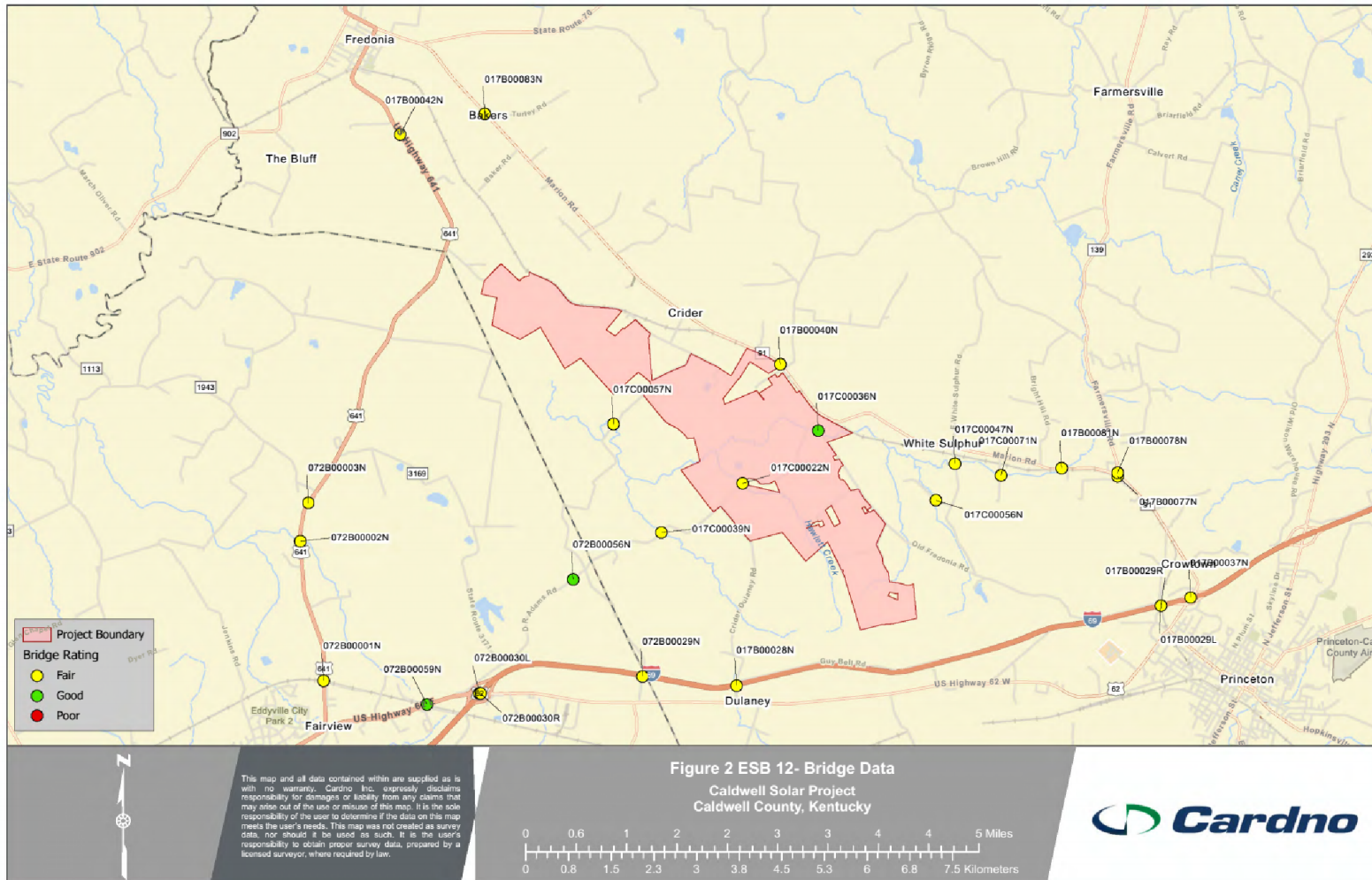
Notes: (1) Proposed entrance locations are listed in the Caldwell Site Entrances Figure provided to the Siting Board in response to Data Request 1.

(2) In addition to the local roads listed above, Project traffic will also travel on Old Fredonia Road to access many of the proposed entrances.

Source: Caldwell Solar, LLC, December 2021, and Harvey Economics.

The Applicant also provided a map illustrating the locations of bridges in the Project area; that illustration can be seen in Exhibit 5-14, below. The majority of bridges identified are in fair condition, three are in good condition and none are in poor condition. In terms of weight limits, the majority of bridges are listed as Open – No Restrictions. One bridge on I-69, two on US 641 and one located on a local road south the of the Project site have weight limits of 32-44 tons. If overweight vehicles need to cross a bridge, Caldwell Solar will obtain and be in compliance with all necessary permits from the applicable road authority.

**Exhibit 5-14.  
Bridge Locations and Conditions in the Caldwell Solar Project Area**



Source: Caldwell Solar, LLC, January 2022.



Between one and three laydown yards are anticipated to be developed within the Project site, to include parking areas for construction workers and staging areas for Project components during construction. The locations of those areas have not been finalized but are anticipated to be located in areas accessible from main roads and near site entrances.

Approximately 18.5 miles of graveled roadways will be constructed across the Project site. Internal roads will be 16 to 20 feet wide in straight sections and 40 feet wide for curved areas or at internal intersections. Access road construction will take approximately three to four months to complete.

**Baseline traffic volumes and road conditions.** The Applicant provided traffic data for major and local roads used to access the Project. Annual average daily traffic and other road descriptors are provided in Exhibit 5-15.

**Exhibit 5-15.**

**Baseline Traffic Data for Local Roads in the Project Area**

<u>Station ID</u>	<u>Roadway</u>	<u>Milepoints</u>	<u>Distance from Project Area (PA)</u>	<u>Annual Average Daily Traffic</u> <sup>(1)</sup>
17565	I-69	73.694-79.771	7,110 feet SE of PA	9,000
17750	KY 91	15.776-23.389	340 feet N of PA	2,741
17755	US 641	0.000-2.877	8,600 feet NW of PA	2,515
17511	KY 91	13.905-15.776	9,900 feet NE of PA	2,465
72016	US 641	2.668-5.715	6,500 feet SW of PA	2,550
17540	CR 1366 (Pleasant Valley Rd.)	1.745-1.945	1,666 feet S of PA	126
17539	CR 1250 (Old Fredonia Rd.)	6.576-6.776	3,060 feet S of PA	79
17689	CR 1372 (Hidden Meadow Ln)	0.078-0.278	3,175 feet E of PA	29
17542	CR 1373 (Skinframe Creek Rd.)	0.133-0.246	Within PA	0
17557	CR 1250 (Old Fredonia Rd.)	5.440-5.640	Within PA	0

Note: (1) The Kentucky Transportation Cabinet does not report traffic data between zero and one.

Source: Caldwell Solar, LLC, December 2021.

**Construction related traffic volumes and routes utilized.** Construction related traffic will include (1) passenger vehicles; (2) heavy-duty trucks; and (3) water trucks:

- Between 60 and 225 workers will be on-site on any individual day, driving personal vehicles, likely pickup trucks. The weight of these vehicles is unknown.
- The average number of delivery trucks per day is anticipated to be 20, with a maximum of 30-40 during peak periods.

- Delivery trucks will be semi-trailers with an expected weight of about 70,000 pounds per truck. The exception will be delivery of the two main power transformers which will be on semis with an expected weight between 235,000 and 290,000 pounds.
- One to two water trucks are expected to access the site each day. These vehicles have an expected weight of 15,000 lbs.

The Applicant has stated that large deliveries will occur via US 641 and KY 91 (Marion Road); however, travel on local roads to the site will also be necessary for direct site access. Caldwell Solar will obtain all necessary permits for oversized or overweight deliveries. The Applicant also indicated that improvements to local roads may occur if determined to be necessary. Such improvements may include road widening, adding aggregate, widening curves or adding turning radii, and adding driveway aprons to transition to Project access roads.

The number of construction vehicles utilizing specific individual roads to access the Project site has not been determined. The Applicant did not provide any information regarding the change in traffic volumes on specific roadways but stated that construction vehicles will be spread out through the site on any given day. Caldwell Solar indicated that they would coordinate construction routes with the Caldwell County Road Supervisor.

**Construction traffic management.** The Applicant addresses traffic management during construction as follows:

- In the event of a road closure, notice will be given to the local road authority and to impacted businesses and residents at least 24 hours before the event.
- If possible, Caldwell Solar will give the right of way on Fredonia Quarry Road to local residents and businesses.
- Safety precautions will be taken, including signage and flagmen, to prevent traffic collisions.
- A Traffic Management Plan will be prepared prior to construction.

**Operations related traffic volumes.** The Traffic Study indicated that traffic in the operational phase will be negligible and limited to a small maintenance crew. The study concluded that traffic function would not be impacted.

**Road degradation.** Caldwell Solar does not anticipate any damage to existing roadway infrastructure.

**Railways.** There are two railway lines in the Project area, the Fredonia Valley Railroad (FVRR) and the Paducah and Louisville Railroad (PAL). Caldwell Solar has indicated that large equipment, such as the main power transformers, may be delivered by railroad, but they have not had any discussions with either railway. Construction vehicles will likely need to cross the railroads in different locations; the Applicant will work with the railroads directly if a crossing agreement is needed.

**Fugitive dust.** The Applicant expects some dust generation from Project construction and has indicated that best management practices (BMP) will be employed. These BMPs include covering loads and applying water to suppress dust. Compacted gravel internal roads may also contribute airborne dust particles and water will be applied as needed. Caldwell Solar will apply water to local gravel roads and will also clean dirt that is tracked onto paved roads. During operations, the Project site will be irrigated on an as needed basis, depending on weather conditions and vegetation establishment.

**HE's evaluation of impacts.** HE conducted the following additional research and analyses related to traffic, road degradation and fugitive dust.

**Local road conditions.** In addition to I-69, both KY 91 (Marion Road) and US 641 will be the likely major roadways traveled by delivery vehicles. According to the Kentucky Transportation Cabinet's (KTC) Truck Weight Classification Map, KY 91 (Marion Road) and US 641 near the Project site are rated for 80,000 pounds (40-ton) gross vehicle weights.<sup>64</sup> Gross vehicle weight is the total weight of the vehicle, including passengers and cargo. No weight limit information is available for local roads surrounding the Project site.

HE made the following observations about local roads during the Project site visit:

- *KY 91 (Marion Road)* – two-lane, striped, blacktop road with adequate width for two cars to pass.
- *W. White Sulphur Road* – narrow two-lane, blacktop road.
- *Old Fredonia Road* – narrow two-lane, blacktop road, difficult for two cars going different directions to pass. There is a FVRR railroad crossing with no barriers leading to one Project access point.
- *Craig Cemetery Road* – narrow, one car, chipseal road with some gravel and limited shoulder, in reasonable condition. The road has several 90 degree turns and a small culvert.
- *Old Bobby Gill Road* – narrow, gravel, one vehicle road with a culvert and no shoulder.
- *Crider-Dulaney Road* – narrow, blacktop, one vehicle road.
- *Pleasant Valley Road* – blacktop road, tight two-lane, in good condition, but no shoulder. There is a 90-degree turn in one area.
- *Fredonia Quarry Road* – one lane, gravel road in reasonable condition.

During the site visit (a weekday morning), there was little to no traffic on local roads surrounding the Project site. Appendix B provides photos from the site visit, including several of local road conditions.

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<sup>64</sup> <https://transportation.ky.gov/Planning/Documents/Weight%20Class.pdf>

**Baseline traffic volumes.** The Applicant provided traffic counts for roads in the Project area, as shown previously in Exhibit 5-15. HE confirmed that no additional data for other roads are available, which is likely due to the low volumes of traffic expected on those roads.

**Construction related traffic impacts.** Caldwell Solar’s estimates of the number of construction vehicles accessing the site on an average day and on a peak day allowed HE to estimate the total number of daily vehicle trips (to and from the site) on those days (Exhibit 5-16).

**Exhibit 5-16.**

**Estimated Daily Vehicle Trips to the Caldwell Solar Project Site, Average Day and Peak Day**

	Vehicle Trips	
	Average Day	Peak Day
Worker Vehicles	240	450
Water Trucks	4	4
Delivery Trucks	40	80
<b>Total</b>	<b>284</b>	<b>534</b>

Note: Vehicle trips account for trips going to the Project site and trips going away from the Project site each day.

Sources: Caldwell Solar, LLC, December 2021, and Harvey Economics.

The Applicant has not provided any information about the number of vehicles likely to use any individual road. Therefore, HE made estimates of traffic increases on US 641 and KY 91 (Marion Road) under two sets of assumptions: (1) construction traffic equally distributed between those roads, resulting in an average day traffic increase of about five to six percent on each road and a peak day traffic increase of 10 to 11 percent on each road; and (2) construction traffic distributed in a 75 percent/25 percent pattern between the main roads, resulting in an average daily traffic increase of about eight percent and a peak daily traffic increase of between 15 and 16 percent on the more heavily trafficked road. The peak construction period is expected to occur over a period of about six months.

The estimated traffic increases may create noticeable, but perhaps acceptable, increases on KY 91 (Marion Road) and US 641. However, it is difficult to determine the effects on local roads in the Project area. Those roads are lightly traveled, so increases in traffic volume are likely to be noticeable. Although the magnitude of change to any single road cannot be determined, HE offers the following observations:

- On peak days, the increased traffic on local roads could be dramatic. While it will likely be predominately local residents who are impacted, this change may create negative attitudes about the Project.
- Average day traffic will also create noticeable changes in traffic volumes in the Project area.

- The narrow roads and lack of shoulders on many roads in the Project area will require drivers to pull over to pass and will increase the inconvenience to local residents during the construction period.
- Large trucks and a lack of shoulders may create untenable situations where there is nowhere for either the truck or oncoming vehicles to pull over.

This information suggests that carpooling will be important for minimizing traffic impacts to local residents during the construction period.

**Operations-related traffic impacts.** With fewer than ten staff members working regular business hours and the occasional off-hours maintenance and repair, traffic impacts during operations should be minimal. HE does not expect significant traffic effects related to operation of the facility.

**Impacts to railways.** The extent to which Project traffic will impact the local FVRR and PAL railways is unknown. The Applicant should work with FVRR and PAL to determine if railway crossings by Project delivery trucks will be an issue.

**Road degradation.** The lack of information about the weight limits, types of existing traffic (especially large trucks) and baseline traffic levels on some roads make it difficult to predict if road degradation will occur. Despite this, the nature of the local roads to be used to access the Project site suggests that either extensive work will need to be done in advance of Project onset or that degradation will occur, and Caldwell Solar will need to work with Caldwell County road authorities to correct the damage.

The Kentucky Transportation Cabinet (KTC) Pavement Conditions interactive map provides data regarding road conditions for individual segments of state and county roads; pavement conditions data are not available for local or city roads.<sup>65</sup> Pavement conditions are measured by several factors, including an International Roughness Index (IRI) and a Pavement Distress Index (PDI); higher values of these indices indicate rougher pavement or poorer pavement conditions. The portion of US 641 near the Project site has an IRI of 83.24 and a PDI of 0.03; that route is color coded green (on a scale of green, yellow and red) and treatments are recommended to occur by 2030. However, just south of Fredonia Quarry Road, the color code changes to red based on a IRI of 106.71, PDI of 0.79 and recommended treatment year of 2020. KY 91 (Marion Road) from I-69 to the junction of Pleasant Valley Road is also coded red with an IRI of 105.39, PDI of 0.77 and a recommended treatment year of 2021. HE interprets these data to mean that KY 91 and a small portion of US 641 near the Project site are currently in poor condition. No pavement conditions data is available for other local roads.

While the Applicant identified bridges in the Project area that might experience Project-related traffic, HE also consulted the KTC's bridge weight limit map.<sup>66</sup> Most of the bridges in the area are black, which indicates no restrictions. However, there are a few that are green, which

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<sup>65</sup> <https://maps.kytc.ky.gov/pavementconditions/>

<sup>66</sup> <https://maps.kytc.ky.gov/bridgeweightlimits/>

indicates some restrictions. These restrictions should be taken into account when developing routes for semi-trailers and any heavy vehicles.

Given the estimates of Project-generated traffic during construction and the available information about road and bridge conditions, the Applicant should be prepared to repair any damage due to commuting workers or heavy trucks traveling on the local roadways.

**Fugitive dust.** Fugitive dust should not be an issue given the Applicant's proposed efforts to reduce dust with the application of water.

**Conclusions and recommendations.** Based on our review of the SAR and subsequent information provided by the Applicant, as well as other secondary research conducted regarding roads and dust, HE offers the following conclusions regarding traffic, fugitive dust, and road degradation:

- The lack of information about routes to the Project site is a concern. Special care should be taken in developing a plan to consider road conditions, railroad crossings, bridges and culverts, the presence or lack of road shoulders, and vehicle weights.
- Access to the Project site from US 641 or KY 91 (Marion Road) will require cars and semi-trucks to travel on small local roads. The large number of entrances planned for the Project (15) might distribute construction vehicles across the site, minimizing traffic impacts, or might result in a feeling of overwhelming traffic in the general area for local residents.
- Construction traffic will likely be noticeable on local roads surrounding the Project site, including Old Fredonia Road, Skinframe Creek Road, Pleasant Valley Road and others. Few homes are located in that area and vehicle trips will likely be distributed across several roads near and within the Project site, potentially reducing impacts to residents and drivers. However, construction traffic could be disruptive to some local residents.
- The nature of the local access roads will require that drivers pull over for large vehicles. While residents may be accustomed to this, it might be a point of dissatisfaction. Additionally, some local roads may not be wide enough to allow for safe passage of multiple vehicles, in their current condition.
- Construction traffic on Fredonia Quarry Road will be combined with that of the Lafarge Quarry for some period of the 16-month construction phase. In addition to the quarry, one residence is located at the end of that road; those residents run a plant nursery business from their property that requires customers to use Fredonia Quarry Road for access. The combination of construction traffic, quarry traffic and local business traffic will likely cause congestion when construction occurs in that area.
- Road degradation may be an issue in some areas on local roads, depending on the amount of traffic using certain smaller or less maintained roads.

- Caldwell Solar should consider incentives or other means of encouraging carpooling to reduce the number of worker vehicles and to minimize traffic-related effects, including the potential for congestion, accidents, noise or dust issues.
- While KY 91 and US 641 are rated to support the weight of most of the Project deliveries, the two transformer deliveries far exceed the weight limits of either of those roads. A plan to accomplish these deliveries is needed. Utilizing a railway may be a good option.
- Given the small number of employees on-site during operations, HE does not anticipate any noticeable traffic impacts during the operational period.
- Fugitive dust should not be an issue given the Applicant's proposed efforts to reduce dust with the application of water.

**Need for mitigation.** The Applicant should consider certain mitigation to reduce impacts associated with traffic and dust:

1. The Applicant shall comply with all laws and regulations regarding the use of roadways and bridges.
2. The Applicant will fix or pay for damage resulting from any vehicle transport to the Project site. For damage resulting from vehicle transport in accordance with all permits, those permits will be controlling.
3. The Applicant shall implement ridesharing between construction workers when feasible, use appropriate traffic controls or allow flexible working hours outside of peak hours to minimize any potential delays during AM and PM peak hours.
4. The Applicant shall consult with the Kentucky Transportation Cabinet (KYTC) regarding truck and other construction traffic and obtain necessary permits from the KYTC.
5. The Applicant shall consult with the Caldwell County Road Department (CCRD) regarding truck and other construction traffic and obtain necessary permits from the CCRD.
6. The Applicant should work with the Commonwealth road authorities and the CCRD to perform road surveys, before and after construction activities, on all roads to be used by construction vehicles.
7. The Applicant shall comply with any road use agreement executed with the CCRD. Such an agreement might include special considerations for overweight loads, routes utilized by heavy trucks, road weight limits and bridge weight limits.
8. The Applicant shall develop and implement a traffic management plan to minimize the impacts on traffic flow and keep traffic and people safe. Any such traffic

management plan shall also identify any noise concerns during the construction phase and develop measures that would address those noise concerns.

9. The Applicant shall consult with FVRR, PAL and the KYTC, if necessary, to evaluate potential impacts to railroad crossings from Project traffic. If necessary, the Applicant shall develop additional, specific mitigation measures applicable to impacts on affected railroad crossings.
10. The Applicant shall properly maintain construction equipment and follow best practices related to fugitive dust throughout the construction process. Dust impacts shall be kept at a minimum level.

## **Economic Impacts**

Evaluation of the potential economic effects of the Caldwell Solar Project is based on knowledge of the Project's construction timeline and activities and the solar facility's long-term operational activities. Project employment needs, local expenditures (labor, materials/supplies, equipment) and payment of applicable taxes and other fees are considered over the short- and long-term and placed within the context of existing demographic and economic conditions.

**General methods of assessment.** Both the construction and operational phases should be evaluated to include:

- Detailed understanding of the project: Specific activities to occur, the timeline of those activities, geographic extent of project effects;
- Quantification of direct effects: Number of employees and range of wage levels, materials purchases, supplies and equipment and associated sales tax payments, other tax payments including property taxes. Determining the portion of purchases to occur in the local area or within the Commonwealth is key;
- Estimation of total effects: Use of region and industry specific multipliers to estimate indirect and induced effects to calculate total effects such as employment, income and overall economic activity;
- Other social or economic benefits, including potential non-monetary benefits, to the local community or surrounding area; and
- Potential curtailments or impacts to other industries.

**Summary of information provided by the Applicant.** The Caldwell Solar Application included an Economic Impact Analysis (Exhibit F) prepared by Cardno. That report includes a discussion and explanation of the Project's economic benefits, including estimates of employment, labor income, total economic output and tax revenues generated by Project construction and operations for the Commonwealth of Kentucky and a regional Socioeconomic Area of Interest (SAOI), including Caldwell, Crittenden and Lyon counties. In



response to HE inquiries, the Applicant provided additional information regarding construction and operational expenditures and tax payments.

Excerpts from the Applicant's economic impact analysis and supplemental materials included the following:

**Capital investment:** Capital investment for the Caldwell Solar Project is estimated at approximately \$317 million. Much of the total expenditures for this project are expected to be spent outside of the Regional SAOI or Kentucky, including the solar panels, trackers and other major equipment. Because those components are typically manufactured outside of Kentucky, spending on those items is not expected to directly affect the economies of Caldwell County, the Regional SAIO or Kentucky. Caldwell Solar is likely to purchase materials such as steel, rebar and cable within Kentucky. Additionally, aggregate, concrete and building supplies for the O&M building may be purchased from within the Regional SAOI. Overall, the Project will generate about \$17.5M of economic output for Kentucky, including a much smaller portion for the Regional SAOI.

**Construction employment and earnings:** Construction of the facility is anticipated to require approximately 161 full-time equivalent (FTE) workers over the 12 to 16 month construction period.<sup>67</sup> Given the estimates of labor income provided, the average earnings per construction worker amount to about \$69,350 over the full construction period. Given the circulation of construction-related monies throughout the local area, the Project would also generate some additional new jobs, or FTEs, and income in other economic sectors.<sup>68</sup>

The Applicant states that they intend to hire employees "as locally as possible," but that their ability to do so is heavily dependent on the selected construction contractor and the availability of local employees with the necessary skill sets. The Economic Impact Analysis states that approximately 0.7 FTEs are expected to be hired from within the Regional SAOI for Project construction. That estimate is based on Cardno's approach to scaling state-level estimates to the local region; the Applicant has stated that the estimates of regional employment, earnings and output are likely conservative.<sup>69</sup>

Exhibit 5-17 presents the employment, income and economic output generated by Project construction, both in Kentucky as a whole and in the Regional SAOI.

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<sup>67</sup> 1 job = 1 FTE = 2,080 hours worked in one year. A part-time or temporary position would constitute a fraction of one job or FTE. Therefore, the number of individual people hired for construction will likely be greater than the estimated number of FTEs.

<sup>68</sup> These are referred to as indirect and induced jobs.

<sup>69</sup> Cardno's methodologies are discussed in more detail later in this section.

**Exhibit 5-17.**

**Estimated Economic Benefits of the Proposed Caldwell Solar Project, Construction Phase**

	Commonwealth of Kentucky			Regional SAOI		
	Employment	Earnings	Economic Output	Employment	Earnings	Economic Output
Direct	160.6	\$11.1 M	\$17.5 M	0.7	\$46.0 K	\$72.3 K
Total	261.0	\$21.9 M	\$47.1 M	1.5	\$90.3 K	\$194.5 K

Notes: (1) Employment is measured as FTEs; the number of individual workers may be greater than the number of FTEs.

(2) Estimates for the Commonwealth of Kentucky include the Regional SAOI.

(3) The Regional SAOI includes Caldwell, Crittenden and Lyon Counties.

Source: Caldwell Solar, LLC, October 2021.

**Operational employment and earnings:** Caldwell Solar anticipates hiring approximately five employees to perform the Project’s regular operation and maintenance work, including inspection and maintenance of electrical equipment, ground and buffer vegetation and access drives. Salaries for those employees are estimated to be approximately \$60,000 FTE per year.<sup>70</sup> Operational purchases made within the Regional SAOI might include items such as fuel, utilities, fuses, rags, tools and lubricants. Again, due to the scaling approach used by the Applicant’s consultant to determine regional benefits based on the state-level estimates, the regional employment, earnings and output during Project operations are very low and, as the Applicant has stated, are likely conservative.

Exhibit 5-18 presents the employment, income and economic output generated by Project operations, both in Kentucky as a whole and in the Regional SAOI.

**Exhibit 5-18.**

**Estimated Economic Benefits of the Proposed Caldwell Solar Project, Operations Phase**

	Commonwealth of Kentucky			Regional SAOI		
	Employment	Earnings	Economic Output	Employment	Earnings	Economic Output
Direct	5.0	\$300.8 K	\$300.8 K	0.0	\$1.2 K	\$1.2 K
Total	10.3	\$629.9 K	\$1.3 M	0.0	\$2.6 K	\$5.4 K

Notes: (1) Employment is measured as FTEs; the number of individual workers may be greater than the number of FTEs.

(2) Estimates for the Commonwealth of Kentucky include the Regional SAOI.

(3) The Regional SAOI includes Caldwell, Crittenden and Lyon Counties.

(4) Operational employment in the Regional SAOI may actually be as many as the full five employees estimated for the Commonwealth.

Source: Caldwell Solar, LLC, October 2021.

<sup>70</sup> The Applicant has stated that the Economic Impact Analysis utilizes conservative estimates and that Project operations may require as many as seven employees, with salaries of up to \$70,000 per year.

**Property tax revenues:** Caldwell Solar is estimated to generate approximately \$265,000 in annual tax revenue over the life of the Project, including \$233,000 in annual tax revenue for Caldwell County. Assuming a 20-year operational period, the Project would generate a total of \$5.3 million in tax revenue (\$4.6 million in Caldwell County); assuming a 25-year operational period, the Project would generate a total of \$6.6 million in tax revenue (\$5.8 million in Caldwell County).

Of the \$233,000 in annual tax revenues for Caldwell County, approximately \$40,000 is estimated to go directly to the County and other local jurisdictions and approximately \$193,000 is estimated to go to the Caldwell County School District.

**Other economic benefits:** Caldwell Solar will also contribute up to \$40,000 per year for 20 years to a local charitable organization, amounting to about \$800,000 over the life of the Project.

**HE's evaluation of impacts.** An economic impact analysis can be an opportunity to identify the monetary and other benefits provided by Project construction and operational activities. A meaningful discussion of the monetary and other benefits must provide some quantification of said benefits, along with additional context to determine the magnitude of those benefits:

- For most solar facilities, the purchase of materials, supplies and equipment makes up a large portion of total project construction costs. The majority of the Project's capital expenditures are anticipated to occur out-of-state, limiting the economic benefits to the Commonwealth. In response to HE inquiries, the Applicant noted that a relatively small portion of the materials and supplies required for construction would be sourced from within Caldwell County or surrounding counties (Regional SAOI). Therefore, the economic benefits of construction will come mainly from labor activities.
- It is also important to note that direct construction jobs, as well as indirect and induced, will be temporary, resulting from the 12 to 16 month construction period. Additionally, the portion of construction period jobs realized for Caldwell County (or Regional SAOI) residents will depend on the number of available and qualified workers in the area.
- The Applicant's consultant used an economic modeling tool to develop estimates of the Project's economic impacts at the state level.<sup>71</sup> Subsequently, to estimate local (Regional SAOI) benefits, Cardno scaled the statewide results by the portion of State Gross Domestic Product represented by the three-county area.<sup>72</sup> HE believes that approach results in an inaccurate estimates of local benefits; however, we agree that

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<sup>71</sup> As noted in the Economic Impact Analysis report, the Jobs and Economic Development Impact (JEDI) tool was developed by the National Renewable Energy Laboratory (NREL) and is widely used to estimate the benefits of power generation projects.

<sup>72</sup> Cardno stated that they could have used the tool to develop a local or regional model, which would have eliminated the scaling adjustments; however, the consultant did not choose that approach.

the resulting estimates are lower than the actual employment, earnings and output will be during construction and operations.

- HE believes that many more local residents can be hired for both construction and operations of the Caldwell facility than indicated by the Applicant's analysis, bringing with them additional earnings and output benefits for the region.
- Annual operations and maintenance expenditures for the Project would be small. The majority of economic benefits generated during operations would result from employee earnings and property tax payments.
- Property taxes distributed to local entities within Caldwell County, including the Caldwell County School District, will provide additional revenue for these agencies; however, those payments will generally amount to a small percentage of total tax revenues for any individual entity.
- Landowner leases are not mentioned in the economic analysis. Those landowners will realize direct benefits from the Project via lease payments.

**Conclusions and recommendations.** Construction and operation of the Caldwell Solar facility will provide some limited economic benefits to the region and to the Commonwealth. Overall, the Project will result in measurable, but temporary, positive economic effects to the region during the construction phase. Construction activity will generate regional employment and income opportunities; those effects will be temporary, but local hires will increase employment and incomes to an area that needs it. Most construction purchases will be made outside of Kentucky.

Operational economic benefits will be confined mostly to property tax revenues, although these are assumed to be relatively minor in terms of total County tax revenues. Those payments will generally amount to a small percentage of total tax revenues for any individual public entity. Operational employment will be minimal, and purchases of materials or supplies will be small on an annual basis. The additional contributions to local charitable organizations are a benefit to the local area; however, at this point it is unclear exactly who will benefit and how.

**Need for mitigation.** Socioeconomic impacts of the Caldwell Solar facility represent a positive, albeit small, contribution to the region. The following mitigation measures could be implemented to increase economic benefits within Caldwell County and the Regional SAOI and provide more detailed information about the Project's local economic benefits:

1. The Applicant should attempt to hire local workers and contractors to the extent they are qualified to perform the construction and operations work.
2. The Applicant should consider opportunities to optimize local benefits; for example, by purchasing materials, if possible, in the local area during construction and operation.

## **Decommissioning Activities**

Decommissioning is the process of safely closing the solar facility to retire it from service at the end of its useful life, and subsequently returning the land to its original condition. This might include removal of solar panels and all associated facilities, and restoration of the property to pre-Project conditions. Although not specifically addressed in the statutes, the Siting Board requested that HE discuss the potential impacts associated with decommissioning activities.

**General methods of assessment.** The types of impacts likely to result from decommissioning might be similar in nature to those experienced during construction. For example, workers would need to commute to the site daily, trucks would be required to haul equipment away using local roads and noise may be generated by all of the activity. Therefore, the methods of assessing decommissioning impacts would be similar to those employed to evaluate the construction phase effects. Removal and disposal of the project components should also be addressed in this assessment.

**Summary of information provided by the Applicant.** Attachment E of the SAR provides the Applicant's Decommissioning Methodology and Plan, which lays out the procedures for restoring the site to its original use, or to other economic land uses as desired by the relevant landowner, at the end of the Project's operational life. According to the Applicant, the Caldwell solar facility would have an expected useful life of 20 to 25 years.

**Decommissioning plan and activities.** According to the Decommissioning Plan, the Project is presumed to be at the end of its useful life if the Project generates no electricity for a continuous period of 12 months. Caldwell Solar will notify Caldwell County officials of upcoming decommissioning activities at least 30 days prior to the commencement of decommissioning. The following general decommissioning activities will occur:

- Removal of panels
- Removal of weather stations, inverters, electrical equipment, racking and scrap
- Removal of piles to a depth of at least three feet
- Removal of access roads
- Removal of electrical collection lines to a depth of at least three feet
- Removal of fencing
- Removal of the collection substation

Some components may be left in place under certain circumstances, as noted in the Decommissioning Plan. If a landowner desires that private access roads remain in place for their use, Caldwell Solar will obtain a written request from the landowner for a road or structure to remain in place.

Following the completion of decommissioning activities, it is anticipated that the site will primarily be converted back to its pre-construction land uses. The land will be

graded as necessary and will be decompacted to allow for productive agricultural use. Decommissioning of the Project, including the removal of materials followed by site restoration, should be completed in approximately 12-18 months.

Additionally, Application materials state that lease agreements with participating landowners commit the Applicant to removing any construction debris and restoring the portions of the land not occupied by the solar facilities to substantially the same conditions as prior to construction of the Project.

**Anticipated decommissioning costs.** Caldwell Solar will contract with a qualified engineering consultant to prepare a cost estimate for the decommissioning activities for the entire Project, based on the final Project site plan. Caldwell Solar will reevaluate decommissioning costs with a qualified engineering consultant every five years during the life of the Project.

**Financial assurance.** If requested, Caldwell will post a financial surety with Caldwell County as the obligee that is equal to the net cost of decommissioning the Project (decommissioning costs minus salvage value). According to the Applicant, lease agreements with participating landowners also contain language to provide financial security related to the removal of the Project.

**HE's evaluation of impacts.** The impacts of decommissioning activities are likely to be somewhat smaller than those of construction. Fewer workers may be able to complete facility removal activities in a shorter time period, as compared to construction activities. Additionally, decommissioning work may not require the same level of experience or skill sets as project construction, resulting in the employment of more general laborers at lower wages. Therefore, the benefits to local employment and income during decommissioning would be somewhat less than those described for the construction phase.

**Conclusions and recommendations.** HE believes that decommissioning the facility and returning the site to its original condition can be accomplished once all the components will be removed. After reclamation, the Applicant would return the land to its pre-Project productive use and property value, and eliminate long term Project-related negative impacts, compared with simply shutting the solar facility. This process will also have a modest and temporary positive economic stimulus to the region.

The Applicant has suggested that economic incentives exist for decommissioning, but HE believes that is highly uncertain due to costs for decommissioning and metal prices 20 years in the future.

**Need for mitigation.** The Applicant's approach to decommissioning and restoration includes removal of above-ground and underground structures associated with the Project, as well as site restoration activities. Commitments regarding land restoration are included in individual lease agreements with participating landowners. To ensure that all decommissioning commitments are met, we recommend the following:

1. The Applicant shall file a full and explicit decommissioning plan with the Siting Board or its successors as well as Caldwell County. This plan shall commit the Applicant to removing all facility components, above-ground and below-ground, regardless of depth, from the Project site. Internal roadways and other structures, such as the O&M building, shall also be removed unless the landowner states in writing that they prefer those to remain in place. The decommissioning plan shall be completed at least one month prior to construction of the Project.
2. The Applicant, its successors, or assigns shall decommission the entire site of the Project once it ceases producing electricity for a continuous period of 12 months. Decommissioning shall include the removal of all solar panels, racking, and equipment including concrete pads and trenched electrical wiring.
3. As applicable to individual lease agreements, the Applicant, its successors, or assigns will abide by the specific land restoration commitments agreed to by individual property owners, as described in each executed lease agreement.
4. The Applicant shall file a bond with Caldwell County Fiscal Court, equal to the amount necessary to effectuate the explicit or formal decommissioning plan, naming Caldwell County as an obliged or a third-party (or secondary, in addition to individual landowners) beneficiary of that bond, so that Caldwell County will have the authority to draw upon the bond to effectuate the decommissioning plan as needed. For land in which there is no bonding requirement otherwise, Caldwell County shall be the primary beneficiary of the decommissioning bond for that portion of the Project. The bond(s) shall be in place at the time of commencement of operation of the Project.
5. The bond amount should be reviewed and updated every five years at the expense of the Applicant to determine and update the cost of facility removal. This review shall be conducted by an individual or firm with experience or expertise in the costs of removal or decommissioning of electric generating facilities. Certification of this review shall be provided to the Siting Board or its successors and the Caldwell County Fiscal Court. Such certification shall be by letter and shall include the current amount of the anticipated bond and any change in the costs of removal or decommissioning.
6. If the Applicant proposes to retrofit the current proposed facility, it shall demonstrate to the Siting Board that the retrofit facility will not result in a material change in the pattern or magnitude of impacts compared to the original project. Otherwise, a new Site Assessment Report will be submitted for Siting Board review. The term retrofit is defined as the facility being re-designed such that the facility has a different type of operations or function, i.e., no longer operates as a solar electric generation facility.
7. The Applicant shall also prepare a new Site Assessment Report for Siting Board review if the Applicant intends to retire the currently proposed facility and employ a different technology.
8. The Applicant or its assigns must provide notice to the Siting Board if during any two-year period, it replaces more than twenty percent of its facilities. The Applicant shall

commit to removing the debris and replaced facility components from the Project site and Caldwell County upon replacement. If the replaced facility components are properly disposed of at a permitted facility, they do not have to be physically removed from Caldwell County. However, if the replaced facility components remain in Caldwell County, the Applicant must inform the Siting Board of where the replaced facility components are being disposed of.

9. Any disposal or recycling of Project equipment, during operations or decommissioning of the Project, shall be done in accordance with applicable laws and requirements.

## **Public Outreach and Communication**

The Application details the public involvement activities undertaken by Caldwell Solar, LLC staff. Those activities included the following events and actions taken to notify and inform Caldwell County officials and residents about the Project:

- Public meetings and events:
  - On August 25, 2020, Caldwell representatives hosted in-person open office hours in the community to allow members of the public to attend and learn about the Project.
  - On August 25, 2020, Caldwell representatives hosted a virtual presentation to share information about the Project with the public. A copy of the presentation slide deck was posted on the Project’s website following the meeting.
  - A public information meeting for the Project was held on June 17, 2021, at the University of Kentucky Research and Education Center in Princeton. Notice of that meeting was published in The Times Leader, the Caldwell County newspaper, on May 29, 2021. The meeting was conducted as an “open house” format, where Project representatives provided information on the development, permitting, construction, and operation of the proposed Caldwell Solar Project. Attendees were able to view Project maps, ask questions, and take-home Project materials. According to the Application, the public information meeting was attended by 27 participants, including participating landowners, neighbors and public officials.
- Outreach to surrounding landowners and others:
  - On February 24, 2020, Caldwell representatives met in person with Caldwell County Judge Executive Larry Curling and District Magistrates to introduce the Project and answer initial questions.
  - On July 10, 2020, a Caldwell representative had a one-on-one phone call with the current Caldwell County Schools Superintendent, Nate Huggins to introduce the Caldwell Solar Project and answer initial questions.



- In early August 2020, a Caldwell representative had a one-on-one phone call with Caldwell County Judge Executive Larry Curling to provide updates on the status of the Project and answer questions
- On August 12, 2020, Caldwell representatives gave a virtual introductory Project presentation to Caldwell County Judge Executive Larry Curling.
- On August 17, 2020, Caldwell representatives gave an introductory Project presentation to the Caldwell County Schools Board of Education at a regularly scheduled Caldwell County Schools Board of Education meeting.
- On August 25, 2020, Caldwell representatives gave an introductory Project presentation to the Caldwell County Fiscal Court at a regularly scheduled Caldwell County Fiscal Court meeting.
- On September 22, 2021, a notice of application was published in The Times Leader. Adjacent landowners to the Project were sent notice of application letters on September 24, 2021, via registered mail.
- A Project website was developed to provide the public with details on how to attend the public information meeting, a map showing the Project Area, aerial imagery, parcel information for all participating properties in Caldwell County, opportunity to submit questions and comments regarding the Project, a summary of frequently asked questions and responses, and instructions on how to request more information. The website address is <https://nationalgridrenewables.com/caldwell/>.

As part of HE’s site visit to the Project area, HE met with the Caldwell County Judge Executive, Larry Curling. Mr. Curling indicated that public awareness of the Project was low. However, as noted earlier in this Section (Scenic Compatibility and Property Value Impacts), some local residents – landowners with property near the Project site – have expressed a general opposition to the Project.

HE also spoke with the Caldwell County Property Valuation Administrator, Ronald Wood, who commented that he believes local residents are largely unaware of the Project.<sup>73</sup> Mr. Wood has not heard much from local residents regarding the Project, but what he has heard concerns decommissioning, clean-up of the Project site and potential environmental degradation.

**Need for mitigation.** Because of the limited attendance at the local public meeting and the general sense of local unawareness of the Project, it is suggested that the Applicant pursue additional public outreach and engagement activities within Caldwell County.

## **Complaint Resolution**

Prior to construction, Caldwell Solar plans to send out notice letters to all residents within 1,500 feet of the Project and provide contact information that landowners can use to raise issues

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<sup>73</sup> HE staff spoke with Mr. Ronald Wood on January 13, 2021.

or concerns with Project representatives. The Applicant has also stated that Caldwell Solar will respond to any complaints or other issues that landowners bring up and will work with landowners to resolve the issues to the extent possible.

**Need for mitigation.** The Applicant's described approach to resolving complaints is vague and generally undefined. A formal process for addressing complaints should be developed and followed during the construction and operational periods to address any issues associated with visual, noise or other Project-related impacts. The following measures should be undertaken to implement a complaint resolution process:

1. The Applicant should develop and implement a complaint resolution plan that describes the process for filing complaints during construction and during operations, and this plan should be provided to Caldwell County and the Siting Board. The complaint resolution plan should explain how the complaint will be addressed; the timeframe in which a complainant can expect a response; and an explanation of how resolution will be determined if the complainant is not satisfied with the response from the Applicant.
2. The Applicant should submit to the Siting Board, annually, a status report associated with the complaint resolution plan, recounting the individual complaints, how the Applicant addressed those complaints and the ultimate resolution of those complaints, and whether or not the resolution was to the complainant's satisfaction.

# SECTION 6

## Recommended Mitigation

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This section identifies actions the Applicant can take to mitigate potential negative impacts on certain regional resources. Other regulatory processes will determine the need for particular actions; these are only noted here, and HE makes no recommendation as to their merit. Beyond those actions, HE recommends a list of mitigation actions for Siting Board and Applicant consideration.

### Regulatory Actions and Mitigation Outside Siting Board Jurisdiction

The Siting Board should be aware of the following permitting and regulatory actions that will require Applicant compliance and possible mitigation efforts. No action on these actions is required by the Siting Board since these are outside the Siting Board’s jurisdiction. Exhibit G of the Application states that all necessary air, water and waste permits have been or will be obtained before construction and operation of the Project and may include:

**Exhibit 6-1.**  
**Environmental Permits Required for Construction or Operation of the Caldwell Solar Facility**

Permit	Regulatory Agency	Activity	Authority
Kentucky Pollutant Discharge Elimination System (KPDES) Individual Permit	Kentucky Division of Water (DOW)	Discharge of process wastewater, non-process wastewater or stormwater from a point source.	KRS 224.10-100, 224.16-050, 224.70-110, 224.70-120, 401 KAR 5:001, and 401 KAR 5:055–5:080
KPDES Construction Storm Water Discharge General Permit	DOW	Stormwater discharges from construction activities that disturb one or more acres.	KRS 224.16-050, 224.16-060, 401 KAR 5:055 and 5:060
KPDES Wastewater Facility Construction Permit	DOW	If installation of sewers or pump stations is involved, a Wastewater Facility Construction Permit is required.	KRS 224.10-100, 224.16-050, 224.70-110, and 401 KAR 5:005
General Permit for Floodplain Development	DOW, Caldwell County	Development in, along, or across a stream requires a floodplain permit.	KRS 151.230
Water Withdrawal Permit	DOW	Withdrawal of public water.	KRS 151.140, 401 KAR 4:010 and 4:200
Section 404 Clean Water Act Permit / Section 10 Rivers and Harbors Act Permit (Individual)	U.S. Army Corps of Engineers	Permit for structures and/or work in or affecting navigable Waters of the United States.	33 CFR 322.3
Section 401 Water Quality Certification	DOW	Any discharge into waters of the Commonwealth. associated with any federally licensed or permitted activity.	§ 401 CWA KRS 224.16-050 401 KAR Ch. 5

Source: Caldwell Solar, LLC, October 2021.

A Cumulative Environmental Assessment (CEA) is also provided in Exhibit G of the Application. That report includes an environmental assessment of potential air, water, and waste impacts from construction and operation of the Caldwell Solar Project. The Application states that Caldwell Solar will file the CEA with the Kentucky Energy and Environment Cabinet concurrently with its Application to the Siting Board.

## **Mitigation for Siting Board and Applicant Consideration**

The following mitigation measures are based upon: (1) Applicant commitments set forth in the SAR; (2) measures discussed with the Applicant in subsequent information exchanges or discussions; and (3) additional mitigation steps HE believes will reduce or eliminate negative Project impacts and are reasonable for the Applicant to undertake.

In performing this comprehensive review of the Caldwell Solar Application and supplemental materials, HE has gained an understanding of the Project, the location, the construction and operational activities, the Applicant's intentions, and the Project's impacts. Our recommended mitigation actions are intended to reduce or eliminate potential adverse impacts.

### **A. Site development plan:**

1. A final site layout plan should be submitted to the Siting Board upon completion of the final site design. Deviations from the preliminary site layout plan, which formed the basis for HE's review, should be clearly indicated on the revised graphic. Those changes could include, but are not limited to, location of solar panels, inverters, transformers, substation, operations and maintenance building or other Project facilities or infrastructure.
2. Any change in Project boundaries from the information which formed this evaluation should be submitted to the Siting Board for review.
3. The Siting Board will determine if any deviation in the boundaries or site layout plan is likely to create a materially different pattern or magnitude of impacts. If not, no further action is required, but if yes, the Applicant will support the Siting Board's effort to revise its assessment of impact and mitigation requirements.
4. A final, Project-specific, construction schedule, including revised estimates of on-site workers and commuter vehicle traffic, should be submitted to the Siting Board. Deviations from the preliminary construction schedule should be clearly indicated.
5. The Siting Board will determine whether any deviation to the construction schedule or workforce estimates is likely to create a materially different pattern or magnitude of impacts. If not, no further action is required. If so, the Applicant will support the Siting Board's effort to revise its assessment of impacts and mitigation requirements.
6. The Applicant or its contractor will control access to the site during construction and operation. All construction entrances will be gated and locked when not in use.

7. The Applicant's access control strategy will include appropriate signage to warn potential trespassers. The Applicant will ensure that all site entrances and boundaries have adequate signage, particularly in locations visible to the public, local residents and business owners.
8. According to National Electrical Safety Code regulations, the security fence must be installed prior to any electrical installation work. The substation will have its own separate security fence and locked access installed.

**B. Compatibility with scenic surroundings:**

1. Existing vegetation between the solar arrays and nearby roadways and homes shall be left in place, to the extent feasible, to help minimize visual impacts and screen the Project from nearby homeowners and travelers.
2. The Applicant will not remove any existing vegetation except to the extent it must remove such vegetation for the construction and operation of Project components.
3. The Applicant shall implement planting of native evergreen species as a visual buffer to mitigate viewshed impacts, particularly in areas directly adjacent to the Project without existing vegetation.
4. The Applicant shall carry out visual screening consistent with the plans proposed in its Application, Site Assessment Report and Exhibits included as attachments to Caldwell Solar's responses to Siting Board Data Requests, and ensure proposed new vegetative buffers are successfully established and develop as expected over time. Should vegetation used as buffers die over time, the Applicant shall replace them as appropriate.
5. Any changes to the vegetative buffering plan or site infrastructure layout (i.e., panels, inverters, etc.) included in the Application materials will be submitted to the Siting Board for review. If the Siting Board deems those changes to be significant, the Board may require the Applicant to further modify the buffering plan.
6. The Applicant shall provide a visual buffer between Project infrastructure and residences or other occupied structures with a line of sight to the facility to the reasonable satisfaction of the affected adjacent property owners. If vegetation is used, plantings should reach eight feet high within four years. To the extent that an affected property owner indicates to the Applicant that a visual barrier or vegetative buffer is not necessary, Caldwell Solar will obtain that property owner's written consent and submit such consent in writing to the Siting Board.
7. The Applicant should plant vegetative buffers along the Project boundary near the Adamson Cemetery to reduce or eliminate views of solar panels or other Project infrastructure from that location.

8. Landscape screening will extend and connect to existing site vegetation, if any, to help create a more natural transition between existing vegetation and Applicant developed vegetation.
9. The Applicant will develop a vegetation management plan that describes the approach and procedures for maintaining or replacing vegetative buffers as needed.
10. The Applicant shall cultivate at least two acres of native pollinator-friendly species on-site.
11. The Applicant will use anti-glare panels and operate the panels in such a way that glare from the panels is minimized or eliminated. The Applicant will immediately adjust solar panel operations upon any complaint about glare from those living, working, or traveling in proximity to the Project. Failing this, the Applicant will cease operations until the glare is rectified.
12. The Applicant will work with homeowners and business owners to address concerns related to the visual impact of the Project on its neighbors.

**C. Potential changes in property values and land use:**

1. No unique mitigation measures are recommended related to potential impacts to property values or adjacent land uses because other mitigation can accomplish this. However, close coordination by the Applicant with impacted and concerned homeowners regarding potential visual impacts and impacts from noise, traffic or other Project activities should be initiated.

**D. Anticipated peak and average noise levels:**

1. The Applicant shall notify residents and businesses within 2,400 feet of the Project boundary about the construction plan, the noise potential, and the mitigation plans at least one month prior to the start of construction.
2. The Applicant shall respond to any complaints related to noise levels or noise causing activities occurring during construction or operations via a formal and clearly developed complaint resolution program.
3. If pile driving activity occurs within 1,500 feet of a noise sensitive receptor, the Applicant shall implement a construction method that will suppress the noise generated during the pile driving process (i.e., semi-tractor and canvas method; sound blankets on fencing surrounding the Project site; or any other comparably effective method).
4. The Applicant should limit the construction activity, process and deliveries to the hours of 8:00 am to 6:00 pm, Monday through Saturday. No construction work should be conducted on Sundays.
5. The Applicant shall place panels, inverters and substation equipment consistent with the distances to noise receptors indicated in the Applicant's noise study and with the

Applicant's proposed setbacks. Nevertheless, the Applicant shall not place solar panels or string inverters, if used, closer than 150 feet from a residence, church or school, 25 feet from non-participating adjoining parcels, and 50 feet from adjacent roadways. The Applicant shall not place a central inverter, and, if used, energy storage systems closer than 450 feet from a residence, church, or school. These setbacks shall not be required for residences owned by landowners involved in the Project that explicitly agree to lesser setbacks and have done so in writing. All agreements by participating landowners to lesser setbacks must be filed with the Siting Board prior to commencement of construction of the Project.

**E. Road and rail traffic, fugitive dust, and road degradation:**

1. The Applicant shall comply with all laws and regulations regarding the use of roadways and bridges.
2. The Applicant will fix or pay for damage resulting from any vehicle transport to the Project site. For damage resulting from vehicle transport in accordance with all permits, those permits will be controlling.
3. The Applicant shall implement ridesharing between construction workers when feasible, use appropriate traffic controls or allow flexible working hours outside of peak hours to minimize any potential delays during AM and PM peak hours.
4. The Applicant shall consult with the Kentucky Transportation Cabinet (KYTC) regarding truck and other construction traffic and obtain necessary permits from the KYTC.
5. The Applicant shall consult with the Caldwell County Road Department (CCRD) regarding truck and other construction traffic and obtain necessary permits from the CCRD.
6. The Applicant should work with the Commonwealth road authorities and the CCRD to perform road surveys, before and after construction activities, on all roads to be used by construction vehicles.
7. The Applicant shall comply with any road use agreement executed with the CCRD. Such an agreement might include special considerations for overweight loads, routes utilized by heavy trucks, road weight limits and bridge weight limits.
8. The Applicant shall develop and implement a traffic management plan to minimize the impacts on traffic flow and keep traffic and people safe. Any such traffic management plan shall also identify any noise concerns during the construction phase and develop measures that would address those noise concerns.
9. The Applicant shall consult with FVRR, PAL and the KYTC, if necessary, to evaluate potential impacts to railroad crossings from Project traffic. If necessary, the Applicant

shall develop additional, specific mitigation measures applicable to impacts on affected railroad crossings.

10. The Applicant shall properly maintain construction equipment and follow best practices related to fugitive dust throughout the construction process. Dust impacts shall be kept at a minimum level.

**F. Economic impacts:**

1. The Applicant should attempt to hire local workers and contractors to the extent they are qualified to perform the construction and operations work.
2. The Applicant should consider opportunities to optimize local benefits; for example, by purchasing materials, if possible, in the local area during construction and operation.

**G. Decommissioning:**

1. The Applicant shall file a full and explicit decommissioning plan with the Siting Board or its successors as well as Caldwell County. This plan shall commit the Applicant to removing all facility components, above-ground and below-ground, regardless of depth, from the Project site. Internal roadways and other structures, such as the O&M building, shall also be removed unless the landowner states in writing that they prefer those to remain in place. The decommissioning plan shall be completed at least one month prior to construction of the Project.
2. The Applicant, its successors, or assigns shall decommission the entire site of the Project once it ceases producing electricity for a continuous period of 12 months. Decommissioning shall include the removal of all solar panels, racking, and equipment including concrete pads and trenched electrical wiring.
3. As applicable to individual lease agreements, the Applicant, its successors, or assigns will abide by the specific land restoration commitments agreed to by individual property owners, as described in each executed lease agreement.
4. The Applicant shall file a bond with Caldwell County Fiscal Court, equal to the amount necessary to effectuate the explicit or formal decommissioning plan, naming Caldwell County as an obliged or a third-party (or secondary, in addition to individual landowners) beneficiary of that bond, so that Caldwell County will have the authority to draw upon the bond to effectuate the decommissioning plan as needed. For land in which there is no bonding requirement otherwise, Caldwell County shall be the primary beneficiary of the decommissioning bond for that portion of the Project. The bond(s) shall be in place at the time of commencement of operation of the Project.
5. The bond amount should be reviewed and updated every five years at the expense of the Applicant to determine and update the cost of facility removal. This review shall be conducted by an individual or firm with experience or expertise in the costs of removal or decommissioning of electric generating facilities. Certification of this



review shall be provided to the Siting Board or its successors and the Caldwell County Fiscal Court. Such certification shall be by letter and shall include the current amount of the anticipated bond and any change in the costs of removal or decommissioning.

6. If the Applicant proposes to retrofit the current proposed facility, it shall demonstrate to the Siting Board that the retrofit facility will not result in a material change in the pattern or magnitude of impacts compared to the original project. Otherwise, a new Site Assessment Report will be submitted for Siting Board review. The term retrofit is defined as the facility being re-designed such that the facility has a different type of operations or function, i.e., no longer operates as a solar electric generation facility.
7. The Applicant shall also prepare a new Site Assessment Report for Siting Board review if the Applicant intends to retire the currently proposed facility and employ a different technology.
8. The Applicant or its assigns must provide notice to the Siting Board if during any two-year period, it replaces more than twenty percent of its facilities. The Applicant shall commit to removing the debris and replaced facility components from the Project site and Caldwell County upon replacement. If the replaced facility components are properly disposed of at a permitted facility, they do not have to be physically removed from Caldwell County. However, if the replaced facility components remain in Caldwell County, the Applicant must inform the Siting Board of where the replaced facility components are being disposed of.
9. Any disposal or recycling of Project equipment, during operations or decommissioning of the Project, shall be done in accordance with applicable laws and requirements.

#### **H. Public outreach and communication:**

1. The Applicant should pursue additional public outreach and engagement activities within Caldwell County because of the limited attendance at the local public meeting and the general sense of local unawareness of the Project.

#### **I. Complaint resolution program:**

1. The Applicant should develop and implement a complaint resolution plan that describes the process for filing complaints during construction and during operations, and this plan should be provided to Caldwell County and the Siting Board. The complaint resolution plan should explain how the complaint will be addressed; the timeframe in which a complainant can expect a response; and an explanation of how resolution will be determined if the complainant is not satisfied with the response from the Applicant.
2. The Applicant should submit to the Siting Board, annually, a status report associated with the complaint resolution plan, recounting the individual complaints, how the Applicant addressed those complaints and the ultimate resolution of those complaints, and whether or not the resolution was to the complainant's satisfaction.