Wayne County, North Carolina
Board of Commissioners

December 5, 2023
224 E. Walnut Street
Courthouse 4th Floor
Goldsboro, NC 27530

MINUTES

8:00 A.M. AGENDA BRIEFING

During the scheduled briefing and prior to the regularly scheduled meeting, the Board of Commissioners held an advertised briefing session to discuss the items of business on the agenda.

The briefing began at 8:04 a.m. with County Manager Chip Crumpler reviewing the agenda. He presented the following to be added to the agenda:

*Motion to appropriate $375,000 towards the Goldsboro Union Station stabilization project contingent on the Save Union Station Group raising $750,000 and the City of Goldsboro contributing $375,000 for the project, based upon the future use of the property being retail, commercial, and for use as a train depot only, and the appropriate budget amendment, under Unfinished Business.

*Motion to remove restrictions from lots 6 and 7 at ParkEast under the Consent Agenda.

The board discussed the addition of the Union Station motion under unfinished business. The board moved the motion to the Consent Agenda.

Staff Attorney Andrew Neal reviewed the motion to remove restrictions from lots 6 and 7 at ParkEast.

Planning Director Berry Gray reviewed the public hearings.

Finance Director Angie Boswell reviewed the budget amendments.

Staff Attorney Andrew Neal reviewed the farm lease bids and answered questions from the board.

Members Present: Chairwoman Barbara Aycock; Vice-Chairman Chris Gurley; Commissioner George Wayne Aycock, Jr.; Commissioner Joe C. Daughtery; Commissioner Freeman Hardison, Jr.; and Commissioner Antonio Williams.

Members Absent: Commissioner Bevan Foster

9:00 A.M. CALL TO ORDER - Chairwoman Barbara Aycock

The Wayne County Board of Commissioners met on Tuesday, December 5, 2023, at 9:06 a.m. in the Commissioners Meeting Room in the Wayne County Courthouse Annex, Goldsboro, North Carolina, after due notice thereof had been given.

Members present: Chairwoman Barbara Aycock; Vice-Chairman Chris Gurley; Commissioner George Wayne Aycock, Jr.; Commissioner Joe C. Daughtery; Commissioner Bevan Foster; Commissioner Freeman Hardison, Jr.; and Commissioner Antonio Williams.

Members absent: None

INVOCATION - Vice-Chairman Chris Gurley

Vice-Chairman Chris Gurley gave the invocation.

PLEDGE OF ALLEGIANCE - Commissioner George Wayne Aycock, Jr.

Commissioner George Wayne Aycock, Jr., led the Board of Commissioners in the Pledge of Allegiance to the Flag of the United States of America.

ORGANIZATION - County Attorney E. B. Borden Parker Presiding

1. Election of Chairman.

County Attorney E. B. Borden Parker opened the floor for nominations for chairman of the Wayne County Board of Commissioners.

Commissioner George Wayne Aycock, Jr., nominated Vice-Chairman Chris Gurley for chairman. No other nominations were made.

Upon motion of Commissioner George Wayne Aycock, Jr., the Board of Commissioners unanimously approved the nomination of Chris Gurley as Chairman of the Wayne County Board of Commissioners.

2. Election of Vice-Chairman.

Chairman Chris Gurley opened the floor for nominations for vice-chairman of the Wayne County Board of Commissioners.

Commissioner Joe C. Daughtery nominated Commissioner George Wayne Aycock, Jr., for vice-chairman.

Commissioner Bevan Foster nominated Commissioner Antonio Williams for vice-chairman.

No other nominations were made.

Upon motion of Commissioner Joe C. Daughtery, the Board of Commissioners approved the nomination of George Wayne Aycock, Jr., as Vice-Chairman of the Wayne County Board of Commissioners by a vote of 5 to 2 with Foster and Williams voting for Antonio Williams.

APPROVAL OF MINUTES

3. Motion to Approve the November 21, 2023 Minutes.

Upon motion of Commissioner Barbara Aycock, the Board of Commissioners unanimously approved the November 21, 2023 minutes.

DISCUSSION/ADJUSTMENT OF AGENDA

4. Motion to Approve the Adjusted December 5, 2023 Agenda.

Upon motion of Commissioner Antonio Williams, the Board of Commissioners unanimously approved the Adjusted December 5, 2023, Agenda.

Added to the agenda were the following:

*Motion to Appropriate $375,000 towards the Goldsboro Union Station stabilization project contingent on the Save Union Station Group raising $750,000 and the City of Goldsboro contributing $375,000 for the project based upon the future use of the property being retail, commercial, and for use as a train depot only, and the appropriate budget amendment, under the Consent Agenda.

*Motion to remove restrictions from lots 6 and 7 at ParkEast.

Following discussion of the adjusted agenda, Commissioner Bevan Foster asked for the Motion to Appropriate $375,000 towards the Goldsboro Union Station stabilization project to be moved to Unfinished Business to allow for discussion.

UNFINISHED BUSINESS

5. Motion to Appropriate $375,000 towards the Goldsboro Union Station stabilization project contingent on Save Union Station Group raising $750,000 and the City of Goldsboro contributing $375,000 for the project based upon the future use of the property being retail, commercial, and for use as a train depot only, and appropriate budget amendment.

County Manager Chip Crumpler read the motion and Commissioner Bevan Foster asked for specifics regarding the number of projects submitted by the state for federal funding. Mr. Foster stated though Julie Metz stated there were two North Carolina projects submitted, he learned there were twelve. Chairman Chris Gurley stated he had a conversation with a rail representative who said the two North Carolina projects of Asheboro to Raleigh and Wilmington to Raleigh were favored, but no decision had been made. Mr. Foster stated he wanted correct information before making a decision and asked for more clarity.

Chairman Gurley said it had been discussed during the 8:00 a.m. agenda briefing and it was the consensus of the board to provide the $375,000 with contingencies.

Commissioner Antonio Williams stated the project would change the blight in the neighborhood, but Mr Foster said the $1.5 million would not do any of that, but rather it would take another $10 million to revitalize the building and he said the board was promising $375,000 blindly.

Chairman Gurley expressed his concerns on the amount of costs of the eventual repairs, as the $1.5 million was only to stabilize the building. Mr. Foster again discussed discrepancies between what the board was told by Julie Metz and what was factual.

The board discussed the pros and cons at length.

Upon motion of Commissioner Antonio Williams, the Board of Commissioners unanimously approved the motion to appropriate $375,000 towards the Goldsboro Union Station stabilization project, contingent on Save Union Station Group raising $750,000 and the City of Goldsboro contributing $375,000 for the project, and based upon the future use of the property being retail, commercial, and for use as a train depot only, and the appropriate budget amendment.

9:00 A. M. PUBLIC HEARINGS

6. Public Hearing to receive public comments on a request to rezone 19 acres from RA-20 to R-10 for property located off US Hwy 70 W identified as Tax Parcel 2671904358.

At 9:29 a.m., Chairman Chris Gurley opened the Public Hearing to receive public comments. Planning Director Berry Gray explained the rezoning request, attached hereto as Attachment A, and answered questions from the board.

As no one signed up to speak, Chairman Gurley closed the Public Hearing at

9:34 a.m.

Upon motion of Commissioner Joe C. Daughtery, the Board of Commissioners unanimously approved the request to rezone 19 acres from RA-20 to R-10 for property located off US Highway 70 West, identified as Tax Parcel 2671904358.

RECESS BOARD OF COMMISSIONERS MEETING

At 9:35 a.m., Chairman Chris Gurley recessed the meeting of the Wayne County Board of Commissioners.

RECONVENE THE WAYNE COUNTY BOARD OF ADJUSTMENT

At 9:35 a.m., Chairman Chris Gurley reconvened the November 21, 2023, Board of Adjustment meeting.

7. Board of Adjustment Public Hearing to receive public comment on the Special Use Permit for Piney Grove Solar Energy Facility.

At 9:35 a.m., Chairman Chris Gurley opened the Public Hearing to receive public comment on the Special Use Permit for Piney Grove Solar Energy Facility. Clerk to the Board Carol Bowden administered the oath to Planning Director Berry Gray, Piney Grove Solar representatives Thomas Terrell, Tom Delafield, Tommy Cleveland, and Nick Kirkland, as well as citizens Ryan Nalley, David Vinson, Gabe Mitchel, and JoAnn Summerlin.

Planning Director Berry Gray gave an overview of the project, attached hereto as Attachment B.

At 10:03 a.m., Mr. Thomas Terrell began his formal presentation and gave each commissioner and certain staff members a notebook compilation of the project. Due to the size of the material, the notebook will be available for viewing in the Clerk to the Board's office.

At 10:40 a.m., Commissioner Barbara Aycock left the meeting.

At 10:44 a.m., Commissioner Freeman Hardison, Jr., left the meeting.

At 10:49 a.m., Commissioner Freeman Hardison, Jr., rejoined the meeting.

At 10:53 a.m., Commissioner Antonio Williams left the meeting.

At 10:55 a.m., Commissioner Antonio Williams rejoined the meeting.

At 11:42 a.m., the Public Hearing was closed.

Upon motion of Commissioner Antonio Williams, the Wayne County Board of Adjustment approved the Special Use Permit for Piney Grove Solar Energy Facility, subject to the recommendations of Planning Director Berry Gray, by a vote of 4 to 2, with C. Gurley and W. Aycock voting against.

RECESS - At 11:58 a.m., Chairman Chris Gurley recessed the Board of Adjustment meeting.

RECONVENE - At 12:08 p.m., Chairman Chris Gurley reconvened the Board of Adjustment meeting.

8. Board of Adjustment Public Hearing to receive public comment on the Special Use Permit for Turtle Cove Solar Energy Facility.

At 12:08 p.m., Chairman Chris Gurley opened the public hearing to receive public comments on the Special Use Permit request for Turtle Cove Solar Energy Facility. Planning Director Berry Gray, Mr. Thomas Terrell, Mr. Tom

Delafield, Mr. Tommy Cleveland, and Mr. Nick Kirkland were previously administered the oath by Clerk to the Board Carol Bowden. Additional witnesses, Mr. Ron Hess, Mr. Wallace Creech, and Mr. K. A. Thompson, III, were administered the oath.

Planning Director Berry Gray gave an overview of the project and permit request, attached hereto as Attachment C, and answered questions from the board.

Mr. Terrell gave his formal presentation to the board, including notebooks which, due to their size, will remain available for viewing in the Clerk to the Board's office.

All those sworn in either presented facts or their support for the project.

At 12:46 p.m, Chairman Chris Gurley closed the public hearing.

Upon motion of Commissioner Antonio Williams, the Board of Adjustment unanimously approved the Special Use Permit for Turtle Cove Solar Energy Facility, contingent upon Planning Director Berry Gray's recommendations.

ADJOURN THE WAYNE COUNTY BOARD OF ADJUSTMENT

At 12:47 p.m., Chairman Chris Gurley adjourned the Wayne County Board of Adjustment.

RECONVENE WAYNE COUNTY BOARD OF COMMISSIONERS MEETING

At 12:47 p.m., Chairman Chris Gurley reconvened the meeting of the Wayne County Board of Commissioners.

CONSENT AGENDA

Upon motion of Commissioner Joe C. Daughtery, the Board of Commissioners unanimously approved the Consent Agenda. The following items were approved:

9. Late Disabled Veteran Exemption Application

10. Late Present Use Value Application

11. Budget Amendments
    # 206 - Services on Aging and #209 - Finance (JCPC)

12. Motion to Approve the 2024-2026 Wayne County Farm Lease Bids.
    Attached hereto as Attachment D.

13. Motion to Approve the Addition of Shepherds Field Drive, Shepherd Court, Lamb Court, and Mutton Drive to the NCDOT State Maintenance System.
    Attached hereto as Attachment E.

14. Motion to Adopt Resolution 2023-27 Authorizing Wetzel Pyrotechnics to use Pyrotechnics on December 31, 2023, for the Mount Olive Pickle Drop in the Town of Mount Olive, contingent on approval by the Wayne County Inspections Department.
    Attached hereto as Attachment F.

PUBLIC COMMENTS

Mr. Dennis Lewis spoke about no longer having his pyrotechnics business and his concerns regarding the fees charged by the inspections department.

COUNTY MANAGER'S REPORT

County Manager Chip Crumpler stated he attended the Goldsboro City Council meeting for the swearing-in of the new council. He congratulated the new and returning members and spoke of the Christmas parades already held and the upcoming parades.

BOARD OF COMMISSIONERS COMMITTEE REPORTS

Commissioner Bevan Foster discussed his concerns about him and Commissioner Antonio Williams not being considered for the vice-chairman position in the four years they've been on the board. He stated the board should consider everyone at the table. He also stated he attended three of the local Christmas parades and did not expect to have as much fun as he had. He said the kids truly enjoyed the candy and "snow".

Commissioner Freeman Hardison, Jr., agreed with Mr. Foster's comments about the vice-chairman position.

Vice-Chairman George Wayne Aycock, Jr., agreed with Mr. Foster on the parades and loved the snow machines added this year.

Commissioner Antonio Williams shared his thoughts on being on the Board of Adjustment, the plight of farmers and landowners, and the standards the board must follow to make a decision on requests.

Commissioner Joe C. Daughtery shared his thoughts on the new Goldsboro City Council and his hope of a change in their working relationship with the county. He discussed bringing new industry into Wayne County and the dependency on utilities from the City of Goldsboro. He also commended the board for their vote in favor of supporting Union Station.

Chairman Chris Gurley thanked the board for their confidence in naming him chairman and discussed the fun he had attending the Christmas parades.

CLOSED SESSION

At 8:31 a.m., upon motion of Commissioner Antonio Williams, the Board of Commissioners unanimously declared itself in closed session to discuss the qualifications, competence, performance, character, fitness, condition of appointment, or condition of initial appointment of an individual, public officer, or employee.

Members Present: Chairman Chris Gurley; Vice-Chairman George Wayne Aycock, Jr.; Commissioner Barbara Aycock; Commissioner Joe C. Daughtery; Commissioner Bevan Foster; Commissioner Freeman Hardison, Jr.; and Commissioner Antonio Williams.

Others Present: Human Resources Director Sara Larson. (First session only.)

At 8:44 a.m., Commissioner Bevan Foster joined the meeting.

At 9:02 a.m., upon motion of Commissioner Antonio Williams, the Board of Commissioners unanimously declared itself in regular session.

At 1:06 p.m., upon motion of Commissioner Joe C. Daughtery, the Board of Commissioners unanimously declared itself in closed session to discuss the expansion of business and industry in Wayne County.

Members Present: Chairman Chris Gurley; Vice-Chairman George Wayne Aycock, Jr.; Commissioner Barbara Aycock; Commissioner Joe C. Daughtery; Commissioner Bevan Foster; Commissioner Freeman Hardison, Jr.; and Commissioner Antonio Williams.

Others Present: County Manager Chip Crumpler; Assistant County Manager

Ginger Moore; County Attorney E. B. Borden Parker; Staff Attorney Andrew Neal; Finance Director Angie Boswell; EDR Director of Business and Project Management Craig Foucht; Deputy Clerk Kayla Whitley; and Clerk to the Board of County Commissioners Carol Bowden. (Second session only.)

At 1:34 p.m., upon motion of Commissioner Joe C. Daughtery, the Board of Commissioners unanimously declared itself in regular session.

ADJOURNMENT

At 1:36 p.m., Chairman Chris Gurley adjourned the meeting of the Wayne County Board of Commissioners.

_____

Carol Bowden, Clerk to the Board

WAYNECOUNTY
NORTH CAROLINA

Wayne County Citizens
Public Hearing Notice

The Wayne County Board of Commissioners will conduct a public hearing Tuesday, December 5, 2023 to consider a proposed amendment to the Wayne County Zoning Map. The hearing will be held during the 9am meeting in the Wayne County Commissioners Meeting Room, Wayne County Courthouse Annex, 224 East Walnut Street, Goldsboro, NC. The item to be discussed:

Z-23-02 – Amend the Wayne County Zoning Map by rezoning an 18 acre tract from RA-20 to R-10. The property is located in Fork Township off US Hwy 70 West behind the Adair development and is listed in the Wayne County Tax Office as Parcel Number 2671904358.

The public is invited to attend and speak at this hearing and/or submit any comments. Written comments before the meeting may be submitted to the Wayne County Planning Department, PO Box 227, Goldsboro, NC 27533 or berry.gray@waynegov.com. Questions may be directed to the Planning Department by calling 919-731-1650.

Carol Bowden
Clerk to the Board

MEMORANDUM

To: Wayne County Board of Commissioners

From: Berry Gray, Planning Director

Date: October 6, 2023

Re: Zoning Map Change, Z-23-02

Item: Rezoning from Residential Agricultural-20 (RA-20) to R-10
Size: 18 acres
Parcel ID# 2671904358
Property Owner/Applicant: Adair LLC
Location: US Hwy 70 West, Fork Township

The applicant is currently looking to rezone property off of US Hwy 70 west behind the Adair development from Residential Agricultural-20 (RA-20) to R-10.

The property is currently vacant. Adjacent zoning includes RA-20 behind and beside the property and it is currently vacant. The property to the north is within the City Limits of Goldsboro and zoned SC for commercial use and R6 for high density residential. The R10 District would allow for higher density residential development. The subject property is not located within a Flood Hazard Area. The Wayne County Growth Strategies Map identifies this property as being within an Urban Transition area which promotes higher density residential development.

Urban Transition Areas include those parts of the planning area that are not currently urban in character but that, during the next two decades, are likely to reach a level of development requiring urban services. These areas may have some services already in place including, particularly, centralized water and sewer. Other services, including stormwater management, are likely to be in place here within twenty years. Urban Transition Areas should be a secondary area for planning, programming and providing public urban services. Those parts of the Urban Transition Area that have good soils and drainage, are not in the floodplain, have road capacity available, and have sewer service nearby should generally be developed at 3 or more units per acre. Land areas constrained by poor soils and/or lack of topography and resulting flooding problems should generally be developed at lower densities.

The proposed rezoning is consistent with the following Wayne County Comprehensive Plan policies:

Policy 1.9: ACCESS TO HIGHER INTENSITY DEVELOPMENT shall generally not be permitted through an area of lower intensity development. For example, access to a multi-family development, major park facility or large traffic generator shall not be permitted through a single-family residential neighborhood.

Policy 3.8: Wayne County shall encourage a "TOWN AND COUNTRY" DEVELOPMENT PATTERN that makes the provision of county services (e.g. Sheriff's patrol, school bus pick-ups,

etc.) more economical and the installation, maintenance and replacement of non-sprawling infrastructure (e.g. water and sewer lines) less expensive.

Policy 4.4: URBAN LEVEL DEVELOPMENT STANDARDS (e.g. sidewalks, streetlights, storm water improvements, etc.) shall generally be applied to areas preferred for urban development. Such standards may be modified when site-specific conditions warrant a more environmentally sensitive, low impact approach.

Policy 4.6: Whether located in an Urban or Rural area, new development should occur at DENSITIES APPROPRIATE FOR THE SITE. Density factors shall include whether the site is within an environmentally sensitive area, the type of sewage treatment available, the topography and drainage of the site, the capacity of transportation facilities serving the site, the proximity of the site to other existing services, and other relevant factors.

Policy 7.3: Factors used to determine preferred locations for MULTI-FAMILY DEVELOPMENTS may include: proximity to employment and shopping centers, access to major thoroughfares and transit services, the availability of public services and facilities, storm water management issues, and compatibility with adjacent areas and land uses.

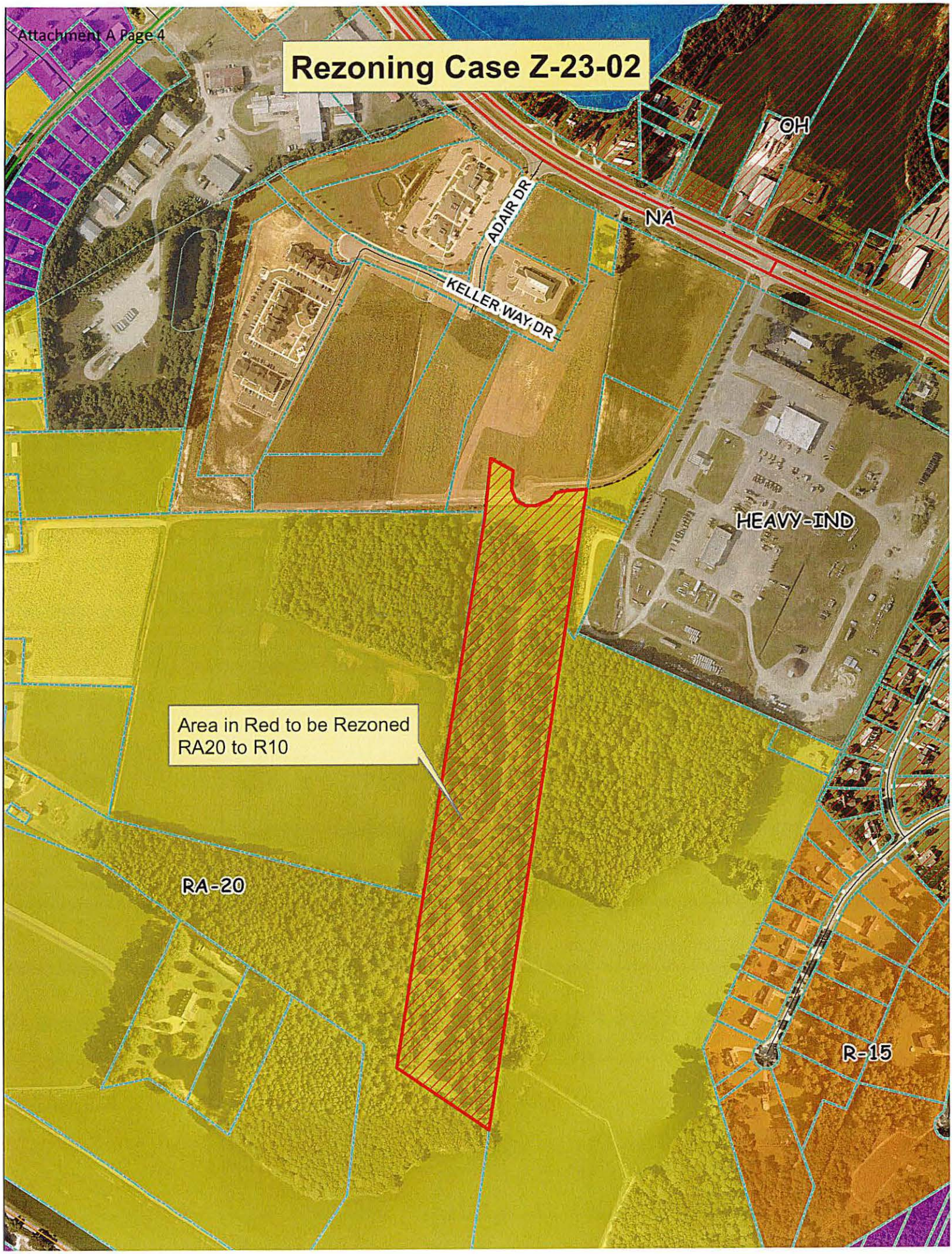
The property is within the following service areas:

Schools: Rosewood Elementary, Middle and High Schools
Water – Fork Sanitary District
Fire – Rosewood
EMS – Station 2
Transportation - MPO
Water Supply Watershed – Yes
Voluntary Agriculture District – No
Wetlands – No
Board of Commissioners District – 4
Noise Zone Area – No
SJAFB Airspace Area – Yes

Recommendation: The Wayne County Planning Board recommends approval of the rezoning request. NC General Statutes require that the Board consider the following items in making a decision on a rezoning:

1) Consistency with the Comprehensive Land Use Plan: Staff's opinion is that the request is consistent with Policies 1.9, 3.8, 4.4, 4.6 and 7.3 listed above considering that the proposed zoning is compatible with the Urban Transition area of the Land Use Plan and higher density and mixed use development are concentrated in this area with higher capacity road networks and existing infrastructure.

2) Consider if the request is reasonable and in the public interest: Staff's opinion is that the request is reasonable and in the public interest since the Land Use Plan identifies this area as an Urban Transition area and the adjacent property to the north is mixed use and higher density.


Rezoning Case Z-23-02
OH
NA
ADAIR DR
KELLER WAY DR
HEAVY-IND
Area in Red to be Rezoned
RA20 to R10
RA-20
R-15

WAYNECOUNTY
NORTH CAROLINA

Wayne County Citizens
Public Hearing Notice

The Wayne County Board of Adjustment will conduct public hearings on Tuesday, December 5, 2023 to consider two Special Use Permit requests. The hearings will be held during the 9am meeting in the Wayne County Commissioners Meeting Room, Wayne County Courthouse Annex, 224 East Walnut Street, Goldsboro, NC. The items to be discussed:

S-23-02 – Piney Grove Solar Energy Facility. Based on Section 5B of the Wayne County Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities, Renewable Energy Services has requested a Special Use Permit for a solar energy facility in the airspace control surface area of Seymour Johnson AFB. The property is located in New Hope Township in the vicinity of Piney Grove Church Road, St John Church Road, and Sutton Road and is listed in the Wayne County Tax Office as Parcel Number 3545084858, 3545177422, 3545152020, 3545127863, 3545355825, 3545559408, 3545432221, 3545348250, 3545324013, 3545409898, 3545626519, 3545726840, 3545713044, 3544796889, and 3545522420.

S-23-03 – Turtle Cove Solar Energy Facility. Based on Section 5B of the Wayne County Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities, Renewable Energy Services has requested a Special Use Permit for a solar energy facility in the airspace control surface area of Seymour Johnson AFB and RA 20 Zoning District. The property is located in Saulston Township in the vicinity of Hood Swamp Road, Water Shed Road, and La Grange Road and is listed in the Wayne County Tax Office as Parcel Number 3650023058, 3650046762, 3640933373, 3650202418, 3650311092, 3559094370, 3650140810, 3650042930, 3640956757, 3650222187, 3650330486, 3650171652, 3559483738, and 3650506214.

The public is invited to attend and speak at these hearings and/or submit any comments. Written comments before the meeting may be submitted to the Wayne County Planning Department, PO Box 227, Goldsboro, NC 27533 or berry.gray@waynegov.com. Questions may be directed to the Planning Department by calling 919-731-1650.

Carol Bowden
Clerk to the Board

MEMORANDUM

To: Wayne County Board of Adjustment

From: Berry Gray, Planning Director

Date: November 1, 2023

Re: Special Use Permit for Proposed Solar Energy Facility Located in the Airspace Control Surface Area for Seymour Johnson AFB

Item: Piney Grove Solar
Parcel ID#: 3545084858, 3545177422, 3545152020, 3545127863, 3545355825, 3545559408, 3545432221, 3545348250, 3545324013, 3545409898, 3545626519, 3545726840, 3545713044, 3544796889, 3545522420
Property Owner: Emmitt Hare, Mildred G Maxwell, Jo Ann Cruse Summerlin, Storage Properties Inc, William Earl Cruse, Edna Faye Cruse Williams, Jerry L Lynch, Angularem LLC, Jimmy Patrick Lynch, Diane H Lynch,
Developer: Renewable Energy Services
Surveyor/Engineer: Kimley Horn
New Hope Township
Piney Grove Church Road, St John Church Road, Sutton Road

Background: The Wayne County Planning Board approved the site plan for Piney Grove Solar Energy Facility at its October 2023 meeting. The site plan was reviewed by staff and has been determined to meet the minimum requirements of the Wayne County Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities.

Discussion: The proposed solar energy facility is a 67 MWac facility that will be located on 865 acres with 375 built upon acres. The site is currently agricultural and wooded. It is located in the vicinity of Piney Grove Church Road, St John Church Road and Sutton Road. The property is zoned Outer Horizontal Overlay District (OH). The site is located within the airspace control surface area for Seymour Johnson Air Force Base which requires Special Use approval by the Board of Adjustment. Surrounding land uses include a few residential lots, agriculture, vacant and wooded. The site plan meets the requirements as outlined in the Wayne County Ordinance Regulating Solar Energy Facilities for setbacks and fencing.

Seymour Johnson Air Force Base has reviewed the request and does have concerns regarding glare and that the project may create a hazard with aircraft bird strikes. If approved, SJAFB recommends the conditions outlined in the following Recommendation.

The property is within the following service areas:
Fire –Seven Springs and El Roy
EMS – Station 1 and 11
Water Supply Watershed – No
Voluntary Agriculture District – No
Wetlands – Yes but excluded from built area

Board of Commissioners District – 5 and 6

Section 5B of the Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities in Wayne County, NC requires that solar facilities within the Airspace Control Surface Area be considered by the Wayne County Board of Adjustment as a Special Use.

Sections 54.1 and 54.2 of the Wayne County Zoning Ordinance, as it relates to special uses, states that permission may be granted for the establishment of special uses as shown in the district regulations if the Board of Adjustment finds from the evidence produced after a study of the complete records that:

A. The proposed use does not affect adversely the general plans for physical development of the county and will not be contrary to the purposes stated in these regulations;

B. The proposed use will not adversely affect the health and safety of the county residents and will not be detrimental to the use or development of adjacent properties or other neighborhood uses;

C. The proposed use will not be affected adversely by existing uses, and will be placed on a lot of sufficient size to satisfy the space requirements of said use;

D. The proposed use will not constitute a nuisance or hazard because of the number of persons who will use such a facility, the vehicular movement or the noise or fume generation; and

E. The proposed use shall be subject to the minimum dimensional requirements of the district in which it is to be located, and shall conform to the off-street parking and loading regulations.

Additional Restrictions.

A. The Board of Adjustment may issue a special use permit if its findings are favorable. As an additional safeguard, the board may impose or require as conditions such additional restrictions and standards as may be necessary to protect the health and safety of the community, and to protect the value and use of property in the general neighborhood.

Recommendation: The Wayne County Board of Adjustment should consider a Public Hearing to receive comments on the proposed Special Use Permit Request and then consider taking action on the Special Use request. Staff recommends the following conditions of approval to address comments received from the Seymour Johnson Air Force Base, 4th Fighter Wing:

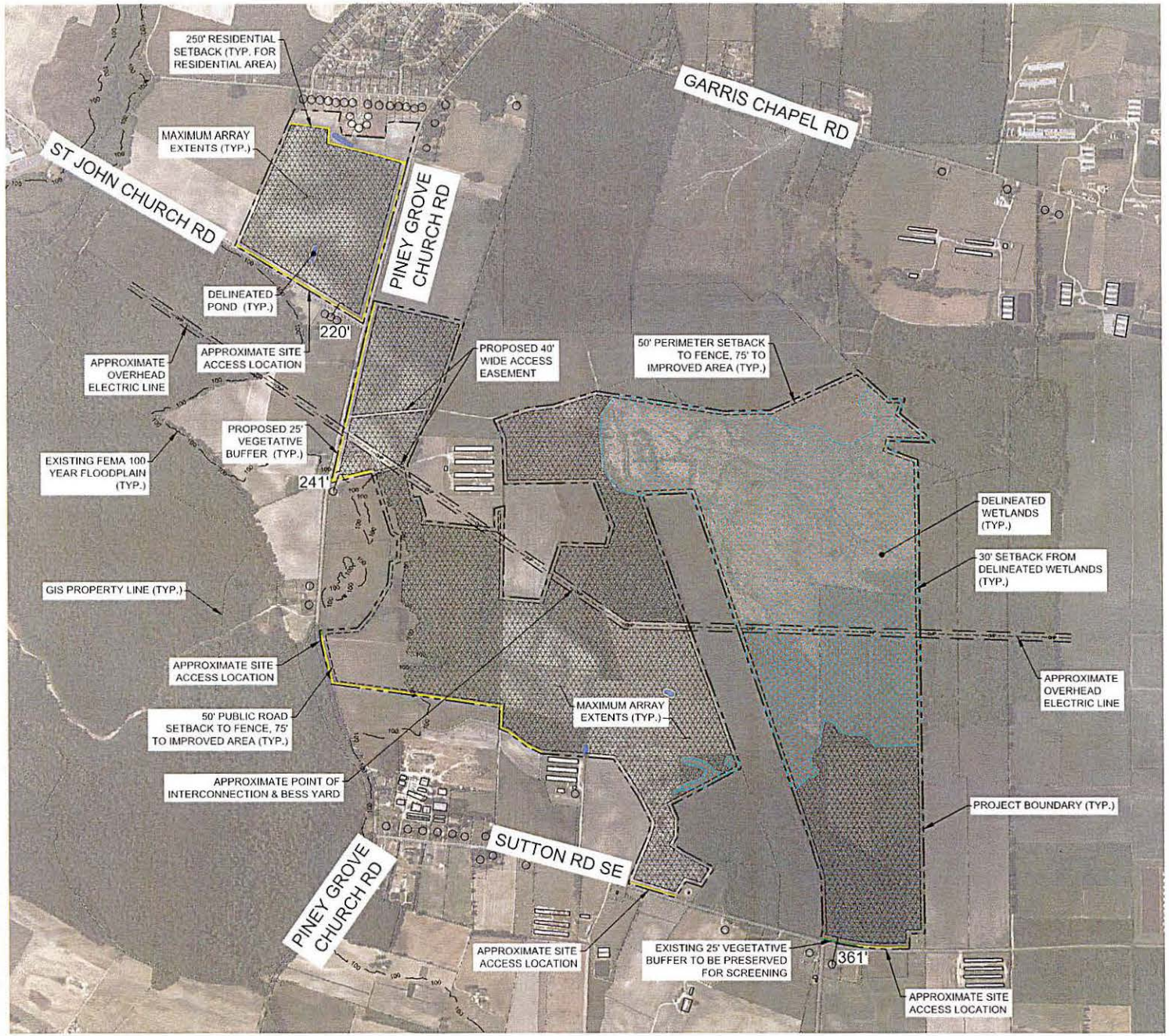
1) In comparing the yellow and green glare within the report, with and without anti-reflective coating (ARC) on the smooth glass photovoltaic solar panels, we concluded that the ARC panels significantly reduced the amount of yellow glare. Therefore, we highly recommend such materials be installed to reduce the glint and glare exposed to the Seymour Johnson AFB and transient aircrews;
2) The project owner should partner with the United States Department of Agriculture (USDA) representatives at Seymour Johnson AFT to allow USDA access to the project to observe hazardous wildlife conditions and advise on mitigation strategies to reduce bird attractants; and

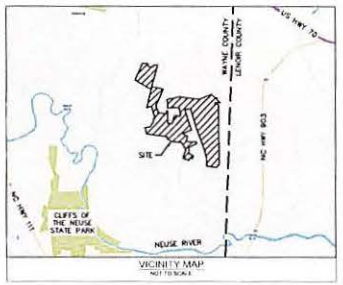
3) The project owner should implement long term wildlife mitigation efforts on-site as part of the development plan;

Supporting documents attached as evidence:

Area Map
Approved Site Plan
Special Use Permit Application
Findings of Fact Response
Buffer Plan
Decommissioning Plan
Health and Safety Assessment
Property Impact Study
Landscape Plan
Comments from Seymour Johnson AFB


Piney Grove Solar S-23-02
St John Church Rd
Piney Grove Church Rd
OH
Text
Sutton Rd
NA
LYNCH RD
Areas in yellow denote solar facility location.





VICINITY MAP
NOT TO SCALE

SITE DATA TABLE	
PROJECT AREA	865+/- ACRES
PARCEL ID #	3545084858, 3545177422, 3545152529, 3545127863, 3545355825, 3545334658, 3545432227, 3545348250, 3545326273, 3545409846, 3545439578, 3545728940, 3545715044, 3544146869, 3545522402
ZONING JURISDICTION	WAYNE COUNTY
CURRENT ZONING	OH (OUTER HORIZONTAL HEIGHT DISTRICT)
ADJACENT PROPERTY ZONING	OH (OUTER HORIZONTAL HEIGHT DISTRICT)
CURRENT LAND USE	AGRICULTURAL / FORESTED
PROPOSED LAND USE	SOLAR ENERGY
REQUIRED SETBACKS	PERIMETER: 50' TO IMPROVED AREA PUBLIC ROADWAY: 80' TO IMPROVED AREA ADJACENT RESIDENTIAL/CHURCH: 100' FROM PRINCIPAL BUILDING
PROPOSED SETBACKS	PERIMETER: 50' TO FENCE, 75' TO IMPROVED AREA PUBLIC ROADWAY: 50' TO FENCE, 75' TO IMPROVED AREA ADJACENT RESIDENTIAL/CHURCH: 250' FROM PRINCIPAL BUILDING TO IMPROVED AREA IN A RESIDENTIAL AREA
LANDSCAPE REQUIREMENTS	25' WHERE ADJOINING RESIDENTIAL AND ALONG ROADWAYS
PROPOSED LANDSCAPE BUFFER	25' WHERE ADJOINING RESIDENTIAL AND ALONG ROADWAYS

LEGEND

- PROJECT BOUNDARY
- GIS PROPERTY LINE
- PERIMETER SETBACK
- APPROXIMATE ELECTRIC EASEMENT
- APPROXIMATE EXISTING OVERHEAD TRANSMISSION LINE
- 100 — FEMA 100 YEAR FLOODPLAIN
- DELINEATED WETLANDS
- DELINEATED PONDS
- MAXIMUM ARRAY EXTENTS
- EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
- PROPOSED VEGETATIVE BUFFER
- RESIDENTIAL BUILDING
- INDUSTRIAL BUILDING

NOTES

1. PROJECT BOUNDARY SHOWN IS BASED ON FILES RECEIVED FROM RENEWABLE ENERGY SERVICES, LLC ON 08/22/2023
2. PARCEL BOUNDARIES SHOWN ARE BASED ON PUBLICLY AVAILABLE NORTH CAROLINA GIS DATA ACCESSED ON 08/24/2023
3. ALL EXISTING TRANSMISSION LINES SHOWN ARE APPROXIMATE LOCATIONS BASED ON PUBLICLY AVAILABLE GIS DATA ACCESSED ON 08/24/2023
4. 100 YR FLOODPLAIN LINEWORK IS BASED ON PUBLICLY AVAILABLE FEMA GIS DATA ACCESSED ON 08/24/2023
5. WETLANDS AND WATERS ARE BASED ON ENVIRONMENTAL FIELD DELINEATION LINEWORK PROVIDED BY RENEWABLE ENERGY SERVICES, LLC DATED 08/24/2023
6. THE LOCATION OF PROPOSED EQUIPMENT INCLUDING BUT NOT LIMITED TO ACCESS LOCATIONS, FENCING, SOLAR ARRAY RACKING, ELECTRICAL EQUIPMENT, VEGETATIVE BUFFER, AND OVERHEAD POLES & LINE, ETC. SHOWN ARE APPROXIMATE AND MAY BE SUBJECT TO MODIFICATIONS DUE TO SITE CONDITIONS, ADDITIONAL PERMITTING REQUIREMENTS, DETAILED DESIGN, EQUIPMENT AND/OR OTHER CONSTRAINTS.
7. THIS PLAN IS PRELIMINARY AND WILL NOT BE RELEASED FOR CONSTRUCTION.
8. THE POINT OF INTERCONNECTION IS APPROXIMATE AND MAY INCLUDE AN ELECTRICAL SUBSTATION. THE POINT OF INTERCONNECTION MAY ALSO INCLUDE A BATTERY ENERGY STORAGE SYSTEM (BESS).
9. THE PROJECT SITE WILL BE ENCLOSED BY FENCING IN COMPLIANCE WITH THE NATIONAL ELECTRIC CODE.
10. ACCESS POINTS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SURVEYED TOPOGRAPHY, UTILITIES, NCDOT PERMITTING, OR ENVIRONMENTAL FEATURES.
11. APPROVAL OF THIS PLAN ESTABLISHES A VESTED RIGHT UNLESS TERMINATED AT AN EARLIER DATE. THE ZONING VESTED RIGHT SHALL BE VALID UNTIL 10/8/28.
12. ON SITE POWER LINES TO BE TAKEN SOLAR PANELS AND INVERTERS WILL BE PLACED UNDERGROUND OR ABOVE GROUND, SUBJECT TO FINAL DESIGN.

NORTH

GRAPHIC SCALE IN FEET
0 300 600 1200

Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919-677-2000 FAX: 919-677-2050
WWW.KIMLEY-HORN.COM
NC FIRM # P-0102

PRELIMINARY
NOT FOR CONSTRUCTION

KHA PROJECT 019458096	
DATE	10/09/2023
SCALE	AS SHOWN
DESIGNED BY	SHF
DRAWN BY	SSF
CHECKED BY	JS

PINEY GROVE SOLAR
WAYNE COUNTY NORTH CAROLINA

ZONING SITE PLAN

SHEET NUMBER
EX1.0

Wayne County, North Carolina

Petition for Special Use Permit

Date Sep 14, 2023

Applicant Name: Piney Grove Solar, LLC Telephone (919) 637-1139
Address: 5315 Highgate Dr, Suite 202, Durham, NC 27713

Property Owner Name: See "Piney Grove Solar Landowner Info Table" Telephone: ""
Address: ""

1. Property address or location: Off SE Sutton Road & Piney Grove Church Road; Exact 911 address to be finalized closer to construction

2. Zoning classification: Outer Horizontal Area (OH) of Seymour Johnson AFB

3. Requested special use permit: Solar Energy Facility in OH Zoning

4. Property legal description (metes and bounds, or if subdivided, lot, block, subdivision plat book and page number): Legal description of the facility to be established by an ALTA Survey closer to construction

5. Owner's intended use of the property in question if it is reclassified: Solar Energy Facility

6. Explain in detail why you think this petition should be approved: See "Piney Grove Solar_SUP_Findings of Fact vF.pdf"

7. Name and addresses of owners whose property abuts the property in question: See "Piney Grove Solar Adjoiner List.xlsx"

I certify that I, the applicant, have the consent of the owner and act on his behalf in applying for a Special Use Permit.

Date: Sep 14, 2023 Signature: _____
Applicant

Report of the Zoning Enforcement Officer on the property in question: _____

Fee Paid $ _____ Date _____

Date Public Hearing Scheduled _____ Time _____

Dates Public Hearing Advertised _____

Petition: Approved _____ Petition No. _____
Denied

Piney Grove Solar_Wayne County NC_Special Use Permit Application (Draft)

Final Audit Report 2023-09-14

Created:	2023-09-14
By:	Erika Shinpaugh (eshinpaugh@r-e-services.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAA-Bcp4JjElf--Xj-QQKILtwONFqLPrPXj

"Piney Grove Solar_Wayne County NC_Special Use Permit Application (Draft)" History

Document created by Erika Shinpaugh (eshinpaugh@r-e-services.com)
2023-09-14 - 5:16:00 PM GMT

Document emailed to Matt Delafield (mdelafield@r-e-services.com) for signature
2023-09-14 - 5:18:53 PM GMT

Email viewed by Matt Delafield (mdelafield@r-e-services.com)
2023-09-14 - 5:22:42 PM GMT

Document e-signed by Matt Delafield (mdelafield@r-e-services.com)
Signature Date: 2023-09-14 - 5:22:48 PM GMT - Time Source: server

Agreement completed.
2023-09-14 - 5:22:48 PM GMT

Piney Grove Solar – Special Use Permit Findings of Fact

09/15/2023

1. **The proposed use does not affect adversely the general plans for physical development of the county and will not be contrary to the purposes stated in these regulations:**

Piney Grove Solar is in general conformity with "The Wayne County Comprehensive Plan" (WCCP 2009). The Growth Strategy Map below shows that the project site, the location of which is marked in red, falls predominantly within the Rural Area of the County. Solar is a good partner to rural adjacent uses as it is not a permanent development, allowing the land to be returned to agriculture or timber at the end of facility's usable life, after decommissioning has occurred (WCCP 2009 Policy 4.1). Additionally, allowing the land to lay fallow with only native grasses growing on it, allows the fertility of the soil to be restored over time, preserving the long-term productivity of the land as farmland (WCCP 2009 Policy 4.1). Solar development onsite will occur at an appropriate density for surrounding uses, with only 30 - 40% of the site being covered by modules, and the majority the remaining land left as open space (WCCP 2009 Policy 4.6). This practice of spacing arrays out is required to avoid them shading one another as the sun moves to different angles in the sky throughout the day, which would reduce electricity production. Additionally, other urban services or features, such as sewer service, street lighting, sidewalks, or increased traffic capacity will not experience increased demand from the solar facility, further maintaining the rural nature of the area (WCCP 2009 Policy 4.1, 4.2, 4.3, 4.4, 4.5).

Additionally, it is a common concern that solar is or will take a large portion of agricultural land out of use in the county & state. As the "North Carolina Solar Land Use and Agricultural" (2022) report, which will be entered into the record at public hearing, points out, solar PV currently only occupies 0.12% of total land area in the state, and only 0.28% of agricultural land. To emphasize this, this is a total of less than 1/3 of 1% of agricultural land that is taken up by solar farms. Transmission-scale projects such as Piney Grove Solar can only be sited where transmission line access is available. With only a handful of transmission lines running through each county, solar development is naturally constrained to corridors of parcels with transmission lines running across them and the parcels that adjoin them. This means that the vast majority of the county will not qualify for similar solar facilities to be built, and individual solar development will not deter overall goals for rural and agricultural preservation in the county (WCCP 2009 Policy 4.1). Additionally, solar development is further constrained by which transmission lines have the capacity to take on the additional load created by the solar facility. Duke Energy Progress, which owns and operates the transmission lines in Wayne County, has strict regulations which safeguard lines from becoming over-constrained. Although lines can be upgraded, this process is very expensive, incentivizing projects to spread throughout the grid and minimizing excessive solar burden in specific counties. For these reasons, and in line with ratified, bi-partisan-supported House Bill 951, solar can be considered as one of the highest and best uses for the parcels optioned to Piney Grove Solar. Since Duke Energy has been legally mandated to decarbonize its grid, it must move towards diversified energy sources including

solar, resulting in county & state benefits including increased grid stability and reliability, as well as decreasing cost to ratepayers over time.

Additionally, the project borders a Conservation Area on the Growth Strategy Map. Piney Grove Solar will be a good fit for this area as it will avoid development in any 100-year floodplain and will go through a required stormwater permitting process with NC DEQ, resulting in any necessary stormwater features being installed and maintained. These features will include preserving ditches and riparian buffers. Additional control measures that may be installed include, but are not limited to, sediment basins, silt fencing, enhanced drainage swales, and bioretention areas. These closely regulated measures control runoff, minimizing any potential impact to adjacent properties and the nearby Walnut Creek and Neuse River. This is harmonious with the WCCP 2009 as it meets the goal of conservation in this area through carefully regulated protection measures and avoiding direct development in the most environmentally sensitive of areas.

Finally, the project will provide economic benefit and contribute significantly to the county tax base without drawing on public resources provided by the county such as sewage services, emergency services, or schools (WCCP 2009 Policy 2.5). In fact, the project will encourage a diverse tax base in the county while providing public funding for the county including for infrastructure improvements, educational programs, and quality of life and beautification efforts such as historical preservation and public parks (WCCP 2009 Policy 2.1, 2.3, 2.4, 2.9, 2.10, 2.12). Additionally, Piney Grove Solar will take approximately one year to construct, and during that time, an estimated 150 construction workers will work on the facility. In addition to the construction labor, the extended construction schedule will foster significant spending in Wayne County, increasing the local economy (WCCP 2009 Policy 2.1 & 2.8). Piney Grove Solar is committed to working with the Wayne County Development Alliance and the Wayne County Chamber of Commerce to ensure local contractors have the opportunity to bid on work throughout the construction process, including in the fuel, equipment maintenance and parts, grading and site preparation, fencing, solid waste, lodging, food and beverage, and landscape materials industries.

2. **The proposed use will not adversely affect the health and safety of the county residents and will not be detrimental to the use or development of adjacent properties or other neighborhood uses:**

When completed, the Piney Grove Solar facility will be built in accordance with the building codes of North Carolina and Wayne County, using UL approved equipment. The system will be built to the wind rating of the region. There will be a perimeter fence securing the facility. Solar panels have been studied extensively by the Environmental Protection Agency (EPA) and the North Carolina State Clean Energy Center and have been deemed landfill safe due to the absence of hazardous materials. The electric and magnetic fields (EMF) from facilities have also been measured and have been deemed indistinguishable from Earth's magnetic fields at the project fence line. If the final site design includes batteries, adequate design will be provided to ensure all local, state and federal requirements regulating outdoor battery storage have been met.

Several hundred solar farms have been approved in North Carolina after the local county or municipality found, based on evidence, that health & safety standards were met, and there is no

evidence, based on constructed solar farms, that the finding was incorrect. A Health & Safety Assessment Report was prepared for this project by a licensed North Carolina engineer, in which additional information and evidence is provided showing that the operation of the facility will not result in any negative impacts to public health or safety for residents of Wayne County. This report is included as a part of this application.

A property values impact study by Kirkland Appraisals, a licensed North Carolina appraiser, was conducted for this project. It is included in this application and will be entered into the record at the applicant's public hearing. The impact study was conducted using the matched-pairs appraisal analysis technique and found that there is no measurable difference in price or time on the market for properties adjoining a solar facility compared with similar properties not adjacent to solar farms, provided that there are sufficient setbacks and buffering as identified in the analysis. Solar facilities do not exhibit any typical public nuisance characteristics that would harm adjacent property values since they do not produce emissions, noise, glare, hazardous chemicals or measurable traffic. These data and facts demonstrate that the facility will not substantially injure the value of adjoining or abutting properties and is therefore a harmonious use for existing adjoining uses or possible future development. The applicant will also present evidence at the hearing that NC Courts have determined that subjective feelings of how something looks is not evidence that it is inharmonious with an area.

3. **The proposed use will not be affected adversely by existing uses, and will be placed on a lot of sufficient size to satisfy the space requirements of said use:**

Piney Grove Solar will not affect, nor be affected by, existing uses. The solar energy system will be remotely monitored, with no full-time personnel onsite. Therefore, no adjoining or nearby uses, including subdivisions, agriculture, animal husbandry, or similar uses, will cause nuisances that would detract from the ability of solar facility to operate. Similarly, since the facility will be completely enclosed by a perimeter security fence, the activities occurring on adjoining parcels will not have the ability to physically interfere with the facility.

Although the facility has 865 acres under site control, modules are likely to only cover about 350 to 400 acres of the site, with a ground coverage ratio of between 30 - 40%. Additionally, over 90% of the site will be covered with native grasses and vegetation, including underneath the arrays. The project will also meet or exceed all setbacks required by the county from adjoining property lines and uses. For these reasons, there will plenty of open space within the site and between adjacent uses.

4. **The proposed use will not constitute a nuisance or hazard because of the number of persons who will use such a facility, the vehicular movement or the noise or fume generation:**

During the life of the facility, Piney Grove Solar will be operated and maintained by a licensed and insured management firm in accordance with the Landscaping Maintenance Plan submitted as a part of this application. The operations and maintenance (O&M) provider will be responsible for overseeing the maintenance and upkeep of all elements of the facility, which include, but are not limited to, driveway/roads, stormwater management, landscaping, fencing, electrical connections, modules, inverters, and transformers. There will be no full-time on-site

personnel, negating any concerns about the number of persons onsite, and instead the Project and associated electrical equipment will be remotely operated and monitored 24/7 via supervisory control and data acquisition (SCADA) equipment. A phone number will be posted at the site entrance to enable community members to contact the site manager if they have any questions or concerns about the facility.

Additionally, long-term impact to roads or traffic are negligible from the operation of the facility. Piney Grove Solar will take any steps needed to maintain and repair roads both during and after construction if any issues occur. Temporary traffic control measures will also be implemented during construction if needed. Once constructed, internal access roads will be utilized as much as possible to minimize impacts to neighbors and the local road network. During the life of the facility, the average solar farm generates one or two vehicle trips per month, as contrasted with an average single-family home that generates 9.52 vehicle trips per day (Institute of Transportation Engineers, Trip Generation Manual, 9th ed.).

Similarly, one home (or a group of new homes, such as a new subdivision) would generate traffic and suburban noise in the form of lawn mowers, leaf blowers, and common noises created whenever people gather. Farming and timber uses could cause noises via farming equipment or gunshots. In contrast, the inverters are the only components of a solar farm that produce a noise. When standing directly next to one you might hear a hum similar to an air conditioner. From outside the facility, they are impossible to hear over ambient noises created by wind, birds, background traffic, etc. For this reason, there will be no noise-related nuisances created by the facility, and other noisier uses will be precluded.

Finally, solar farms do not emit any light and only operate during the day. There will be no lighting at night. Additionally, the facility produces no odors, and use as a solar farm precludes other uses associated with odors such as hog or turkey houses. In sum, there will be no impact to neighbors from the operation of the facility, as there will be no personnel onsite, no increased traffic generation, and no noise, light, or odor generation.

5. **The proposed use shall be subject to the minimum dimensional requirements of the district in which it is to be located, and shall conform to the off-street parking and loading regulations:**

Piney Grove Solar will meet all dimensional & design requirements of a Solar Energy Facility that falls within the Outer Horizontal Area (OH), one of the Seymour Johnson AFB Airspace Control Surfaces as defined in the 2011 Air Installation Compatible Use Zone (AICUZ) report or subsequent reports. The facility will provide any studies requested during correspondence with the Air Force Base. Additionally, pre-existing vegetation will be maintained or a landscape buffer will be installed with a minimum width of twenty-five feet (25 ft.) where the project directly adjoins public roadways or residential parcels.

The facility will also be enclosed by a security fence that is at least six feet (6 ft.) in height, and the project is exploring the possibility of using a wild-life friendly, fixed-knot fence that is at least seven feet (7 ft.) in height as an alternative option. Finally, the facility proposes setbacks of at least 50 feet from roadways and adjoining property lines to the facility fence line, unless where adjoining residential properties in a residential area, in which case the project proposes

setbacks of at least 250 ft from the principal building to the improved areas, starting with internal access roads. These design specifications meet and generally exceed the requirements set by the county.

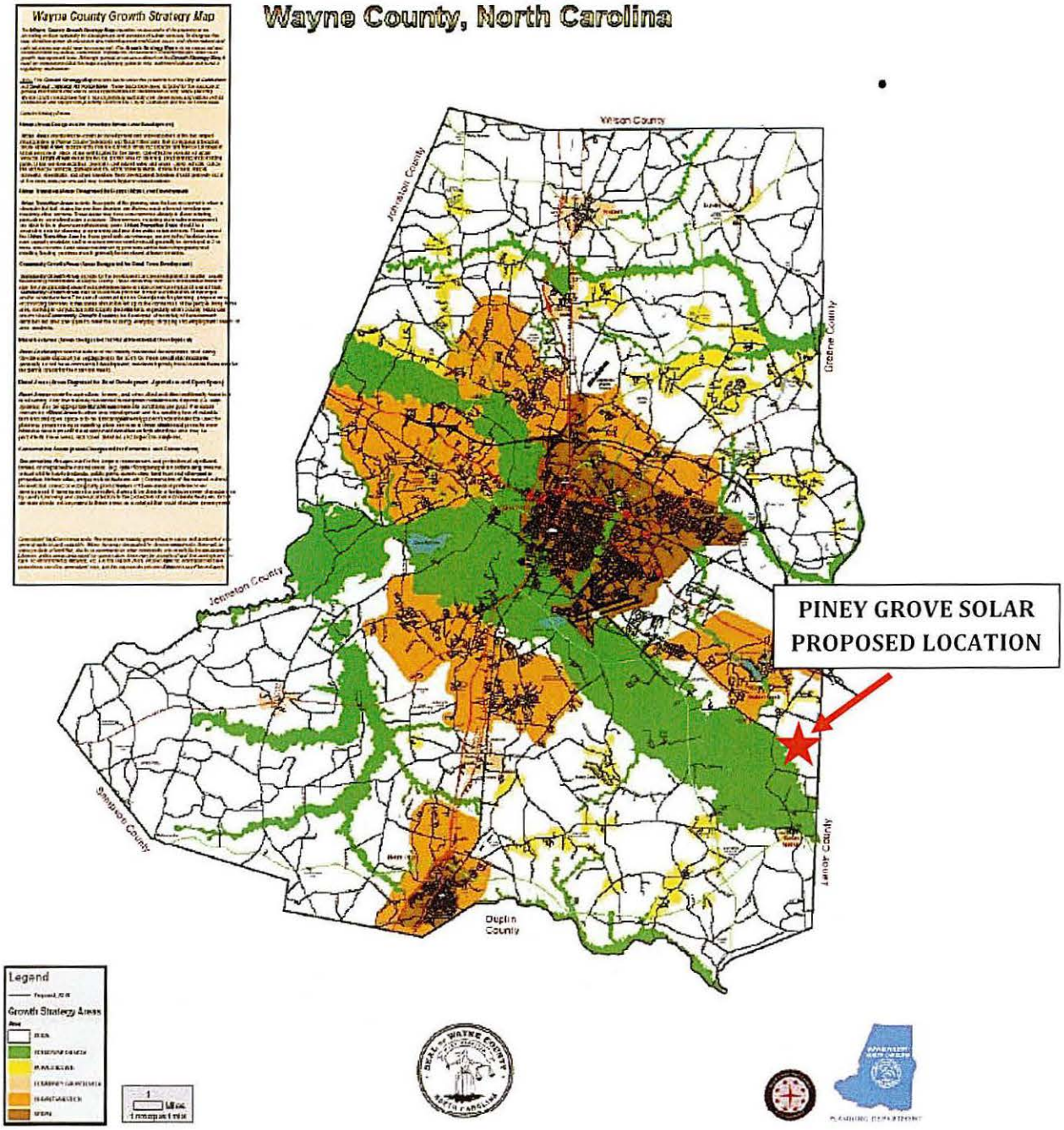
There will be no off-street parking or loading required. The security fence around the perimeter of the property will be the first improvement constructed, after which will come the internal access road. Designated internal loading and equipment pads off this access road will be denoted as part of the engineering process, where any unloading of equipment for the facility will occur.

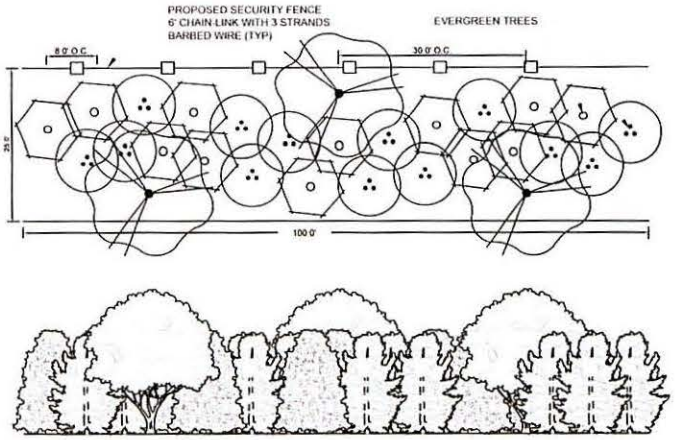
As a part of its special use permit application, the proposed facility will submit all required deliverables defined in the "Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities in Wayne County NC" (Amended, 2016), as well as few additional volunteered deliverables. Piney Grove Solar will submit a Site Plan, Decommissioning Plan, and Landscape Buffer Visualization. The Site Plan will show an overview of the project design including the setbacks, panel sizes, and location of property lines, buildings and road right of ways, as outlined by the ordinance. The Decommissioning Plan will define the decommissioning process, how often the plan will be updated, and the decommissioning cost estimate. The Landscape Buffer Visualization will outline the layout of all proposed landscaping, with property buffers between the facility fence line and bordering residential uses and public roads, and the scheduled maintenance of the property. The Landscape Buffer Visualization will also provide visual simulations of the proposed vegetative buffers.

ZX

Growth Strategy Areas

Wayne County, North Carolina





GRAPHIC SCALE IN FEET
0 10 20 40

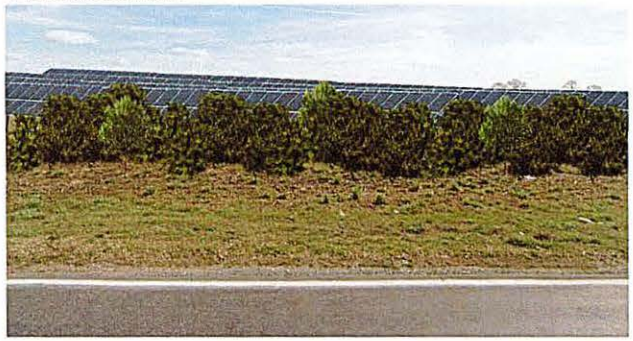
PLANT SCHEDULE

TREES		BOTANICAL NAME	COMMON NAME	SPACING	SIZE
	12	PRUNUS CAROLINIANA	CAROLINA CHERRY LAUREL	8' O.C.	2" CAL, 6' MIN. HT.
	3	QUERCUS VIRGINIANA	SOUTHERN LIVE OAK	AS SHOWN	2" CAL, 8-10' HT.
	13	VIBURNUM AWABUKI 'CHINDO'	CHINDO SWEET VIBURNUM	8' O.C.	2" CAL, 6' MIN. HT.

GENERAL NOTES:

1. THE PROPOSED VEGETATIVE BUFFER SHOWN IN THIS EXHIBIT IS BASED ON SECTION 18-195 IN THE WAYNE COUNTY, NC ZONING ORDINANCE. ALL SOLAR ENERGY FACILITIES LOCATED IN A RESIDENTIAL AREA SHALL HAVE A MINIMUM LANDSCAPE BUFFER OF 25 FEET. THE BUFFER SHALL CONTAIN EVERGREEN TREES OR SHRUBS PLANTED NO MORE THAN 8 FEET APART AND AT LEAST 4 FEET TALL AT TIME OF PLANTING. THE BUFFER SHALL OBTAIN A HEIGHT OF 10 FEET WITHIN 3 GROWING SEASONS. THE TREES OR SHRUBS MAY BE TRIMMED BUT NO LOWER THAN A HEIGHT OF 10 FEET.
2. THE DESIGN OF THE SOLAR ENERGY FACILITIES BUFFERS SHALL USE MATERIALS, COLORS, TEXTURES, SCREENING AND LANDSCAPING, THAT WILL BLEND THE FACILITY INTO THE NATURAL SETTING AND EXISTING ENVIRONMENT.
3. THE PURPOSE OF THIS ILLUSTRATION IS TO DEPICT AN ESTIMATE OF THE OPAQUENESS, LAYERING, AND SIZE OF PROPOSED VEGETATION AT 1-5 YEARS OF GROWTH FROM PLANTING.
4. PROPOSED BUFFER PLANTINGS ALONG ROAD FRONTAGE TO BE LOCATED SO AS TO NOT CONFLICT WITH EXISTING OVERHEAD POWERLINES.

1-YEAR GROWTH



3-YEAR GROWTH



5-YEAR GROWTH



LANDSCAPE BUFFER
September 2023

Piney Grove Solar
WAYNE COUNTY, NORTH CAROLINA

Kimley»Horn

Kimley»Horn

PINEY GROVE SOLAR DECOMMISSIONING PLAN SEPTEMBER 2023

Purpose

This decommissioning plan is provided by Piney Grove Solar, LLC (the "Project Company") and will detail the projected decommissioning demands associated with the proposed project.

The purpose of this decommissioning plan is to provide procedures and an opinion of probable construction cost for partial or full closure of the solar facility. A decommissioning plan and estimate are being provided to satisfy the specific guidelines set in the Ordinance Regulating The Operation and Maintenance Of Solar Energy Facilities In Wayne County NC Section Nine, Page 4, Requirement B. This decommissioning plan details general provisions for facility deconstruction and site restoration. This decommissioning plan shall take effect upon facility abandonment, discontinuation of operation, or expiration of the use permit as defined by Wayne County Code.

Site Location

Piney Grove Solar proposes to build a photovoltaic (PV) solar facility ("Solar Facility") in Wayne County, NC. The Facility is located on Piney Grove Church Road and within tax parcel identification numbers 3545084858, 3545177422, 3545152020, 3545127863, 3545355825, 3545559408, 3545432221, 3545348250, 3545324013, 3545409898, 3545626519, 3545726840, 3545713044, 3544796889, 3545522420 ("Property").

Anticipated Service Life of the Project

At the end of its project life, the Solar Facility shall be decommissioned in accordance with this Decommissioning Plan ("Plan"), restoring the site to as close to its agreed-upon post-decommissioned state as practicably possible upon expiration or termination of the Power Purchase Agreement. The Solar Facility carries an expected useful lifetime of 40 years, including potential replacement or upgrades to equipment during that time.

Decommissioning responsibilities include the removal of perimeter fences, any concrete or steel foundations, all metal structures (mounting racks and trackers), all photovoltaic (PV) modules, aboveground and underground cables, transformers, inverters, fans, switch boxes, substation and otherwise restoring the premises to its original condition or mutually-agreed upon state. Other Plan activities include the management of materials and waste, associated erosion & sedimentation control, and a decommissioning fund agreement overview.

Decommissioning Risk Over the Lifecycle of a Project

The probability of an event that would lead to abandonment or long-term interruption is extremely low during the first 25 to 30 years of the Project life. Accordingly, the risk of decommissioning the Project is extremely low during this time frame because:

- Project owners have sophisticated financing structures that allow the lender or tax equity partner to step in and rectify the event that may lead to abandonment.
- Most critical solar components have original equipment manufacturer (OEM) warranties with long terms that include labor and parts. A warranty is an agreement or guarantee outlined by a manufacturer to a customer that defines performance requirements for a product or service. Warranties give customers a form of insurance if the purchased product or service does not adhere to quality standards. These warranties assure the Project owner, financing parties, and other stakeholders, that equipment will perform as expected which minimizes the risk of a decommissioning event. Average warranty lengths for critical solar components range from 5 to 10 years, with production warranties on solar panels extending to 25 years.
- Solar projects consist of many networked components designed to absorb solar energy and convert to electrical energy. The failure of any single component will not result in a substantial reduction of energy generation that could lead to a decommissioning event.
- Solar projects are required to maintain replacement value property damage insurance coverage and business interruption insurance coverage. Business interruption insurance covers the loss of income that a business suffers after a disaster or equipment failure. Typical solar business interruption insurance covers income loss for twelve months from the date of the event triggering the loss.
- The replacement costs of solar components will typically decline over time, and accordingly, costs to replace failed or damaged equipment after lapsed OEM warranties will not create large financial hurdles for the Project.
- In the early stages of the Project, the resale value of the equipment is significantly higher than the decommissioning costs, resulting in a net positive (revenue).

Considering the reasons stated above, a decommissioning bond early in the life of a solar project life is not required to assure the coverage facility removal and site restoration costs.

Solar power is an increasingly popular form of renewable energy around the world and as an alternative to the burning of fossil fuels, solar ranks alongside wind and hydropower as essential energy options for the future of the planet. Solar also offers the additional benefit of being easier to build, operate, and decommission with minimal environmental risks. Recent rises in popularity and use can be linked to lower installation and operation costs and it is expected that this pattern will continue, further reducing the risk of a decommissioning event.

Decommissioning Risks Over Time

As previously noted, the probability of a decommissioning event that would lead to abandonment or long-term financial interruption is extremely low during the first 15 to 20 years of the Project life and

accordingly, the financial risk to decommission the Project is also extremely low. A risk analysis approach is presented here for informational purposes only and has not been considered in the decommissioning cost estimates present in this Plan.

It is important to note that there are two aspects to consider when evaluating the risk for decommissioning the Project:

1. The risk of the need to decommission the Project as a whole (Project termination risk), and
2. The risk of failing to recuperate the cost of the decommissioning activities (decommissioning funding).

The most important concern for the Wayne County is the ability to recuperate the cost of decommissioning and restoration of the land to pre-Project conditions. The presence of a Power Purchase Agreement (PPA) in the first 40 years of the Project makes the likelihood of decommissioning very low during that time.

Risks over the expected life of the project include, but were not limited to:

- Years 1-5 – Minimal Project termination or financial risk due to presence of PPA with guarantee to purchase power, resale of value components, component warranties, value of facility.
- Years 5-15 – Similar consideration of previous period, except minimal increased financial risk due to the decrease in resale value of used components and rise in technological improvements of new equipment in market.
- Years 15-25 – Similar consideration of previous period, with slightly increased risk as warranties start to expire. Value of equipment is still substantial but decreasing.
- Years 25-30 – Similar consideration of previous period, warranties continue to expire; value of equipment diminishes with age and technological improvements in market.
- Years 30-40 – PPA expires, Project termination and funding risks increase, value of equipment diminishes, and technological improvements in market. A rise in salvage value of removed equipment due to diminishing natural resources and improvements in the efficiency of recycling/extraction technologies will offset the cost of decommissioning.

Commencement of Decommissioning

This Plan assumes that the Facility will be decommissioned under any of the following conditions:

1. The land lease (including the exercise of any extension options) ends and will either not be renewed or a new lease will not be entered into for the Project.
2. The system does not produce power for sale for a consecutive 12-month period, except in the instance of a force majeure event in which the Project is being repaired and/or restored.
3. The system is damaged and will not be repaired or replaced.

Removal of Nonutility Owned Equipment

To decommission the Solar Facility, the Project will include at a minimum:

- Disconnection from the utility power grid
- Removal of all Facility components: panels, inverters, wire, cable, combiner boxes, transformers, racks, trackers, tracker motors, weather monitoring, control system apparatus, etc.
- Removal of all non-utility owned equipment (at point of interconnection), conduits, structures, fencing, and foundations to a depth of at least three feet below grade.
- In order to minimize impacts to vegetated areas and prevent erosion at the time of decommissioning, it is not anticipated that the site will be re-graded.
- Plant vegetation suitable for the location, native to the region, and which matches surrounding vegetation.

The owner of the leased property may request in writing for certain items to remain, e.g., access roads.

This decommissioning plan is based on current best management practices and procedures. This Plan may be subject to revision based on new standards and emergent best management practices at the time of decommissioning. Permits will be obtained as required and notification will be given to necessary stakeholders prior to decommissioning.

The decommissioning process will maximize the recycling, reuse and salvage of applicable facility components, which are outlined in the opinion of probable construction costs. Based on the extent of decommissioning, prior to beginning construction activities, the developer will submit applicable demolition and construction plans and permit applications which will outline the schedule and extents of demolition. Decommissioning activities will not begin prior to issuance of approved permits by local regulatory agencies with appropriate jurisdiction.

Restoration of Property

At the time of decommissioning, the Project Company will restore the Solar Facility to a meadow-like or other agreed upon condition. All waste and excess materials will be disposed of in accordance with municipal, provincial, and federal regulations. Waste that can be recycled under municipal programs will be recycled accordingly. Provided, however, the Project Company shall not be required to replace any structures that were removed to build the Solar Facility.

The restoration will consist of de-compaction of the topsoil by disking or tilling and re-vegetation of the property. At the end of the project the area will be seeded and fertilized with native vegetation as needed to return the site to as close as practicable to original or initially agreed-upon condition. Landscaping and entrance will remain following site restoration. The future use of the land will be determined at the time of decommissioning. Deciding factors will be influenced by County land use and comprehensive plans and regulations at such time in the future.

The developer will coordinate with the County to monitor vegetation and drainage following restoration until permanent vegetation is established. Erosion and sediment control, re-seeding, soil stabilization, weed control and fertilization will be provided by the developer as needed until the site is stabilized and approved to be completed by the County.

Upon completion of the site restoration, a final report of activities will be submitted to the County documenting the process and results.

Time Period to Complete Decommissioning

The Project Company will have twelve (12) months from the date decommissioning commences to complete decommissioning. Provided, however, the Project Company shall be able to request an extension of an additional six (6) month intervals if it is in good faith diligently decommissioning and is delayed due to weather conditions or other items outside its control.

Party Responsible for Decommissioning

The Project Company is responsible for this decommissioning, provided however that the Project Company may contract with a third-party to perform the decommissioning on its behalf. Nothing in this plan relieves any obligation that the real estate property owner may have to remove the Facility as outlined in the Conditional Use Permit in the event the operator of the Facility does not fulfill this obligation.

Decommissioning Cost Estimate and Bonding

An engineer's opinion of probable construction cost and analysis of material salvage value were prepared as part of this decommissioning plan. Exhibit A summarizes the probable costs and salvage values associated with decommissioning. Exhibit B summarizes probable costs associated with decommissioning exclusive of salvage values. Exhibit C summarizes probable costs associated with trucking panels to approved recycling facilities.

Piney Grove Solar, LLC will be required to submit detailed engineering plans at the time of decommissioning, and obtain construction permits as required by appropriate authorities.

Expenses associated with decommissioning the Project will be dependent on labor costs at the time of decommissioning. For the purposes of this report, current RSMeans data was used to estimate labor, material, and equipment expenses. Fluctuation and inflation of the labor costs were not factored into the estimates.

The total probable cost of decommissioning excluding a salvage but including a 1.5% inflation factor is **$3,274,000**. Inflation accounts for approximately $807,000 over a 20-year period.

Resale/Salvage Value Estimate

There is a robust secondary market for resale of solar PV panels worldwide and a network of facilities available for recycling panels. Solar PV panels are estimated to degrade less than 0.5% per year, meaning they're expected to operate at 90% of capacity after 20 years. Panel manufacturers will guarantee the performance for each individual module and replace defective modules per the terms of warranty. Panels can therefore be sold for a price higher than their scrap value.

In general, the highest component value would be expected at the time of construction with declining value over the life of the Project. Over most of the Project's life, components such as the solar panels could be sold in the wholesale market for reuse or refurbishment. As panel efficiency and power production decrease due to aging and/or weathering, the resale value will decline accordingly.

Secondary markets for used solar components include other utility scale solar facilities with similar designs that may require replacement equipment due to damage or normal wear over time; other buyers (e.g., developers, consumers) that are willing to accept a slightly lower power output in return for a significantly lower price point when compared to new equipment. The solar facility's additional supporting components, such as inverters, transformers, racking and piles, can be dismantled and resold for scrap value. Inverters and transformers are comprised of salvageable materials such as copper, aluminum, and silver. Piles and other steel components can likewise be recovered and salvaged. Resale values at the end of Year 20 for equipment of significant value were calculated with straight-line depreciation after an instant depreciation of the original material cost.

A current sampling of reused solar panels indicates a wide range of pricing depending on age and condition ($0.10 to $0.50 per watt). Future pricing of solar panels is difficult to predict currently, due to the relatively young age of the market, changes to solar panel technology, and the ever-increasing product demand. Using straight line depreciation, a conservative estimation of the value of solar panels in Year 20 at $0.005 per watt would yield approximately $560,907. Increased costs of removal, for resale versus salvage, would be expected to preserve the integrity of the panels; however, the net revenue would still be substantially higher than the estimated salvage value.

The resale value of components such as trackers, may decline more quickly; however, the salvage value of the steel that makes up a larger portion of the tracker is expected to stay at or above the value used in this report.

The price used to value the steel in this report is $152.18 per ton. The price used to value copper in this report is $2.13 per lb.

The cost estimate for Year 20 shows that the net cost to decommission the site is (Salvage Value ($3,956,000.00) – Decommissioning Cost ($2,467,000.00) = Net Surplus ($1,488,000.00)). Additionally, was assumed inflation of 1.5% per year over the next 20 years, the net surplus would increase (Net Surplus with Inflation valued at $1,975,000.00).

Kimley»Horn

EXHIBIT A

DECOMMISSIONING COST ESTIMATE

Piney Grove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma At Year 1
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Estimated Salvage Value	Total Cost (incl. markups)	Total Net Price
Mobilization	1	LS			($112,180)	($112,180)
Administration	500	HR	($113.72)		($56,859)	($56,859)
Temporary Facilities	1	LS			($13,870)	($13,870)
Safety	1	LS			($9,400)	($9,400)
Legal Expenses	1	LS			($2,470)	($2,470)
General Liability Insurance	1	LS			($10,070)	($10,070)
Contractor's G&A	1	LS			($19,020)	($19,020)
SWPPP, Erosion Control Measures (Disturbed Area)	456	Ac	($670.00)		($305,520)	($305,520)
Seeding	23	Ac	($1,331.42)		($30,356)	($30,356)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	23	Ac	($687.71)		($15,680)	($15,680)
Remove and Recycle Chain link Fence, 6' High	62,015	LF	($3.63)	$10,419	($225,254)	($214,835)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	$15,585	($77,925)	($62,340)
Removal and Recycle AC Cables	94,500	LF	($0.20)	$6,642	($19,107)	($12,465)
Removal and Recycle Above Ground DC Cables	7,507,584	LF	($0.10)	$527,708	($747,483)	($219,775)
Removal and Recycle Under Ground DC Cables	210,000	LF	($0.11)	$14,761	($23,233)	($8,472)
Backfill AC and DC trenches	304,500	LF	($0.19)		($58,527)	($58,527)
Removal and Recycle of Combiner boxes	210	EA	($245.80)		($51,617)	($51,617)
Remove and Recycle Inverters	21	EA	($7,147.31)	$1,766,573	($150,094)	$1,616,479
Removed and Recycle Photovoltaic Modules	159,432	EA	($1.97)	$21,959,683	($314,041)	$21,645,643
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	39,102	EA	($3.60)	$208,269	($140,674)	$67,595
Remove and Recycle Support Assemblies	3,859,926	LB	($0.02)	$192,996	($77,041)	$115,955
Contaminated Soils Testing	1	LS			($2,000)	($2,000)
Reclamation Monitoring and Maintenance	1	LS			($5,000)	($5,000)
			Year 1 cost	**$ 24,703,000**	**($2,467,000)**	**$22,235,000**

General Notes:

1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

Salvage Notes:

1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Piney Grove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma At Year 20
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Estimated Salvage Value	Total Cost (incl. markups)	Total Net Price
Mobilization	1	LS			($112,180)	($112,180)
Administration	500	HR	($113.72)		($56,859)	($56,859)
Temporary Facilities	1	LS			($13,870)	($13,870)
Safety	1	LS			($9,400)	($9,400)
Legal Expenses	1	LS			($2,470)	($2,470)
General Liability Insurance	1	LS			($10,070)	($10,070)
Contractor's G&A	1	LS			($19,020)	($19,020)
SWPPP, Erosion Control Measures (Disturbed Area)	456	Ac	($670.00)		($305,520)	($305,520)
Seeding	23	Ac	($1,331.42)		($30,356)	($30,356)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	23	Ac	($687.71)		($15,680)	($15,680)
Remove and Recycle Chain link Fence, 6' High	62,015	LF	($3.63)	$10,419	($225,254)	($214,835)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	$15,585	($77,925)	($62,340)
Removal and Recycle AC Cables	94,500	LF	($0.20)	$6,642	($19,107)	($12,465)
Removal and Recycle Above Ground DC Cables	7,507,584	LF	($0.10)	$527,708	($747,483)	($219,775)
Removal and Recycle Under Ground DC Cables	210,000	LF	($0.11)	$14,761	($23,233)	($8,472)
Backfill AC and DC trenches	304,500	LF	($0.19)		($58,527)	($58,527)
Removal and Recycle of Combiner boxes	210	EA	($245.80)		($51,617)	($51,617)
Remove and Recycle Inverters	21	EA	($7,147.31)	$13,103	($150,094)	($136,991)
Removed and Recycle Photovoltaic Modules	159,432	EA	($1.97)	$2,966,428	($314,041)	$2,652,387
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	39,102	EA	($3.60)	$208,269	($140,674)	$67,595
Remove and Recycle Support Assemblies	3,859,926	LB	($0.02)	$192,996	($77,041)	$115,955
Contaminated Soils Testing	1	LS			($2,000)	($2,000)
Reclamation Monitoring and Maintenance	1	LS			($5,000)	($5,000)
Year 20 cost in current dollars				**$ 3,956,000**	**($2,467,000)**	**$1,488,000**
Projected inflation (1.5%)				**$ 1,293,000**	**($807,000)**	**$487,000.00**
Year 20 cost in future dollars				**$ 5,249,000**	**($3,274,000)**	**$1,975,000**

General Notes:
1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

Salvage Notes:
1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Kimley»Horn

EXHIBIT B

DECOMMISSIONING COST ESTIMATE EXCLUDING SALVAGE

Piney Grove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Total Cost (incl. markups)
Mobilization	1	LS		($112,180)
Administration	500	HR	($113.72)	($56,859)
Temporary Facilities	1	LS		($13,870)
Safety	1	LS		($9,400)
Legal Expenses	1	LS		($2,470)
General Liability Insurance	1	LS		($10,070)
Contractor's G&A	1	LS		($19,020)
SWPPP, Erosion Control Measures (Disturbed Area)	456	Ac	($670.00)	($305,520)
Seeding	23	Ac	($1,331.42)	($30,356)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	23	Ac	($687.71)	($15,680)
Remove and Recycle Chain link Fence, 6' High	62,015	LF	($3.63)	($225,254)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	($77,925)
Removal and Recycle AC Cables	94,500	LF	($0.20)	($19,107)
Removal and Recycle Above Ground DC Cables	7,507,584	LF	($0.10)	($747,483)
Removal and Recycle Under Ground DC Cables	210,000	LF	($0.11)	($23,233)
Backfill AC and DC trenches	304,500	LF	($0.19)	($58,527)
Removal and Recycle of Combiner boxes	210	EA	($245.80)	($51,617)
Remove and Recycle Inverters	21	EA	($7,147.31)	($150,094)
Removed and Recycle Photovoltaic Modules	159,432	EA	($1.97)	($314,041)
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	39,102	EA	($3.60)	($140,674)
Remove and Recycle Support Assemblies	3,859,926	LB	($0.02)	($77,041)
Contaminated Soils Testing	1	LS		($2,000)
Reclamation Monitoring and Maintenance	1	LS		($5,000)
			Year 20 cost in current dollars	**($2,467,000)**
			Projected inflation (1.5%)	**($807,000)**
			Year 20 cost in future dollars	**($3,274,000)**

General Notes:
1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

Salvage Notes:
1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Kimley»Horn

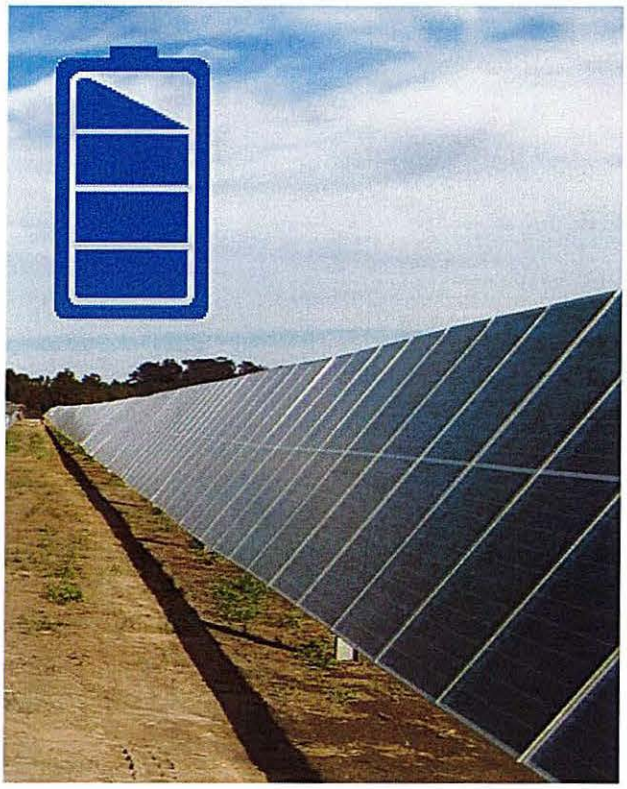
EXHIBIT C

TRUCKING COST BREAKDOWN

Piney Grove Solar
Wayne County, NC
Panel Trucking Costs

$/mo/truck rental	$	4,000
$/mo/truck labor (FT+benefits)*	$	5,000
$/mo/truck maintenance	$	500
$/mo/truck insurance	$	1,000
Total $/mo/truck cost	$	10,500.00
$/gallon gas	$	3.80
miles /gallon		8
Mileage (Wayne, NC to Raleigh, NC) roundtrip		120
Total fuel cost per trip	$	57.00
Capacity in tons per trip		20
total number of panels		159,432
panel weight (tons)		4,783
Misc. Waste (tons)		20
Total trips		241
Loading/unloading hours per trip		1
road hours per trip		3.0
hours per day		10
days/month		21
trips per month per truck		52.5
Total truck months		5
Subtotal of Truck and Labor Cost	$	52,500
Fuel Cost	$	13,737
Total Trucking Cost	**$**	**66,237**

*Assumes truck labor only works half of the month at standard heavy truck operator rates



HEALTH AND SAFETY ASSESSMENT REPORT

Piney Grove Solar
67 MW_{AC} Photovoltaic Facility with
~27 MW_{AC} / 4-hour Battery
Wayne County, NC

ABSTRACT

This is an assessment of the potential health and safety impacts of the proposed 67 MW_{AC} Piney Grove Solar photovoltaic facility with battery energy storage (BES) in Wayne County, NC. Considering the project design and location, the assessment evaluates the potential positive and negative impacts of the project on public health and safety. Most of the project area will be covered by solar equipment, which produces valuable electricity without producing any air, water, or soil emissions. The primary health and safety risk of the system equipment is toxicity, which is considered in detail in this assessment. The battery equipment will occupy a tiny portion of the site's footprint and will provide many benefits to the electric grid. The primary health and safety risk of the battery equipment is fire, which is minimized by advanced battery technologies, 24/7 monitoring, new battery regulations, and the long distance between the equipment and the public. The conclusion of the assessment is that the Piney Grove Solar facility will not create negative health and safety impacts. The clean electricity the project will produce will reduce the burning of fossil fuels, which will reduce pollution and provide millions of dollars' worth of local public health benefits as a result, based on U.S. Environmental Protection Agency estimates.

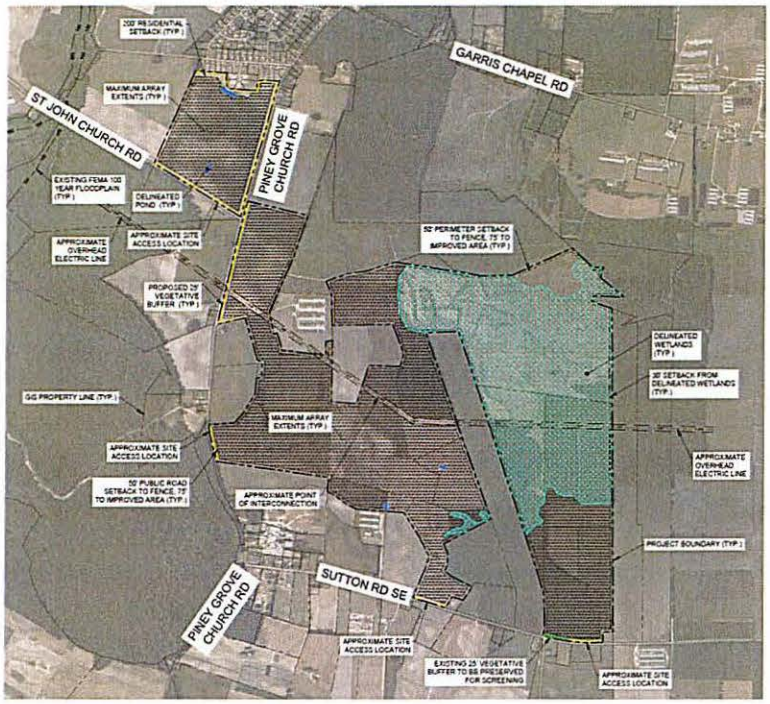
Tommy Cleveland, PE
Consulting Engineer
Solar Health and Safety Expert

September 6, 2023

Health & Safety Assessment Report

Piney Grove Solar (with batteries) – Wayne County, NC

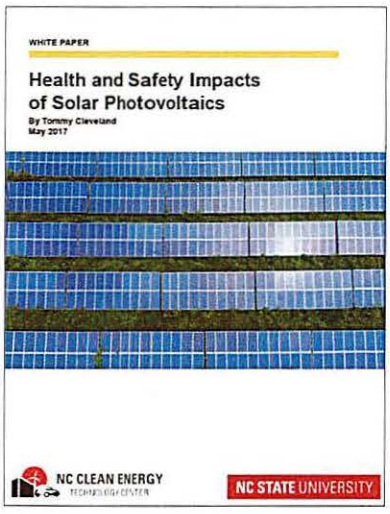
Project Overview:



- **Project Name:** Piney Grove Solar
- **Developer**: Renewable Energy Services
- **Project Area (inside fence)**: ~371 acres
- **PV Capacity**: 67 MW_{AC} (~87 MW_{DC})
- **Solar Panels**: bi-facial crystalline silicon: Hanwha Q Cells 580W or equivalent
- **Structure**: single-axis trackers (north-south rows, 60° E to 60° W)
- **Inverters**: central station type: SMA Sunny Central 4000 (4.0 MW) or equivalent
- **Battery Energy Storage (BES):** 23 to 30 MW_{AC} with 4-hour duration (~108 MWh), AC-coupled
- **Battery Type:** lithium-ion batteries, manufactured by a Duke Energy approved battery cell vendor
- **Point of Interconnection to Grid**: Duke Energy Progress 230 kV transmission line passing diagonally through the middle of the project area
- **Interconnection Equipment**: Duke Energy Progress 230 kV switchyard and project's 34.5kV/230kV substation adjacent to the transmission line, internal to areas of PV modules

Report Author

The author of this report is **Tommy Cleveland, PE**, (the "Author") a consulting engineer licensed as a professional engineer in NC since 2007. Mr. Cleveland graduated from North Carolina State University ("NC State") with undergraduate and master's degrees in mechanical engineering, where he focused on energy. His solar career started with his master's thesis, which led to working over 12 years at the North Carolina Clean Energy Technology Center at NC State University. While at the university, Tommy worked on nearly every aspect of solar energy; from teaching, to testing equipment, to research & development, to leading a statewide stakeholder group in the development of a template solar ordinance. During his time at NC State, North Carolina installed more photovoltaic ("PV") capacity than any state other than California, mostly in the form of 2-5 MW_{AC} utility-scale solar facilities covering around 40 acres each. Utility-scale solar was unfamiliar to the hundreds of communities around the state where the systems were proposed, and many of those communities had questions about the technology and its potential to harm public health or the environment in their community. Many of those questions found their way to Mr. Cleveland and he expanded his already broad knowledge of PV to research and find answers to the questions being asked. Over time he became an expert on the potential health and safety impacts of PV and was the lead author of the 2017 NC State white paper on the topic (pictured to the left). Since mid-2017 Mr. Cleveland has worked as a solar engineer at an energy engineering firm conducting interconnection commissioning of utility-scale solar and battery facilities for utilities in North and South Carolina. In this role Mr. Cleveland was the engineer responsible for (interconnection) commissioning over 60 PV sites and 4 battery sites.



Executive Summary



This report assesses the potential health and safety impacts of the proposed Piney Grove Solar 67 MW_{AC} solar photovoltaic with battery energy storage project. The Piney Grove Solar facility, located in Wayne County, North Carolina, will install crystalline silicon solar panels on single-axis tracking racks that slowly rotate each row of panels to follow the sun across the sky. Large central station inverters will convert the DC solar electricity generated by the solar panels into grid-synced AC electricity. Containerized battery systems, capable of storing and discharging energy, will be located at the system substation at the point of interconnection to the grid. Transformers will boost the voltage of the PV and battery inverters for connection to an onsite substation that connects to a transmission power line running through the project.

Photovoltaic (PV) panels are not new. They have been used and studied for over 40 years and are well understood by the scientific community. Utility-scale solar facilities are newer, but they too have been installed and studied for over a decade, and scientists also have a clear understanding of their function and impacts.

Utility-scale battery energy storage systems are newer still but have been maturing very quickly in the last few years. Piney Grove Solar will use a leading lithium-ion battery technology from a top manufacturer.

Photovoltaic systems produce emission-free electricity. This replaces electricity production from fossil fuel power plants that produce harmful emissions. The health benefits of clean solar electricity are hard to put a dollar figure on, but the EPA's best attempt at doing just that puts the value in the Carolinas between 1.7 and 3.8 cents per kWh produced. Even at the bottom end of this range, this equates to approximately $2.6 million of public health benefit per year for the Piney Grove Solar project, and over $77 million in 30 years.

The only identifiable risks to health and safety of the PV aspects of the Piney Grove Solar project are not unique to solar but exist for any source or use of electricity. These are electric shock, arc flash, and fire. Due to world-class safety regulations in the U.S. and an experienced solar industry, these risks are extremely low, and the secure and isolated nature of ground-mounted PV facilities, including Piney Grove Solar, results in minimal risk to the general public.

Common concerns about toxicity and EMF from solar facilities are understandable, but the operating characteristics and materials present in the equipment means that neither toxicity nor EMF pose a material risk to public health or safety. Research and experience regarding heat island effect and solar glare shows that, like other utility-scale PV projects, the Piney Grove Solar project will not create either of these potential impacts. The single-axis trackers at Piney Grove Solar that will keep the panels facing in the direction of the sun minimizes the potential for the project to create any glare.



Modern US battery codes and standards minimize the risk of fire, effectively removing the risk of explosion. A battery fire would damage equipment but due to the distance between the batteries and the public, a fire would not negatively impact public health or safety.

Based on my knowledge of engineering and science, personal experience with PV and battery technology, review of academic research, and review of project materials provided by Renewable Energy Services my findings and opinions are summarized as follows:

- The Piney Grove Solar project will result in a significant reduction of regional air pollution.
- The Piney Grove Solar project will not result in any negative impacts to public health or safety.
- The Piney Grove Solar facility will not increase the temperature of the area surrounding the site.
- The Piney Grove Solar facility is not expected to create any glare hazards or other negative glare impacts for aviation.
- The Piney Grove Solar project is not expected to create bothersome noise for any neighbors.

Introduction

Purpose:

This report assesses the potential health and safety impacts of the proposed Piney Grove Solar ("Piney Grove") 67 MW_{AC} solar with battery energy storage (BES) project. It also seeks to educate readers on the health and safety impacts of photovoltaic and battery energy storage systems using accurate scientific sources of information, including providing resources for further reading.

Battery Assessment

FOLLOW THE BATTERY ICON FOR ASSESSMENT OF BATTERIES

System Overview: Solar with Batteries

The proposed Piney Grove Solar facility is a utility-scale photovoltaic generation facility with lithium-ion battery energy storage. The energy storage is in the form of containerized battery systems with inverters separate from the PV inverters, which is referred to as "AC-coupled" batteries. The batteries will all be located in a single area near the point of interconnection to the grid. In general, the batteries are charged by solar during peak hours and discharged when there is little or no sun shining but grid electricity is in high demand, and it repeats this cycle daily.

Overview of Potential Impacts:

The proposed solar photovoltaic (PV) and BES system is likely to remain in operation at least 30 years, and this report considers its potential impacts in Wayne County from the start of construction onward, including decommissioning of the project and restoration of the land. This assessment considers all aspects of the project but focuses on those unique to solar with battery energy storage projects.

*Potential **Positive** Health and Safety Impacts:*

Every utility-scale PV project significantly reduces pollution by producing emission-free electricity that replaces electricity that otherwise would have been largely produced by burning coal and natural gas. Burning these fossil fuels for electricity production is a significant source of air, water, and soil pollution, so reducing their use is a clear public health benefit.

The US Environmental Protection Agency (EPA) conducted a study to determine how much pollution PV systems save and to estimate the public health value of the cleaner air, water, and soil they provide. These experts calculated that in the Carolinas, based on the sunshine available, the way electricity is produced, and the public health impacts of fossil fuel-fired electricity, every kilowatt-hour (kWh) of solar electricity produced provides 1.7 to 3.8 cents of public health benefit.[1] At this rate of benefit, **the Piney Grove Solar project will produce $2.6 - $5.8 million of public health benefits every year**, which would add up to **$77 - $173 million over the life of the project**. The public health benefits of generating pollution-free electricity with PV are very significant.

It is relatively simple to replace a small amount of grid energy with utility-scale solar energy, but as the portion of grid energy provided by solar becomes more significant it becomes increasingly challenging to integrate more solar without sacrificing reliability or power quality. Energy storage is a simple solution to overcome most of these challenges, and recent cost reductions and increased experience makes it feasible to integrate significant energy storage into solar facilities. While many types of energy storage are technically possible, battery energy storage has proven to be most practical. So, the inclusion of battery energy storage in projects like Piney Grove Solar improve the economics of the projects, such that some projects may not be feasible without the benefits of the batteries.

The positive benefits of photovoltaics are widely understood and well documented, so this report will not address them further. Furthermore, the positive public health impacts of the Piney Grove Solar project significantly outweigh any health and safety risks, as described below. The ability of energy storage to facilitate increased solar energy on the grid is widely understood and well documented, but direct analysis of the positive benefits of a battery system is less common. A life

[1] US Environmental Protection Agency, Public Health Benefits-per-kWh of Energy Efficiency and Renewable Energy in the US: A Technical Report. 2nd Ed, May 2021, www.epa.gov/statelocalenergy/public-health-benefits-kwh-energy-efficiency-and-renewable-energy-united-states

cycle environmental impacts assessment of utility-scale battery energy storage in California found that when the positive and negative carbon impacts of batteries are considered, that the batteries reduce the carbon footprint of the grid due to the storage's ability to store and release solar energy that otherwise would have gone unproduced due to curtailment.[2]

*Potential **Negative** Health and Safety Impacts:*

All electricity generating facilities, including photovoltaics and batteries, provide some potential for negative health and safety impacts, however the Piney Grove project does not present negative health and safety risks to the general public due to its location or technology (photovoltaic generation with battery energy storage). The only aspect of the PV portion of the system at Piney Grove Solar that presents risk of physical harm is the potential for electrical shock, arc flash, or fire, which are hazards present with any electrical system and not unique to solar. There are several other aspects of PV systems that often raise public health and safety concerns, but no other aspect of PV systems poses any material risk of negative public health or safety impacts.

Like PV systems, battery systems also produce a limited electrical shock and arc flash hazard, however unlike PV systems, batteries also have the potential for toxicity, fire, and explosion hazards. While it is possible for lithium-ion batteries to catch fire, release toxic gases, and even explode, these hazards at the Piney Grove Solar site do not pose any risk to the general public because the battery systems are outdoors and hundreds of feet from the closest neighbor.

The major health and safety risk of the project is not due to the solar or battery technologies but is standard construction hazards for construction workers building the site, which does not pose any safety risk to the general public.

Utility-scale PV is becoming a mature industry, but still rapidly growing. The underlying PV technologies of silicon and cadmium telluride have been studied in the laboratory and in the field for well over 30 years. So, the products, practices, regulations, and policies in the PV industry have a well-established base to build upon. Also, research literature on potential negative impacts of PV goes back decades. Modern utility-scale battery energy storage is a rapidly emerging industry, largely building on the success of lithium-ion batteries in consumer products and electric vehicles. So, the products, practices, regulations, and polices in the BES industry are changing extremely rapidly, often with technology change leading policy and regulations. Even though there have been years of experience with batteries in laptops and phones, stationary multi-megawatt battery systems are still somewhat new. The industry is only a handful of years old, with equipment to be installed in 2023 or later being much more mature than technology installed just 3 or 4 years ago. In that time, codes and standards have gone from being designed for small lead-acid battery emergency back-up power to being robust regulations built on several years of early BES experience with input from a wide array of battery stakeholders and experts. Just 3-4 years ago the regulations for stationary battery left system safety to the equipment manufacturers. During this "wild west" period of utility-scale BES development many valuable safety lessons were learned. See below for several publications on the potential health and safety impacts of battery energy storage systems.

Sources for Further Reading on Battery Impacts:

- Sandia National Lab: Grid-scale Energy Storage Hazard Analysis & Design Objectives for System, August 2020
- Energy Response Solutions, Inc.: Energy Storage System Safety: Comparing Vanadium Redox Flow and Lithium-Ion Based Systems, Aug 2017
- National Fire Protection Association (NFPA): Energy Storage Systems Safety Fact Sheet, June 2020
- New York State Energy Research and Development Authority: New York Battery Energy Storage System Guidebook for Local Governments, December 2020
- Electric Power Research Institute (EPRI): Energy Storage Integration Council (ESIC) Energy Storage Implementation Guide, March 2019
- Electric Power Research Institute (EPRI): Lessons Learned: Lithium Ion Battery Storage Fire Prevention and Mitigation – 2021, June 2021

[2] Balakrishnan, Brutsch, Jamis, et al, Environmental Impacts of Utility-Scale Battery Storage in California, 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), June 2019, www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/Environmental-Impacts-of-Utility-Scale-Battery-Storage-in-California.ashx

Evidence for the lack of any significant environmental, health, or safety impact of the proposed Piney Grove project is provided by the required State Environmental Review Clearinghouse (the "State Clearinghouse") review, which is required as a part of the project's Certificate of Public Convenience and Necessity ("CPCN") application process. The North Carolina Environmental Policy Act of 1971 (G.S. 113A 1-13), also known as the State Environmental Policy Act ("SEPA"), defines the state policy designed to maintain and protect the state's environment. The statute requires state agencies to the fullest extent possible identify significant environmental effects of their actions and to implement measures to minimize negative effects. The State Clearinghouse consists of all applicable state agencies, who review and comment on every request for a CPCN. The State Clearinghouse includes the North Carolina Department of Natural and Cultural Resources, NC Wildlife Resources Commission, The Division of Waste Management, North Carolina Department of Agriculture and Consumer Services, and others. The Piney Grove project has not yet applied for a CPCN, but before this required certificate is granted by the NC Utilities Commission, the State Clearinghouse must review the proposed project and find it to be in compliance with the North Carolina Environmental Policy Act.

In addition to the State Clearinghouse review, the Project has many environmental regulations and permitting processes that it must comply with. One notable environmental protection regulation is the Sedimentation Pollution Control Act of 1973.[3] This act requires construction projects, including utility-scale solar facilities, to meet requirements designed to keep sediment from entering our natural watercourses (e.g. streams, rivers, lakes, etc.) and to keep sediment from washing onto adjacent property. The North Carolina Department of Environmental Quality (DEQ) enforces the act through their local offices spread around the state, which includes requiring DEQ approval of a site-specific erosion and sedimentation control plan before disturbing any soil. The approved Erosion and Sedimentation Control plan must be adhered to throughout construction and until adequate groundcover to stabilize the soil is established.

This assessment report will address all the potential health and/or safety risks of the Piney Grove project, including common concerns that have no potential for public health impact. Specifically, this report addresses the following possible negative impacts/concerns:

- Electrical Shock and Arc Flash
- Fire and Emergency Response
- Toxicity / Chemical
- Electromagnetic Fields (EMF)
- Heat Island Effect
- Glare and noise

To meet the Wayne County solar ordinance, Piney Grove Solar will provide a 25ft-deep evergreen vegetative buffer between the project and adjacent residential areas. The project fence will be setback at least 50ft from the project's property line and from roads. This is a larger buffer than many existing solar facilities and most other land uses. This combination of setback and vegetative screening will largely separate the public from this project and minimize its impacts, including the visual/aesthetic impact of seeing the equipment.

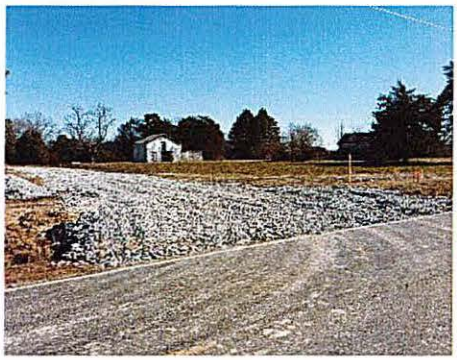
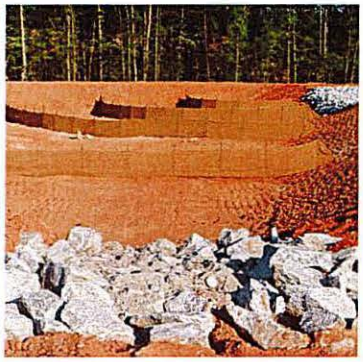
Before addressing each of these impact categories, this report provides an overview of utility-scale photovoltaic and battery energy storage equipment and facility construction and operations. These photos should help introduce utility-scale PV and batteries to any reader who has not toured a facility during construction or operation.

[3] North Carolina Environmental Quality webpage: Erosion and Sediment Control Laws and Rules, retrieved 2/8/2023, https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/erosion-and-sediment-control/erosion-and-sediment-control-laws-and-rules

Equipment, Construction, and Operations[4]

To understand the potential impacts of a utility-scale PV and battery system it is helpful to understand the components of the facility, as well as how a facility is constructed and maintained. The components and practices in this overview are typical of the industry and representative of the proposed Piney Grove Solar project. The initial site work occurs first, but the order of the other construction steps is flexible and may occur concurrently.

Initial Site Work (construction entrance/driveway, sedimentation and erosion control installation, clearing and grubbing, potentially some grading, perimeter fence, and internal roads)


Underground Work (trenching for wires from PV combiner boxes to inverters, inverter pad installation, medium voltage cables to interconnection equipment)





PV Panel Structure/Racking (driving of steel piles, installation of racking "tables", installation of PV panels)





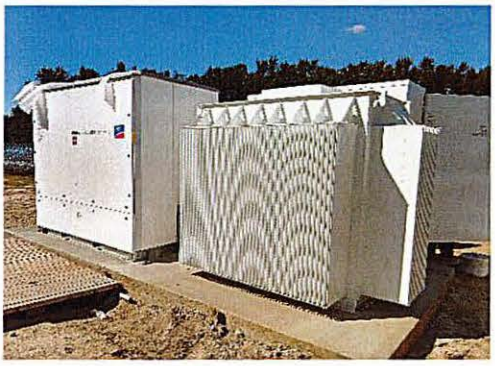
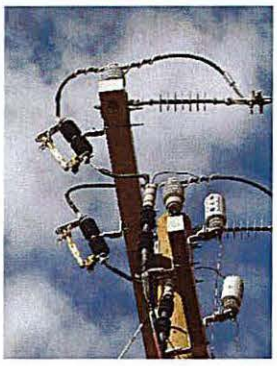
[4] Photo sources: author, ncre-usa.com, NC DEQ, blueoakenergy.com, solarbuildermag.com, hbc-inc.com, solarprofessional.com, enr.com, dynapower.com, ie-corp.com, ccrenew.com, and landiscontracting.com

Electrical Work (connection of PV module wiring, combiner boxes, inverters, batteries, transformers, interconnection facilities)

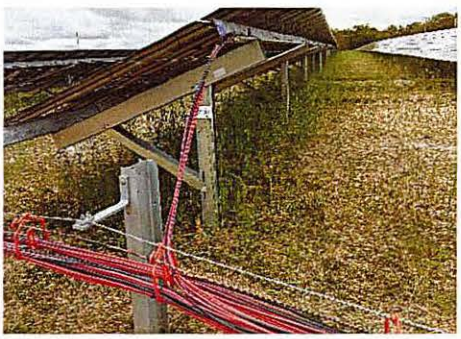




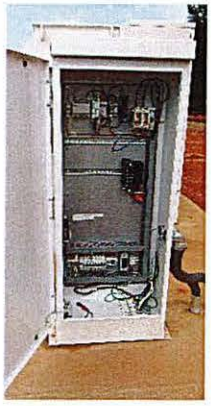



Establishment of Ground Cover (required to close out sedimentation and erosion control permit)




Operations and Maintenance (24/7 monitoring, vegetation maintenance, preventative maintenance)





Electrical Shock and Arc Flash

Any electricity over 50 volts presents an electrical shock hazard, including the electricity in PV and battery facilities. However, like electrical systems in buildings, the solar and battery facility must adhere to the National Electrical Code (NEC) and the equipment must be certified to the appropriate UL safety standards. Unlike buildings, members of the public are restricted from entering a utility-scale solar facility. To help ensure that only qualified people have access to the equipment, the NEC requires a secure perimeter security fence with electrical warning signs. The lack of public access coupled with the high U.S. electrical safety standards essentially eliminates the risk of electric shock for the public.



Figure 1. Perimeter Fence with Warning Signs

In circuits with significant available fault current there is another electrical hazard, called arc flash, which is an explosion of energy that can occur due to a short circuit. This explosive release of energy causes a flash of light and heat, creating a shockwave that can knock someone off their feet. The risk of arc flash in a solar and battery facility is no different than the risk at commercial or industrial buildings, except that solar facilities are much less accessible. Equipment with an arc flash risk require arc flash warning labels, and only trained personnel wearing the proper personal protective equipment are allowed in it. Due to the secure perimeter and the high U.S. electrical safety standards there is essentially no arc flash risk to the public.

Fire Risk and Emergency Response

Every electrical system has some risk of starting a fire, including electrical systems in residential, commercial, and industrial buildings. It is this hazard that motivated creation of the National Electrical Code over 100 years ago. Due to the high standard required by the NEC, modern electrical systems rarely start fires. Like electrical systems in buildings, ground-mounted photovoltaic systems and battery energy storage systems must also adhere to the NEC, including sections of the NEC with specific rules for PV and for batteries.

Fire Risk: Solar

In the rare case that a PV system has a fault that starts a fire, there is very little combustible material present for it to ignite. The only flammable portions of PV panels are the few thin plastic layers, the plastic junction box, and the insulation on its wires. The inverters are also capable of igniting, however like PV modules, they consist primarily of non-flammable materials.

The inverters and transformers are located on concrete pads or raised steel platforms that are isolated from other equipment and vegetation, so a fire in this equipment poses little treat of spreading.

Heat from a small flame is not adequate to ignite a PV panel, but an intense fire or an electrical fault can ignite a PV panel. One real-world example illustrating the low flammability of PV panels occurred during July 2015 in an arid area of California. Three acres of grass under a utility-scale PV facility burned without igniting the panels mounted just above the grass.[5] Another example occurred recently (2022) in Florida, where there was a 5-acre grass fire under a portion of a 400-acre PV facility that did not ignite any modules.[6]

Fire Risk: Transformers

The most significant fire hazard at a utility-scale solar facility may be the oil in the transformers. There are medium voltage transformers dispersed throughout the site located by each inverter, called inverter step-up ("ISU") transformers, and there is a large transformer in the interconnection substation, known as the generator step-up ("GSU") transformer. Traditionally these types of transformers are filled with a non-PCB mineral oil, which is derived from petroleum, and is electrically insulating but flammable. A popular alternative to mineral oil is a transformer fluid made of biodegradable vegetable oil, such as FR3 by Cargill or VG-100 by GE. This type of oil not only has several performance benefits over mineral oil, but it is also dramatically reduces the fire hazard of transformers. These vegetable oils' flash point of 330°C is dramatically hotter than mineral oil transformer fluid (160°C). Unlike mineral oil, FR3 and VG-100 are classified as a K-class, "high-fire-point", "fire-resistant", and "less-flammable" fluid. Also classified as "nonpropagating", it is self-extinguishing, and will not continuously burn if ignited. Mineral oil, however, will keep burning for hours when ignited, with no feasible way to stop it until all the oil is consumed. However, neither mineral oil- or vegetable oil-filled transformers create a fire hazard for the community or property surrounding the solar facility because even in a worst-case scenario of a transformer fire, this equipment is located in the middle of a field, far from other flammable materials and far from neighboring properties. Typically, the only thing at risk of being ignited by a transformer fire in a utility-scalar facility is the groundcover (i.e. grass, clover, etc.), which is only a risk in particularly dry conditions. A grass fire is relatively easy to control and poses negligible fire risk to the community.

There are best practices for how to prepare for and conduct an emergency response at a transformer. For example, see the NERC lessons learned document in the Sources for Further Reading at the end of this section.

Fire Risk: Batteries



Batteries can store a lot of energy, which makes them valuable but can also mean they have the potential to unintentionally release that energy very quickly, which can cause a fire or even lead to an explosion. The degree of fire risk varies greatly not only between battery chemistries but also between different battery systems. There have been some fires at utility-scale batteries in recent years in the US and around the world, however newer battery systems have learned from these experiences and have corrected many of problems that led to these early fires.[7] Our understanding of battery fires and how to avoid them has rapidly increased the last few years as experience has grown from near zero to many thousands of systems. With this experience has come improved battery systems and improved codes and standards.

Generally, all utility-scale batteries are packaged in outdoor-rated containerized enclosure with a battery management system (BMS) and any needed HVAC capabilities. By far the most common type of utility-scale battery is lithium-ion. While there are several different lithium-ion chemistries, all the varieties on the market today consist of cells that each contain a solid anode and cathode separated by liquid electrolyte, which is generally flammable. Many of these cells are connected into a module, several modules are connected in a rack, and several racks are connected in the containerized battery system. Each level has physical barriers and a protective battery management system.

The fire risk starts at the cell level, where if a cell faults or is abused in some way it often produces heat. It is possible for the heating to continue until the cell is generating heat more quickly than it can dissipate the heat, resulting in a rapid, accelerating rise in temperature, which is known as thermal runaway. When the cell reaches high temperatures, it vents

[5] Matt Fountain. The Tribune. Fire breaks out at Topaz Solar Farm. July 2015. www.sanluisobispo.com/news/local/article39055539.html
[6] WBMM News 13, Fire breaks out at Jackson Co. solar farm. August 2022, www.youtube.com/watch?v=byE_BpUX2mc
[7] EPRI, Lessons Learned: Lithium Ion Battery Storage Fire Prevention and Mitigation – 2021, June 2021
https://www.epri.com/research/products/000000003002021208

gases that are often flammable and toxic. The heat from a single cell in thermal runaway could cause nearby cells to also go into thermal runaway, causing more heat and the potential to drive more cells into thermal runaway. However, there are early warning signs of problems before there is any smoke or fire, allowing for automatic protection systems to act early enough to avoid the worst impacts and potentially avoid thermal runaway all together. The national electrical code (NEC) requires that the battery be certified to UL 1973, the battery safety standard for stationary batteries, which includes a requirement that the battery module does not allow fire outside of the module or any explosion. The NEC also requires the battery system to be certified to UL 9540 that addresses the safety of the entire battery system.

In addition to updated equipment standards, there are new installation standards, notability the (National Fire Protection Association) NFPA 855 Standard for the Installation of Stationary Energy Storage Systems which covers the "design, construction, installation, commissioning, operation, maintenance, and decommissioning of stationary ESS." This standard addresses everything from hazard assessment to emergency response planning, and determines when large scale fire testing per UL 9540A is required. UL 9540A is the U.S.'s "Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems", which was first published in late 2017 and has recently had a significant impact on the safety of battery systems. The test starts with a cell level test and only proceeds to module, unit, and installation level tests if the lower-level tests find a fire risk. The UL 9540A test for the cell level consists of attempts to cause the battery to burn or emit flammable gas. The abuse tests include driving a 2.5-inch nail through the battery, overcharging the battery to 200% of nominal charge, and short circuiting the positive and negative terminals of the battery. Any off gassing is captured and analyzed to determine the gases released, and the tests are videoed, with all this data included in the test results.

With lithium-ion batteries there is always some risk of fire, however when built and installed in compliance with the modern US battery safety codes and standards the risk of fire is extremely small and the risk of explosion is practically zero. Due to the isolation of the Piney Grove Solar batteries from the public due to being located inside of the solar facility and proper emergency response planning and training, even a battery explosion would not impact the public. In a worst-case scenario of a large fire in a battery enclosure that destroys the entire unit, the only potential impact to the public is due to the smoke emitted by the fire. The smoke from a lithium-ion battery fire is very similar to the smoke from a fire of a similar mass of common plastics[8], which is more toxic than wood smoke and likely more toxic than the smoke from a burning building. However, at Piney Grove Solar the significant distance from each battery enclosure to the nearest neighbors makes the potential health impact from smoke from a battery fire insignificant.[9]

Thus, there is very little chance of a fire in the batteries at Piney Grove Solar, and even the worst-case situation of a fire in a single battery enclosure would not produce enough smoke for long enough to have a material impact on public health.

Emergency Response: Solar

No special equipment is required to respond to a fire incident at a utility-scale PV facility. The most important thing for first responders to know is that as long as the sun is shining on the PV panels they will produce voltage that is dangerous to touch, but there is no danger in touching undamaged panels. There are multiple electrical disconnect switches in PV systems which allows problem areas to be electrically isolated quickly.

Risks of fire associated with vegetative ground cover are reduced by landscaping plans that keep this vegetation low. Local emergency responders typically have access to open locked gates and training on the electrical hazards within the site. So, they are able to safely extinguish grass fires inside of the facility, or monitor and protect the areas surrounding the facility, to ensure the fire does not spread to surrounding areas. The solar facility is remotely monitored around the clock, and responding personnel are available for emergencies. The International Association of Fire Fighters (IAFF) provides online training on responding to fires at photovoltaic facilities at www.iaff.org/solar-pv-safety.

[8] Sandia National Laboratories, Grid-scale Energy Storage Hazard Analysis & Design Objectives for System Safety, August 2020, https://www.osti.gov/servlets/purl/1662020

[9] An example of toxic smoke impact analysis for a project using Tesla MegaPack lithium-ion battery with a church and residences approximately 200 feet from the batteries: Hazards Assessment Final Report Orni 34 LLC Battery Energy Storage System Prepared for Santa Barbara County, Nov. 2019, https://files.ceqanet.opr.ca.gov/257908-2/attachment/lD6EjpwCFrLAn_Z0Z-SNkEMFUIsW7hhYR-5owwCukaV4k_p5sk_bEIvYOC3UYKgeBtfprFm-FaYmK0eu0

Emergency Response: Batteries



No special equipment is needed to respond to a battery fire. In fact, many facilities direct firefighters to not fight the battery fire at all but to allow the fire to burn itself out. In this case, the site's emergency response plan likely calls for a defensive firefighting approach in which firefighters may spray adjacent equipment with water to ensure the fire doesn't spread beyond a single battery enclosure. When the plan calls for actively fighting the battery, the best method is to douse the fire with large volumes of water. The NFPA 855 installation standard requires that the facility create an emergency response plan and provide the plan and training to the local fire department. The appropriate first responders' actions will vary depending on the type of battery at the site, so it is vital that the facility create an emergency response plan specific to the equipment and procedures of that facility and educate the local fire departments on the equipment and the response plan. The National Fire Protection Association (NFPA) provides on-line training on PV and Energy Storage: https://catalog.nfpa.org/Energy-Storage-and-Solar-Systems-Safety-Online-Training-P20882.aspx

Sources for Further Reading on Fire and Emergency Response:

- Duke Energy: Fire Safety Guidelines for Rooftop- and Ground-Mounted Solar Photovoltaic (PV) Systems, September 2015
- North American Electric Reliability Corporation (NERC): Lessons Learned, Substation Fires: Working with First Responders, February 2019
- Sandia National Lab: Grid-scale Energy Storage Hazard Analysis & Design Objectives for System, August 2020
- Energy Storage Association (ESA), Operational Risk Management in the U.S. Energy Storage Industry: Lithium-Ion Fire and Thermal Event Safety, September 2019
- Electric Power Research Institute (EPRI): Energy Storage Integration Council (ESIC) Energy Storage Implementation Guide, March 2019
- Electric Power Research Institute (EPRI): Proactive First Responder Engagement for Battery Energy Storage System Owners and Operators, September 2021
- Tesla: Lithium-Ion Battery Emergency Response Guide, 2022 (Version 2.6)
- also see *Sources for Further Reading on Battery Impacts* on page 5 of this report



Toxicity (Equipment and Operations)

Toxicity is probably the most common health and safety concern about photovoltaic systems, although as detailed below the systems do not pose a material toxicity risk to the public or the environment. This report examines all possible sources of toxicity, from site construction to decommissioning at the end of the project life. The potential sources of toxicity are organized into two categories: equipment and operations and maintenance (O&M).

Toxicity: Equipment

The main equipment at a solar facility is PV modules (a.k.a. solar panels or PV panels), metal structures for mounting the solar panels, and wiring to collect the electricity they produce. The other major components are inverters and transformers. Inverters are enclosed power electronic equipment that do not contain liquids and are treated like other electronic waste at the end of their life. Transformers contain non-toxic mineral oil or vegetable oil and are no different than the typical transformers outside of most residences, schools, and shopping centers. Solar panels have raised the most public concerns related to toxicity, so they are covered in depth below, but since transformers contain liquid they are also addressed. The other components in the facility include the steel racking, the conduits (PVC plastic and galvanized steel), and copper and aluminum wires. The conduit and wires are normal construction materials. The racking for the PV panels is generally galvanized steel posts with galvanized steel or aluminum cross members. None of these supporting materials (wire, conduit, and racking) create a toxicity concern. The galvanized coating on the steel is a zinc coating, and zinc is a vital mineral for human health. PVC plastic and galvanized steel conduits and all types of copper and aluminum wiring have been building staples for many decades. These materials have not caused a toxicity concern in buildings where people are close to this

equipment day and night so there is no reason to think they have any risk of creating a toxicity concern when used at a utility scale solar facility.

Contents of PV Panels

The Piney Grove Solar project will install top of the line silicon-based PV panels sourced from a reputable manufacturer meeting established criteria including third-party ratings for performance, reliability, and bankability (Bloomberg Tier I, the highest rating[10]). Specifically, the project plans to use a bi-facial monocrystalline silicon module. The project plans are designed based on 580 watt modules manufactured by Hanwha Q Cells, but other manufacturers make equivalent modules that could be used instead with no change in quality, should the project be unable to source that specific module. The PV panels are the most expensive and most important component in a solar facility, so the owner performs due diligence to ensure that the panels selected and delivered to the project are properly manufactured, certified, and tested.

The diagram below shows the components of a typical single-glass silicon PV panel, including a closeup of the solar cells and the electrical connections. Over 80% of the weight of a PV panel is the tempered front glass cover (or, front and back heat-strengthened glass) and the structural aluminum frame, which work together to create a strong, durable panel that outlasts its typical 25 to 30-year performance warranty. The encapsulation films are clear plastic lamination layers that protect the cells and electrical contacts from moisture for the life of the panel. These layers also maintain the panel as a single unit in the event of breakage of the glass cover(s), similar to the film in auto windshields that keeps them watertight and from fragmenting if the windshield shatters.

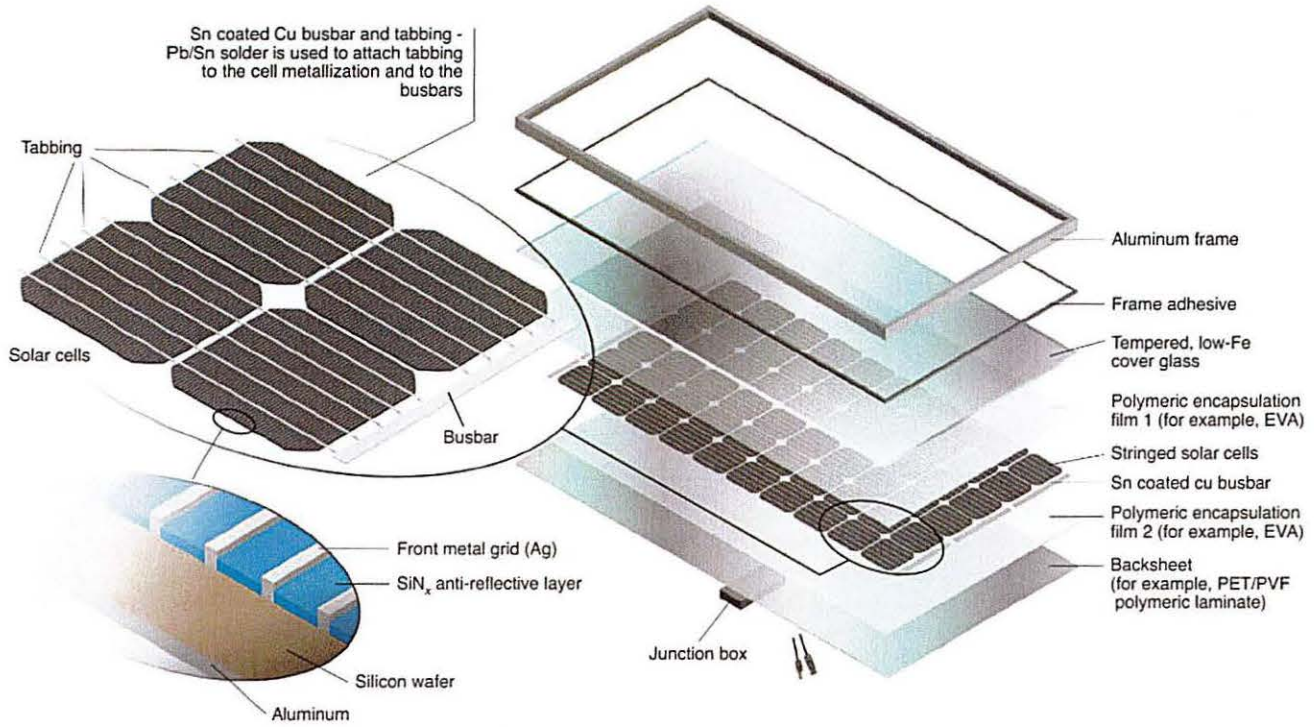


Figure 2. Contents of Framed Crystalline Silicon Panels (Source: NREL)

As can be seen in the above diagram, there are no liquids to leak from a broken panel. The plastic layers are inert. The silicon PV cells are nearly 100% silicon, which is harmless and is the second most common element in the Earth's crust. The only components of a PV panel that have any potential of toxic impact is the solder used to connect the solar cells together and to the busbars at the end of the panel, and the thin strips of silver that collect electricity from each cell. The solder, which is the

[10] The financial information firm Bloomberg has developed a tiering system for PV module makers based on bankability that is the standard the PV industry uses to differentiate between the hundreds of manufacturers of solar modules on the market. Tier 1 is the highest of three tiers, which are determined by banks' confidence in a manufacturer's PV panels as demonstrated by their willingness to supply project financing backed only by the assets of the project. The details are described by BloombergNEF in this document: PV Module Tier 1 List Methodology https://data.bloomberglp.com/bnef/sites/4/2012/12/bnef_2012-12-03_PVModuleTiering.pdf

same tin-lead solder standard in the electronic industry, is 36% lead. The tiny amount of silver in a panel does not create a toxicity hazard, but it does add potential recycling value.

Even though there is only a tiny amount of lead in each panel, the total amount of lead in all the PV modules in a utility-scale project adds up to a considerable amount of lead. However, these PV panels are spread out over a large area and when the amount of lead in the PV panels is compared to the amount of lead naturally occurring in the soil under the PV array, it is obvious that even if all the lead somehow leached out of every module (which as explained below is impossible), the increase in total lead in the soil would be less than the naturally occurring difference between different soils. Across the US soils naturally have between about 10 and 50 mg of lead per kg of soil, with the average being somewhere in the 20s. Across 83 USGS survey locations across N.C., the values ranged from 5 to 46 with an average of 20 and a median of 18.[11] For a location that naturally has 15 mg of lead per kg of soil, all the lead in all the PV modules in the facility would have the same amount of lead as just the top 4 inches of soil at the site.[12]



Figure 3. Contents of Cadmium Telluride Panels (Source: NREL); Front and Rear Photo of First Solar Series 7 CdTe Panels (Source: First Solar)

The leading alternative PV technology to silicon-based PV is Cadmium telluride (CdTe), which is by far the most common thin film PV technology. **While Piney Grove Solar plans to use silicon modules and not any CdTe modules, this assessment report is still providing a basic introduction to CdTe modules in case a switch is necessary and because it is not uncommon for stakeholders to have confusion about the differences in the two technologies.** CdTe is referred to as thin film because the active layers are less than 1/10th the thickness of a human hair. Figure 3 above contains two images, on the left is a not-to-scale diagram of the layers for a CdTe PV module (thickness dimension provided in image), and the right image is a photo of two First Solar CdTe modules showing the back of one module and the front of another. The PV cells consist of an incredibly thin layer of cadmium telluride with an even thinner coating of cadmium sulfide (roughly 1/60th the thickness of the CdTe film). Above these active layers is a transparent conducting metal oxide, commonly tin oxide (SnO_2), and below the active layers is a layer of metal to conduct away the electricity. This thin stack is sandwiched between two sheets of heat-strengthened glass that provides electrical insulation and physical protection. Like silicon modules there is no liquid to leak. The only aspect of CdTe modules that raises toxicity concern is the cadmium in the cadmium telluride and cadmium sulfide. Cadmium is a toxic heavy metal, but when cadmium is chemically bonded to tellurium in the crystalline cadmium telluride compound, it has only 1/100th toxicity to humans of cadmium on its own (i.e. not bonded to another element in a compound, also known as free cadmium).[13] The compound cadmium telluride is very stable, so it does not easily break down into cadmium and tellurium.

[11] Smith, D.B., Cannon, W.F., Woodruff, L.G., Solano, Federico, Kilburn, J.E., and Fey, D.L., 2013, Geochemical and Mineralogical Data for Soils of the Conterminous United States: U.S. Geological Survey Data Series 801, 19 p., http://pubs.usgs.gov/ds/801/

[12] PV: 12 g of lead (per panel) per 65 ft^2 (panel footprint of 21.5 ft^2 / ground coverage ratio of 0.40) = 0.223 g of lead/ft^2
Soil: 15 mg of lead per kg of soil * 45 kg of soil per ft^3 * 4 inches (0.333 ft) soil depth * 65 ft^2 = 14.61 g of lead / 65 ft^2 = 0.225 g of lead/ft^2

[13] C. Miller, I.M. Peters, and S. Zaveri, Thin Film CdTe Photovoltaics and the U.S. Energy Transition in 2020, https://qesst.org/resources/thin-film-pv-report-2020/, June 2020

Cadmium telluride PV panels have been in use for decades, and their potential for creating a health hazard has been studied as long. As shown in the sections below and the some of the reading resources linked at the end of this section, CdTe panels are extremely safe and do not pose any risk to public health and safety, including when installed in large numbers.

Broken PV Panels

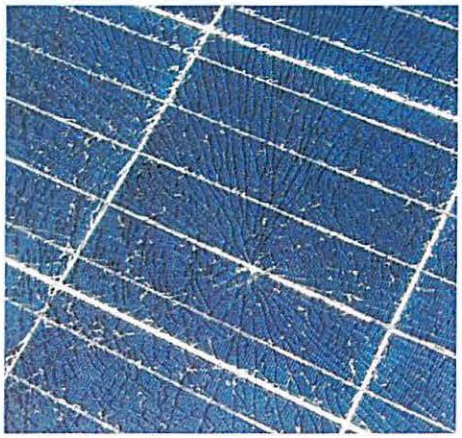


Figure 4. Close-up photo of impact point that broke the glass front of this PV panel

There is zero risk of toxicity escape from undamaged PV panels because any lead is sealed from air and water exposure. Individual panels damaged during the life of the solar facility are identified in days to months through either remote monitoring of system performance or from visual inspections during maintenance by onsite staff. In 2019 an international team of experts conducted an International Energy Agency - Photovoltaic Power Systems Programme (IEA-PVPS) study to assess if there is a public health hazard caused by lead leaching from the broken PV panels during the life of a utility-scale solar facility utilizing conservative assumptions to evaluate extreme scenarios.[14] The study examined worst-case exposure routes of soil, air, and ground water for a typical 100 MW_{AC} PV facility. For example, the worst-case residential groundwater exposure assumed that all broken panels from the entire array were within 25 feet of the groundwater well, and the chemicals released from every broken panel transported to the same groundwater well. The study found that worst-case lead exposure via air, soil, and water were each orders of magnitude less than the levels defined by the US Environmental Protection Agency (EPA) to have no adverse health effects. In the case of water, the health-screening level is the same as the maximum concentration level (MCL) set by the EPA for water quality in public water systems. This study demonstrates that there is no risk to public health from lead leached from broken PV panels.

PFAS

Some solar opponents have raised questions about the possibility of per- and poly-fluoroalkyl substances ("PFAS") chemicals being emitted by solar panels. PFAS chemicals are a group of man-made chemicals informally known as "forever chemicals" due to their durability in the environment. These chemicals have been used in many industrial and consumer products for over 60 years, including food packaging materials, firefighting foam, waterproof clothing, stain resistant carpet treatments, and thousands more.

As explained in a fact sheet from the University of Michigan entitled "Facts about solar panels: PFAS contamination", PV panels do not contain PFAS materials.[15] Neither the self-cleaning coating on top of the solar panel, the adhesives in the panel, nor the front or rear covers/substrates contain PFAS. The "backsheet", or traditional rear substrate of a silicon PV panel, is the thin opaque plastic layer on the rear of a single-glass PV panel that provides electrical insulation and physical protection for the rear of the PV cells. Polyvinyl fluoride (PVF) is the base material for the most common backsheet material (Tedlar), but several other materials have also been used as backsheets, some consisting of multiple layers. Depending on which definition of PFAS that is used, PVF may be classified as PFAS, however the most recent and applicable definition of what is and is not a PFAS material was created by the Organization for Economic Co-operation and Development (OECD)[16] in 2021 and PVF does not meet this modern PFAS definition[17].

---

[14] P. Sinha, G. Heath, A. Wade, K. Komoto, 2019, Human health risk assessment methods for PV, Part 2: Breakage risks, International Energy Agency (IEA) PVPS Task 12, Report T12-15:2019. ISBN 978-3-906042-87-9, September 2019

[15] "Clean Energy in Michigan" Series, Number 12, Facts about solar panels: PFAS contamination, By Dr. Annick Anctil, https://graham.umich.edu/media/pubs/Facts-about-solar-panels--PFAS-contamination-47485.pdf

[16] OECD is an intergovernmental organization with representatives of 38 industrialized countries. OCED developed the updated definition in response to an international call for "programmes and regulatory approaches to reduce emissions and the content of relevant perfluorinated chemicals of concern in products..." OECD Portal on Per and Poly Fluorinated Chemicals: www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

[17] OECD (2021), Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, OECD Series on Risk Management, No. 61, OECD Publishing, Paris. www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/terminology-per-and-polyfluoroalkyl-substances.pdf

However, not all PV panels even have a backsheet, in fact the trend in PV module design is to replace the backsheet with a thin sheet of glass so that the module has thinner front and rear sheets of glass instead of a thicker sheet of front glass and a thin plastic backsheet. Bi-facial modules like those planned for Piney Grove Solar, require a clear glass covering on their back to allow light to reach the rear of the PV cells and therefore do not have a backsheet. Thus, the bi-facial modules at Piney Grove Solar should not contain any PFAS, by any definition of PFAS.

PV Panel End-of-Life

PV panels last a very long time, but they do not last forever. Their output declines slightly each year, but panels rarely fail in less than 40 years. The expected economic life of utility-scale PV panels is 25-40 years, at which point they may be replaced by new panels or the entire project may be decommissioned, bringing the land back to how it was before the solar facility was installed. In both instances, the original PV panels are removed from the site. Although not required by the county, **the project lease agreement with each landowner requires that the project provide a decommissioning security equal to 125% of the decommissioning cost (gross decommissioning cost minus salvage value) to ensure funds are available if needed for decommissioning the project**. There are three possible fates for solar panels at the end of their economic life at a project:

- **Reuse**: When the PV panels at the Piney Grove Solar project are decommissioned they will likely still produce at least 75% of their original output and have another decade of productive life, making them most valuable to be reused as solar panels on rooftops or ground-mounted applications. Markets for used solar panels exist today and are likely to be much more mature and widely available in 30-40 years when the Piney Grove Solar PV panels near the end of their life.
- **Recycling**: Any panels that are not reused as working panels could be recycled. Currently in the US, it is possible to recycle the largest constituents of silicon PV panels (glass, aluminum frame, copper wires) using the existing glass and metal recycling infrastructure. Today this recycling comes at a cost premium to disposing the panels in a landfill. However, as PV recycling technology improves and the number of panels reaching end-of-life increases dramatically, it is possible that in the future recycling PV panels will more than pay for itself. Recycling plants built specifically to recycle PV panels can recycle nearly 100% of the panel, including the valuable silver and refined silicon they contain, and can be optimized for the task, significantly reducing the cost to recycle each panel. In 2018 the first industrial-scale PV-specific recycling plant was built, in France, and in 2022 the first large scale PV recycling plant in the US was built. These initial PV recycling plants will not have the capacity to recycle the millions of installed PV panels, but in the coming decades it is expected that PV-specific recycling plants will become much more commonplace. PV recycling technology is clearly still in its infancy. However, it is expected that when the Piney Grove PV panels reach the end of their useful life in 30+ years, the US PV recycling infrastructure will be robust, such that reuse or recycling of the PV panels will be the preferred options or required by new U.S. regulations, as it has been for years in Europe.

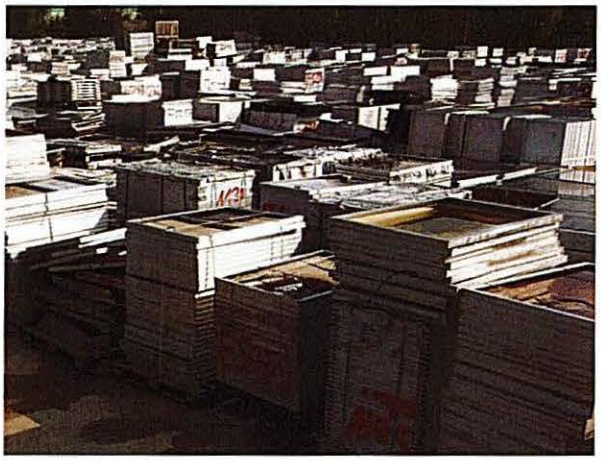


Figure 5. PV Panels Waiting to be Recycled (Source: LuxChemtech GmbH)

  The Solar Energy Industries Association (SEIA) started the SEIA National PV Recycling Program several years ago to accelerate PV recycling in the US. Currently the program aggregates the services offered by recycling vendors and PV manufacturers, making it easier for the industry to select a cost-effective and environmentally responsible end-of-life management solution. **The program identifies Preferred Recycling Partners through an evaluation process. These partners are capable of recycling PV modules, inverters, and other related equipment today**. The current SEIA PV Recycling Partners are listed on the program's website, and full access to the program and the Preferred Recycling Partners is available to SEIA members.

- **Disposal**: If panels are not reused or recycled, federal waste management laws (Resource Recovery and Conservation Act, RCRA) require that PV panels, like any other commercial/industrial waste, be disposed of properly, which would typically be in a landfill. In order to determine the proper disposal method, RCRA requires that all commercial/industrial waste be identified as either hazardous or non-hazardous waste, which is generally determined for PV panels using the Toxic Characteristic Leaching Procedure (TCLP) test developed by the U.S. EPA. This test seeks to simulate landfill

conditions and check for leaching of 8 toxic metals and 32 organic compounds. Limited data has been published about the TCLP test results of solar panels, but it is known that some older silicon panels that contain more lead than modern panels exceed the TCLP test limits for lead. Researchers at Arizona State University's Photovoltaic Reliability Laboratory have done the most robust investigation of methods for conducting accurate TCLP test on PV panels, and their latest research found that all three of the modern crystalline silicon PV panels tested passed the TCLP test, classifying them as non-hazardous waste.[18]

A worst-case scenario would be tons of PV panels being disposed of in a non-sanitary landfill, which is essentially a huge pile of garbage with little to no effort to minimize leaching from the waste. This type of landfill is illegal in many world regions, including in North Carolina. A recent IEA-PVS research study on PV panels disposal risks used this worst-case situation to evaluate the potential for cancer and non-cancer hazards through comparison of predicted exposure-point concentrations in soil, air, groundwater, and surface water with risk-based screening levels created by the EPA and the World Health Organization (WHO).[19] One the report's authors, Gavin Heath with the US Department of Energy's National Renewable Energy Laboratory (NREL), summarized their findings about lead in silicon PV panels this way: "under the worst-case conditions, none of them exceeded health-screening thresholds, meaning they're not deemed to potentially have significant enough risk that you'd want to do a more detailed health risk assessment."[20] The worst-case scenario defined in the research has many conservative assumptions, and thus likely overestimates the risk of disposal in a *non-sanitary* landfill. It is important to stress that North Carolina only allows solid waste disposal in sanitary landfills, which are engineered facilities with plastic liners, leachate collection systems, and covers, all of which dramatically reduce the potential for human exposure compared to the non-sanitary landfill assumed in the study. This and other research show that if the Piney Grove Solar PV panels are disposed of in a landfill they will not create any negative public health impact.

In 2019 the North Carolina legislature passed HB 329 (S.L. 2019-132), requiring the NC Department of Environmental Quality ("DEQ") to prepare a report to guide rulemaking regarding decommissioning of solar PV and other renewable energy facilities and proper disposal of their equipment. The report issued January 1, 2021 and titled *Final Report on the Activities Conducted to Establish a Regulatory Program for the Management and Decommissioning of Renewable Energy Equipment*, provides a thorough discussion addressing many questions landowners and communities may have about solar decommissioning. DEQ compiled the input and commentary of numerous stakeholders, including the renewable energy industry, environmental organizations, and academia, including the author and NC State University's Clean Energy Technology Center. The report is well researched and very informative. DEQ provides several key findings and recommendations, but no recommendations for changes in NC regulations of solar. **One of the report's key findings is that "According to Division of Waste Management experts, if every end-of-life PV module is disposed of in landfills, landfill capacities will not be negatively impacted."**

In South Carolina in 2021, the South Carolina legislature required the SC Department of Health and Environmental Control (DHEC) to prepare a report similar in scope to the NC DEQ report published 2021. While this report does not have any impact on regulations at Piney Grove, stakeholders may find value in the report. SC DHEC was required to prepare a report on research and recommendations on End-of-Life Management of Photovoltaic Modules and Energy Storage Systems, addressing six specific issues laid out by the legislature. The 50-page report titled *Final Report on the Activities Conducted to Establish a Program for End-of-Life Management of Photovoltaic Modules and Energy Storage Systems* was issued June 30, 2022. **The report describes end-of-life of PV modules topics that align with the content of this health and safety assessment, including the following conclusions: "The Department of Health and Environmental Control believes it is in the best interest of South Carolina to continue to promote the use of solar energy in our state to decrease energy costs, promote economic development, increase consumer choice in energy consumption and hopefully reduce pollution and emissions."** The report continues, "We must also be sure not to compromise human and environmental health in the process of installing and decommissioning solar energy facilities." Throughout the report DHEC suggests commonsense approaches to ensuring the long-term safety of utility-scale solar based on state and federal regulations.

---

[18] Tamizhmani, G., et al. (2019). Assessing Variability in Toxicity Testing of PV Modules. In 2019 IEEE 46th Photovoltaic Specialists Conference (pp. 2475-2481). Institute of Electrical and Electronics Engineers Inc.. https://doi.org/10.1109/PVSC40753.2019.8980781 Publicly-accessible version: dev-pvreliability.ws.asu.edu/sites/default/files/93_assessing_variability_in_toxicity_testing_of_pv_modules.pdf

[19] P. Sinha, G. Heath, A. Wade, K. Komoto, Human health risk assessment methods for PV, Part 3: Module disposal risks, International Energy Agency (IEA) PVPS Task 12, Report T12-16:2020. ISBN 978-3-906042-96-1, May 2020

[20] Green Tech Media, Landfilling Old Solar Panels Likely Safe for Humans, IEA Research Suggests, April 2020, www.greentechmedia.com/articles/read/solar-panel-landfill-deemed-safe-as-recycling-options-grow

Transformer Oil

While PV modules and inverters do not have any liquids that could leak into the environment, the generator step-up (GSU) transformer in the substation and the inverter step-up (ISU) transformers located with each inverter do contain an oil. Several types of oil can be used in transformers to provide the needed electrical insulation and cooling, but the most common type of transformer oil is mineral oil, which has been used in transformers since transformers were first manufactured in the 1890s. Due to the large volume of oil contained in a GSU transformer, they are installed with a secondary containment structure under them to contain any oil leaked or spilled. The smaller ISU transformers are approximately the same size as the transformers located throughout every community; behind schools, shopping centers, apartments, etc., and they typically do not provide secondary containment. However, ongoing monitoring of transformer temperature and pressure, and regular preventative maintenance, is likely to find the rare leak when it is still small before it has a chance to leak much oil.



Figure 6. GSU Transformer with Secondary Containment to Capture any Leaked Oil

There was a time when most transformer oil was toxic. From 1929 to 1977 polychlorinated biphenyls (PCBs), a man-made alternative to mineral oil, was commonly used as transformer oil instead of mineral oil. However, the toxicity of PCBs was eventually understood, leading to PCBs being banned in the US in 1979. Today, transformers either use mineral oil or vegetable oil, both of which are free of PCBs. Mineral oil is non-toxic to humans, in fact "baby oil" that is commonly used to soothe babies' skin is a scented mineral oil. Although non-toxic to humans, mineral oil is an environmental contaminate and harmful to aquatic ecosystems, so any release to the environment should be avoided. The potential for negative environmental impact from spilled vegetable oil is much less because these oils are biodegradable, so the time they impact the environment is short-lived. Federal regulations dating back to the Clean Water Act of 1973 require that facilities with significant quantities of oil prevent pollution of water.[21] The current EPA regulations require that facilities with over 1,320 gallons oil, and with the potential for spilled oil to impact surface water, develop and implement an oil spill prevention, control and countermeasure (SPCC) plan. While the risk of negative environmental impact from a transformer oil spill/leak cannot be eliminated entirely, these regulations along with standard industry practices result in a low probability for a substantial spill and a high probability for a quick clean-up response to minimize impact if a spill were to ever occur.

Contents of Batteries

The components of lithium-ion batteries vary because there are many different battery chemistries in use and several different cell construction types. And while lithium itself is non-toxic, some lithium-ion batteries do include some toxic heavy metals such as cobalt, nickel, or manganese. During the operational life of the batteries any metals in the cells are sealed inside of the batteries and thus have no impact on human health. The solvent-based liquid electrolyte in each cell is very difficult to get to leak out of a cell and will quickly evaporate if it does. In addition to the battery cells, the battery system also includes a battery management system that consists of sensors, switches, and similar controls equipment. The battery enclosure is typically an outdoor-rated steel enclosure.

Batteries End-of-Life

The performance of stationary batteries slowly degrades, eventually resulting in enough reduction of energy capacity that the battery is considered to have reached the end of its life. The expected lifespan of lithium-ion batteries is on the order of 10 to 20 years.

At the end of its life the batteries will be safely decommissioned, which will involve de-energizing the batteries to a low voltage, disconnecting each battery module from the system, removing battery modules and associated components, preparing the list of materials and components for removal, disposal, or recycling, and then shipping them to their next

[21] Environmental Protection Agency, webpage: Overview of the Spill Prevention, Control, and Countermeasure (SPCC) Regulation, www.epa.gov/oil-spills-prevention-and-preparedness-regulations/overview-spill-prevention-control-and

location. Transport of some battery components, including shipping via a shipping provider, is regulated by the United States Department of Transportation (U.S DOT).

Most of the non-battery components of the system have readily available scrap markets, such as steel, aluminum, and copper. Much like end-of-life PV modules, end-of-life batteries can be repurposed for second life applications, recycled, or landfilled.

- **Recycling** – Lithium-ion batteries are recyclable. Currently only a small percentage of lithium-ion batteries are recycled, but that is changing very quickly. The US is just starting to build facilities that can fully recycle lithium-ion batteries into battery constituents ready to build new lithium-ion batteries. While there are many challenges to creating a robust, cost-effective collection and recycling industry for lithium-ion batteries, it does appear to be technically possible. The US Department of Energy as well as several industry groups and private companies are investing in research and development that they hope will lead to widespread recycling of lithium-ion batteries in the US.

- **Disposal** – When batteries are not repurposed or recycled, batteries are disposed as waste. Battery disposal is governed by EPA Universal Waste rules, which require waste handlers to separate hazardous materials for disposal under federal laws but allow the disposal of the remaining non-hazardous waste per state and local requirements. Once the fire risk is removed from the batteries (either by mechanical or chemical means), non-hazardous materials not recovered for reuse or recycling can be disposed of through municipal waste streams. While some lithium chemistries are considered non-hazardous, many batteries have toxic constituents that require treatment as hazardous materials. The potential toxicity of Li-ion battery materials varies widely by chemistry; for example, where nickel, cobalt, or lead are present in battery chemistries in significant quantities, precautions must be taken at disposal or incineration sites in line with the hazards of those individual materials.[22]

Toxicity: Operations & Maintenance

The operations and maintenance (O&M) activities for a solar and battery energy storage site are rather limited. Often the most significant effort is maintenance of the vegetation on the site. The PV equipment and the battery equipment require some, but limited, scheduled and unscheduled maintenance.

Site and Solar Operations & Maintenance

The only two aspects of operations and maintenance (O&M) of solar system that have raised concerns about toxicity are the fluids used to wash PV panels and herbicides used to maintain vegetation.

- **Panel Washing** – Across North Carolina there is ample rain to keep the panels clean. If the panels need to be washed, it would occur infrequently and typically with use of only deionized water and cleaning brushes.

- **Herbicides** – The industry standard practice for maintaining the vegetation at solar facilities is similar to how most cities maintain their city parks, which is they primarily rely on mowing and string trimmers for vegetation management, and use herbicides along fences, in roads, and around some equipment. Parks and solar facilities also use herbicides to strategically remove problem weeds, especially woody weeds, to maintain a healthy cover of the desired species of grasses and other low-growing vegetation. This mode of herbicide use applies significantly less herbicide volume than is commonly applied in NC agriculture. For example, Round-Up-Ready crops are common row crops that have been engineered for the entire field, including the crops, to be sprayed with Round-Up (glyphosate) several times each season. Additionally, farmers applying most types of herbicides to their fields are not required to be certified or licensed, but a NC commercial pesticide applicators license is required to apply any herbicide to a solar facility.

[22] Energy Storage Association (ESA), End-of-Life Management of Lithium-ion Energy Storage Systems, April 2020, https://energystorage.org/wp/wp-content/uploads/2020/04/ESA-End-of-Life-White-Paper-CRI.pdf

Batteries Operation and Maintenance

Battery operation does not produce any emissions, and they require very little maintenance during their operating lifetime. The battery systems require some scheduled maintenance for things like cleaning HVAC air filters and annual or semi-annual visual checks of electrical connections. Some systems use an anti-freeze liquid coolant that might require replacement during the life of the system, but this does not pose a health or safety hazard.

Sources for Further Reading on Toxicity/End-of-Life:

- International Renewable Energy Agency (IRENA): End-of-Life management: Solar Photovoltaic Panels, June 2016
- Electric Power Research Institute (EPRI): Environmental and Economic Considerations for PV Module End-of-Life Management, December 2018
- EPRI: Feasibility Study on Photovoltaic Module Recycling in the United States, April 2018
- EPRI: Solar Photovoltaics End of Life Management Infographic, March 2021
- National Renewable Energy Laboratory (NREL): A Circular economy for PV system materials, April 2021
- North Carolina Department of Environmental Quality: Final Report on the Activities Conducted to Establish a Regulatory Program for the Management and Decommissioning of Renewable Energy Equipment, January 2021
- Energy Storage Association (ESA): End-of-Life Management of Lithium-ion Energy Storage Systems, April 2020
- EPRI: Lithium Ion Battery Energy Storage End of Life Management Infographic, April 2021
- ReCell Center: A national collaboration of industry, academia and national laboratories working together to advance recycling technologies along the entire battery life-cycle for current and future battery chemistries (website)
- NAATBatt: Laws, Regulations and Best Practices for Lithium Battery Packaging, Transport and Recycling in the United States and Canada (webpage)

Electromagnetic Fields (EMF)

Exposure to EMF, or electric and magnetic fields, is a fact of everyday modern life. Electromagnetic fields come in many different frequencies, ranging from grid electricity with a frequency of 60 hertz to x-rays and gamma rays that are billions of billions of times faster. The faster the frequency the stronger the EMF. The EMF coming from grid electricity, including from the inverters, transformers, and AC wires to be used at the Piney Grove Solar facility, has much lower frequency and therefore much lower energy than the EMF from cell phones, wireless internet, and even radio and TV towers. The solar panels, the batteries, and the wires connecting both of them to the inverters carry direct current (DC) electricity, which has a frequency of zero hertz, and thus produces static electric and magnetic fields. The voltage and current of these circuits are both relatively low, so the electric and magnetic fields they produce are both rather weak. The static magnetic fields the PV panels generate are much weaker than the Earth's natural static magnetic field, which can be demonstrated by a compass still pointing north when placed near the panels.

Electric fields are created around wires and equipment wherever a voltage exists, however it is easily blocked with common materials such as metal, wood, and soil. The World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to electric fields (0 to 100,000 Hz) at levels generally encountered by members of the public.[23] The proposed solar project does not produce any voltages higher than the existing power lines, and therefore does not produce any electric fields not generally encountered by members of the public.

Magnetic fields are the other aspect of EMF, and they are created by electric current. Typical Americans are exposed to about 1 milligauss of magnetic field from grid electricity (60 Hz) on average during their day, primarily from sources at homes and work[24]. The primary source of magnetic fields in a solar facility are the inverters and the short section of wires between each central inverter and its step-up transformer. To convert direct current to alternating current, inverters use a series of solid-

[23] WHO factsheet: Electromagnetic fields and public health, Exposure to extremely low frequency fields, June 2007, www.who.int/peh-emf/publications/facts/fs322/en/

[24] World Health Organization (WHO), webpage: Electromagnetic Fields – Typical exposure levels at home and in the environment, www.who.int/peh-emf/about/WhatisEMF/en/index3.html

state switches that turn off and on several thousand times a second, creating EMF in the range of 5 kHz to 100 kHz, which is much faster than the 60 Hz of grid electricity but still much slower than even the lowest frequency radio signals. The highest electrical current of any portion of the solar facility occurs in the inverters, ISU transformers, and the few feet of wire between them, making this the source for the strongest magnetic fields in the facility.

Since the strength of a magnetic field decreases dramatically with increasing distance from the source, these magnetic fields only extend about 50-300 feet from the inverter and ISU transformer, at which point the magnetic fields would be expected to measure less than 0.5 milligauss, which is less than half the typical American's average 60 Hz EMF exposure over a day.[25, 26] The locations of the inverters and ISU transformers at the Piney Grove Solar project are defined on the preliminary site plan, which could change some before construction but are generally expected to remain the same. Based on the current site plan, the closest inverter/transformer to a home is 400 feet, with most homes adjacent to the facility being over 1,000 feet from the closest inverter/transformer pad, resulting in effectively no EMF from the PV facility reaching any neighboring homes. Similarly, the magnetic fields from substations generally do not extend far enough to leave the fence around the substation, so the same can be expected for the Project's substation.[27]

The bottom line is that the EMF from the Piney Grove Solar PV system is unlikely to leave the solar site boundary, and thus is not expected to increase the EMF exposure of any neighbors. Even if some EMF from the PV facility were to extend beyond the fenced perimeter of the site, there would still be no public health impact because low levels of extremely low frequency (ELF) EMF exposure are not harmful to humans. After extensive study of the potential health impacts of EMF from grid electricity the World Health Organization (WHO) concludes:

> *"Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health."*[28]

Sources for Further Reading on EMF:

- Electric Power Research Institute: EMF and Your Health: 2019 Update, December 2019
- World Health Organization: Electromagnetic Fields (accessed September 2022)

Heat Island Effect

The localized effects of large-scale PV facilities on temperature and moisture are not yet well understood. However, the localized micro-climate effects of large-scale PV facilities are understood well enough to determine that they do not create a heat island effect similar to the well-documented urban heat island effect from dark, massive, surfaces in urban environments, such as asphalt paved streets and parking lots, that cause urban areas to be significantly warmer than the surrounding rural area during the day and night. The changes that solar panels may make to the way land absorbs, reflects, and emits the energy from sunlight are minimal compared to the changes created by buildings, vehicles, and many miles of concrete and asphalt. By comparison, solar panels absorb and reflect a similar amount of solar energy as vegetation and soil. Solar panels are lightweight and cannot store large amounts of thermal energy, and the ground remains covered in vegetation with its natural exposure to air and water.

Initial research into the potential for PV systems to cause a heat island effect have used a variety of techniques, including conceptual energy flow calculations, advanced fluid dynamic computer simulations, and field measurements of

[25] Study of Acoustic and EMF Levels from Solar Photovoltaic Projects. Tech Environmental, Inc., December 2012, https://www.masscec.com/resources/study-acoustic-and-emf-levels-solar-photovoltaic-projects
[26] EPRI technical report, Electric and Magnetic Field Exposure Levels (0 to 3 GHz) in Occupational Environments near Photovoltaic Energy Generation Facilities, November 2012, https://www.epri.com/research/products/1023797
[27] www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf
[28] World Health Organization (WHO), webpage: Electromagnetic Fields – Summary of health effects, www.who.int/peh-emf/about/WhatisEMF/en/index1.html

temperature.[29, 30, 31] This research found a range of different effects on temperature, but none indicate that a large PV system could affect the temperature of the surrounding community. Most found that compared to similar undeveloped land the air temperature in a solar facility increases during the day, but the nighttime results were mixed. Some studies found PV sites to be cooler than non-PV sites at night, but others found them to be warmer. Much of this variation is likely explained by the different climates studied but may also be due to the different methods of the studies. Much of the research on solar heat island effect occurred in arid regions of the U.S. southwest where the results are unlikely to translate perfectly to wetter climates in the southeast. In a written statement of evidence Greg Barron-Gafford, leading solar heat island effect researcher, says that he expects that when the area under the PV array is vegetated with grass that the localized heat island effect his research found in dry climates will be greatly reduced.[32]

The available studies agree that the slight increase of air temperature in the PV site dissipates quickly with height and distance from the panels as natural processes remove and spread the heat. As a result, any temperature increase that may occur at the Piney Grove Solar project during the day will be limited to the site and will not increase the temperature of any of the surrounding community.

Sources for Further Reading on Heat Island Effect:

- EPA: Learn About Heat Islands, (accessed September 2022)

Glare

Photovoltaic panels are designed to absorb, and thus not reflect, the solar energy that they receive. However, when sunlight strikes the glass front of a solar panel at a glancing angle a significant portion of the solar radiation is reflected, which can potentially lead to solar glint (a brief flash) or glare. Glint or glare can temporarily impact a person's vision, including pilots landing aircraft, or motorists driving vehicles. However, the conditions required for a PV project to create glare rarely occur. PV facilities, such as Piney Grove Solar, that utilize single axis trackers to slowly rotate the solar panels to follow the sun have even less potential to create glare because the trackers help avoid a situation where sunlight hits the panels at a glancing angle. Most modern trackers implement an advanced control strategy known as "backtracking" that increases the electricity production of the site by flattening the tilt of the panels early and late in the day to keep the rows of solar panels from shading one another. Backtracking can result in brief periods near sunrise and sunset where the sun strikes the panels at a glancing angle, creating a situation that could result in a few minutes of visible glare at sunrise and sunset. For anyone to see this glare they must be looking across the solar panels in the direction of the rising or setting sun, which is a situation where the sun obviously will create significant glare for the viewer with or without the solar project.



Figure 7. 20 MW PV System at Indianapolis International Airport (Photo source: inhabitat.com)

A clear indication of the ability to avoid glare problems from large ground-mounted PV systems are the PV systems installed on airports across the U.S., including Denver International and Indianapolis International. While there is the potential for a PV

[29] Broadbent, Ashley & Krayenhoff, Eric & Georgescu, Matei & Sailor, David. (2019). The Observed Effects of Utility-Scale Photovoltaics on Near-Surface Air Temperature and Energy Balance. Journal of Applied Meteorology and Climatology. 58. 10.1175/JAMC-D-18-0271.1.
[30] Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016).
[31] V. Fthenakis and Y. Yu, "Analysis of the potential for a heat island effect in large solar farms," 2013 IEEE 39th Photovoltaic Specialists Conference (PVSC), Tampa, FL, 2013, pp. 3362-3366, doi: 10.1109/PVSC.2013.6745171.
[32] G. Barron-Gafford, Statement of Evidence by Greg Barron-Gafford on Solar Heat Islanding Issues, May 2018, www.planning.vic.gov.au/__data/assets/pdf_file/0024/126555/301-Expert-Witness-Statement-of-G-Barron-Gafford-PVHI-May-2018-Lemnos.pdf

system to create glare, there is also the ability to predict when and where a system may create glare and incorporate any needed mitigation before construction. The Federal Aviation Administration (FAA) and the U.S. Department of Energy (DOE) developed specialized solar glare analysis software to predict when and where a PV project may produce glint or glare for sensitive receptors nearby. That original software technology has been licensed to a 3rd firm (Forge Solar) that continues to improve and refine the software, which has been validated to accurately predict solar glare.

In May of 2021, the FAA replaced the long-standing interim solar glare policy with a (final) policy that no longer restricts solar developed on airport property from creating glare visible to pilots. The policy explains that the new acceptance of glare visible to pilots is in recognition that pilots often experience glare during landing from bodies of water and that glare from solar is not meaningfully different.[33] The new policy does still prohibit on-airport PV systems from creating any glare visible in an air traffic control tower. While the FAA policy only applies to PV developed on airport property, it is reasonable to follow the same policy for PV plants sited near airport property.

The two closest airports in the National Plan of Integrated Airport Systems (NPIAS)[34] are the Mount Olive Municipal Airport (W40) and Kinston Regional Jetport (ISO). Mount Olive Municipal Airport is approximately 10 miles southwest of the closest solar panel and Kinston Regional Jetport is approximately 12 miles northeast of the closest solar panel. Kinston Regional Jetport has an air traffic control tower, but Mount Olive Municipal Airport does not have a control tower. Previous conservative FAA guidance was to conduct a software glare hazard analysis when a PV facility is proposed within 5 nautical miles (5.75 miles) of an airport.[35] With both airports being over 10 miles away from the project and the closer airport, Mount Olive Municipal Airport, not having an air traffic control tower, there is no chance for Piney Grove to create a glare hazard at these airports. However, there is a military air base, Seymour Johnson Air Force Base, located somewhat closer, approximately 6 miles northwest of the closest solar panel. Due to the proximity of this air base, the Piney Grove project plans to have a third-party engineer conduct a software glare hazard analysis of the project, however the result of this glare study are not yet available. Due to the distance from the air base, and the tracking design of the solar array, the author expects that the study will find no potential for Piney Grove to create a glare hazard for aviation.

Sources for Further Reading on Solar Glare:

- National Renewable Energy Laboratory (NREL): Research and Analysis Demonstrate the Lack of Impacts of Glare from Photovoltaic Modules, July 2018
- ForgeSolar: PV Planning and glare analysis software help documentation, (accessed September 2022)

Noise

Solar panels are silent, but some of the other components of a PV system produce some sound, although they are rarely heard by anyone outside of the project fence. The loudest equipment is the inverters, but the transformers and tracking systems also make some sound. These numerous sources of sound are dispersed throughout the facility, but the physics of sound are such that these dispersed sources of sound are non-additive. For example, if there are 50 inverters spaced across a utility-scale solar facility and you are close enough to hear some inverter noise, you could turn off the 49 inverters farthest from you and you likely wouldn't notice the difference between the sound from 1 inverter and the sound from 50 inverters. Even if two inverters are right next to each other and an even distance from you, the perceived volume of the sound coming from the two inverters is very similar to the sound from just one inverter. So, the potential for someone offsite to hear any sound generated inside a utility-scale PV project is determined by the closest and loudest source of sound. Thus, some simple

[33] "Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports", https://www.federalregister.gov/documents/2021/05/11/2021-09862/federal-aviation-administration-policy-review-of-solar-energy-system-projects-on-federally-obligated

[34] The National Plan of Integrated Airport Systems (NPIAS) identifies nearly 3,310 existing and proposed airports that are included in the national airport system. The NPIAS contains all commercial service airports, all reliever airports, and selected public-owned general aviation airports. www.faa.gov/airports/planning_capacity/npias

[35] NC Template Solar Ordinance, Appendix F: Airports. https://nccleantech.ncsu.edu/wp-content/uploads/2018/06/NC-Template-Solar-Ordinance.pdf

analysis of the sound coming from the closest sources to a point of interest, such as a home, can effectively estimate the level of sound from the PV project at that location.

Before providing site-specific analysis of the potential for noise impacts from the Piney Grove project, it is useful to put the sound from the PV project in context. Our world is full of sounds, day and night, even in quiet rural areas, and any sounds from the PV project would be in concert with the existing sounds. The appropriate analysis metric is not if the sounds are audible, but if they are noticeable or bothersome, and US and international organizations have published guidance on this topic based on research on how sound impacts the public.

In 1972, the US passed the Noise Control Act, which required the EPA to define criteria for protecting the public health and wellbeing from noise interference. In response, the EPA developed guidance that included recommended sound levels limits at residential structures (or places in which quiet is a basis for use)[36]. This guidance recommends that noises at residences be limited to 55 dBA L_{dn}, where L_{dn} is the average sound level of a 24-hour period with the inclusion of a 10-dB penalty during the nighttime hours of 10PM to 7AM. So, the 55 dBA L_{dn} limit could be met with 55 dBA daytime noise and 45 dBA nighttime noise, or a 24-hour noise (L_{eq}) of 48.6 dBA. In addition to the EPA guidance, the United Nations WHO published "Guidelines for Community Noise" (1999) which suggested daytime and nighttime protective noise levels, which are to be applied outside the bedroom window.[37] During the day (7AM to 11PM), the equivalent continuous sound level threshold to protect against serious annoyance is 55 dBA L_{eq}, and 50 dBA L_{eq} to protect against moderate annoyance. During the night (11PM to 7AM), the averaged equivalent continuous sound level threshold is 45 dBA L_{eq}. So, the EPA and the WHO recommend similar daytime noise limits (~55 dBA and 55 to 50 dBA, respectively), and similar nighttime limits as well (~45 dBA and 45 dBA, respectively). Without local noise regulations or recommendations, these recommended noise limits from EPA and WHO provide well-established criteria for acceptable noise in rural residential areas.

At this stage of project development, the site plan can be used to conduct a preliminary screening level noise impact assessment. Available sound power data from representative equipment is used in this assessment, so the installed equipment could have somewhat different noise generation, but the difference is expected to be insignificant. Both the PV panels and the batteries require inverters, which is the loudest piece of equipment in the facility. The PV inverters are planned to be a 4.0 MW central model, and this assessment used sound data from one of the most common central inverters on the market today, with a capacity of 3.6 MW. The battery inverters are not yet specified, but will not be any larger or louder than the PV inverters.

Generally, the difference in sound from different transformers of a similar capacity is minimal, so like the inverter, the representative sound data for the substation transformer is expected to be very similar to the equipment installed at Piney Grove. The third and final component that makes some noise is the motor in the tracker system, which is often located in the center of some rows of solar panels. There is a wide variety of tracker system systems with varying numbers, sizes, and styles of motors. Due to the uncertainty about the tracker that will be installed, a very conservative sound power level is used for the tracker motors in this assessment. The ISU transformers located with each inverter also makes some noise but is significantly quieter than the inverter, so it has negligible impact on the sound level heard some distance from the inverter/transformer pair, so for simplicity the ISU transformers are not included in this screening level noise impact assessment.

The following analysis starts with the sound power level of the equipment, which is measured in decibels but is different than sound pressure level, which is also measured in decibels and is used to describe how loud a sound is to humans. The sound power level of the equipment is a measure of the total acoustic energy emitted from a source of noise. The sound power level value and the distance between the equipment and the person is all that is needed to calculate the loudness of the sound in the person's ears, which is the sound pressure level. The sound power levels of representative equipment are as follows[38]: 3.6 MW inverter: 101 dBA, substation transformer: 88 dBA, and tracker motors: 90 dBA. The distance used in this

[36] US Environmental Protection Agency (EPA), "Information on Levels of Environmental Loise Requisite to Protect Public Health and Welfare With An Adequate Margin of Safety", 1974, https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF

[37] World Health Organization (WHO), "Guidelines for Community Noise", 1999, https://apps.who.int/iris/handle/10665/66217

[38] Inverter and substation transformer sound data provided in *Speedway Solar Sound Study Report*, Revision 1 dated 10/29/2020. Produced by Burns McDonnell for Duke Energy project in Cabarrus County, NC. Tracker motor data and inverter data provided in Kaliski, et. al. Noise-Con 2020 Conference paper titled "An Overview of Sound From Commercial Photovoltaic Facilities", https://rsginc.com/wp-content/uploads/2021/04/Kaliski-et-al-2020-An-overview-of-sound-from-commercial-photovolteic-facilities.pdf

sound assessment is an estimation of the closest distance between that equipment and a residence based on the Piney Grove Solar site plan dated 8/21/2023, which will be used in the calculation of the worst-case noise at the homes closest to the project. 400-ft is the estimate for the inverters and 150-ft is used for the tracker motors. The substation transformer is located in the substation, which is more than 3,000 feet from the closest residence. The battery inverters will be located near the substation and assumed to also be at least 3,000 feet from the closest residence. The sound pressure level (in dBA) can be calculated from the sound power level (in dBA) and the distance from the source as follows:

Sound pressure level = sound power level – 20 x log (distance in feet)

- PV Inverters: 101 dBA – 20 x log (400 feet) = 49.0 dBA
- Battery Inverters: 101 dBA – 20 x log (3000 feet) = 31.5 dBA
- Substation transformer: 88 dBA – 20 x log (3000 feet) = 18.5 dBA
- Tracker motors: 90 dBA – 20 x log (150 feet) = 46.5 dBA

These worst-case sound estimates for the PV system meet the EPA and WHO recommended guidelines for daytime noise in a residential setting (~50 dBA), which is the only time the PV inverters and tracker motors are expected to make any noise. The battery inverters may operate at night, and these inverters are well below the EPA and WHO recommended guidelines for nighttime noise in a residential setting (45 dBA). It is important to note that this analysis assumes a clear line-of-sight area between the equipment and the residence, so any vegetation or other obstacles between the PV equipment and the residence will reduce the sound reaching the residence compared to these estimates. It is also important to note that the tracker motors only operate for short periods of time throughout the day and the inverters only produce their maximum sound when operating at maximum power. While this simplified noise impact assessment is limited in capability compared to noise analysis software, this analysis reflects the physics of sound propagation and uses noise data from representative equipment, allowing for a simple yet accurate estimate of worst-case sound impacts. Considering that the surrounding vegetation and solar panels will block some of this sound, this noise estimates should not cause significant concern about noise impacts. In conclusion, the Piney Grove Solar project is not expected to create noise interference or be bothersome to any neighbors.

Sources for Further Reading on Noise:

- World Health Organization (WHO), Guidelines for Community Noise, 1999

Conclusions

Based on my knowledge of engineering and science, personal experience with PV and battery technology, review of academic research, and review of materials provided by Renewable Energy Services about the proposed Piney Grove Solar PV and battery energy storage facility in Wayne County, North Carolina, my findings and opinions are summarized as follows:

- The Piney Grove Solar project will result in a significant reduction of regional air pollution.
- The Piney Grove Solar project will not result in any negative impacts to public health or safety.
- The Piney Grove Solar facility will not increase the temperature of the area surrounding the site.
- The Piney Grove Solar facility is not expected to create any glare hazards or other negative glare impacts for aviation.
- The Piney Grove Solar project is not expected to create bothersome noise for any neighbors.

Kirkland Appraisals, LLC

Richard C. Kirkland, Jr., MAI
9408 Northfield Court
Raleigh, North Carolina 27603
Phone (919) 414-8142
rkirkland2@gmail.com
www.kirklandappraisals.com

August 29, 2023

Mr. Tom Delafield
Piney Grove Solar, LLC
5315 Highgate Drive, Suite 202
Durham, NC 27713

RE: Proposed Piney Grove Solar Farm, Piney Grove Church Road, Goldsboro, Wayne County, NC

Mr. Delafield

At your request, I have considered the impact of a proposed 67 MW solar farm with a Battery Energy Storage System (BESS) with a 26 MW 4-hour capacity, proposed to be constructed on a portion of a 891-acre assemblage of land on Piney Grove Church Road, Goldsboro, Wayne County, North Carolina. Specifically, I have been asked to give my professional opinion on whether the proposed solar farm will have any impact on adjoining property value and whether "the location and character of the use, if developed according to the plan as submitted and approved, will be in harmony with the area in which it is to be located."

To form an opinion on these issues, I have researched and visited existing and proposed solar farms in North Carolina, researched articles through the Appraisal Institute and other studies, and discussed the likely impact with other real estate professionals. I have not been asked to assign any value to any specific property.

This letter is a limited report of a real property appraisal consulting assignment and subject to the limiting conditions attached to this letter. My client is Piney Grove Solar, LLC, represented to me by Mr. Tom Delafield. My findings support the application. The effective date of this consultation is August 29, 2023.

Conclusion

The matched pair analysis in the attached report shows no impact in home values due to abutting or adjoining a solar farm as well as no impact to abutting or adjacent vacant residential or agricultural land where there are sufficient setbacks and buffering as identified in the analysis. The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all indicate that a solar farm is a compatible use for rural/residential transition areas and that it would function in a harmonious manner with this area.

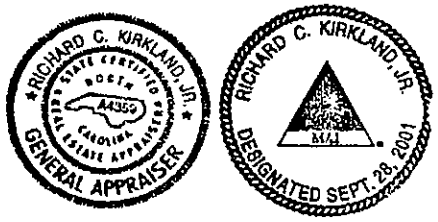
Very similar solar farms in very similar areas have been found by hundreds of towns and counties not to have a substantial injury to abutting or adjoining properties, and many of those findings of no impact have been upheld by N.C. Courts or overturned by N.C. Courts when a board found otherwise (see for example *Dellinger. v. Lincoln County*). Similar solar farms have been approved adjoining agricultural uses, schools, churches, and residential developments. Industrial uses rarely absorb negative impacts from adjoining uses. This same pattern of development has been identified in this report showing that this is not a local phenomenon, but found in Virginia, North Carolina, Maryland, Tennessee, and Florida as representative of the Mid-Atlantic and Southeastern U.S.

Based on the data and analysis in this report, it is my professional opinion that the solar farm proposed at the subject property will have no impact on the value of adjoining or abutting property and that the proposed use is in harmony with the area in which it is located. I note that some of the positive implications of a solar farm that have been expressed by people living next to solar farms include protection from future development of residential developments or other more intrusive uses, reduced dust, odor and chemicals from former farming operations, protection from light pollution at night, it is quiet, and there is no traffic.

Similarly, the paired sales data on BESS systems in this report show no impact at distances much closer than the proposed 840 feet at the project, which supports a finding of no impact on the adjoining property value.

If you have any questions please call me any time.

Sincerely,



Richard C. Kirkland, Jr., MAI
State Certified General Appraiser



Nicholas D. Kirkland
State Certified General Appraiser

Table of Contents

Conclusion 1
I. Proposed Project and Adjoining Uses 4
II. Methodology and Discussion of Issues 12
III. Research on Solar Farms 14
A. Appraisal Market Studies 14
B. Articles 17
C. Broker Commentary 18
IV. University Studies 18
A. University of Texas at Austin, May 2018 18
B. University of Rhode Island, September 2020 19
C. Georgia Institute of Technology, October 2020 20
D. Master's Thesis: ECU by Zachary Dickerson July 2018 21
E. Lawrence Berkeley National Lab, March 2023 22
V. Assessor Surveys 28
VI. Solar Farms Identified in Wayne and Adjoining Counties 31
VII. Market Analysis of the Impact on Value from Solar Farms 33
A. North Carolina Data 34
B. Southeastern USA Data – Over 5 MW 71
C. Summary of National Data on Solar Farms 73
VIII. Scope of Research 75
IX. Specific Factors Related To Impacts on Value 76
X. Battery Energy Storage System (BESS) 79
A. BESS Paired Sales Analysis/Market Research 82
XI. Conclusion 98
XII. Certification 99
Professional Experience 100
Professional Affiliations 100
Education 100
Continuing Education 100

I. Proposed Project and Adjoining Uses

Proposed Use Description

This 67 MW solar farm with a Battery Energy Storage System (BESS) with a 26 MW 4-hour capacity is proposed to be constructed on a portion of a 891-acre assemblage of land on Piney Grove Church Road, Goldsboro, Wayne County, North Carolina. Adjoining land is primarily a mix of residential and agricultural uses, which is very typical of solar farm sites.

The BESS will be a 26 MW system with a 4-hour duration. The BESS is located at the point of interconnection shown on the map.

Adjoining Properties

I have considered adjoining uses and included a map to identify each parcel's location. The closest adjoining home is proposed to be 175 feet from the closest solar panel, the average distance is 626 feet. The closest adjoining homes are the townhome units on St. John Church Road and is across that road from the solar farm project.

The breakdown of those uses by acreage and number of parcels is summarized below.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	7.87%	61.29%
Agricultural	91.86%	32.26%
Utility	0.27%	6.45%
Total	**100.00%**	**100.00%**

The BESS will be located at the Point of Interconnection which is southeast of the poultry farm located at southeast of the intersection of St John Church Road and Piney Grove Road. The closest non-participating home to the BESS is 3,130 feet to the south and located on the other side of a poultry farm.


2-19
1
20
21
62
61
60
22
25
26
59
58
23
24
57
27
56
55
43
42
37
44-54
36
41
39
38
40

Surrounding Uses

#	MAP ID	Owner	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Panel
1	3535896265	Farnetani	79.50	Agricultural	4.97%	1.61%	N/A
2	3546003333	Lewis	0.70	Residential	0.04%	1.61%	390
3	3546004352	Blackmon	0.51	Residential	0.03%	1.61%	420
4	3546005362	Jensen	0.50	Residential	0.03%	1.61%	420
5	3546005362	Jones	0.49	Residential	0.03%	1.61%	370
6	3546007370	Watters	0.49	Residential	0.03%	1.61%	330
7	3546008279	Shivar	0.48	Residential	0.03%	1.61%	465
8	3546009123	Danis	0.57	Residential	0.04%	1.61%	365
9	3545099928	Aldana	0.73	Residential	0.05%	1.61%	310
10	3545190973	Aiello	0.49	Residential	0.03%	1.61%	300
11	3545192976	Arizmendez	1.25	Residential	0.08%	1.61%	385
12	3546102171	Ashmali	0.81	Residential	0.05%	1.61%	480
13	3546104280	Nelson	0.73	Residential	0.05%	1.61%	795
14	3546105290	Bundy	0.69	Residential	0.04%	1.61%	835
15	3546106189	Flores	0.69	Residential	0.04%	1.61%	920
16	3546107197	Hutchinson	0.78	Residential	0.05%	1.61%	980
17	3546200020	Crumpler	1.36	Residential	0.09%	1.61%	1,020
18	3546200020	Crumpler	0.44	Residential	0.03%	1.61%	N/A
19	3545199740	Hanson	1.92	Residential	0.12%	1.61%	760
20	3546300623	Hare	71.46	Agricultural	4.47%	1.61%	N/A
21	3545597056	De Araujo	255.13	Agricultural	15.95%	1.61%	N/A
22	3545465929	Sutton	150.38	Agricultural	9.40%	1.61%	N/A
23	3545253308	Barwick	29.16	Agricultural	1.82%	1.61%	N/A
24	3545344777	Edmondson	33.43	Agricultural	2.09%	1.61%	N/A
25	3545467565	Sutton	4.52	Residential	0.28%	1.61%	N/A
26	3545869184	Kinsey	46.60	Agricultural	2.91%	1.61%	N/A
27	3545816716	Sutton	75.44	Agricultural	4.72%	1.61%	N/A
28	3544892381	Belfast	0.93	Utility	0.06%	1.61%	N/A
29	3544787432	Wayne Sanit	41.46	Agricultural	2.59%	1.61%	N/A
30	3544798050	Uzzell	4.34	Residential	0.27%	1.61%	N/A
31	3544784927	Lynch	2.58	Residential	0.16%	1.61%	N/A
32	3544791072	Lynch	2.26	Residential	0.14%	1.61%	300
33	3544689620	Lynch	2.82	Residential	0.18%	1.61%	N/A
34	3544587430	Sutton	97.91	Agricultural	6.12%	1.61%	N/A
35	3544698169	Staps	0.91	Residential	0.06%	1.61%	240
36	3544587430	Sutton	77.30	Agricultural	4.83%	1.61%	N/A
37	3545507807	Edmondson	25.88	Agricultural	1.62%	1.61%	N/A
38	3544597413	Lynch	15.09	Residential	0.94%	1.61%	N/A
39	3544593915	Wayne	1.20	Utility	0.08%	1.61%	N/A
40	3544498533	Sutton	9.67	Residential	0.60%	1.61%	N/A

#	MAP ID	Owner	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Panel
41	3544494903	Wayne	0.94	Utility	0.06%	1.61%	N/A
42	3545403930	Sutton	25.02	Agricultural	1.56%	1.61%	N/A
43	3545317422	Angularem	8.21	Residential	0.51%	1.61%	N/A
44	3545308556	Angularem	0.77	Residential	0.05%	1.61%	N/A
45	3545306465	Wayne	1.20	Utility	0.08%	1.61%	N/A
46	3544395863	Vinson	13.71	Residential	0.86%	1.61%	N/A
47	3545302312	Parks	0.86	Residential	0.05%	1.61%	1,370
48	3544391883	Best	4.74	Residential	0.30%	1.61%	N/A
49	3544297971	Grady	11.34	Residential	0.71%	1.61%	N/A
50	3545208308	Cruse	1.14	Residential	0.07%	1.61%	1,475
51	3545207734	Vinson	1.28	Residential	0.08%	1.61%	1,300
52	3545215122	Vinson	4.75	Residential	0.30%	1.61%	N/A
53	3545212609	Vinson	22.98	Agricultural	1.44%	1.61%	N/A
54	3545127352	NVinson	20.57	Agricultural	1.29%	1.61%	N/A
55	3545127863	Hare	98.78	Agricultural	6.18%	1.61%	N/A
56	3545049046	Maxwell	19.81	Residential	1.24%	1.61%	N/A
57	3545041672	Lane Farms	25.08	Agricultural	1.57%	1.61%	N/A
58	3545055485	Whitfield	1.00	Residential	0.06%	1.61%	N/A
59	354506139	Farnetani	73.28	Agricultural	4.58%	1.61%	N/A
60	3545077475	Minchew	2.44	Residential	0.15%	1.61%	175
61	3545084858	Hare	120.69	Agricultural	7.55%	1.61%	N/A
62	3535788221	Wise	99.27	Agricultural	6.21%	1.61%	N/A
		Total	**1599.460**		**100.00%**	**100.00%**	626

Demographics Around Subject Property

I have pulled demographic data around a 1-mile, 3-mile and 5-mile radius from the middle of the project as shown on the following pages.



Housing Profile

28551 2
28551, La Grange, North Carolina
Ring: 1 mile radius

Prepared by Esri
Latitude: 35.30547
Longitude: -77.83975

Population		Households	
2010 Total Population	37	2023 Median Household Income	$60,722
2020 Total Population	39	2028 Median Household Income	$60,675
2023 Total Population	39	2023-2028 Annual Rate	-0.02%
2028 Total Population	38		
2023-2028 Annual Rate	-0.52%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	20	100.0%	23	100.0%	22	100.0%
Occupied	20	100.0%	23	100.0%	22	100.0%
Owner	13	65.0%	19	82.6%	19	86.4%
Renter	7	35.0%	4	17.4%	3	13.6%
Vacant	0	0.0%	0	0.0%	0	0.0%

	2023		2028	
Owner Occupied Housing Units by Value	**Number**	**Percent**	**Number**	**Percent**
Total	19	100.0%	18	100.0%
<$50,000	2	10.5%	0	0.0%
$50,000-$99,999	1	5.3%	0	0.0%
$100,000-$149,999	1	5.3%	0	0.0%
$150,000-$199,999	3	15.8%	1	5.6%
$200,000-$249,999	2	10.5%	2	11.1%
$250,000-$299,999	2	10.5%	3	16.7%
$300,000-$399,999	4	21.1%	6	33.3%
$400,000-$499,999	1	5.3%	1	5.6%
$500,000-$749,999	3	15.8%	5	27.8%
$750,000-$999,999	0	0.0%	0	0.0%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$262,500		$350,000	
Average Value	$289,474		$395,833	

Census 2010 Housing Units	**Number**	**Percent**
Total	20	100.0%
In Urbanized Areas	0	0.0%
In Urban Clusters	0	0.0%
Rural Housing Units	20	100.0%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

Housing Profile

28551 2
28551, La Grange, North Carolina
Ring: 3 mile radius

Prepared by Esri
Latitude: 35.29541
Longitude: -77.84373

Population		Households	
2010 Total Population	2,757	2023 Median Household Income	$82,042
2020 Total Population	3,201	2028 Median Household Income	$93,612
2023 Total Population	3,371	2023-2028 Annual Rate	2.67%
2028 Total Population	3,436		
2023-2028 Annual Rate	0.38%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	1,115	100.0%	1,386	100.0%	1,418	100.0%
Occupied	992	89.0%	1,237	89.2%	1,272	89.7%
Owner	796	71.4%	1,018	73.4%	1,058	74.6%
Renter	196	17.6%	219	15.8%	214	15.1%
Vacant	123	11.0%	149	10.8%	146	10.3%

	2023		2028	
Owner Occupied Housing Units by Value	**Number**	**Percent**	**Number**	**Percent**
Total	1,019	100.0%	1,058	100.0%
<$50,000	50	4.9%	22	2.1%
$50,000-$99,999	61	6.0%	41	3.9%
$100,000-$149,999	78	7.7%	27	2.6%
$150,000-$199,999	124	12.2%	55	5.2%
$200,000-$249,999	115	11.3%	84	7.9%
$250,000-$299,999	122	12.0%	140	13.2%
$300,000-$399,999	231	22.7%	304	28.7%
$400,000-$499,999	70	6.9%	102	9.6%
$500,000-$749,999	148	14.5%	264	25.0%
$750,000-$999,999	17	1.7%	18	1.7%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	3	0.3%	1	0.1%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$283,402		$352,632	
Average Value	$315,677		$386,413	

Census 2010 Housing Units	**Number**	**Percent**
Total	1,115	100.0%
In Urbanized Areas	141	12.6%
In Urban Clusters	83	7.4%
Rural Housing Units	891	79.9%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

©2023 Esri

Housing Profile

28551 2
28551, La Grange, North Carolina
Ring: 5 mile radius

Prepared by Esri
Latitude: 35.29531
Longitude: -77.84373

Population		Households	
2010 Total Population	10,776	2023 Median Household Income	$60,944
2020 Total Population	10,908	2028 Median Household Income	$72,659
2023 Total Population	11,084	2023-2028 Annual Rate	3.58%
2028 Total Population	11,007		
2023-2028 Annual Rate	-0.14%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Housing Units	4,725	100.0%	5,010	100.0%	4,993	100.0%
Occupied	4,293	90.9%	4,412	88.1%	4,413	88.4%
Owner	3,071	65.0%	3,355	67.0%	3,407	68.2%
Renter	1,222	25.9%	1,057	21.1%	1,006	20.1%
Vacant	431	9.1%	598	11.9%	580	11.6%

	2023		2028	
Owner Occupied Housing Units by Value	**Number**	**Percent**	**Number**	**Percent**
Total	3,354	100.0%	3,406	100.0%
<$50,000	364	10.9%	248	7.3%
$50,000-$99,999	617	18.4%	513	15.1%
$100,000-$149,999	435	13.0%	363	10.7%
$150,000-$199,999	396	11.8%	249	7.3%
$200,000-$249,999	353	10.5%	305	9.0%
$250,000-$299,999	300	8.9%	371	10.9%
$300,000-$399,999	459	13.7%	640	18.8%
$400,000-$499,999	130	3.9%	205	6.0%
$500,000-$749,999	266	7.9%	480	14.1%
$750,000-$999,999	29	0.9%	30	0.9%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	5	0.1%	2	0.1%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$182,955		$253,369	
Average Value	$226,744		$279,000	

Census 2010 Housing Units	**Number**	**Percent**
Total	4,725	100.0%
In Urbanized Areas	384	8.1%
In Urban Clusters	1,123	23.8%
Rural Housing Units	3,219	68.1%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

II. Methodology and Discussion of Issues

Standards and Methodology

I conducted this analysis using the standards and practices established by the Appraisal Institute and that conform to the Uniform Standards of Professional Appraisal Practice. The analyses and methodologies contained in this report are accepted by all major lending institutions, and they are used in Virginia and across the country as the industry standard by certified appraisers conducting appraisals, market analyses, or impact studies and are considered adequate to form an opinion of the impact of a land use on neighboring properties. These standards and practices have also been accepted by the courts at the trial and appellate levels and by federal courts throughout the country as adequate to reach conclusions about the likely impact a use will have on adjoining or abutting properties.

The aforementioned standards compare property uses in the same market and generally within the same calendar year so that fluctuating markets do not alter study results. Although these standards do not require a linear study that examines adjoining property values before and after a new use (e.g. a solar farm) is developed, some of these studies do in fact employ this type of analysis. Comparative studies, as used in this report, are considered an industry standard.

The type of analysis employed is a Matched Pair Analysis or Paired Sales Analysis. This methodology is outlined in **The Appraisal of Real Estate**, Twelfth Edition by the Appraisal Institute pages 438-439. It is further detailed in **Real Estate Damages**, Third Edition, pages 33-36 by Randall Bell PhD, MAI. Paired sales analysis is used to support adjustments in appraisal work for factors ranging from the impact of having a garage, golf course view, or additional bedrooms. It is an appropriate methodology for addressing the question of impact of an adjoining solar farm. The paired sales analysis is based on the theory that when two properties are in all other respects equivalent, a single difference can be measured to indicate the difference in price between them. Dr. Bell describes it as comparing a test area to control areas. In the example provided by Dr. Bell he shows five paired sales in the test area compared to 1 to 3 sales in the control areas to determine a difference. I have used 3 sales in the control areas in my analysis for each sale developed into a matched pair.

Determining what is an External Obsolescence

An external obsolescence is a use of property that, because of its characteristics, might have a negative impact on the value of adjacent or nearby properties because of identifiable impacts. Determining whether a use would be considered an external obsolescence requires a study that isolates that use, eliminates any other causing factors, and then studies the sales of nearby versus distant comparable properties. The presence of one or a combination of key factors does not mean the use will be an external obsolescence, but a combination of these factors tends to be present when market data reflects that a use is an external obsolescence.

External obsolescence is evaluated by appraisers based on several factors. These factors include but are not limited to:

1) Traffic. Solar Farms are not traffic generators.

2) Odor. Solar farms do not produce odor.

3) Noise. Solar farms generate no noise concerns with noise levels below ambient noise outside of the fence in most layouts and makes even less noise at night.

4) Environmental. Solar farms do not produce toxic or hazardous waste. Grass is maintained underneath the panels so there is minimal impervious surface area.

5) Appearance/Viewshed. This is the one area that potentially applies to solar farms. However, solar farms are generally required to provide significant setbacks and landscaping buffers to address that concern. Furthermore, any consideration of appearance of viewshed impacts has to be considered in comparison with currently allowed uses on that site. For example if a residential subdivision is already an allowed use, the question becomes in what way does the appearance impact adjoining property owners above and beyond the appearance of that allowed subdivision or other similar allowed uses.

6) Other factors. I have observed and studied many solar farms and have never observed any characteristic about such facilities that prevents or impedes neighbors from fully using their homes or farms or businesses for the use intended.

Relative Solar Farm Sizes

Solar farms have been increasing in size in recent years. Much of the data collected is from existing, older solar farms of smaller size, but there are numerous examples of sales adjoining 75 to 80 MW facilities that show a similar trend as the smaller solar farms. This is understandable given that the primary concern relative to a solar farm is the appearance or view of the solar farm, which is typically addressed through setbacks and landscaping buffers. The relevance of data from smaller solar farms to larger solar farms is due to the primary question being one of appearance. If the solar farm is properly screened, then little of the solar farm would be seen from adjoining property regardless of how many acres are involved.

Larger solar farms are often set up in sections where any adjoining owner would only be able to see a small section of the project even if there were no landscaping screen. Once a landscaping screen is in place, the primary view is effectively the same whether adjoining a 5 MW, 20 MW or 100 MW facility.

I have split out the data for the matched pairs adjoining larger solar farms only to illustrate the similarities later in this report.

Steps Involved in the Analysis

The paired sales analysis employed in this report follows the following process:

1. Identify sales of property adjoining existing solar farms.
2. Compare those sales to similar property that does not adjoin an existing solar farm.
3. Confirmation of sales are noted in the analysis write ups.
4. Distances from the homes to panels are included as a measure of the setbacks.
5. Topographic differences across the solar farms themselves are likewise noted along with demographic data for comparing similar areas.

There are a number of Sale/Resale comparables included in the write ups, but most of the data shown is for sales of homes after a solar farm has been announced (where noted) or after a solar farm has been constructed.

III. Research on Solar Farms

A. Appraisal Market Studies

I have also considered a number of impact studies completed by other appraisers as detailed below.

CohnReznick – Property Value Impact Study: Adjacent Property Values Solar Impact Study: A Study of Eight Existing Solar Facilities

Patricia McGarr, MAI, CRE, FRICS, CRA and Andrew R. Lines, MAI with CohnReznick completed an impact study for a proposed solar farm in Cheboygan County, Michigan completed on June 10, 2020. I am familiar with this study as well as a number of similar such studies completed by CohnReznick. I have not included all of these studies but I submit this one as representative of those studies.

This study addresses impacts on value from eight different solar farms in Michigan, Minnesota, Indiana, Illinois, Virginia and North Carolina. These solar farms are 19.6 MW, 100 MW, 11.9 MW, 23 MW, 71 MW, 61 MW, 40 MW, and 19 MW for a range from 11.9 MW to 100 MW with an average of 31 MW and a median of 31.5 MW. They analyzed a total of 24 adjoining property sales in the Test Area and 81 comparable sales in the Control Area over a five-year period.

The conclusion of this study is that there is no evidence of any negative impact on adjoining property values based on sales prices, conditions of sales, overall marketability, potential for new development or rate of appreciation.

Christian P. Kaila & Associates – Property Impact Analysis – Proposed Solar Power Plant Guthrie Road, Stuarts Draft, Augusta County, Virginia

Christian P. Kaila, MAI, SRA and George J. Finley, MAI developed an impact study as referenced above dated June 16, 2020. This was for a proposed 83 MW facility on 886 acres.

Mr. Kaila interviewed appraisers who had conducted studies and reviewed university studies and discussed the comparable impacts of other development that was allowed in the area for a comparative analysis of other impacts that could impact viewshed based on existing allowed uses for the site. He also discussed in detail the various other impacts that could cause a negative impact and how solar farms do not have such characteristics.

Mr. Kaila also interviewed county planners and real estate assessors in eight different Virginia counties with none of the assessor's identifying any negative impacts observed for existing solar projects.

Mr. Kaila concludes on a finding of no impact on property values adjoining the indicated solar farm.

Fred Beck, MAI, CCIM – Impact Analysis in Lincoln County 2013

Mr. Fred Beck, MAI, CCIM completed an impact analysis in 2013 for a proposed solar farm that concluded on a negative impact on value. That report relied on a single cancelled contract for an adjoining parcel where the contracted buyers indicated that the solar farm was the reason for the cancellation. It also relied on the activities of an assessment impact that was applied in a nearby county.

Mr. Beck was interviewed as part of the Christian Kalia study noted above. From that I quote "Mr. Beck concluded on no effect on moderate priced homes, and only a 5% change in his limited

research of higher priced homes. His one sale that fell through is hardly a reliable sample. It also was misleading on Mr. Beck's part to report the lower re-assessments since the primary cause of the re-assessments were based on the County Official, who lived adjacent to the solar farm, appeal to the assessor for reductions with his own home." In that Clay County Case study the noted lack of lot sales after announcement of the solar farm also coincided with the recession in 2008/2009 and lack of lot sales effectively defined that area during that time.

I further note, that I was present at the hearing where Mr. Beck presented these findings and the predominance of his argument before the Lincoln County Board of Commissioner's was based on the one cancelled sale as well as a matched pair analysis of high-end homes adjoining a four-story call center. He hypothesized that a similar impact from that example could be compared to being adjacent solar farm without explaining the significant difference in view, setbacks, landscaping, traffic, light, and noise. Furthermore, Mr. Beck did have matched pairs adjoining a solar farm in his study that he put in the back of his report and then ignored as they showed no impact on property value.

Also noted in the Christian Kalia interview notes is a response from Mr. Beck indicating that in his opinion "the homes were higher priced homes and had full view of the solar farm." Based on a description of screening so that "the solar farm would not be in full view to adjoining property owners. Mr. Beck said in that case, he would not see any drop in property value."

NorthStar Appraisal Company – Impact Analysis for Nichomus Run Solar, Pilesgrove, NJ, September 16, 2020

Mr. William J. Sapio, MAI with NorthStar Appraisal Company considered a matched pair analysis for the potential impact on adjoining property values to this proposed 150 MW solar farm. Mr. Sapio considered sales activity in a subdivision known as Point of Woods in South Brunswick Township and identified two recent new homes that were constructed and sold adjoining a 13 MW solar farm and compared them to similar homes in that subdivision that did not adjoin the solar farm. These homes sold in the $1,290,450 to $1,336,613 price range and these homes were roughly 200 feet from the closest solar panel.

Based on this analysis, he concluded that the adjoining solar farm had no impact on adjoining property value.

Mary McClinton Clay, MAI – McCracken County Solar Project Value Impact Report, July 10, 2021

Ms. Mary Clay, MAI reviewed a report by Kirkland Appraisals in this case and also provided a differing opinion of impact. She cites a number of other appraisal studies and interestingly finds fault with heavily researched opinions, while praising the results of poorly researched studies that found the opposing view.

Her analysis includes details from solar farms that show no impact on value, but she dismisses those.

She cites the University of Texas study noted later in this report, but she cites only isolated portions of that study to conclude the opposite of what that study specifically concludes.

She cites the University of Rhode Island study noted alter in this report, but specifically excludes the conclusion of that study that in rural areas they found no impact on property value.

She cites lot sales near Spotsylvania Solar without confirming the purchase prices with brokers as indicative of market impact and has made no attempt to compare lot prices that are contemporaneous. In her 5 lot sales that she identifies, all of the lot prices decline with time from

2015 through 2019. This includes the 3 lot sales prior to the approval of the solar farm. The decrease in lot values shown in this chart are more indicative of the trend in the market, than of any impact related to the solar farm. Otherwise, how does she explain the drop in price from 2015 to 2017 prior to the solar farm approval.

She considers data at McBride Place Solar Farm and does a sale/resale analysis based on Zillow Home Value Index, which is not a reliable indication for appreciation in the market. She then adjusted her initial sales prior to the solar farm over 7 years to determine what she believes the home should have appreciated by and then compares that to an actual sale. She has run no tests or any analysis to show that the appreciation rates she is using are consistent with the market but more importantly she has not attempted to confirm any of these sales with market participants. I have spoken with brokers active in the sales that she cites and they have all indicated that the solar farm was not a negative factor in marketing or selling those homes.

She has considered lot sales at Sunshine Farms in Grandy, NC. She indicates that the lots next to the solar farm are selling for less than lots not near the solar farm, but she is actually using lot sales next to the solar farm prior to the solar farm being approved. She also ignores recent home sales adjoining this solar farm after it was built that show no impact on property value.

She also notes a couple of situations where solar developers have purchased adjoining homes and resold them or where a neighbor agreement was paid as proof of a negative impact on property value. Given that there are over 2,500 solar farms in the USA as of 2018 according to the U.S. Energy Information Administration and there are only a handful of such examples, this is clearly not an industry standard but a business decision. Furthermore, solar developers are not in the business of flipping homes and are in a position very similar to a bank that acquires a home as OREO (Other Real Estate Owned), where homes are frequently sold at discounted prices, not because of any drop in value, but because they are not a typically motivated seller. Market value requires an analysis of a typically motivated buyer and seller. So these are not good indicators of market value impacts.

The comments throughout this study are heavy in adjectives, avoids stating facts contrary to the conclusion and shows a strong selection bias.

Kevin T. Meeks, MAI – Corcoran Solar Impact Study, June 19, 2017

Mr. Kevin Meeks, MAI reviewed a report by Kirkland Appraisals in this case and also provided a additional research on the topic with additional paired sales. The sales he considered are well presented and show that they were confirmed by third parties and all of the broker commentary is aligned with the conclusion that the adjoining solar farms considered had no impact on the adjoining home values.

Mr. Meeks also researched a 100 MW project in Chisago County, known as North Star Solar Garden in MN. He interviewed local appraisers and a broker who was actively marketing homes adjoining that solar farm to likewise support a finding of no impact on property vaue.

Conclusion of Impact Studies

Of the six studies noted three included actual sales data to derive an opinion of no impact on value. The two studies to conclude on a negative impact includes the Fred Beck study based on no actual sales data, and he has since indicated that with landscaping screens he would not conclude on a negative impact. The other study by Mary Clay shows improper adjustments for time, a lack of confirmation of sales comparables, and exclusion of data that does not support her position.

I have relied on these studies as additional support for the findings in this impact analysis.

B. Articles

I have also considered a number of articles on this subject as well as conclusions and analysis as noted below.

Farm Journal Guest Editor, March 22, 2021 – Solar's Impact on Rural Property Values

Andy Ames, ASFMRA (American Society of Farm Managers and Rural Appraisers) published this article that includes a discussion of his survey of appraisers and studies on the question of property value related to solar farms. He discusses the university studies that I have cited as well as Patricia McGarr, MAI.

He also discusses the findings of Donald A. Fisher, ARA, who served six years at the Chair of the ASFMRA's National Appraisal Review Committee. He is also the Executive Vice President of the CNY Pomeroy Appraiser and has conducted several market studies on solar farms and property impact. He is quoted in the article as saying, "Most of the locations were in either suburban or rural areas, and all of those studies found either a neutral impact, or ironically, a positive impact, where values on properties after installation of solar farms went up higher than time trends."

Howard Halderman, AFM, President and CEO of Halderman Real Estate and Farm Management attended the ASFMRA solar talk hosted by the Indiana Chapter of the ASFMRA and he concludes that other rural properties would likely see no impact and farmers and landowners shown even consider possible benefits. "In some cases, farmers who rent land to a solar company will insure the viability of their farming operation for a longer time period. This makes them better long-term tenants or land buyers so one can argue that higher rents and land values will follow due to the positive impact the solar leases offer."

More recently in August 2022, Donald Fisher, ARA, MAI and myself led a webinar on this topic for the ASFMRA discussing the issues, the university studies and specific examples of solar farms having no impact on adjoining property values.

National Renewable Energy Laboratory – Top Five Large-Scale Solar Myths, February 3, 2016

Megan Day reports form NREL regarding a number of concerns neighbors often express. Myth #4 regarding property value impacts addresses specifically the numerous studies on wind farms that show no impact on property value and that solar farms have a significantly reduced visual impact from wind farms. She highlights that the appearance can be addressed through mitigation measures to reduce visual impacts of solar farms through vegetative screening. Such mitigations are not available to wind farms given the height of the windmills and again, those studies show no impact on value adjoining wind farms.

North Carolina State University: NC Clean Energy Technology Center White Paper: Balancing Agricultural Productivity with Ground-Based Solar Photovoltaic (PV) Development (Version 2), May 2019

Tommy Cleveland and David Sarkisian wrote a white paper for NCSU NC Clean Energy Technology Center regarding the potential impacts to agricultural productivity from a solar farm use. I have interviewed Tommy Cleveland on numerous occasions and I have also heard him speak on these issues at length as well. He addresses many of the common questions regarding how solar farms work and a detailed explanation of how solar farms do not cause significant impacts on the soils, erosion and other such concerns. This is a heavily researched paper with the references included.

North Carolina State University: NC Clean Energy Technology Center White Paper: Health and Safety Impacts of Solar Photovoltaics, May 2017

Tommy Cleveland wrote a white paper for NCSU NC Clean Energy Technology Center regarding the health and safety impacts to address common questions and concerns related to solar farms. This is a heavily researched white paper addressing questions ranging from EMFs, fire safety, as well as vegetation control and the breakdown of how a solar farm works.

C. Broker Commentary

In the process of working up the matched pairs used later in this report, I have collected comments from brokers who have actually sold homes adjoining solar farms indicating that the solar farm had no impact on the marketing, timing, or sales price for the adjoining homes. I have comments from 12 such brokers within this report including brokers from Kentucky, Virginia, Tennessee, and North Carolina.

I have additional commentary from other states including New Jersey and Michigan that provide the same conclusion.

IV. University Studies

I have also considered the following studies completed by four different universities related to solar farms and impacts on property values.

A. University of Texas at Austin, May 2018

An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations

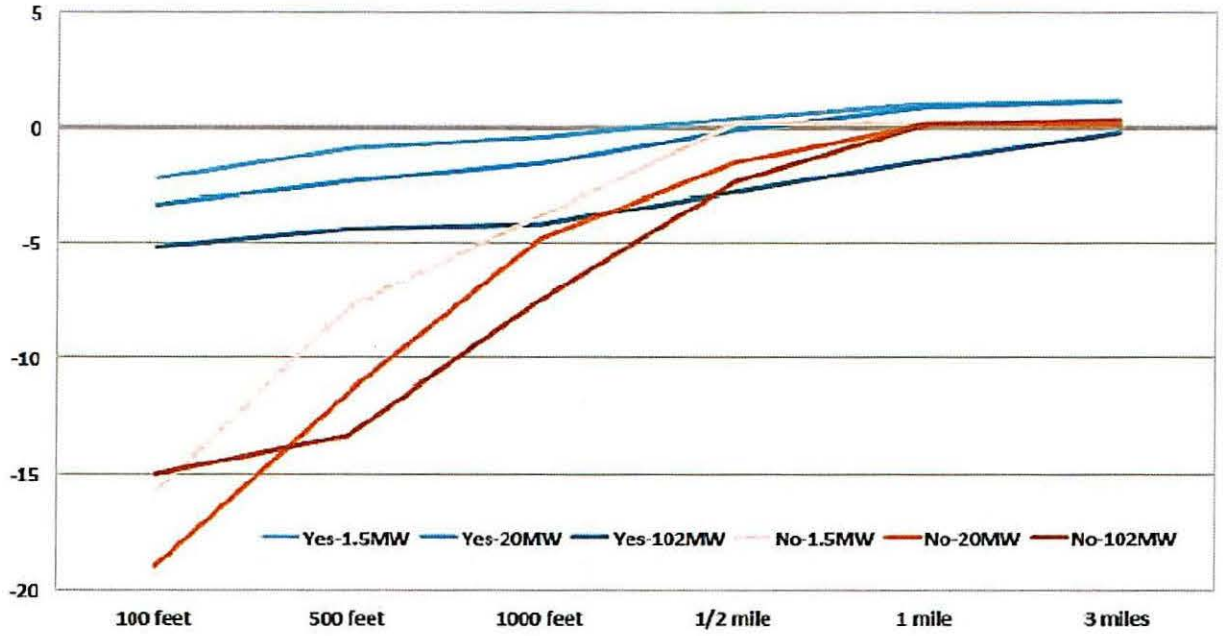
This study considers solar farms from two angles. First it looks at where solar farms are being located and concludes that they are being located primarily in low density residential areas where there are fewer homes than in urban or suburban areas.

The second part is more applicable in that they conducted a survey of appraisers/assessors on their opinions of the possible impacts of proximity to a solar farm. They consider the question in terms of size of the adjoining solar farm and how close the adjoining home is to the solar farm. I am very familiar with this part of the study as I was interviewed by the researchers multiple times as they were developing this. One very important question that they ask within the survey is very illustrative. They asked if the appraiser being surveyed had ever appraised a property next to a solar farm. There is a very noticeable divide in the answers provided by appraisers who have experience appraising property next to a solar farm versus appraisers who self-identify as having no experience or knowledge related to that use.

On Page 16 of that study they have a chart showing the responses from appraisers related to proximity to a facility and size of the facility, but they separate the answers as shown below with appraisers with experience in appraising properties next to a solar farm shown in blue and those inexperienced shown in brown. Even within 100 feet of a 102 MW facility the response from experienced appraisers were -5% at most on impact. While inexperienced appraisers came up with significantly higher impacts. This chart clearly shows that an uninformed response widely diverges from the sales data available on this subject.

Chart B.2 - Estimates of Property Value Impacts (%) by Size of Facility, Distance, & Respondent Type

Have you assessed a home near a utility-scale solar installation?



Furthermore, the question cited above does not consider any mitigating factors such as landscaping buffers or screens which would presumably reduce the minor impacts noted by experienced appraisers on this subject.

The conclusion of the researchers is shown on Page 23 indicated that "Results from our survey of residential home assessors show that the majority of respondents believe that proximity to a solar installation has either no impact or a positive impact on home values."

This analysis supports the conclusion of this report that the data supports no impact on adjoining property values.

B. University of Rhode Island, September 2020

Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island

The University of Rhode Island published a study entitled **Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island** on September 29, 2020 with lead researchers being Vasundhara Gaur and Corey Lang. I have read that study and interviewed Mr. Corey Lang related to that study. This study is often cited by opponents of solar farms but the findings of that study have some very specific caveats according to the report itself as well as Mr. Lang from the interview.

While that study does state in the Abstract that they found depreciation of homes within 1-mile of a solar farm, that impact is limited to non-rural locations. On Pages 16-18 of that study under Section 5.3 Heterogeneity in treatment effect they indicate that the impact that they found was limited to non-rural locations with the impact in rural locations effectively being zero. For the study they defined "rural" as a municipality/township with less than 850 population per square mile.

They further tested the robustness of that finding and even in areas up to 2,000 population per square mile they found no statistically significant data to suggest a negative impact. They have not specifically defined a point at which they found negative impacts to begin, as the sensitivity study stopped checking at the 2,000-population dataset.

Where they did find negative impacts was in high population density areas that was largely a factor of running the study in Massachusetts and Rhode Island which the study specifically cites as being the 2nd and 3rd most population dense states in the USA. Mr. Lang in conversation as well as in recorded presentations has indicated that the impact in these heavily populated areas may reflect a loss in value due to the scarce greenery in those areas and not specifically related to the solar farm itself. In other words, any development of that site might have a similar impact on property value.

Based on this study I have checked the population for the New Hope Township of Wayne County. This township has a population of 16,032 people for 2023 based on hometownlocator.com and a total area of 63.12 square miles for an indication population density of 254 people per square mile. This is well below the threshold indicated by the Rhode Island Study for a finding of no impact on property value.

I therefore conclude that the Rhode Island Study supports the indication of no impact on adjoining properties for the proposed solar farm project.

Township Of New Hope Data & Demographics (As of July 1, 2023)

POPULATION	
Total Population	16,032 (100%)
Population in Households	15,415 (96.2%)
Population in Families	13,117 (81.8%)
Population in Group Quarters[1]	617 (3.8%)
Population Density	254
Diversity Index[2]	72

HOUSING	
Total HU (Housing Units)	6,676 (100%)
Owner Occupied HU	3,815 (57.1%)
Renter Occupied HU	2,230 (33.4%)
Vacant Housing Units	631 (9.5%)
Median Home Value	$176,273
Average Home Value	$221,201
Housing Affordability Index[3]	132

INCOME	
Median Household Income	$56,490
Average Household Income	$79,924
% of Income for Mortgage[4]	19%
Per Capita Income	$30,882
Wealth Index[5]	68

HOUSEHOLDS	
Total Households	6,045
Average Household Size	2.55000000000
Family Households	4,339
Average Family Size	3

C. *Georgia Institute of Technology, October 2020*

Utility-Scale Solar Farms and Agricultural Land Values

This study was completed by Nino Abashidze as Post-Doctoral Research Associate of Health Economics and Analytics Labe (HEAL), School of Economics, Georgia Institute of Technology. This research was started at North Carolina State University and analyzes properties near 451 utility-

scale ground-mount solar installations in NC that generate at least 1 MW of electric power. A total of 1,676 land sales within 5-miles of solar farms were considered in the analysis.

This analysis concludes on Page 21 of the study "Although there are no direct effects of solar farms on nearby agricultural land values, we do find evidence that suggests construction of a solar farm may create a small, positive, option -value for land owners that is capitalized into land prices. Specifically, after construction of a nearby solar farm, we find that agricultural land that is also located near transmission infrastructure may increase modestly in value."

This study supports a finding of no impact on adjoining agricultural property values and in some cases could support a modest increase in value.

D. Master's Thesis: ECU by Zachary Dickerson July 2018

A Solar Farm in *My* Backyard? Resident Perspectives of Utility-Scale Solar in Eastern North Carolina

This study was completed as part of a Master of Science in Geography Master's Thesis by Zachary Dickerson in July 2018. This study sets out to address three questions:

1. Are there different aspects that affect resident satisfaction regarding solar farms?

2. Are there variations in satisfaction for residents among different geographic settings, e.g. neighborhoods adjacent to the solar farms or distances from the solar farms?

3. How can insight from both the utility and planning sectors, combined with knowledge gained from residents, fill gaps in communication and policy writing in regard to solar farms?

This was done through survey and interview with adjacent and nearby neighbors of existing solar farms. The positive to neutral comments regarding the solar farms were significantly higher than negative. The researcher specifically indicates on Page 46 "The results show that respondents generally do not believe the solar farms pose a threat to their property values."

The most negative comments regarding the solar farms were about the lack of information about the approval process and the solar farm project prior to construction.

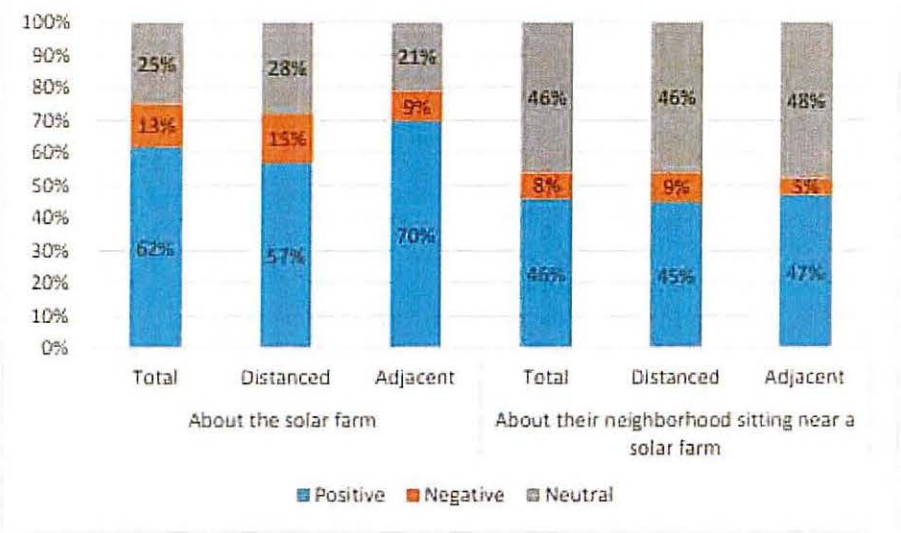
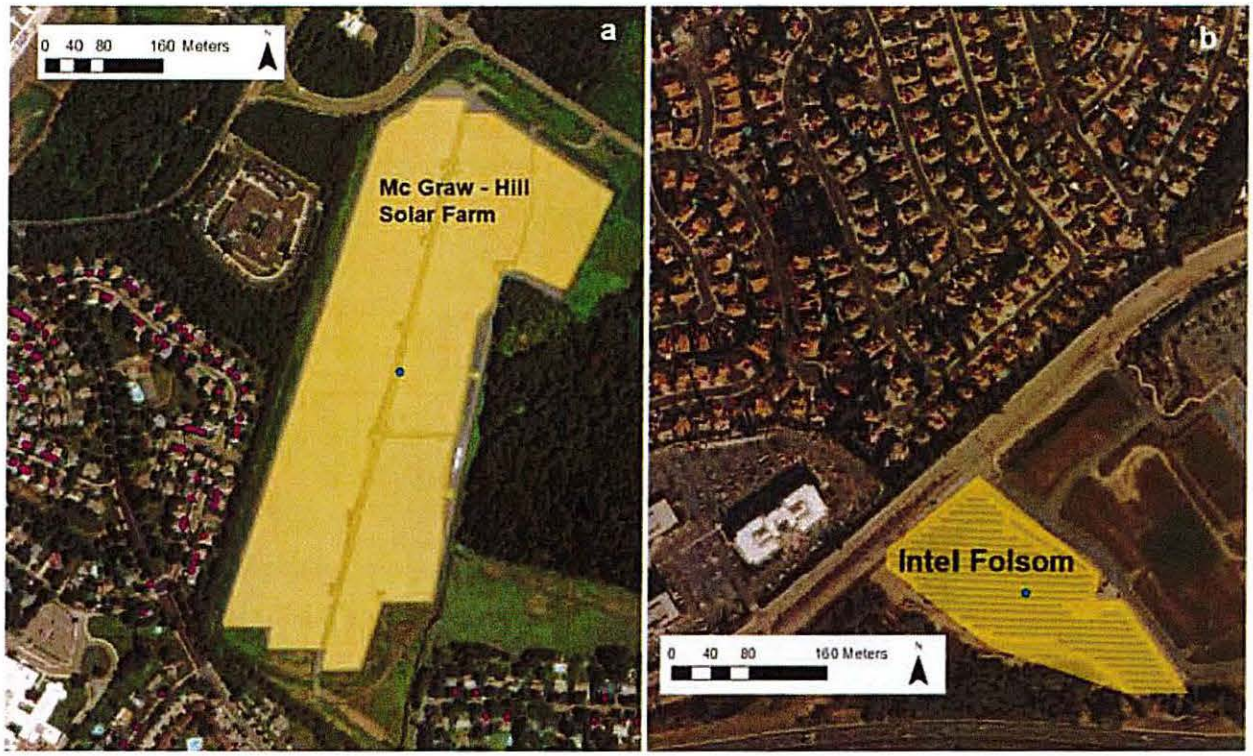


Figure 11: Residents' positive/negative word choices by geographic setting for both questions

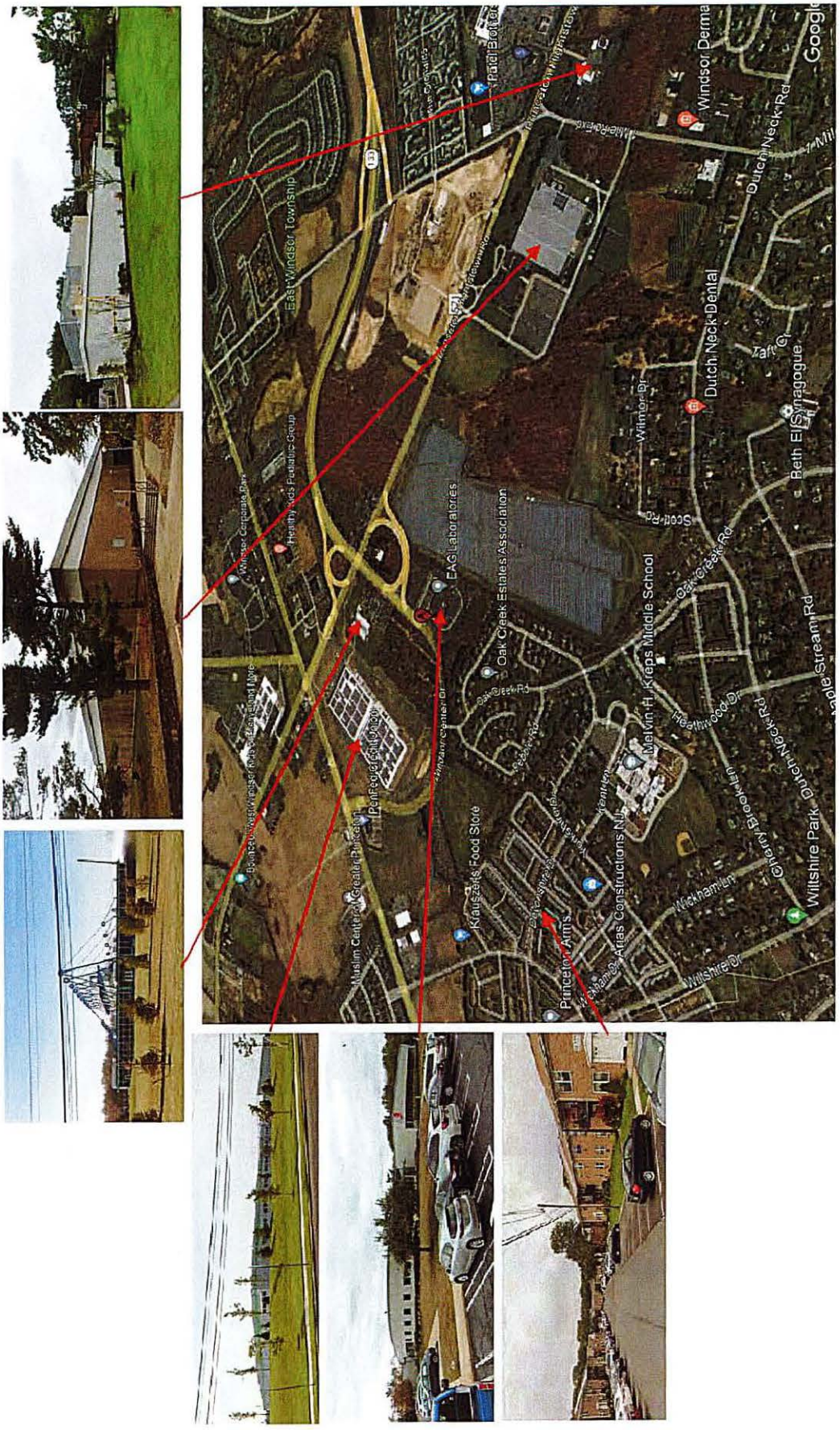
E. Lawrence Berkeley National Lab, March 2023

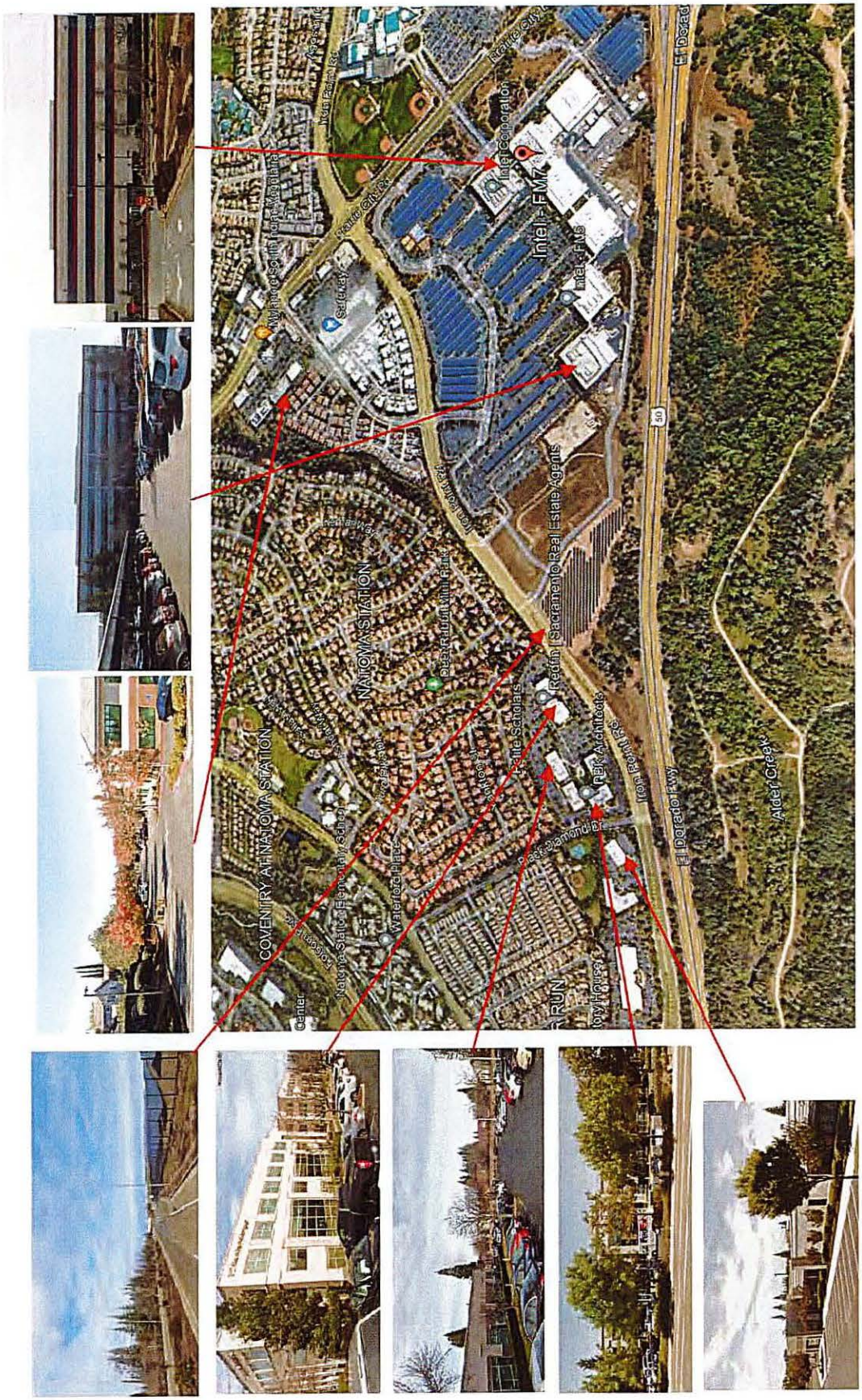
Shedding light on large-scale solar impacts: An analysis of property values and proximity to photovoltaics across six U.S. states

This study was completed by researchers including Salma Elmallah, Ben Hoen, K. Sydny Fujita, Dana Robson, and Eric Brunner. This analysis considers home sales before and after solar farms were installed within a 1-mile radius and compared them to home sales before and after the solar farms at a 2-4 mile radius. The conclusion found a 1.5% impact within 1 mile of a solar farm as compared to homes 2-4 miles from solar farms. This is the largest study of this kind on solar and addresses a number of issues, but also does not address a number of items that could potentially skew these results. First of all, the study found no impact in the three states with the most solar farm activity and only found impacts in smaller sets of data. The data does not in any way discuss actual visibility of solar farms or address existing vegetation screens. This lack of addressing this is highlighted by the fact that they suggest in the abstract that vegetative shading may be needed to address possible impacts. Another notable issue is the fact that they do not address other possible impacts within the radii being considered. This lack of consideration is well illustrated within the study on Figure A.1 where they show satellite images of McGraw Hill Solar Farm in NJ and Intel Folsom in CA. The Folsom image clearly shows large highways separating the solar farm from nearby housing, but with tower office buildings located closer to the housing being considered. In no place do they address the presence of these towers that essentially block those homes from the solar farm in some places. An excerpt of Fig. A.1. is shown below.



For each of these locations, I have panned out a little further on Google Earth to show the areas illustrated to more accurately reflect the general area. For the McGraw Hill Solar Farm you can see there is a large distribution warehouse to the west along with a large offices and other industrial uses. Further to the west is a large/older apartment complex (Princeton Arms). To the east there are more large industrial buildings. However, it is even more notable that 1.67 miles away to the west is Cranbury Golf Club. Given how this analysis was set up, these homes around the industrial buildings are being compared to homes within this country club to help establish impacts from the solar farm. Even considering the idea that each set is compared to itself before and after the solar farm, it is not a reasonable supposition that homes in each area would appreciate at the same rates even if no solar farm was included. Furthermore the site where the solar farm is located an all of the surrounding uses not improved with residential housing to the south is zoned Research Office (RO) which allows for: manufacturing, preparation, processing or fabrication of products, with all activities and product storage taking place within a completely enclosed building, scientific or research laboratories, warehousing, computer centers, pharmaceutical operations, office buildings, industrial office parks among others. Homes adjoining such a district would likely have impacts and influences not seen in areas zoned and surrounded by zoning strictly for residential uses.


East Windsor Township
Windsor Derma
Dutch Neck Rd
Dutch Neck Dental
Taft Ct
Beth El Synagogue
Wilmer Dr
Scott Rd
Oak Creek Estates Association
EAG Laboratories
Oak Creek Rd
Melvin H. Kreps Middle School
Heather Good Dr
Wickham Dr
Wiltshire Park
Wiltshire Dr
Princeton Arms
Arias Constructions Nj
Kraus Zarfs Food Store
Muslim Center of Greater Princeton
Penfield Condominium
Wilmer Corporate Park
Healthy Kids Pediatric Group
Google


Intel - FM7
NAIOMA STATION
COVENTRY AT NAIOMA STATION
El Dorado Fwy
Alder Creek

On the Intel Folsom map I have shown the images of two of the Intel Campus buildings, but there are roughly 8 such buildings on that site with additional solar panels installed in the parking lot as shown in that image. I included two photos that show the nearby housing having clear and close views of adjoining office parking lots. This illustrates that the homes in that 1-mile radius are significantly more impacted by the adjoining office buildings than a solar farm located distantly that are not within the viewshed of those homes. Also, this solar farm is located on land adjoining the Intel Campus on a tract that is zoned M-1 PD, which is a Light Industrial/Manufacturing zoning. Nearby homes. Furthermore, the street view at the solar farm shows not only the divided four-lane highway that separates the office buildings and homes from the solar farm, but also shows that there is no landscaping buffer at this location. All of these factors are ignored by this study. Below is another image of the Folsom Solar at the corner of Iron Point Road and Intel West Driveway which shows just how close and how unscreened this project is.



Compare that image from the McGraw Hill Street view facing south from County Rte 571. There is a distant view and much of the project is hidden by a mix of berms and landscaping. The analysis makes no distinction between these projects.



The third issue with this study is that it identifies impacts following development in areas where they note that "more adverse home price impacts might be found where LSPVPS (large-scale

photovoltaic project) displace green space (consistent with results that show higher property values near green space." The problem with this statement is that it assumes that the greenspace is somehow guaranteed in these areas, when in fact, they could just as readily be developed as a residential subdivision and have the same impacts. They have made no effort to differentiate loss of greenspace through other development purposes such as schools, subdivisions, or other uses versus the impact of solar farms. In other words, they may have simply identified the impact of all forms of development on property value. This would in fact be consistent with the comments in the Rhode Island study where the researchers noted that the loss of greenspace in the highly urban areas was likely due to the loss of greenspace in particular and not due to the addition of solar panels.

Despite these three shortcomings in the analysis – the lack of differentiating landscape screening, the lack of consideration of other uses within the area that could be impacting property values, and the lack of consideration of alternative development impacts – the study still only found impacts between 0 and 5% with a conclusion of 1.5% within a 1-mile radius. As discussed later in this report, real estate is an imperfect market and real estate transactions typically sell for much wider variability than 5% even where there are no external factors operating on property value.

I therefore conclude that the minor impacts noted in this study support a finding of no impact on property value. Most appraisals show a variation between the highest and lowest comparable sale that is substantially greater than 1.5% and this measured impact for all its flaws would just be lost in the static of normal real estate transactions.

V. Assessor Surveys

I have attempted to contact all of the assessor departments in North Carolina to determine how local assessors are handling solar farms and adjoining property values. I have spoken personally with a number of assessors, but much of this data was obtained via email. I have 39 counties in NC that have both responded to these questions on property value and also have solar farms in that county. I have excluded responses from assessors from counties where there are no current solar farms.

As can be seen in the chart below, of the 39 responses all of the responses have indicated that they make no adjustment to properties adjoining solar farms. Several assessors indicated that it would require an adjoining property owner to appeal their property value with data showing a negative impact before they would make any adjustment and to date they have not had that happen.

I also point out specifically Clay County. I spoke with the assessor there specifically about adjustments that were applied to some properties near a solar farm back in 2008/2011. She was unaware of the details of that event as she was not in this position at that time. As discussed earlier in this report the lower re-assessments at that solar farm were based on a County Official, who owned property adjacent to the solar farm, who made an appeal to the assessor for reductions for his own property. The noted lack of lot sales after announcement of the solar farm however coincided with the recession in 2009 and lack of lot sales effectively defined that area during that time, but without relying on any data the assessor made that change in that time frame based on conversations with the assessor. Since then, Clay County has confirmed that they do not currently make any changes to adjoining property values and the current county assessor was not even aware that they had in the past done so.

NC Assessor Survey on Solar Farm Property Value Impacts

County	Assessor's Name	Number of Farms	Change in Adjacent Property Value
Alexander	Doug Fox	3	No
Buncombe	Lisa Kirbo	1	No
Burke	Daniel Isenhour	3, 2 on 1 parcel, 1 on 3 parcels	No
Cabarrus	Justin	less than 10, more in the works	No
Caldwell	Monty Woods	3 small	No, but will look at data in 2025
Catawba	Lori Ray	14	No
Chatham	Jenny Williams	13	No
Cherokee	Kathy Killian	9	No
Chowan	Melissa Radke	3, 1 almost operational	No
Clay	Bonnie L. Lyvers		No
Davidson	Libby	1	No
Duplin	Gary Rose	34, 2 more in planning	No
Franklin	Marion Cascone	11	No
Gaston	Traci Hovis	3	No
Gates	Chris Hill	3	No
Granville	Jenny Griffin	8	No
Halifax	C. Shane Lynch	Multiple	No
Hoke	Mandi Davis	4	No
Hyde	Donnie Shumate	1 to supplement egg processing plant	No
Iredell	Wes Long	2, 3 others approved	No
Lee	Lisa Faulkner	8	No
Lincoln	Susan Sain	2	No
Moore	Michael Howery	10	No
New Hanover	Rhonda Garner	35	No
Orange	Chad Phillip	2 or 7 depending on breakdown	No
Pender	Kayla Bolick Futrell	6	No
Person	Russell Jones	9	No
Pitt	Russell D. Hill	8, 1 in planning	No
Randolph	Mark Frick	19	No
Rockingham	Mark C McClintock	6	No
Rutherford	Kim Aldridge	20	No
Sampson	Jim Johnson	9, 1 in construction	No
Scotland	James Brown	15, 1 in process	No
Stokes	Richard Brim	2	No
Surry	Penny Harrison	4, 2 more in process	No
Union	Robin E. Merry	6	No
Vance	Cathy E. Renn	13	No
Warren	John Preston	7	No
Wayne	Alan Lumpkin	32	No
Wilson	William (Witt) Putney	~16	No, mass appraisal standards applied

Responses: 39
Negative Impact on Adjoining Value = Yes: 0
Negative Impact on Adjoining Value = No: 39

I have a breakdown of assessor surveys from other states as well and those responses are below. I have not had any assessor indicate a negative adjustment due to adjacency to a solar farm in any state. These responses total 188 with 170 definitively indicating no negative adjustments are made to adjoining property values, 18 providing no response to the question, and 0 indicating that they do address a negative impact on adjoining property value.

Summary of Assessor Surveys

State	Responses	No Impact	Yes Impact	No Comment
North Carolina	39	39		
Virginia	16	16		
Indiana	31	31		
Colorado	15	7		8
Georgia	33	33		
Kentucky	10	6		4
Mississippi	4	2		2
New Mexico	5	5		
Ohio	24	20		4
South Carolina	11	11		
Totals	188	170		18

VI. Solar Farms Identified in Wayne and Adjoining Counties

Solar #	Name	County	City	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
1	Goldsboro	Wayne	Goldsboro	6.65	38	38			35%	23%	0%	42%
23	Freemont	Wayne	Freemont	5	55.26	55.26			0%	100%	0%	0%
34	Elizabeth	Johnston	Smithfield	4	34.85	34.85			12%	81%	0%	7%
35	Nitro	Johnston	Smithfield	5	84.5	26.63			1%	82%	17%	0%
40	Sampson	Sampson	Roseboro	2	49.21	14.32			5%	95%	0%	0%
42	Bizzell 1	Johnston	Selma		82.38	55.06	549	159	8%	52%	40%	0%
43	Bizzell 2	Johnston	Selma		103.01	39.63	232	67	27%	71%	0%	2%
45	Candace	Johnston	Princeton		54	54	642	460	24%	76%	0%	0%
46	Happy	Johnston	Benson		44.344	44.344	1,194	1,130	1%	57%	42%	0%
47	Murdock	Johnston	Clayton		31.882	31.882	374	268	0%	46%	53%	1%
49	Princeton 2	Johnston	Princeton		53.539	32.149	493	139	25%	0%	75%	0%
51	Red Toad Cleveland	Johnston	Smithfield	1.99	161.23	15	123	80	1%	99%	0%	0%
53	Buffalo	Johnston	Selma		49.23	15	N/A	N/A	30%	0%	0%	70%
54	Landmark	Johnston	Willow Springs		24.71	24.71	293	176	6%	51%	43%	0%
59	Longleaf	Johnston	Smithfield		158		1,124	125	3%	70%	27%	0%
60	Piper	Johnston	Princeton		73		350	190	4%	89%	7%	0%
61	Sadie	Johnston	Princeton		109		536	250	1%	8%	91%	0%
62	Signature	Johnston	Princeton		69.038		580	580	7%	93%	0%	0%
63	Wellons	Johnston	Smithfield		99.26		3,150	3,150	1%	4%	95%	0%
64	Lynch	Johnston	Selma		125.39	15	2,626	165	8%	85%	7%	0%
65	Stevens Chapel	Johnston	Smithfield		54.009	15	1,421	110	5%	3%	92%	0%
66	5840 Buffalo	Johnston	Selma		40.47	15	637	220	1%	26%	73%	0%
67	Langdon	Johnston	Four Oaks		32.12		239	90	30%	70%	0%	0%
72	Vinson	Johnston	Clayton		44.46		566	148	12%	88%	0%	0%
73	7807 Buffalo	Johnston	Selma		750.9		273	266	2%	98%	0%	0%
101	Narenco	Johnston	Smithfield		241.74	34.85	1,875	380	20%	77%	3%	0%
106	Scarlett	Lenoir	La Grange		17.03	17.03	1,041	530	7%	93%	0%	0%
122	Church Rd	Johnston	Angier	4.998	43.37	26	724	240	48%	52%	0%	0%
123	Page South	Johnston	Willow Springs		19.373		394	200	57%	43%	0%	0%
144	Highwater II	Wayne	Goldsboro		48.3		N/A	N/A	23%	77%	0%	0%
149	Mule Farm	Johnston	Benson	2	20.48	19	152	55	89%	0%	0%	11%
150	Rosewood	Wayne	Goldsboro		27.53		448	100	10%	80%	10%	0%
152	Goldsboro Esa	Wayne	Goldsboro	4.996	42.99	32	321	180	24%	11%	0%	65%
162	Four Oaks	Johnston	Four Oaks	2	41.84		922	790	2%	71%	27%	0%
168	Wilfork	Wayne	Goldsboro	5	39.4		288	250	4%	96%	0%	0%
169	Icarus	Wayne	La Grange	3	27		293	225	2%	98%	0%	0%
170	Robin	Wayne	Dudley	5	112.89		1,120	445	13%	50%	37%	0%
188	Benson	Johnston	Benson	4.996	32.098		506	255	15%	85%	0%	0%
194	Mt. Olive I	Wayne	Mt. Olive	6.8	129.57		1,119	110	13%	72%	12%	2%
195	Mt. Olive II	Wayne	Mt. Olive	6.65	55.69		319	215	20%	60%	20%	0%
196	S Elm City	Wilson	Elm City		38.41	33.93	167	113	22%	78%	0%	0%
197	E Elm City	Wilson	Elm City		39.79	35.79	262	101	94%	0%	0%	6%
199	Mooring 2	Lenoir	La Grange	5	97.21	25.07	575	575	7%	93%	0%	0%
209	Canon	Johnston	Smithfield	5	101.64	27.37	1,146	215	4%	41%	55%	0%
213	Banner	Johnston	Benson		51.92		1,380	440	3%	51%	46%	0%
218	Wendell	Johnston	Wendell	5	75.06		593	215	19%	67%	14%	0%
230	Thanksgiving Fire	Johnston	Zebulon	1.999	20.3		354	175	19%	81%	0%	0%
256	Jordan & C	Sampson	Faison	1.5	95.05		319	185	1%	99%	0%	0%
296	Lane	Wayne	Goldsboro		168.92	30	2,513	1,985	2%	95%	3%	0%
340	Timothy	Sampson	Dunn	0.48	26.83		694	485	9%	90%	0%	1%
344	Belafonte	Duplin	Calypso	3.4	122.55		1,285	1,285	0%	69%	30%	1%
355	Cookstown	Wayne	Goldsboro	5	62.75	37.1	453	145	35%	44%	21%	0%
368	Warsaw	Duplin	Warsaw	87.5	585.97	499	526	130	11%	66%	21%	3%

Solar #	Name	County	City	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
376	Suncaster	Wayne	Pikeville	5	65.5	39	332	120	15%	85%	0%	0%
377	Ransom	Sampson	Clinton	5	41.52	36	233	185	13%	78%	9%	0%
387	Williams	Johnston	Newton Grove	5	29.33	29.33	393	335	13%	87%	0%	0%
397	McCullen	Sampson	Clinton		53.1	51	225	105	40%	0%	60%	0%
456	Eros	Duplin	Calypso		80.4	31.9	-	-	0%	100%	0%	0%
485	McGrigor	Sampson	Clinton	5	40.99	32.49	315	150	38%	9%	0%	53%
499	Summitt	Wayne	Mt Olive	3	59.67	16.79	761	270	8%	49%	44%	0%
512	Harrison-Van Buren	Sampson	Roseboro	7	200	65.5	1,015	175	7%	84%	9%	0%
515	Truman(NC)	Johnston	Wendell	5	123.27	40.64	1,122	915	19%	28%	53%	0%
553	Overman	Wayne	Goldsboro		242.99	66.6	1,255	580	7%	76%	0%	17%
554	Faraday	Sampson	Dunn	2	136.1	16.08	1,610	450	2%	79%	19%	0%
578	Brick City	Duplin	Wallace	5	47.8	26.5	120	70	26%	21%	0%	53%
587	Ramp	Wayne	Goldsboro	2	15.23	15.23	327	275	100%	0%	0%	0%
588	Wedge	Wayne	Goldsboro	5	32.68	32.68	2,000	2,000	40%	36%	25%	0%
614	HCE Johnston 1	Johnston	Willow Springs	2.6	31.54	13.29	485	335	15%	82%	0%	3%
632	Solar Lee	Wayne	Mount Olive	5	38.06	27	250	88	28%	60%	12%	0%
646	Grifton	Lenoir	Grifton	5	101.51	41.3	1,023	460	5%	59%	35%	1%
647	Highland	Lenoir	Grifton	4.998	117.24	39.24	959	125	5%	25%	52%	18%
648	Exum	Lenoir	Grifton	4.95	55.83	30.19	512	155	13%	87%	0%	0%
652	Overhill	Sampson	Clinton	5	36.8	31.91	435	435	50%	42%	0%	8%
662	South River H4	Sampson	Autryville	0.5	16.73	4.5	506	208	6%	92%	0%	2%
663	Arba	Greene	Snow Hill	5	113.93	32.2	1,278	570	7%	47%	46%	0%
790	Innovative Solar 54	Lenoir	Kinston	50	303.23	303.23	241	115	6%	95%	0%	0%
847	Harding	Greene	Hookerton	3	72.84	72.84	1,719	730	20%	71%	9%	0%
856	Oxbow	Wayne	Brogden	175	1716	1716	524	120	13%	61%	26%	0%
877	Panther Branch	Duplin	Faison	80	1472.5	1472.5	1,135	140	8%	59%	33%	0%
878	Ridgeline	Duplin	Mount Olive	80	498	498	555	300	2%	86%	12%	0%
929	Bear Point	Lenoir	La Grange	73	801	801	553	130	4%	94%	2%	0%
931	Sasser	Wayne	Hopewell	80	1200	1200	425	75	15%	77%	7%	0%
942	Steven Mills	Wayne	Goldsboro	80	1041.5	1041.5	815	115	7%	73%	10%	9%
944	Maple Leaf Solar	Johnston	Selma	79.99	425.99	425.99	573	200	11%	80%	0%	9%

			Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
# of Solar Farms	84	**Average**	18.3	166.9	159.9	749	365	16%	62%	17%	5%
		Median	5.0	55.8	32.6	543	204	9%	71%	3%	0%
		High	175.0	1716.0	1716.0	3150	3150	100%	100%	95%	70%
		Low	0.5	15.2	4.5	120	55	0%	0%	0%	0%

VII. Market Analysis of the Impact on Value from Solar Farms

I have researched hundreds of solar farms in numerous states to determine the impact of these facilities on the value of adjoining property. This research has primarily been in North Carolina, but I have also conducted market impact analyses in Virginia, South Carolina, Tennessee, Texas, Oregon, Mississippi, Maryland, New York, California, Missouri, Florida, Montana, Georgia, Louisiana, and New Jersey.

Wherever I have looked at solar farms, I have derived a breakdown of the adjoining uses to show what adjoining uses are typical for solar farms and what uses would likely be considered consistent with a solar farm use similar to the breakdown that I've shown for the subject property on the previous page. A summary showing the results of compiling that data over hundreds of solar farms is shown later in the Scope of Research section of this report.

I also consider whether the properties adjoining a solar farm in one location have characteristics similar to the properties abutting or adjoining the proposed site so that I can make an assessment of market impact on each proposed site. Notably, in most cases solar farms are placed in areas very similar to the site in question, which is surrounded by low density residential and agricultural uses. In my over 900 studies, I have found a striking repetition of that same typical adjoining use mix in over 90% of the solar farms I have looked at. Matched pair results in multiple states are strikingly similar, and all indicate that solar farms – which generate very little traffic, and do not generate noise, dust or have other harmful effects – do not negatively impact the value of adjoining or abutting properties.

On the following pages I have considered matched pair data specific to Pitt County and adjoining counties. After that I consider solar farm data throughout North Carolina, which repeats some data from the first set.

In the next section I have considered matched pair data throughout the Southeast of the United States as being the most similar states that would most readily compare to North Carolina. This includes data from Florida, Georgia, South Carolina, North Carolina, Tennessee, Virginia and Maryland. I focused on projects of 5 MW and larger though I have significant supplemental data on solar farms just smaller than that in North Carolina that show similar results. This data is available in my files.

I have additional supporting information from other states in my files that show a consistent pattern across the United States, but again, I have focused on the Southeast in this analysis.

across the United States, but again, I have focused on the Southeast in this analysis.

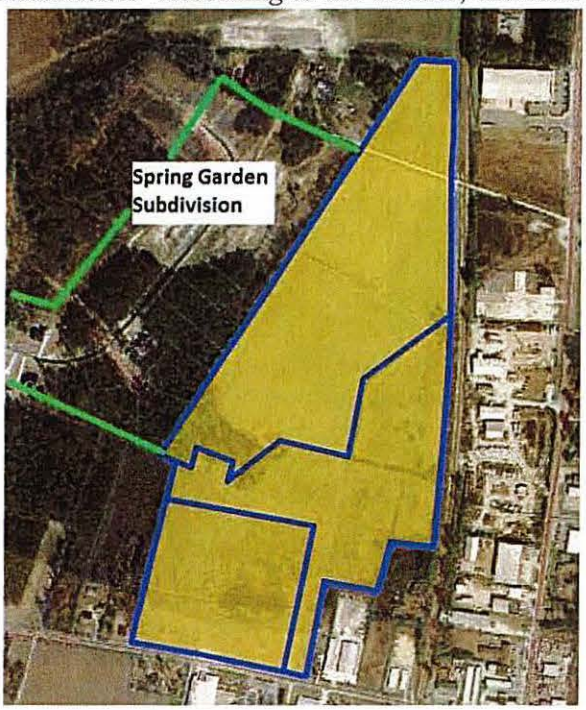
A. North Carolina Data

The following pages detail the matched pairs and how they were derived.

1. Matched Pair – AM Best Solar Farm, Goldsboro, Wayne County, NC

This 5 MW solar farm adjoins Spring Garden Subdivision was built in 2013 and had new homes and lots available for new construction during the approval and construction of the solar farm. The recent home sales have ranged from $200,000 to $250,000. This subdivision sold out the last homes in late 2014. The solar farm is clearly visible particularly along the north end of this street where there is only a thin line of trees separating the solar farm from the single-family homes.

Homes backing up to the solar farm are selling at the same price for the same floor plan as the homes that do not back up to the solar farm in this subdivision. According to the builder, the solar farm has been a complete non-factor. Not only do the sales show no difference in the price paid for the various homes adjoining the solar farm versus not adjoining the solar farm, but there are actually more recent sales along the solar farm than not. There is no impact on the sellout rate, or time to sell for the homes adjoining the solar farm.



I spoke with a number of owners who adjoin the solar farm and none of them expressed any concern over the solar farm impacting their property value.

The data presented on the following page shows multiple homes that have sold in 2013 and 2014 adjoining the solar farm at prices similar to those not along the solar farm. These series of sales indicate that the solar farm has no impact on the adjoining residential use.



The homes that were marketed at Spring Garden are shown below.



The homes adjoining the solar farm are considered to have a light landscaping screen as it is a narrow row of existing pine trees supplemented with evergreen plantings.

Matched Pairs
As of Date: 9/3/2014

Adjoining Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600195570	Helm	0.76	Sep-13	$250,000	2013	3,292	$75.94	2 Story
3600195361	Leak	1.49	Sep-13	$260,000	2013	3,652	$71.19	2 Story
3600199891	McBrayer	2.24	Jul-14	$250,000	2014	3,292	$75.94	2 Story
3600198632	Foresman	1.13	Aug-14	$253,000	2014	3,400	$74.41	2 Story
3600196656	Hinson	0.75	Dec-13	$255,000	2013	3,453	$73.85	2 Story
	Average	1.27		$253,600	2013.4	3,418	$74.27	
	Median	1.13		$253,000	2013	3,400	$74.41	

Adjoining Sales After Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
0	Feddersen	1.56	Feb-13	$247,000	2012	3,427	$72.07	Ranch
0	Gentry	1.42	Apr-13	$245,000	2013	3,400	$72.06	2 Story
	Average	1.49		$246,000	2012.5	3,414	$72.07	
	Median	1.49		$246,000	2012.5	3,414	$72.07	

Adjoining Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600183905	Carter	1.57	Dec-12	$240,000	2012	3,347	$71.71	1.5 Story
3600193097	Kelly	1.61	Sep-12	$198,000	2012	2,532	$78.20	2 Story
3600194189	Hadwan	1.55	Nov-12	$240,000	2012	3,433	$69.91	1.5 Story
	Average	1.59		$219,000	2012	2,940	$74.95	
	Median	1.59		$219,000	2012	2,940	$74.95	

Nearby Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600193710	Barnes	1.12	Oct-13	$248,000	2013	3,400	$72.94	2 Story
3601105180	Nackley	0.95	Dec-13	$253,000	2013	3,400	$74.41	2 Story
3600192528	Mattheis	1.12	Oct-13	$238,000	2013	3,194	$74.51	2 Story
3600198928	Beckman	0.93	Mar-14	$250,000	2014	3,292	$75.94	2 Story
3600196965	Hough	0.81	Jun-14	$224,000	2014	2,434	$92.03	2 Story
3600193914	Preskitt	0.67	Jun-14	$242,000	2014	2,825	$85.66	2 Story
3600194813	Bordner	0.91	Apr-14	$258,000	2014	3,511	$73.48	2 Story
3601104147	Shaffer	0.73	Apr-14	$255,000	2014	3,453	$73.85	2 Story
	Average	0.91		$246,000	2013.625	3,189	$77.85	
	Median	0.92		$249,000	2014	3,346	$74.46	

Nearby Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600191437	Thomas	1.12	Sep-12	$225,000	2012	3,276	$68.68	2 Story
3600087968	Lilley	1.15	Jan-13	$238,000	2012	3,421	$69.57	1.5 Story
3600087654	Burke	1.26	Sep-12	$240,000	2012	3,543	$67.74	2 Story
3600088796	Hobbs	0.73	Sep-12	$228,000	2012	3,254	$70.07	2 Story
	Average	1.07		$232,750	2012	3,374	$69.01	
	Median	1.14		$233,000	2012	3,349	$69.13	

Matched Pair Summary

	Adjoins Solar Farm		Nearby Solar Farm	
	Average	**Median**	**Average**	**Median**
Sales Price	$253,600	$253,000	$246,000	$249,000
Year Built	2013	2013	2014	2014
Size	3,418	3,400	3,189	3,346
Price/SF	$74.27	$74.41	$77.85	$74.46

Percentage Differences

Median Price	-2%
Median Size	-2%
Median Price/SF	0%

I note that 2308 Granville Drive sold again in November 2015 for $267,500, or $7,500 more than when it was purchased new from the builder two years earlier (Tax ID 3600195361, Owner: Leak). The neighborhood is clearly showing appreciation for homes adjoining the solar farm.

The Median Price is the best indicator to follow in any analysis as it avoids outlying samples that would otherwise skew the results. The median sizes and median prices are all consistent throughout the sales both before and after the solar farm whether you look at sites adjoining or nearby to the solar farm. The average size for the homes nearby the solar farm shows a smaller building size and a higher price per square foot. This reflects a common occurrence in real estate where the price per square foot goes up as the size goes down. So even comparing averages the indication is for no impact, but I rely on the median rates as the most reliable indication for any such analysis.

I have also considered four more recent resales of homes in this community as shown on the following page. These comparable sales adjoin the solar farm at distances ranging from 315 to 400 feet. The matched pairs show a range from -9% to +6%. The range of the average difference is -2% to +1% with an average of 0% and a median of +0.5%. These comparable sales support a finding of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	103 Granville Pl	1.42	7/27/2018	$265,000	2013	3,292	$80.50	4/3.5	2-Car	2-Story		385
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	103 Granville Pl								$265,000		-2%
	Not	2219 Granville	$4,382		$1,300	$0				$265,682	0%	
	Not	634 Friendly	-$8,303		-$6,675	$16,721	-$10,000			$258,744	2%	
	Not	2403 Granville	-$6,029		-$1,325	$31,356				$289,001	-9%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	104 Erin	2.24	6/19/2017	$280,000	2014	3,549	$78.90	5/3.5	2-Car	2-Story		315
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	104 Erin								$280,000		0%
	Not	2219 Granville	-$4,448		$2,600	$16,238				$274,390	2%	
	Not	634 Friendly	-$17,370		-$5,340	$34,702	-$10,000			$268,992	4%	
	Not	2403 Granville	-$15,029		$0	$48,285				$298,256	-7%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2312 Granville	0.75	5/1/2018	$284,900	2013	3,453	$82.51	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2312 Granville								$284,900		1%
	Not	2219 Granville	$2,476		$1,300	$10,173				$273,948	4%	
	Not	634 Friendly	-$10,260		-$6,675	$27,986	-$10,000			$268,051	6%	
	Not	2403 Granville	-$7,972		-$1,325	$47,956				$303,659	-7%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2310 Granville	0.76	5/14/2019	$280,000	2013	3,292	$85.05	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2310 Granville								$280,000		1%
	Not	2219 Granville	$10,758		$1,300	$0				$272,058	3%	
	Not	634 Friendly	-$1,755		-$6,675	$16,721	-$10,000			$265,291	5%	
	Not	2403 Granville	$469		-$1,325	$31,356				$295,500	-6%	

I have also considered the original sales prices in this subdivision relative to the recent resale values as shown in the chart below. I have used the FHFA House Price Index Calculator to identify the value anticipated for each property in the second sale based on typical appreciation in the Goldsboro market from that national index. I note that these show that the homes are continuing to appreciate at rates consistent with if not more aggressively than the market indicators as both the average and median differences shown below support a 4 to 5% increase over what the FHFA HPI indicates. There were only 2 out of 14 indicators that suggested lower sales prices than anticipated and both of those occurred during the fast runup in values in 2021/2022 where the difference of a month or two could make significant differences and the FHFA HPI only addresses quarterly differences.

This set of 14 sales shows strong appreciation among the homes adjoining the solar farm. I also note that two of the sales shown below were initially sold in 2012 prior to the solar farm and show a Sale/Resale analysis supporting a finding of no impact on adjoining property value.

	Address	Initial Sale Date	Price	Second Sale Date	Price	FHFA HPI Value	$ Diff.	% Diff.
1	103 Granville Pl	4/1/2013	$245,000	7/27/2018	$265,000	$249,000	$16,000	6.43%
2	105 Erin	7/1/2014	$250,000	6/19/2017	$280,000	$247,000	$33,000	13.36%
3	2312 Granville	12/1/2013	$255,000	5/1/2015	$262,000	$244,000	$18,000	7.38%
4	2312 Granville	5/1/2015	$262,000	5/1/2018	$284,900	$283,000	$1,900	0.67%
5	2312 Granville	5/1/2018	$284,900	9/1/2021	$357,000	$349,000	$8,000	2.29%
6	2310 Granville	8/1/2013	$250,000	5/14/2019	$280,000	$264,000	$16,000	6.06%
7	2308 Granville	9/1/2013	$260,000	11/12/2015	$267,500	$255,000	$12,500	4.90%
8	2308 Granville	11/12/2015	$267,500	4/1/2021	$345,000	$332,000	$13,000	3.92%
9	2304 Granville	9/1/2012	$198,000	6/1/2017	$225,000	$193,000	$32,000	16.58%
10	2304 Granville	6/1/2017	$225,000	5/1/2021	$277,000	$278,000	-$1,000	-0.36%
11	2304 Granville	5/1/2021	$277,000	4/1/2022	$330,000	$325,000	$5,000	1.54%
12	102 Erin	8/1/2014	$253,000	11/1/2016	$270,000	$260,000	$10,000	3.85%
13	104 Erin	6/1/2017	$280,000	5/1/2022	$393,000	$433,000	-$40,000	-9.24%
14	2302 Granville	12/1/2012	$240,000	7/1/2022	$410,000	$375,000	$35,000	9.33%

Average	4.76%
Median	4.41%
High	16.58%
Low	-9.24%

2. Matched Pair – Cookstown Solar Farm, Goldsboro, Wayne County, NC



This 5 MW solar farm was built between 2018 and 2019. I identified a series of sales of the home at 411 N Cottowood Drive over the last 8 years that I have researched with the most recent sale being in 2022. This home is 295 feet from the closest panel. I spoke with Natalie Barber with Statewide Realty (919-738-3270) who indicated that the solar farm had no impact on the sales price or marketing of the home. She noted that you could see the panels somewhat, but not much due to the landscaping.

On the chart below, I have included an analysis of the 2015 sale of the property prior to the solar farm to both the 2020 and the 2022 sales of this home. I have compared both of these sales prices to the FHFA HPI indicator of where the sales price should have appreciated to for comparison.

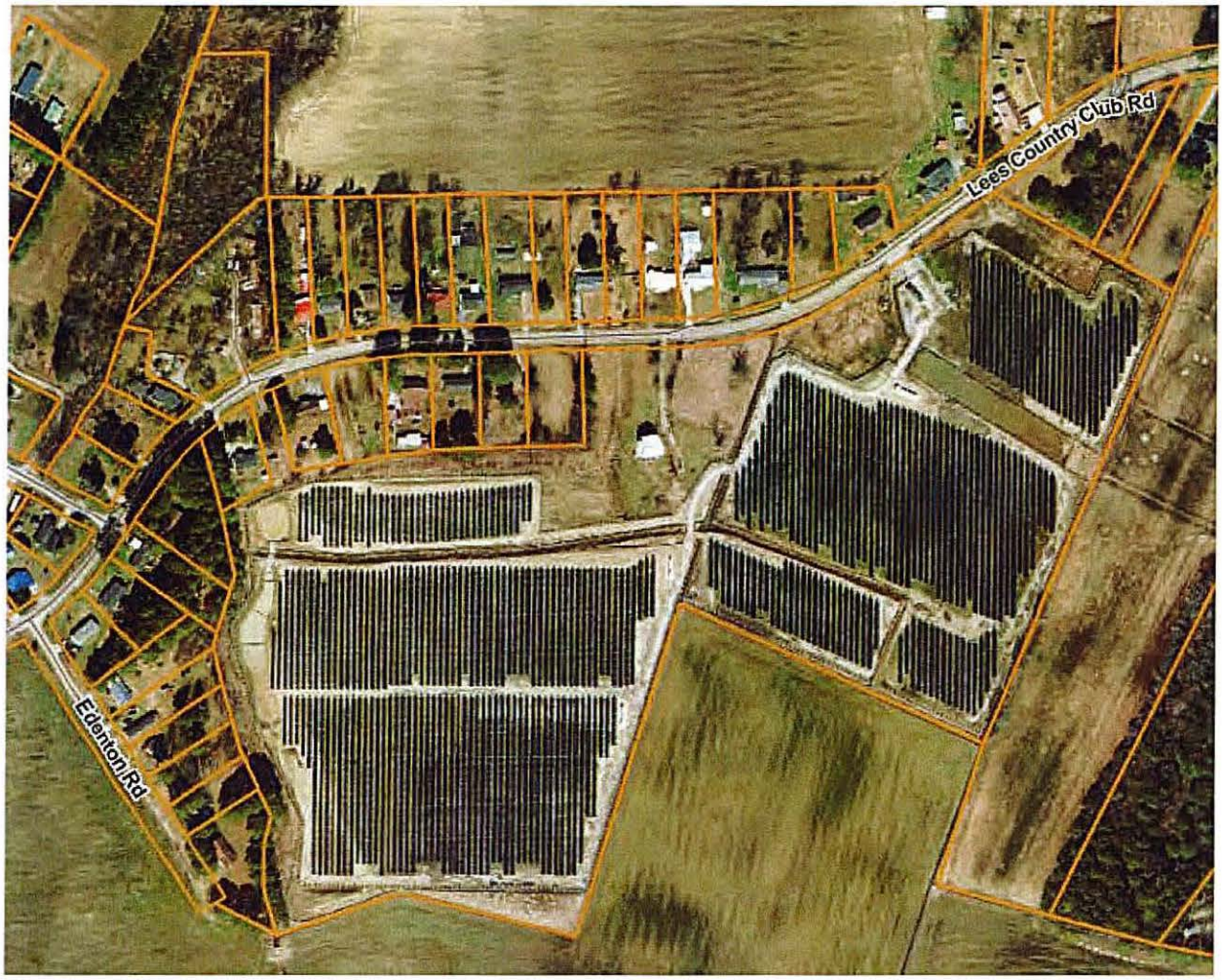
Cookstown Solar Farm

	Address	Initial Sale Date	Price	Second Sale Date	Price	FHFA HPI Value	$ Diff.	% Diff.
1	411 N Cottonwood	6/30/2015	$154,000	7/2/2020	$182,000	$172,000	$10,000	5.81%
2	411 N Cottonwood	6/30/2015	$154,000	10/31/2022	$280,000	$244,000	$36,000	14.75%
3	411 N Cottonwood	7/2/2020	$182,000	10/31/2022	$280,000	$259,000	$21,000	8.11%

Average	9.56%
Median	8.11%
High	14.75%
Low	5.81%

This data shows that in every instance, the home adjoining the solar farm outperformed the expectation and this data strongly suggests a positive relationship between the solar farm and the adjoining home value.

3. Matched Pair – Solar Lee, Mt Olive, Wayne County, NC



This 4.9 MW solar farm was built between 2020 and 2021.

I identified a sale of a home at 296 Lees Country Club Road on April 13, 2022 for $183,900. This home is across the street to the north near the east end of the project and is 185 feet from the closest solar panel.

Solar Lee, Lees Country Club Road, Mt. Olive, Wayne County, NC
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	296 Lees Cntry	0.93	4/13/2022	$183,900	1969	1,975	$93.11	4/2.5	Drive	Br-Rnch		185
	Not	601 Steele	0.41	5/12/2022	$200,000	1964	1,966	$101.73	3/2	2-Carprt	Br-Rnch		
	Not	106 College	0.50	2/11/2022	$191,000	1960	2,050	$93.17	3/2	Drive	Br-Rnch		
	Not	840 N Church	0.60	5/23/2022	$210,000	1953	2,248	$93.42	3/2	Crpt/Gar	Br-Rnch		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	296 Lees Cntry								$183,900		-4%
Not	601 Steele	-$1,466		$5,000	$458	-$5,000		-$10,000	$188,991	-3%	
Not	106 College	$2,945		$8,595	-$3,494	-$5,000			$194,047	-6%	
Not	840 N Church	-$2,124		$16,800	-$12,751	-$5,000		-$15,000	$191,925	-4%	

The paired sales all sold within a very similar time frame and support a difference of -4%, which is within the typical market imperfection and supports a finding of no impact at all.

4. Matched Pair – Gastonia SC Solar, Gastonia, Gaston County, NC





This 5 MW project is located on the south side of Neal Hawkins Road just outside of Gastonia. The property identified above as Parcel 4 was listed for sale while this solar farm project was going through the approval process. The property was put under contract during the permitting process with the permit being approved while the due diligence period was still ongoing. After the permit was approved the property closed with no concerns from the buyer. I spoke with Jennifer Bouvier, the broker listing the property and she indicated that the solar farm had no impact at all on the sales price. She considered some nearby sales to set the price and the closing price was very similar to the asking price within the typical range for the market. The buyer was aware that the solar farm was coming and they had no concerns.

This two-story brick dwelling was sold on March 20, 2017 for $270,000 for a 3,437 square foot dwelling built in 1934 in average condition on 1.42 acres. The property has four bedrooms and two bathrooms. The landscaping screen is light for this adjoining home due to it being a new planted landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	609 Neal Hawkins	1.42	3/20/2017	$270,000	1934	3,427	$78.79	4/2	Open	2-Brick	
Not	1418 N Modena	4.81	4/17/2018	$225,000	1930	2,906	$77.43	3/3	2-Crprt	2-Brick	
Not	363 Dallas Bess	2.90	11/29/2018	$265,500	1968	2,964	$89.57	3/3	Open	FinBsmt	
Not	1612 Dallas Chry	2.74	9/17/2018	$245,000	1951	3,443	$71.16	3/2	Open	2-Brick	Unfin bath

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
609 Neal Hawkins								$270,000			225
1418 N Modena	$7,319		$2,700	$32,271		-$10,000		$257,290	5%		
363 Dallas Bess	$746		-$27,081	$33,179	-$10,000		$53,100	$262,456	3%		
1612 Dallas Chry	$4,110		-$12,495	-$911			$10,000	$235,704	13%		
										7%	

I also considered the newer adjoining home identified as Parcel 5 that sold later in 2017 and it likewise shows no negative impact on property value. This is also considered a light landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style
Adjoins	611 Neal Hawkins	0.78	7/6/2017	$288,000	1991	2,256	$127.66	5/3	2-Gar	1.5 Brick
Not	1211 Still Frst	0.51	7/30/2018	$280,000	1989	2,249	$124.50	3/3	2-Gar	Br Rnch
Not	2867 Colony Wds	0.52	8/14/2018	$242,000	1990	2,006	$120.64	3/3	2-Gar	Br Rnch
Not	1010 Strawberry	1.00	10/4/2018	$315,000	2002	2,330	$135.19	3/2.5	2-Gar	1.5 Brick

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
611 Neal Hawkins								$288,000			145
1211 Still Frst	$1,341		$2,800	$697				$284,838	1%		
2867 Colony Wds	$7,714		$1,210	$24,128				$275,052	4%		
1010 Strawberry	-$4,555		-$17,325	-$8,003	$5,000			$290,116	-1%		
										2%	

5. Matched Pair – Summit/Ranchlands Solar, Moyock, Currituck County, NC



This project is located at 1374 Caritoke Highway, Moyock, NC. This is an 80 MW facility on a parent tract of 2,034 acres. Parcels Number 48 and 53 as shown in the map above were sold in 2016. The project was under construction during the time period of the first of the matched pair sales and the permit was approved well prior to that in 2015.

I looked at multiple sales of adjoining and nearby homes and compared each to multiple comparables to show a range of impacts from -10% up to +11% with an average of +2% and a median of +3%. These ranges are well within typical real estate variation and supports an indication of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
48	Adjoins	129 Pinto	4.29	4/15/2016	$170,000	1985	1,559	$109.04	3/2	Drive	MFG		1,060
	Not	102 Timber	1.30	4/1/2016	$175,500	2009	1,352	$129.81	3/2	Drive	MFG		
	Not	120 Ranchland	0.99	10/1/2014	$170,000	2002	1,501	$113.26	3/2	Drive	MFG		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	129 Pinto								$170,000		-3%
Not	102 Timber	$276	$10,000	-$29,484	$18,809				$175,101	-3%	
Not	120 Ranchland	$10,735	$10,000	-$20,230	$4,598				$175,103	-3%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	105 Pinto	4.99	12/16/2016	$206,000	1978	1,484	$138.81	3/2	Det G	Ranch	
Not	111 Spur	1.15	2/1/2016	$193,000	1985	2,013	$95.88	4/2	Gar	Ranch	
Not	103 Marshall	1.07	3/29/2017	$196,000	2003	1,620	$120.99	3/2	Drive	Ranch	
Not	127 Ranchland	0.00	6/9/2015	$219,900	1988	1,910	$115.13	3/2	Gar/3Det	Ranch	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
105 Pinto								$206,000			980
111 Spur	$6,747	$10,000	-$6,755	-$25,359				$177,633	14%		
103 Marshall	-$2,212	$10,000	-$24,500	-$8,227		$5,000		$176,212	14%		
127 Ranchland	$13,399	$10,000	-$10,995	-$24,523		-$10,000		$197,781	4%		
										11%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
15	Adjoins	318 Green View	0.44	9/15/2019	$357,000	2005	3,460	$103.18	4/4	2-Car	1.5 Brick		570
	Not	195 St Andrews	0.55	6/17/2018	$314,000	2002	3,561	$88.18	5/3	2-Car	2.0 Brick		
	Not	336 Green View	0.64	1/13/2019	$365,000	2006	3,790	$96.31	6/4	3-Car	2.0 Brick		
	Not	275 Green View	0.36	8/15/2019	$312,000	2003	3,100	$100.65	5/3	2-Car	2.0 Brick		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	318 Green View								$357,000		4%
Not	195 St Andrews	$12,040		$4,710	-$7,125	$10,000			$333,625	7%	
Not	336 Green View	$7,536		-$1,825	-$25,425			-$5,000	$340,286	5%	
Not	275 Green View	$815		$3,120	$28,986	$10,000			$354,921	1%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
29	Adjoins	164 Ranchland	1.01	4/30/2019	$169,000	1999	2,052	$82.36	4/2	Gar	MFG		440
	Not	150 Pinto	0.94	3/27/2018	$168,000	2017	1,920	$87.50	4/2	Drive	MFG		
	Not	105 Longhorn	1.90	10/10/2017	$184,500	2002	1,944	$94.91	3/2	Drive	MFG		
	Not	112 Pinto	1.00	7/27/2018	$180,000	2002	1,836	$98.04	3/2	Drive	MFG	Fenced	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	164 Ranchland								$169,000		-10%
Not	150 Pinto	$5,649		-$21,168	$8,085			$5,000	$165,566	2%	
Not	105 Longhorn	$8,816	-$10,000	-$3,875	$7,175			$5,000	$191,616	-13%	
Not	112 Pinto	$4,202		-$3,780	$14,824			$5,000	$200,245	-18%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	358 Oxford	10.03	9/16/2019	$478,000	2008	2,726	$175.35	3/3	2 Gar	Ranch		635
	Not	276 Summit	10.01	12/20/2017	$355,000	2006	1,985	$178.84	3/2	2 Gar	Ranch		
	Not	176 Providence	6.19	5/6/2019	$425,000	1990	2,549	$166.73	3/3	4 Gar	Ranch	Brick	
	Not	1601 B Caratoke	12.20	9/26/2019	$440,000	2016	3,100	$141.94	4/3.5	5 Gar	Ranch	Pool	

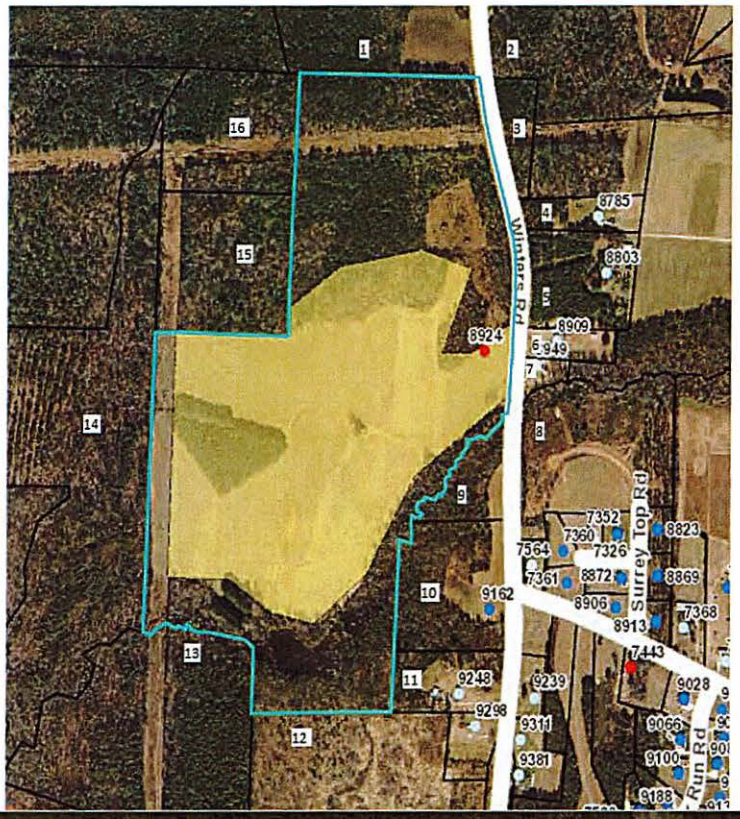
Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	358 Oxford								$478,000		5%
Not	276 Summit	$18,996		$3,550	$106,017	$10,000			$493,564	-3%	
Not	176 Providence	$4,763		$38,250	$23,609		-$10,000	-$25,000	$456,623	4%	
Not	1601 B Caratoke	-$371	$50,000	-$17,600	-$42,467	-$5,000	-$10,000		$414,562	13%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Nearby	343 Oxford	10.01	3/9/2017	$490,000	2016	3,753	$130.56	3/3	2 Gar	1.5 Story	Pool	970
	Not	287 Oxford	10.01	9/4/2017	$600,000	2013	4,341	$138.22	5/4.5	8-Gar	1.5 Story	Pool	
	Not	301 Oxford	10.00	4/23/2018	$434,000	2013	3,393	$127.91	5/3	2 Gar	1.5 Story		
	Not	218 Oxford	10.01	4/4/2017	$525,000	2006	4,215	$124.56	4/3	4 Gar	1.5 Story	VG Barn	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	343 Oxford								$490,000		3%
Not	287 Oxford	-$9,051		$9,000	-$65,017	-$15,000	-$25,000		$494,932	-1%	
Not	301 Oxford	-$14,995	-$10,000	$6,510	$36,838				$452,353	8%	
Not	218 Oxford	-$1,150		$26,250	-$46,036		-$10,000	-$10,000	$484,064	1%	

6. Matched Pair – Tracy Solar, Bailey, Nash County, NC





This project is located in rural Nash County on Winters Road with a 5 MW facility that was built in 2016 on 50 acres. A local builder acquired parcels 9 and 10 following construction as shown below at rates comparable to other tracts in the area. They then built a custom home for an owner and sold that at a price similar to other nearby homes as shown in the matched pair data below. The retained woods provide a heavy landscaped buffer for this homesite.

Adjoining Land Sales After Solar Farm Completed

#	Solar Farm	TAX ID	Grantor	Grantee	Address	Acres	Date Sold	Sales Price	$/AC	Other
9 &10	Adjoins	316003 & 316004	Cozart	Kingsmill	9162 Winters	13.22	7/21/2016	$70,000	$5,295	
	Not	6056	Billingsly		427 Young	41	10/21/2016	$164,000	$4,000	
	Not	33211	Fulcher	Weikel	10533 Cone	23.46	7/18/2017	$137,000	$5,840	Doublewide, structures
	Not	106807	Perry	Gardner	Claude Lewis	11.22	8/10/2017	$79,000	$7,041	Gravel drive for sub, cleared
	Not	3437	Vaughan	N/A	11354 Old Lewis Sch	18.73	Listing	$79,900	$4,266	Small cemetery,wooded

Adjoining Sales Adjusted

Time	Acres	Location	Other	Adj $/Ac	% Diff
				$5,295	
$0	$400	$0	$0	$4,400	17%
-$292	$292	$0	-$500	$5,340	-1%
-$352	$0	$0	-$1,000	$5,689	-7%
-$213	$0	$0	$213	$4,266	19%
				Average	7%

Adjoining Residential Sales After Solar Farm Completed

#	Solar Farm	n	Address	Acres	Date Sold	Sales Price	Built	GLA	$/GLA	BR/BA	Style	Other
9 &10	Adjoins	s	9162 Winters	13.22	1/5/2017	$255,000	2016	1,616	$157.80	3/2	Ranch	1296 sf wrkshp
	Not	n	7352 Red Fox	0.93	6/30/2016	$176,000	2010	1,529	$115.11	3/2	2-story	

Adjoining Sales Adjusted

Time	Acres	YB	GLA	Style	Other	Total	% Diff
						$255,000	
$0	$44,000	$7,392	$5,007	$5,000	$15,000	$252,399	1%

The comparables for the land show either a significant positive relationship or a mild negative relationship to having and adjoining solar farm, but when averaged together they show no negative impact. The wild divergence is due to the difficulty in comping out this tract of land and the wide variety of comparables used. The two comparables that show mild negative influences include a property that was partly developed as a residential subdivision and the other included a doublewide with some value and accessory agricultural structures. The tax assessed value on the improvements were valued at $60,000. So both of those comparables have some limitations for comparison. The two that show significant enhancement due to adjacency includes a property with a cemetery located in the middle and the other is a tract almost twice as large. Still that larger tract after adjustment provides the best matched pair as it required the least adjustment. I therefore conclude that there is no negative impact due to adjacency to the solar farm shown by this matched pair.

The dwelling that was built on the site was a build-to-suit and was compared to a nearby homesale of a property on a smaller parcel of land. I adjusted for that differenced based on a $25,000 value for a 1-acre home site versus the $70,000 purchase price of the larger subject tract. The other adjustments are typical and show no impact due to the adjacency to the solar farm.

The closest solar panel to the home is 780 feet away.

I note that the representative for Kingsmill Homes indicated that the solar farm was never a concern in purchasing the land or selling the home. He also indicated that they had built a number of nearby homes across the street and it had never come up as an issue.

7. Matched Pair – McBride Place Solar Farm, Midland, Cabarrus County, NC



This project is located on Mount Pleasant Road, Midland, North Carolina. The property is on 627 acres on an assemblage of 974.59 acres. The solar farm was approved in early 2017 for a 74.9 MW facility.

I have considered the sale of 4380 Joyner Road which adjoins the proposed solar farm near the northwest section. This property was appraised in April of 2017 for a value of $317,000 with no consideration of any impact due to the solar farm in that figure. The property sold in November 2018 for $325,000 with the buyer fully aware of the proposed solar farm. The landscaping buffer relative to Joyner Road, Hayden Way, Chanel Court and Kristi Lane is considered medium, while the landscaping for the home at the north end of Chanel Court is considered very light.

I have considered the following matched pairs to the subject property.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	4380 Joyner	12.00	11/22/2017	$325,000	1979	1,598	$203.38	3/2	2xGar	Ranch	Outbldg
Not	3870 Elkwood	5.50	8/24/2016	$250,000	1986	1,551	$161.19	3/2.5	Det 2xGar	Craft	
Not	8121 Lower Rocky	18.00	2/8/2017	$355,000	1977	1,274	$278.65	2/2	2xCarprt	Ranch	Eq. Fac.
Not	13531 Cabarrus	7.89	5/20/2016	$267,750	1981	2,300	$116.41	3/2	2xGar	Ranch	

Adjoining Sales Adjusted

Time	Acres	YB	Condition	GLA	BR/BA	Park	Other	Total	% Diff
								$325,000	
$7,500	$52,000	-$12,250	$10,000	$2,273	-$2,000	$2,500	$7,500	$317,523	2%
$7,100	-$48,000	$4,970		$23,156	$0	$3,000	-$15,000	$330,226	-2%
$8,033	$33,000	-$3,749	$20,000	-$35,832	$0	$0	$7,500	$296,702	9%
								Average	3%

The home at 4380 Joyner Road is 275 feet from the closest solar panel.

I also considered the recent sale of a lot at 5800 Kristi Lane that is on the east side of the proposed solar farm. This 4.22-acre lot sold in December 2017 for $94,000. A home was built on this lot in 2019 with the closest point from home to panel at 689 feet. The home site is heavily wooded and their remains a wooded buffer between the solar panels and the home. I spoke with the broker, Margaret Dabbs, who indicated that the solar farm was considered a positive by both buyer and seller as it ensures no subdivision will be happening in that area. Buyers in this market are looking for privacy and seclusion.

The breakdown of recent lot sales on Kristi are shown below with the lowest price paid for the lot with no solar farm exposure, though that lot has exposure to Mt Pleasant Road South. Still the older lot sales have exposure to the solar farm and sold for higher prices than the front lot and adjusting for time would only increase that difference.

Adjoining Lot Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	$/AC	$/Lot
	Adjoins	5811 Kristi	3.74	5/1/2018	$100,000	$26,738	$100,000
	Adjoins	5800 Kristi	4.22	12/1/2017	$94,000	$22,275	$94,000
	Not	5822 Kristi	3.43	2/24/2020	$90,000	$26,239	$90,000

The lot at 5811 Kristi Lane sold in May 2018 for $100,000 for a 3.74-acre lot. The home that was built later in 2018 is 505 feet to the closest solar panel. This home then sold to a homeowner for $530,000 in April 2020. I have compared this home sale to other properties in the area as shown below.

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	5811 Kristi	3.74	3/31/2020	$530,000	2018	3,858	$137.38	5/3.5	2 Gar	2-story	Cement Ext
Not	3915 Tania	1.68	12/9/2019	$495,000	2007	3,919	$126.31	3/3.5	2 Gar	2-story	3Det Gar
Not	6782 Manatee	1.33	3/8/2020	$460,000	1998	3,776	$121.82	4/2/2h	2 Gar	2-story	Water
Not	314 Old Hickory	1.24	9/20/2019	$492,500	2017	3,903	$126.18	6/4.5	2 Gar	2-story	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	5811 Kristi								$530,000		5%
Not	3915 Tania	$6,285		$27,225	-$3,852		-$20,000		$504,657	5%	
Not	6782 Manatee	$1,189		$46,000	$4,995	$5,000			$517,183	2%	
Not	314 Old Hickory	$10,680		$2,463	-$2,839	-$10,000			$492,803	7%	

After adjusting the comparables, I found that the average adjusted value shows a slight increase in value for the subject property adjoining a solar farm. As in the other cases, this is a mild positive impact on value but within the typical range of real estate transactions.

I also looked at 5833 Kristi Lane that sold on 9/14/2020 for $625,000. This home is 470 feet from the closest panel.

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Nearby	5833 Kristi	4.05	9/14/2020	$625,000	2008	4,373	$142.92	5/4	3-Car	2-Brick	
Not	4055 Dakeita	4.90	12/30/2020	$629,000	2005	4,427	$142.08	4/4	4-Car	2-Brick	4DetGar/Stable
Not	9615 Bales	2.16	6/30/2020	$620,000	2007	4,139	$149.79	4/5	3-Car	2-Stone	2DetGar
Not	9522 Bales	1.47	6/18/2020	$600,000	2007	4,014	$149.48	4/4.5	3-Car	2-Stone	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
5833 Kristi								$625,000			470
4055 Dakeita	-$9,220		$5,661	-$6,138		-$25,000		$594,303	5%		
9615 Bales	$6,455		$1,860	$28,042	-$10,000	-$15,000		$631,356	-1%		
9522 Bales	$7,233		$1,800	$42,930	-$5,000			$646,963	-4%		
										0%	

The average difference is 0% impact and the differences are all within a close range with this set of comparables and supports a finding of no impact on property value.

I have also looked at 4504 Chanel Court. This home sold on January 1, 2020 for $393,500 for this 3,010 square foot home built in 2004 with 3 bedrooms, 3.5 bathrooms, and a 3-car garage. This home includes a full partially finished basement that significantly complicates comparing this to other sales. This home previously sold on January 23, 2017 for $399,000. This was during the time that the solar farm was a known factor as the solar farm was approved in early 2017 and public discussions had already commenced. I spoke with Rachelle Killman with Real Estate Realty, LLC the buyer's agent for this transaction and she indicated that the solar farm was not a factor or consideration for the buyer. She noted that you could see the panels sort of through the trees, but it wasn't a concern for the buyer. She was not familiar with the earlier 2017 sale, but indicated that it was likely too high. This again goes back to the partially finished basement issue. The basement has a fireplace, and an installed 3/4 bathroom but otherwise bare studs and concrete floors with different buyers assigning varying value to that partly finished space. I also reached out to Don Gomez with Don Anthony Realty, LLC as he was the listing agent.

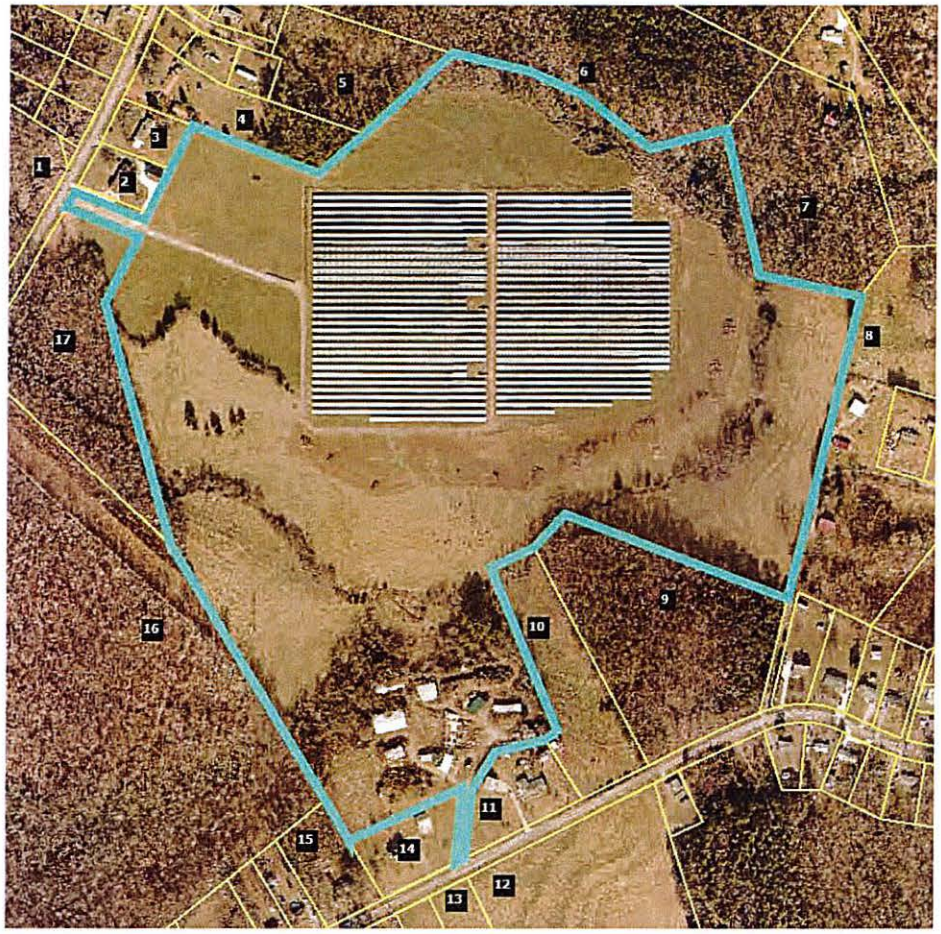
I also looked at the recent sale of 4599 Chanel Court. This home is within 310 feet of solar panels but notably does not have a good landscaping screen in place as shown in the photo below. The plantings appear to be less than 3-feet in height and only a narrow, limited screen of existing hardwoods were kept. The photograph is from the listing.

According to Scott David with Better Homes and Gardens Paracle Realty, this property was under contract for $550,000 contingent on the buyer being able to sell their former home. The former home was apparently overpriced and did not sell and the contract stretched out over 2.5 months. The seller was in a bind as they had a home they were trying to buy contingent on this closing and were about to lose that opportunity. A cash buyer offered them a quick close at $500,000 and the seller accepted that offer in order to not lose the home they were trying to buy. According to Mr. David, the original contracted buyer and the actual cash buyer never considered the solar farm as a negative. In fact Mr. David noted that the actual buyer saw it as a great opportunity to purchase a home where a new subdivision could not be built behind his house. I therefore conclude that this property supports a finding of no impact on adjoining property, even where the landscaping screen still requires time to grow in for a year-round screen.

I also considered a sale/resale analysis on this property. This same home sold on September 15, 2015 for $462,000. Adjusting this upward by 5% per year for the five years between these sales dates suggests a value of $577,500. Comparing that to the $550,000 contract that suggests a 5% downward impact, which is within a typical market variation. Given that the broker noted no negative impact from the solar farm and the analysis above, I conclude this sale supports a finding of no impact on value.



8. Matched Pair – Mariposa Solar, Gaston County, NC



This project is a 5 MW facility located on 35.80 acres out of a parent tract of 87.61 acres at 517 Blacksnake Road, Stanley that was built in 2016.

I have considered a number of recent sales around this facility as shown below.

The first is identified in the map above as Parcel 1, which is 215 Mariposa Road. This is an older dwelling on large acreage with only one bathroom. I've compared it to similar nearby homes as shown below. The landscaping buffer for this home is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000	1958	1,551	$160.54	3/1	Garage	Br/Rnch
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5
Not	1201 Abernathy	27.00	5/3/2018	$390,000	1970	2,190	$178.08	3/2	Crprt	Br/Rnch

Adjoining Residential Sales After Solar Farm Approved					Adjoining Sales Adjusted								
Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000								$249,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$5,583	-$17,136	$129,450	-$20,576	-$10,000			$229,154	8%
Not	110 Airport	0.83	5/10/2016	$166,000	$7,927	-$4,648	$126,825	-$47,078	-$10,000			$239,026	4%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$5,621	-$37,345	$95,475	-$68,048	-$10,000	$5,000		$221,961	11%
Not	1201 Abernathy	27.00	5/3/2018	$390,000	-$4,552	-$32,760	-$69,450	-$60,705	-$10,000			$212,533	15%
											Average		9%

The average difference after adjusting for all factors is +9% on average, which suggests an enhancement due to the solar farm across the street. Given the large adjustments for acreage and size, I will focus on the low end of the adjusted range at 4%, which is within the typical deviation and therefore suggests no impact on value.

I have also considered Parcel 4 that sold after the solar farm was approved but before it had been constructed in 2016. The landscaping buffer for this parcel is considered light.

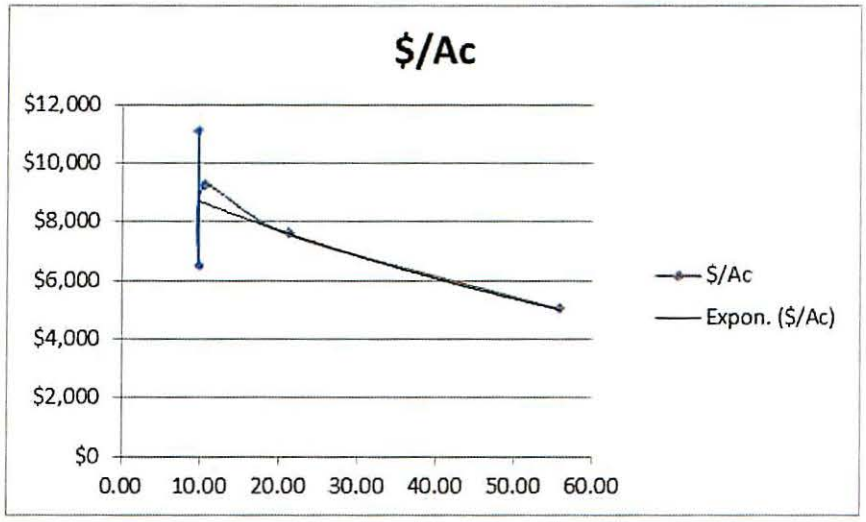
Adjoining Residential Sales After Solar Farm Approved											
Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000	1962	1,880	$95.74	3/2	Carport	Br/Rnch	Det Wrkshop
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch	
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch	
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5	

Adjoining Residential Sales After Solar Farm Approved					Adjoining Sales Adjusted								
Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000								$180,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$15,807	-$12,852	$18,468	$7,513		-$3,000	$25,000	$172,322	4%
Not	110 Airport	0.83	5/10/2016	$166,000	-$3,165	$0	$15,808	-$28,600			$25,000	$175,043	3%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$21,825	-$30,555	-$15,960	-$40,942		$2,000	$25,000	$160,218	11%
											Average		6%

The average difference after adjusting for all factors is +6%, which is again suggests a mild increase in value due to the adjoining solar farm use. The median is a 4% adjustment, which is within a standard deviation and suggests no impact on property value.

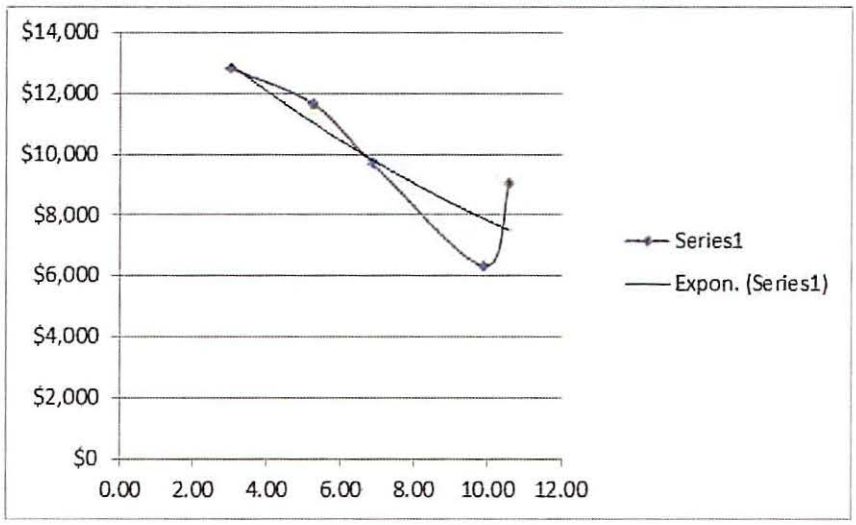
I have also considered the recent sale of Parcel 13 that is located on Blacksnake Road south of the project. I was unable to find good land sales in the same 20-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 20 acres. As can be seen in the chart below, this lines up exactly with the purchase of the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm.

Adjoining Residential Land Sales After Solar Farm Approved						Adjoining Sales Adjusted	
Solar	Tax/Street	Acres	Date Sold	Sales Price	$/Ac	Time	$/Ac
Adjoins	174339/Blacksnake	21.15	6/29/2018	$160,000	$7,565		$7,565
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	$38	$9,215
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$37	$6,447
Not	164243/Alexis	9.75	2/1/2019	$110,000	$11,282	-$201	$11,081
Not	176884/Bowden	55.77	6/13/2018	$280,000	$5,021	$7	$5,027

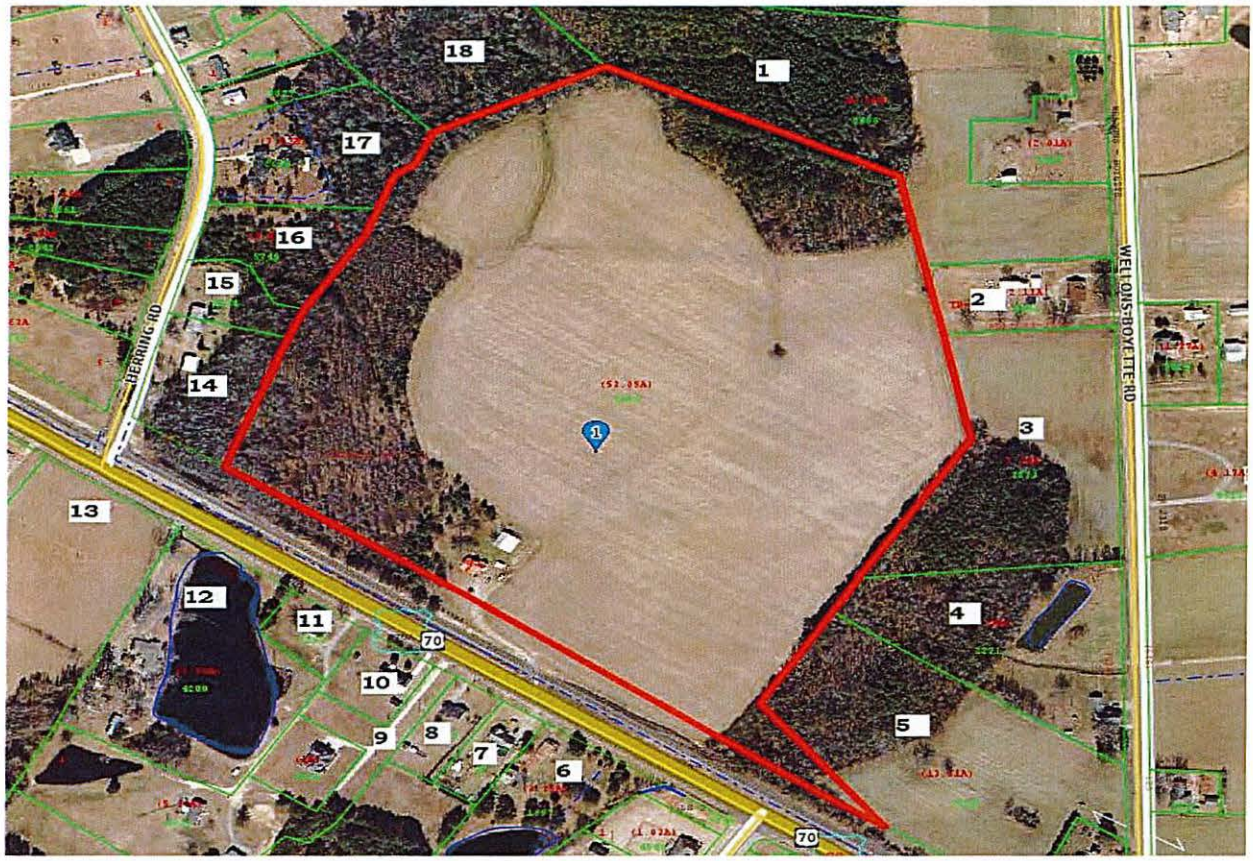


Finally, I have considered the recent sale of Parcel 17 that sold as vacant land. I was unable to find good land sales in the same 7-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 7 acres. As can be seen in the chart below, this lines up with the trendline running right through the purchase price for the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm. I note that this property was improved with a 3,196 square foot ranch built in 2018 following the land purchase, which shows that development near the solar farm was unimpeded.

Adjoining Residential Land Sales After Solar Farm Approved						**Adjoining Sales Adjusted**		
Solar	**Tax/Street**	**Acres**	**Date Sold**	**Sales Price**	**$/Ac**	**Time**	**Location**	**$/Ac**
Adjoins	227039/Mariposa	6.86	12/6/2017	$66,500	$9,694			$9,694
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	-$116		$9,061
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$147		$6,338
Not	177322/Robinson	5.23	5/12/2017	$66,500	$12,715	$217	-$1,272	$11,661
Not	203386/Carousel	2.99	7/13/2018	$43,500	$14,548	-$262	-$1,455	$12,832



9. Matched Pair – Candace Solar, Princeton, Johnston County, NC





This 5 MW solar farm is located at 4839 US 70 Highway just east of Herring Road. This solar farm was completed on October 25, 2016.

I identified three adjoining sales to this tract after development of the solar farm with frontage on US 70. I did not attempt to analyze those sales as they have exposure to an adjacent highway and railroad track. Those homes are therefore problematic for a matched pair analysis unless I have similar homes fronting on a similar corridor.

I did consider a land sale and a home sale on adjoining parcels without those complications.

The lot at 499 Herring Road sold to Paradise Homes of Johnston County of NC, Inc. for $30,000 in May 2017 and a modular home was placed there and sold to Karen and Jason Toole on September 29, 2017. I considered the lot sale first as shown below and then the home sale that followed. The landscaping buffer relative to this parcel is considered medium.

Adjoining Land Sales After Solar Farm Approved							Adjoining Sales Adjusted				
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Other**	**Time**	**Site**	**Other**	**Total**	**% Diff**
16	Adjoins	499 Herring	2.03	5/1/2017	$30,000					$30,000	
	Not	37 Becky	0.87	7/23/2019	$24,500	Sub/Pwr	-$1,679	$4,900		$27,721	8%
	Not	5858 Bizzell	0.88	8/17/2016	$18,000		$390	$3,600		$21,990	27%
	Not	488 Herring	2.13	12/20/2016	$35,000		$389			$35,389	-18%
										Average	5%

Following the land purchase, the modular home was placed on the site and sold. I have compared this modular home to the following sales to determine if the solar farm had any impact on the purchase price.

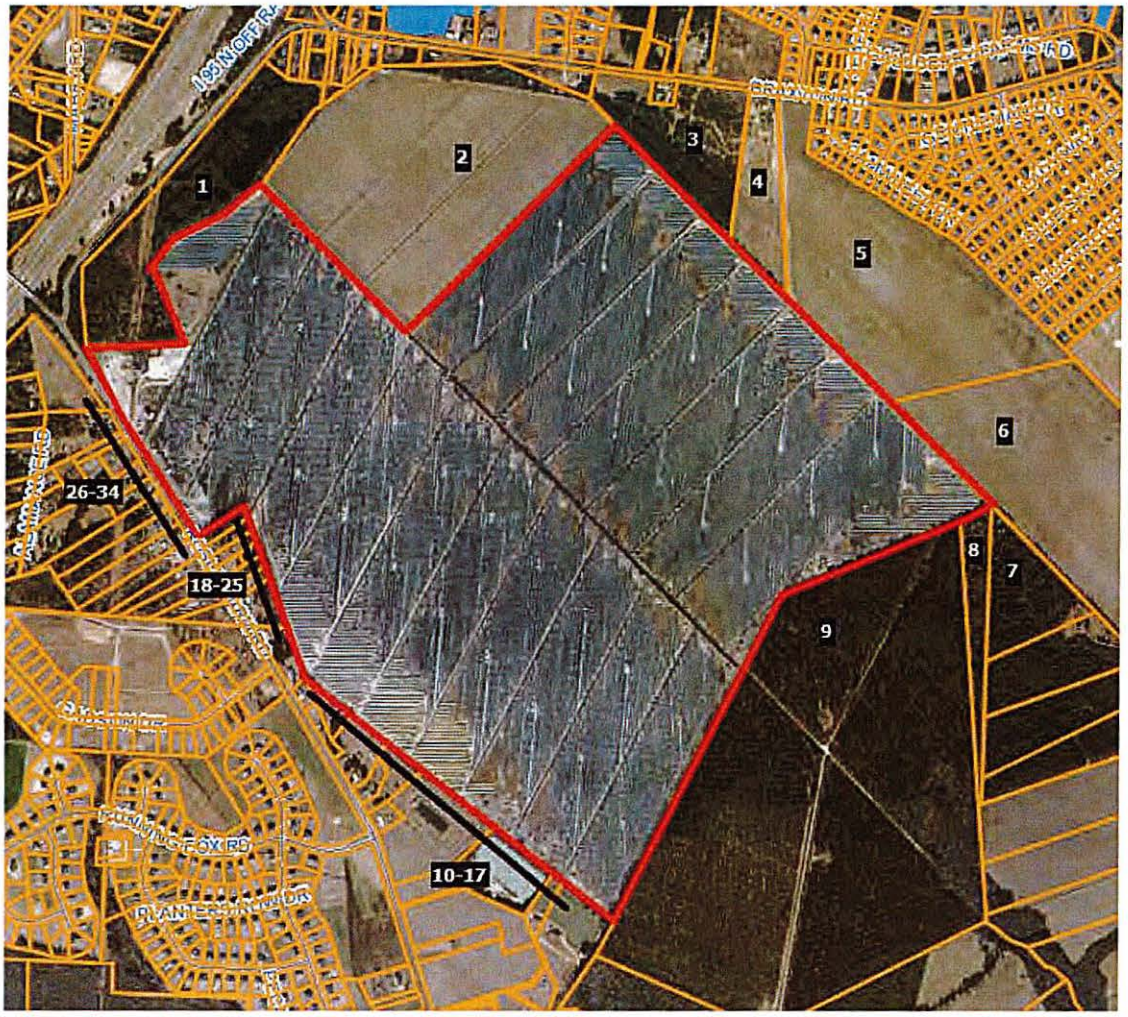
Adjoining Residential Sales After Solar Farm Approved												
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Built**	**GBA**	**$/GBA**	**BR/BA**	**Park**	**Style**	**Other**
16	Adjoins	499 Herring	2.03	9/27/2017	$215,000	2017	2,356	$91.26	4/3	Drive	Modular	
	Not	678 WC	6.32	3/8/2019	$226,000	1995	1,848	$122.29	3/2.5	Det Gar	Mobile	Ag bldgs
	Not	1810 Bay V	8.70	3/26/2018	$170,000	2003	2,356	$72.16	3/2	Drive	Mobile	Ag bldgs
	Not	1795 Bay V	1.78	12/1/2017	$194,000	2017	1,982	$97.88	4/3	Drive	Modular	

Adjoining Residential Sales Af			Adjoining Sales Adjusted									Avg	
Parcel	**Solar**	**Address**	**Time**	**Site**	**YB**	**GLA**	**BR/BA**	**Park**	**Other**	**Total**	**% Diff**	**% Diff**	**Distance**
16	Adjoins	499 Herring								$215,000			488
	Not	678 WC	-$10,037	-$25,000	$24,860	$37,275	-$5,000	-$7,500	-$20,000	$220,599	-3%		
	Not	1810 Bay V	-$2,579	-$20,000	$11,900	$0				$159,321	26%		
	Not	1795 Bay V	-$1,063		$0	$21,964				$214,902	0%		
												8%	

The best comparable is 1795 Bay Valley as it required the least adjustment and was therefore most similar, which shows a 0% impact. This signifies no impact related to the solar farm.

The range of impact identified by these matched pairs ranges are therefore -3% to +26% with an average of +8% for the home and an average of +4% for the lot, though the best indicator for the lot shows a $5,000 difference in the lot value due to the proximity to the solar farm or a -12% impact.

10. Matched Pair – Innovative Solar 46, Roslin Farm Rd, Hope Mills, Cumberland County, NC



This project was built in 2016 and located on 532 acres for a 78.5 MW solar farm with the closest home at 125 feet from the closest solar panel with an average distance of 423 feet.

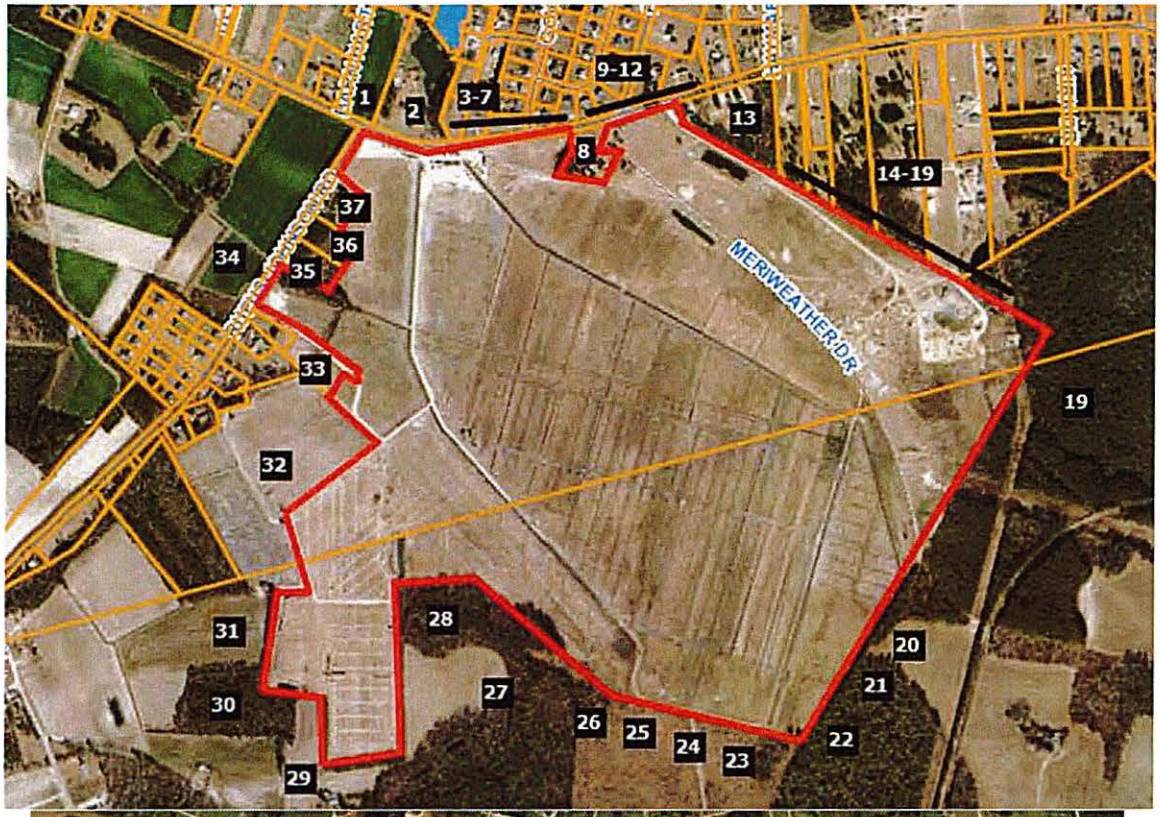
I considered the recent sale of a home on Roslin Farm Road just north of Running Fox Road as shown below. This sale supports an indication of no impact on property value. The landscaping buffer is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	6849 Roslin Farm	1.00	2/18/2019	$155,000	1967	1,610	$96.27	3/3	Drive	Ranch	Brick	435
Not	6592 Sim Canady	2.43	9/5/2017	$185,000	1974	2,195	$84.28	3/2	Gar	Ranch	Brick	
Not	1614 Joe Hall	1.63	9/3/2019	$145,000	1974	1,674	$86.62	3/2	Det Gar	Ranch	Brick	
Not	109 Bledsoe	0.68	1/17/2019	$150,000	1973	1,663	$90.20	3/2	Gar	Ranch	Brick	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	6849 Roslin Farm								$155,000		5%
Not	6592 Sim Canady	$8,278		-$6,475	-$39,444	$10,000	-$5,000		$152,359	2%	
Not	1614 Joe Hall	-$2,407		-$5,075	-$3,881	$10,000	-$2,500		$141,137	9%	
Not	109 Bledsoe	$404	$10,000	-$4,500	-$3,346		-$5,000		$147,558	5%	

11. Matched Pair – Innovative Solar 42, County Line Rd, Fayetteville, Cumberland County, NC





This project was built in 2017 and located on 413.99 acres for a 71 MW with the closest home at 135 feet from the closest solar panel with an average distance of 375 feet.

I considered the recent sales identified on the map above as Parcels 2 and 3, which is directly across the street these homes are 330 and 340 feet away. Parcel 2 includes an older home built in 1976, while Parcel 3 is a new home built in 2019. So the presence of the solar farm had no impact on new construction in the area.

The matched pairs for each of these are shown below. The landscaping buffer relative to these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2923 County Ln	8.98	2/28/2019	$385,000	1976	2,905	$132.53	3/3	2-Car	Ranch	Brick/Pond	340
Not	1928 Shaw Mill	17.00	7/3/2019	$290,000	1977	3,001	$96.63	4/4	2-Car	Ranch	Brick/Pond/Rental	
Not	2109 John McM.	7.78	4/25/2018	$320,000	1978	2,474	$129.35	3/2	Det Gar	Ranch	Vinyl/Pool,Stable	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2923 County Ln								$385,000		3%
Not	1928 Shaw Mill	-$3,055	$100,000	-$1,450	-$7,422	-$10,000			$368,074	4%	
Not	2109 John McM.	$8,333		-$3,200	$39,023	$10,000		$5,000	$379,156	2%	

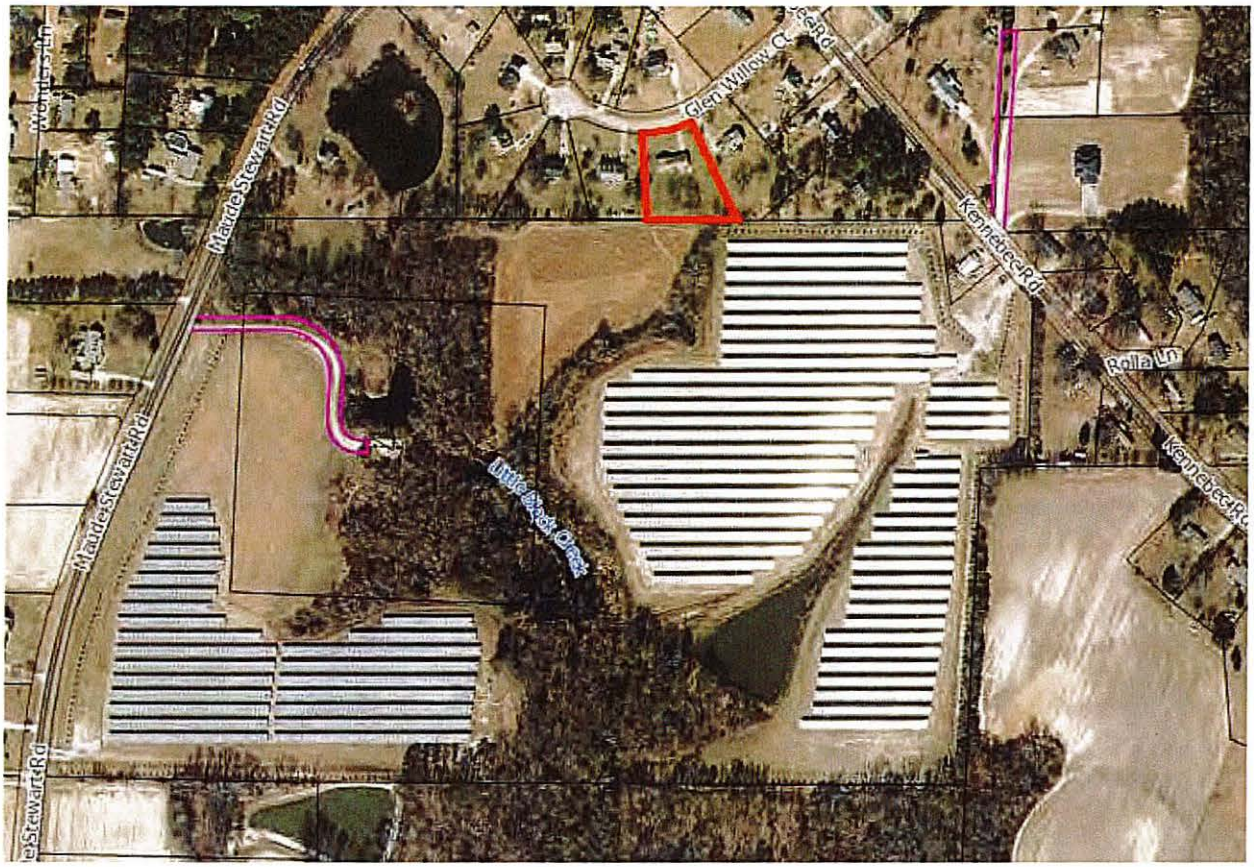
Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2935 County Ln	1.19	6/18/2019	$266,000	2019	2,401	$110.79	4/3	Gar	2-Story		330
Not	3005 Hemingway	1.17	5/16/2019	$269,000	2018	2,601	$103.42	4/3	Gar	2-Story		
Not	7031 Glynn Mill	0.60	5/8/2018	$255,000	2017	2,423	$105.24	4/3	Gar	2-Story		
Not	5213 Brec Brdg	0.92	5/7/2019	$260,000	2018	2,400	$108.33	4/3	3-Gar	2-Story		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2935 County Ln								$266,000		3%
Not	3005 Hemingway	$748		$1,345	-$16,547				$254,546	4%	
Not	7031 Glynn Mill	$8,724		$2,550	-$1,852				$264,422	1%	
Not	5213 Bree Brdg	$920		$1,300	$76			-$10,000	$252,296	5%	

Both of these matched pairs adjust to an average of +3% on impact for the adjoining solar farm, meaning there is a slight positive impact due to proximity to the solar farm. This is within the standard +/- of typical real estate transactions, which strongly suggests no impact on property value. I noted specifically that for 2923 County Line Road, the best comparable is 2109 John McMillan as it does not have the additional rental unit on it. I made no adjustment to the other sale for the value of that rental unit, which would have pushed the impact on that comparable downward – meaning there would have been a more significant positive impact.

12. Matched Pair – Sunfish Farm, Keenebec Rd, Willow Spring, Wake County, NC



This project was built in 2015 and located on 49.6 acres (with an inset 11.25-acre parcel) for a 6.4 MW project with the closest home at 135 feet with an average distance of 105 feet.

I considered the 2017 sale identified on the map above, which is 205 feet away from the closest panel. The matched pairs for each of these are shown below followed by a more recent map showing the panels at this site. The average difference in the three comparables and the subject property is +3% after adjusting for differences in the sales date, year built, gross living area, and other minor differences. This data is supported by the comments from the broker Brian Schroepfer with Keller Williams that the solar farm had no impact on the purchase price. The landscaping screen is considered light.

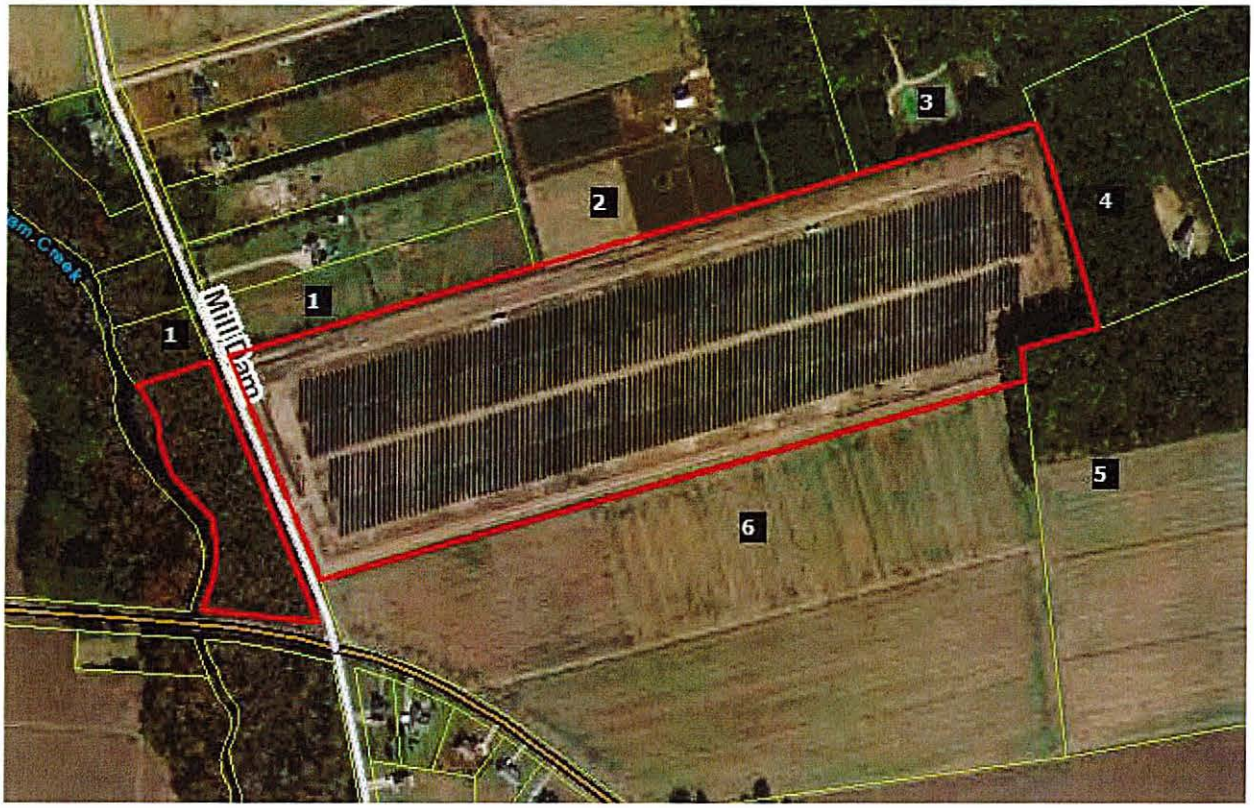
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
	Adjoins	7513 Glen Willow	0.79	9/1/2017	$185,000	1989	1,492	$123.99	3/2	Gar	BR/Rnch
	Not	2968 Tram	0.69	7/17/2017	$155,000	1984	1,323	$117.16	3/2	Drive	BR/Rnch
	Not	205 Pine Burr	0.97	12/29/2017	$191,000	1991	1,593	$119.90	3/2.5	Drive	BR/Rnch
	Not	1217 Old Honeycutt	1.00	12/15/2017	$176,000	1978	1,558	$112.97	3/2.5	2Carprt	VY/Rnch

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	7513 Glen Willow								$185,000		
Not	2968 Tram	$601		$3,875	$15,840		$10,000		$185,316	0%	
Not	205 Pine Burr	-$1,915		-$1,910	-$9,688	-$5,000			$172,487	7%	
Not	1217 Old Honeycut	-$1,557		$9,680	-$5,965	-$5,000		$5,280	$178,438	4%	
											3%

13. Matched Pair – Camden Dam, Camden, Camden County, NC



This 5 MW project was built in 2019 and located on a portion of 49.83 acres.

Parcel 1 noted above along with the home on the adjoining parcel to the north of that parcel sold in late 2018 after this solar farm was approved but prior to construction being completed in 2019. I have considered this sale as shown below. The landscaping screen is considered light.

The comparable at 548 Trotman is the most similar and required the least adjustment shows no impact on property value. The other two comparables were adjusted consistently with one showing significant enhancement and another as showing a mild negative. The best indication is the one requiring the least adjustment. The other two sales required significant site adjustments which make them less reliable. The best comparable and the average of these comparables support a finding of no impact on property value.

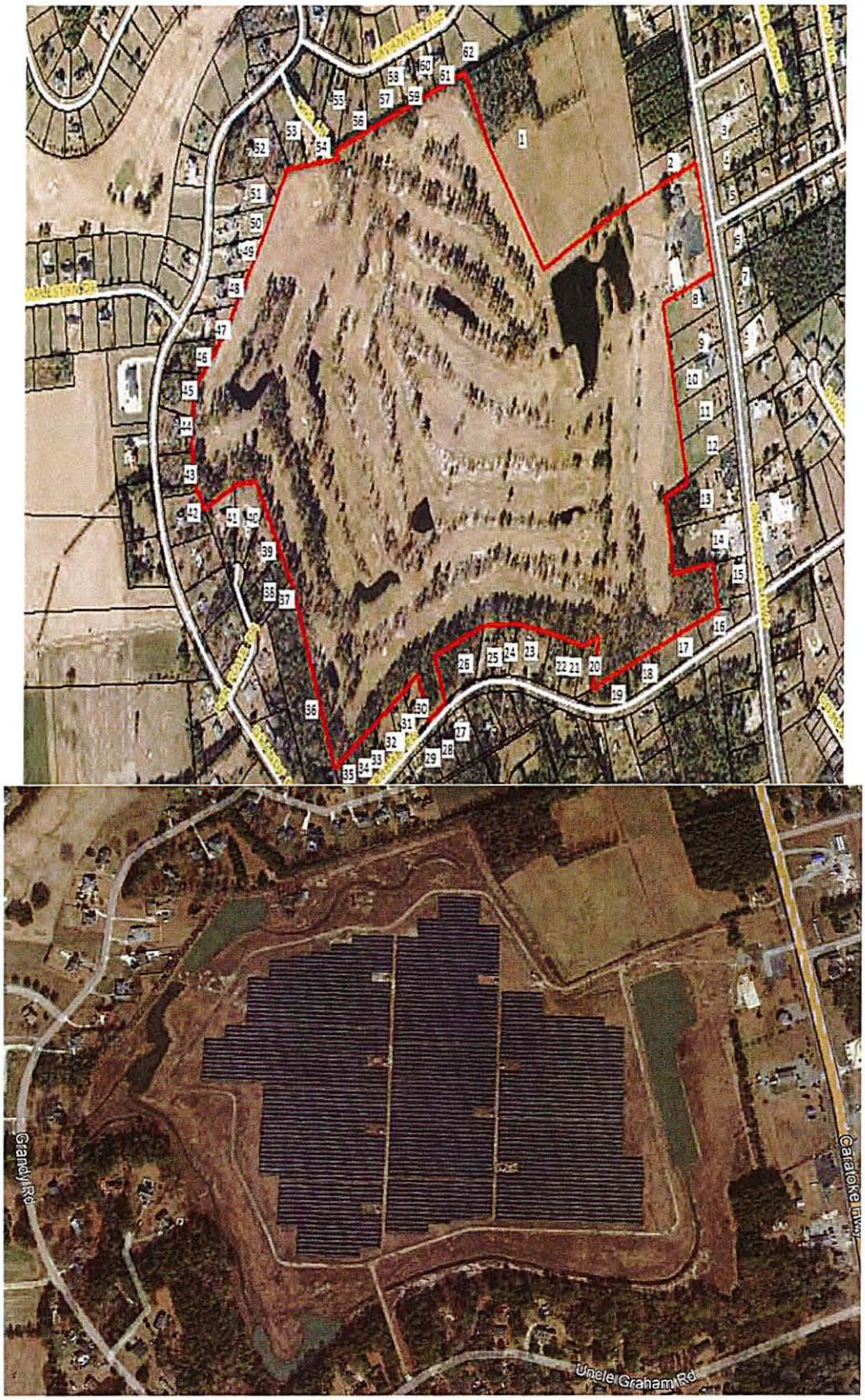
Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	122 N Mill Dam	12.19	11/29/2018	$350,000	2005	2,334	$149.96	3/3.5	3-Gar	Ranch	
Not	548 Trotman	12.10	5/31/2018	$309,000	2007	1,960	$157.65	4/2	Det2G	Ranch	Wrkshp
Not	198 Sand Hills	2.00	12/22/2017	$235,000	2007	2,324	$101.12	4/3	Open	Ranch	
Not	140 Sleepy Hlw	2.05	8/12/2019	$330,000	2010	2,643	$124.86	4/3	1-Gar	1.5 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
122 N Mill Dam								$350,000			342
548 Trotman	$6,163		-$3,090	$35,377	$5,000			$352,450	-1%		
198 Sand Hills	$8,808	$45,000	-$2,350	$607		$30,000		$317,064	9%		
140 Sleepy Hlw	-$9,258	$45,000	-$8,250	-$23,149	$5,000	$30,000		$369,343	-6%		
										1%	

14. Matched Pair – Grandy Solar, Grandy, Currituck County, NC



This 20 MW project was built in 2019 and located on a portion of 121 acres.

Parcels 40 and 50 have sold since construction began on this solar farm. I have considered both in matched pair analysis below. I note that the marketing for Parcel 40 (120 Par Four) identified the lack of homes behind the house as a feature in the listing. The marketing for Parcel 50 (269 Grandy) identified the property as "very private." Landscaping for both of these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	120 Par Four	0.92	8/17/2019	$315,000	2006	2,188	$143.97	4/3	2-Gar	1.5 Story	Pool
Not	102 Teague	0.69	1/5/2020	$300,000	2005	2,177	$137.80	3/2	Det 3G	Ranch	
Not	112 Meadow Lk	0.92	2/28/2019	$265,000	1992	2,301	$115.17	3/2	Gar	1.5 Story	
Not	116 Barefoot	0.78	9/29/2020	$290,000	2004	2,192	$132.30	4/3	2-Gar	2 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
120 Par Four								$315,000			405
102 Teague	-$4,636		$1,500	$910	$10,000		$20,000	$327,774	-4%		
112 Meadow Lk	$4,937		$18,550	-$7,808	$10,000	$10,000	$20,000	$320,679	-2%		
116 Barefoot	-$12,998		$2,900	-$318			$20,000	$299,584	5%		
										0%	

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	269 Grandy	0.78	5/7/2019	$275,000	2019	1,535	$179.15	3/2.5	2-Gar	Ranch	
Not	307 Grandy	1.04	10/8/2018	$240,000	2002	1,634	$146.88	3/2	Gar	1.5 Story	
Not	103 Branch	0.95	4/22/2020	$230,000	2000	1,532	$150.13	4/2	2-Gar	1.5 Story	
Not	103 Spring Lf	1.07	8/14/2018	$270,000	2002	1,635	$165.14	3/2	2-Gar	Ranch	Pool

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
269 Grandy								$275,000			477
307 Grandy	$5,550		$20,400	-$8,725	$5,000	$10,000		$272,225	1%		
103 Branch	-$8,847		$21,850	$270				$243,273	12%		
103 Spring Lf	$7,871		$22,950	-$9,908	$5,000		-$20,000	$275,912	0%		
										4%	

Both of these matched pairs support a finding of no impact on value. This is reinforced by the listings for both properties identifying the privacy due to no housing in the rear of the property as part of the marketing for these homes.

15. Matched Pair – HCE Johnston I, LLC, Benson, NC



This 2.6 MW project was built in 2015 and located on 30.55 acres.

There is a new subdivision that was developed in 2019 just north of this solar farm called Reese's Ridge. This location is near the McGees Crossroads near Mount Pleasant Road. As can be seen in the map below, the adjoining land to the north of this solar farm was purchased in 2017 and subdivided as Reese Ridge with 0.49 to 0.53 acre lots. Most of the trees on this site were cleared as part of the development with a single row of pine trees retained as a buffer along the solar farm. The first six lots on the south side of Reese Drive are around 115 feet from the center point in the lot to the nearest solar farm panel. This tract of land was purchased on September 7, 2017 for $925,000 for 42.388 acres, or $21,822 per acre.

The proposed homes will be custom homes starting at $330,000. County water is available and the homes will use individual septic tanks. I spoke with Amanda with The Rodney Carroll Team who is marketing the homes and she indicated that 7 custom home builders had a lottery to purchase all of the lots.

Three different builders have purchased lots adjoining the solar farm for $60,000 each. Similar lots across Reese Drive and further from the solar farm are selling at the same $60,000 each. At $60,000 this indicates a lot-to-home ratio of 18%, which is typical for new home construction in the county where there is no amenity package.



Since then a home was built and then sold at 63 Reese Drive, which is two lots off of NC 50 and backs up to the solar farm. Similarly, 107 Reese Drive which is six lots off of NC 50 and backs up to the solar farm. I have considered both of these for matched pairs as shown below. These homes are as closed as 105 feet from the solar panels.

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	107 Reese Drive	0.69	11/27/2019	$393,000	2019	2,960	$132.77	3/3	2-Car	1.5 Vinyl	
	Not	200 Reese Drive	0.44	2/19/2020	$400,000	2019	3,209	$124.65	3/2.5	2-Car	1.5 Batten/Stone	
	Not	35 Pawnee Pl	0.65	5/30/2018	$325,000	2017	2,609	$124.57	4/3	2-Car	1.5 Vinyl/Stone	
	Not	278 Timber Wolf	0.88	1/24/2020	$367,443	2019	2,983	$123.18	3/3	2-Car	1.5 Vinyl/Stone	

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	107 Reese Drive								$393,000		5%
	Not	200 Reese Drive	-$2,831		$0	-$24,830	$5,000			$377,338	4%	
	Not	35 Pawnee Pl	$14,954		$3,250	$34,979				$378,183	4%	
	Not	278 Timber Wolf	-$1,796		$0	-$2,266				$363,381	8%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	63 Reese Drive	0.45	3/24/2020	$410,000	2019	3,240	$126.54	4/3	2-Car	Ranch/Wd	
	Not	200 Reese Drive	0.44	2/19/2020	$400,000	2019	3,209	$124.65	3/2.5	2-Car	1.5 Batten/Stone	
	Not	320 Wolf Den	0.97	9/27/2019	$377,780	2019	3,122	$121.01	4/3	2-Car	1.5 Vinyl/Stone	
	Not	37 Makers Way	0.59	5/29/2019	$373,508	2019	3,122	$119.64	4/3	3-Car	1.5 Vinyl/Stone	

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	63 Reese Drive								$410,000		3%
	Not	200 Reese Drive	$1,146		$0	$2,705	$5,000			$408,851	0%	
	Not	320 Wolf Den	$5,699		$0	$9,995				$393,474	4%	
	Not	37 Makers Way	$9,443		$0	$9,882		-$5,000		$387,833	5%	

After adjustments, the two sales support a conclusion of no impact on property value due to the solar farm. I spoke with Rodney Carroll the broker marketing the homes and he indicated that the solar farm had zero impact on the sales price and they were marketing it as the best neighbor you could have.

Conclusion – NC Data

Matched Pair Summary						Adj. Uses By Acreage				1 mile Radius (2020-2023 Data)			
	Name	City	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com	Pop.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	AM Best	Goldsboro	38	5.00	2	38%	23%	0%	39%	1,523	$37,358	$148,375	Light
2	Cookstown	Goldsboro	58	5.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light
3	Solar Lee	Mt Olive	38	4.90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light
4	Gaston SC	Gastonia	35	5.00	48	33%	23%	0%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	2034	80.00	4	4%	94%	0%	2%	382	$79,114	$281,731	Light
6	Tracy	Bailey	50	5.00	10	29%	71%	0%	0%	312	$43,940	$99,219	Heavy
7	McBride	Midland	627	75.00	140	12%	78%	10%	0%	398	$63,678	$256,306	Lt to Med
8	Mariposa	Stanley	36	5.00	96	48%	52%	0%	0%	1,716	$36,439	$137,884	Light
9	Candace	Princeton	54	5.00	22	76%	0%	24%	0%	448	$51,002	$107,171	Medium
10	Innov 46	Hope Mills	532	78.50	0	17%	0%	83%	0%	2,247	$58,688	$183,435	Light
11	Innov 42	Fayetteville	414	71.00	0	41%	0%	59%	0%	568	$60,037	$276,347	Light
12	Sunfish	Willow Spring	50	6.40	30	35%	30%	35%	0%	1,515	$63,652	$253,138	Light
13	Camden Dam	Camden	50	5.00	0	17%	11%	72%	0%	403	$84,426	$230,288	Light
14	Grandy	Grandy	121	20.00	10	55%	0%	24%	21%	949	$50,355	$231,408	Light
15	HCE Johnston	Benson	30	2.60	0	55%	45%	0%	0%	1,169	$65,482	$252,544	Light
	Average		278	24.89	28	35%	33%	24%	8%	1255	$56,094	$198,801	
	Median		50	5.00	10	35%	23%	10%	0%	949	$58,688	$230,288	
	High		2,034	80.00	140	76%	94%	83%	44%	4,689	$84,426	$281,731	
	Low		30	2.60	0	4%	0%	0%	0%	312	$35,057	$99,219	

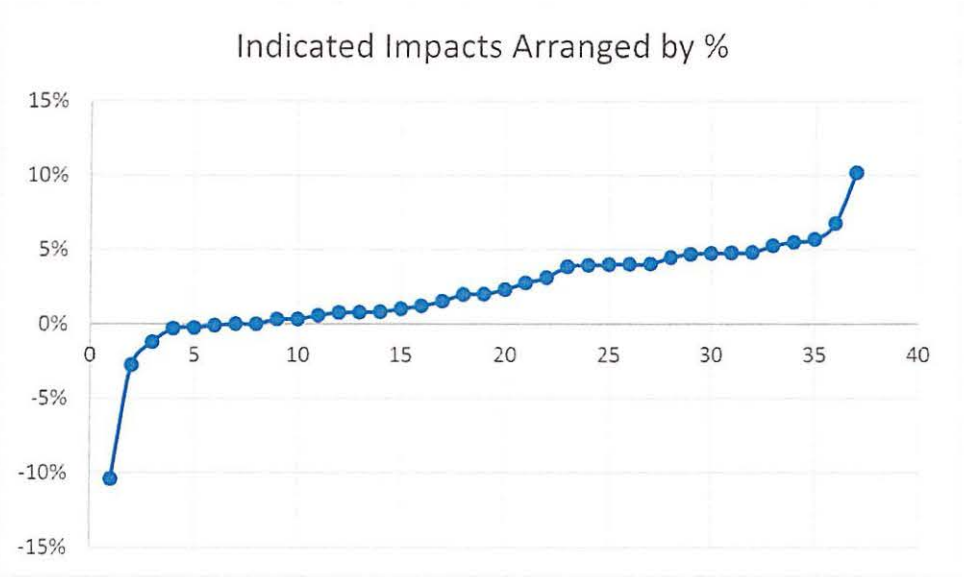
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in farm more urban areas. The median income for the population within 1 mile of a solar farm is $58,688 with a median housing unit value of $230,288. Most of the comparables are under $300,000 in the home price, though I have matched pairs in multiple states over $1,000,000 adjoining solar farms. The adjoining uses show that residential and agricultural uses are the predominant adjoining uses. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for the southeast as shown later in this report.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

I have pulled 37 matched pairs from the above referenced solar farms to provide the following summary of home sale matched pairs and land sales next to solar farms. The summary shows that the range of differences is from -10% to +10% with an average of +2% and median of +2%. This means that the average and median impact is for a slight positive impact due to adjacency to a solar farm. However, this +2% to rate is within the typical variability I would expect from real estate. I therefore conclude that this data shows no negative or positive impact due to adjacency to a solar farm.

While the range is seemingly wide, the graph below clearly shows that the vast majority of the data falls between 0% and +5%. There were only 2 indicators showing an impact below zero and they were -1% and -10%. The other thirty results ranged from zero to +10%.

I therefore conclude that these matched pairs support a finding of no impact on value at the subject property for the proposed project, which as proposed will include a landscaped buffer to screen adjoining residential properties.


Indicated Impacts Arranged by %
15%
10%
5%
0%
-5%
-10%
-15%
0
5
10
15
20
25
30
35
40

B. Southeastern USA Data – Over 5 MW

I have also considered a number of projects throughout the southeast which includes a number of solar farms much larger than those considered in just North Carolina. I have shown the results below. The full write-ups similar to the NC write-ups are available in my files.

Conclusion – Southeast Over 5 MW

Southeast USA Over 5 MW
Matched Pair Summary

							Adj. Uses By Acreage				1 mile Radius (2010-2020 Data)			
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Pop.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375	Light
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746	Lt to Med
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000	Light
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
6	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219	Heavy
7	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
8	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
9	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884	Light
10	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
11	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922	Medium
12	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171	Medium
13	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
14	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
15	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
16	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138	Light
17	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	Light
18	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288	Light
19	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408	Light
20	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939	Light
21	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
22	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
23	Spotysivania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Md to Hvy
	Average			485	57.04	38	24%	48%	22%	6%	923	$63,955	$237,700	
	Median			234	20.00	20	17%	59%	11%	0%	467	$60,037	$231,408	
	High			3,500	617.00	160	76%	98%	94%	44%	4,689	$120,861	$483,333	
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$99,219	

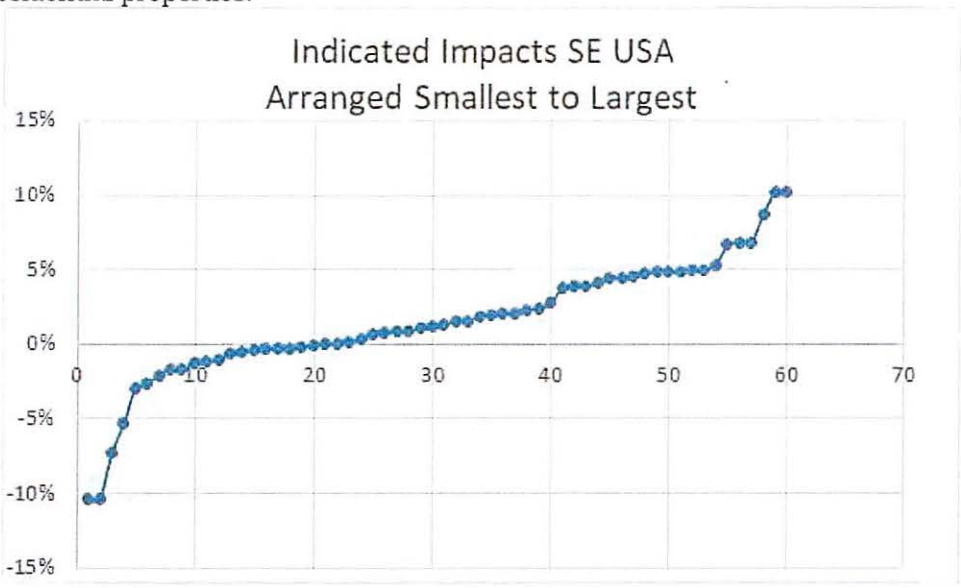
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in farm more urban areas. The median income for the population within 1 mile of a solar farm is $60,037 with a median housing unit value of $231,408. Most of the comparables are under $300,000 in the home price, with $483,333 being the high end of the set, though I have matched pairs in multiple states over $1,000,000 adjoining solar farms. The adjoining uses show that residential and agricultural uses are the predominant adjoining uses. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for Virginia and adjoining states as well as the proposed subject property.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

I have pulled 56 matched pairs from the above referenced solar farms to provide the following summary of home sale matched pairs and land sales next to solar farms. The summary shows that the range of differences is from -10% to +10% with an average of +1% and median of +1%. This means that the average and median impact is for a slight positive impact due to adjacency to a solar farm. However, this +1 to rate is within the typical variability I would expect from real estate. I therefore conclude that this data shows no negative or positive impact due to adjacency to a solar farm.

While the range is seemingly wide, the graph below clearly shows that the vast majority of the data falls between -5% and +5% and most of those are clearly in the 0 to +5% range. This data strongly supports an indication of no impact on adjoining residential uses to a solar farm.

I therefore conclude that these matched pairs support a finding of no impact on value at the subject property for the proposed project, which as proposed will include a landscaped buffer to screen adjoining residential properties.



C. *Summary of National Data on Solar Farms*

I have worked in 24 states related to solar farms and I have been tracking matched pairs in most of those states. On the following pages I provide a brief summary of those findings showing 36 solar farms over 5 MW studied with each one providing matched pair data supporting the findings of this report.

The solar farms summary is shown below with a summary of the matched pair data shown on the following page.

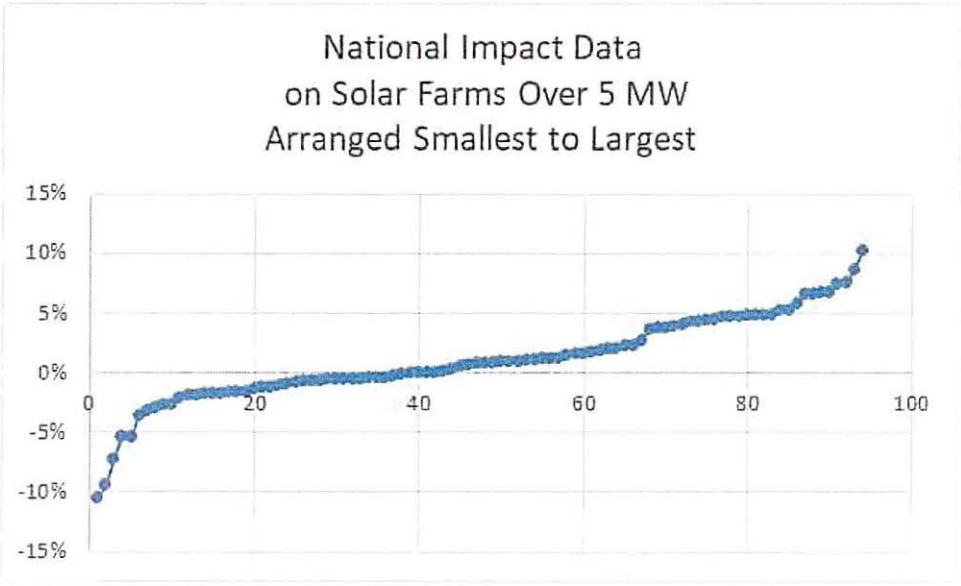
Matched Pair Summary

							Adj. Uses By Acreage				1 mile Radius (2020 Data)		
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Population	Med. Income	Avg. Housing Unit
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731
6	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219
7	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667
8	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306
9	Grand Ridge	Streator	IL	160	20.00	1	8%	87%	5%	0%	96	$70,158	$187,037
10	Dominion	Indianapolis	IN	134	8.60	20	3%	97%	0%	0%	3,774	$61,115	$167,515
11	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884
12	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453
13	Flemington	Flemington	NJ	120	9.36	N/A	13%	50%	28%	8%	3,477	$105,714	$444,696
14	Frenchtown	Frenchtown	NJ	139	7.90	N/A	37%	35%	29%	0%	457	$111,562	$515,399
15	McGraw	East Windsor	NJ	95	14.00	N/A	27%	44%	0%	29%	7,684	$78,417	$362,428
16	Tinton Falls	Tinton Falls	NJ	100	16.00	N/A	98%	0%	0%	2%	4,667	$92,346	$343,492
17	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922
18	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171
19	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076
20	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435
21	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347
22	Demille	Lapeer	MI	160	28.40	10	10%	68%	0%	22%	2,010	$47,208	$187,214
23	Turrill	Lapeer	MI	230	19.60	10	75%	59%	0%	25%	2,390	$46,839	$110,361
24	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138
25	Picture Rocks	Tucson	AZ	182	20.00	N/A	6%	88%	6%	0%	102	$81,081	$280,172
26	Avra Valley	Tucson	AZ	246	25.00	N/A	3%	94%	3%	0%	85	$80,997	$292,308
27	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208
28	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288
29	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408
30	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939
31	Eddy II	Eddy	TX	93	10.00	N/A	15%	25%	58%	2%	551	$59,627	$139,088
32	Somerset	Somerset	TX	128	10.60	N/A	5%	95%	0%	0%	1,293	$41,574	$135,490
33	DG Amp Piqua	Piqua	OH	86	12.60	2	26%	16%	58%	0%	6,735	$38,919	$96,555
34	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320
35	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571
36	Spotyslvania	Paytes	VA	3,500	500.00	160	37%	52%	11%	0%	74	$120,861	$483,333
	Average			362	38.80	32	24%	52%	19%	6%	1,515	$66,292	$242,468
	Median			150	17.80	10	16%	59%	7%	0%	560	$62,384	$230,848
	High			3,500	500.00	160	98%	98%	94%	44%	7,684	$120,861	$515,399
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$96,555

From these 36 solar farms, I have derived 94 matched pairs. The matched pairs show no negative impact at distances as close as 105 feet between a solar panel and the nearest point on a home. The range of impacts is -10% to +10% with an average and median of +1%.

	MW	Avg. Distance		Indicated Impact
Average	44.80	569	Average	1%
Median	14.00	400	Median	1%
High	617.00	1,950	High	10%
Low	5.00	145	Low	-10%

While the range is broad, the two charts below show the data points in range from lowest to highest. There is only 3 data points out of 94 that show a negative impact. The rest support either a finding of no impact or 9 of the data points suggest a positive impact due to adjacency to a solar farm. As discussed earlier in this report, I consider this data to strongly support a finding of no impact on value as most of the findings are within typical market variation and even within that, most are mildly positive findings.



VIII. Scope of Research

I have researched over 1,000 solar farms and sites on which solar farms are existing and proposed in North Carolina Virginia, Illinois, Tennessee, Kentucky as well as other states to determine what uses are typically found in proximity with a solar farm. The data I have collected and provide in this report strongly supports the assertion that solar farms are having no negative consequences on adjoining agricultural and residential values.

Beyond these references, I have quantified the adjoining uses for a number of solar farm comparables to derive a breakdown of the adjoining uses for each solar farm. The chart below shows the breakdown of adjoining or abutting uses by total acreage.

Percentage By Adjoining Acreage

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	19%	53%	20%	2%	6%	887	344	91%	8%
Median	11%	56%	11%	0%	0%	708	218	100%	0%
High	100%	100%	100%	93%	98%	5,210	4,670	100%	98%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

I have also included a breakdown of each solar farm by number of adjoining parcels to the solar farm rather than based on adjoining acreage. Using both factors provide a more complete picture of the neighboring properties.

Percentage By Number of Parcels Adjoining

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	61%	24%	9%	2%	4%	887	344	93%	6%
Median	65%	19%	5%	0%	0%	708	218	100%	0%
High	100%	100%	100%	60%	78%	5,210	4,670	105%	78%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

Both of the above charts show a marked residential and agricultural adjoining use for most solar farms. Every single solar farm considered included an adjoining residential or residential/agricultural use.

IX. Specific Factors Related To Impacts on Value

I have completed a number of Impact Studies related to a variety of uses and I have found that the most common areas for impact on adjoining values typically follow a hierarchy with descending levels of potential impact. I will discuss each of these categories and how they relate to a solar farm.

1. Hazardous material
2. Odor
3. Noise
4. Traffic
5. Stigma
6. Appearance

1. Hazardous material

A solar farm presents no hazardous waste byproduct as part of normal operation. Any fertilizer, weed control, vehicular traffic, or construction will be significantly less than typically applied in a residential development and even most agricultural uses.

The various solar farms that I have inspected and identified in the addenda have no known environmental impacts associated with the development and operation.

2. Odor

The various solar farms that I have inspected produced no odor.

3. Noise

Whether discussing passive fixed solar panels, or single-axis trackers, there is no negative impact associated with noise from a solar farm. The transformer has a hum similar to an HVAC that can only be heard in close proximity to this transformer and the buffers on the property are sufficient to make emitted sounds inaudible from the adjoining properties in most cases. They make even less noise at night.

The various solar farms that I have inspected were inaudible from adjoining roadways.

4. Traffic

The solar farm will have no onsite employee's or staff. The site requires only minimal maintenance. Relative to other potential uses of the site (such as a residential subdivision), the additional traffic generated by a solar farm use on this site is insignificant.

5. Stigma

There is no stigma associated with solar farms and solar farms and people generally respond favorably towards such a use. While an individual may express concerns about proximity to a solar farm, there is no specific stigma associated with a solar farm. Stigma generally refers to things such as adult establishments, prisons, rehabilitation facilities, and so forth.

Solar panels have no associated stigma and in smaller collections are found in yards and roofs in many residential communities. Solar farms are adjoining elementary, middle and high schools as well as churches and subdivisions. I note that one of the solar farms in this report not only adjoins

a church, but is actually located on land owned by the church. Solar panels on a roof are often cited as an enhancement to the property in marketing brochures.

I see no basis for an impact from stigma due to a solar farm.

6. Appearance

I note that larger solar farms using fixed or tracking panels are a passive use of the land that is in keeping with a rural/residential area. As shown below, solar farms are comparable to larger greenhouses. This is not surprising given that a greenhouse is essentially another method for collecting passive solar energy. The greenhouse use is well received in residential/rural areas and has a similar visual impact as a solar farm.









The solar panels are all less than 15 feet high, which means that the visual impact of the solar panels will be similar in height to a typical greenhouse and lower than a single-story residential dwelling. Were the subject property developed with single family housing, that development would have a much greater visual impact on the surrounding area given that a two-story home with attic could be three to four times as high as these proposed panels.

Whenever you consider the impact of a proposed project on viewshed or what the adjoining owners may see from their property it is important to distinguish whether or not they have a protected viewshed or not. Enhancements for scenic vistas are often measured when considering properties that adjoin preserved open space and parks. However, adjoining land with a preferred view today conveys no guarantee that the property will continue in the current use. Any consideration of the impact of the appearance requires a consideration of the wide variety of other uses a property already has the right to be put to, which for solar farms often includes subdivision development, agricultural business buildings such as poultry, or large greenhouses and the like.

Dr. Randall Bell, MAI, PhD, and author of the book **Real Estate Damages**, Third Edition, on Page 146 "Views of bodies of water, city lights, natural settings, parks, golf courses, and other amenities

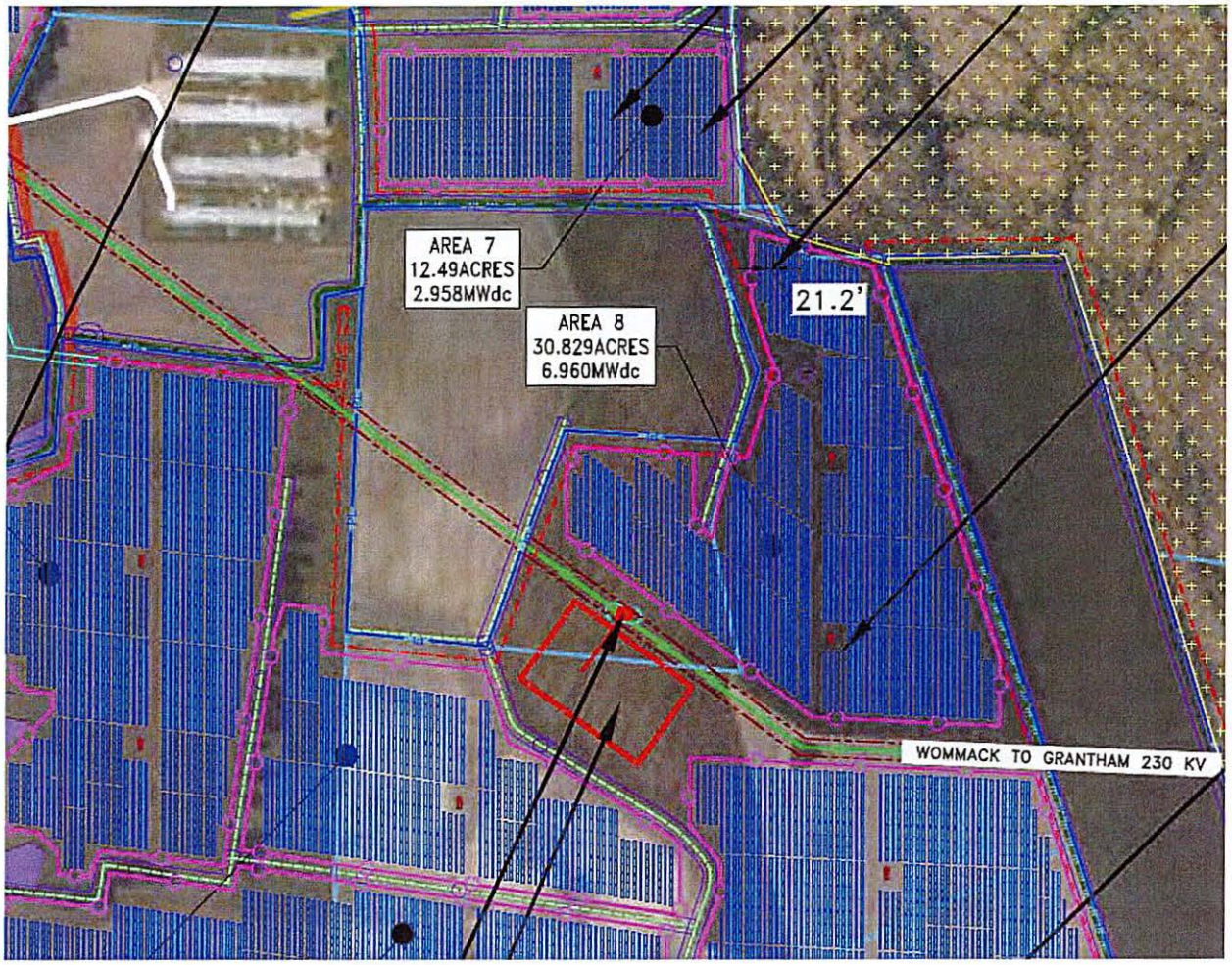
are considered desirable features, particularly for residential properties." Dr. Bell continues on Page 147 that "View amenities may or may not be protected by law or regulation. It is sometimes argued that views have value only if they are protected by a view easement, a zoning ordinance, or covenants, conditions, and restrictions (CC&Rs), although such protections are relatively uncommon as a practical matter. The market often assigns significant value to desirable views irrespective of whether or not such views are protected by law."

Dr. Bell concludes that a view enhances adjacent property, even if the adjacent property has no legal right to that view. He then discusses a "borrowed" view where a home may enjoy a good view of vacant land or property beyond with a reasonable expectation that the view might be partly or completely obstructed upon development of the adjoining land. He follows that with "This same concept applies to potentially undesirable views of a new development when the development conforms to applicable zoning and other regulations. Arguing value diminution in such cases is difficult, since the possible development of the offending property should have been known." In other words, if there is an allowable development on the site then arguing value diminution with such a development would be difficult. This further extends to developing the site with alternative uses that are less impactful on the view than currently allowed uses.

This gets back to the point that if a property has development rights and could currently be developed in such a way that removes the viewshed such as a residential subdivision, then a less intrusive use such as a solar farm that is easily screened by landscaping would not have a greater impact on the viewshed of any perceived value adjoining properties claim for viewshed. Essentially, if there are more impactful uses currently allowed, then how can you claim damages for a less impactful use.

X. Battery Energy Storage System (BESS)

The closest adjoining home to the BESS component of the subject property is shown below on the second map at a measured distance of 840 feet. The first map shows the red box where the Point of Interconnection and batteries are proposed. The second map measures from that area to the closest identified house.



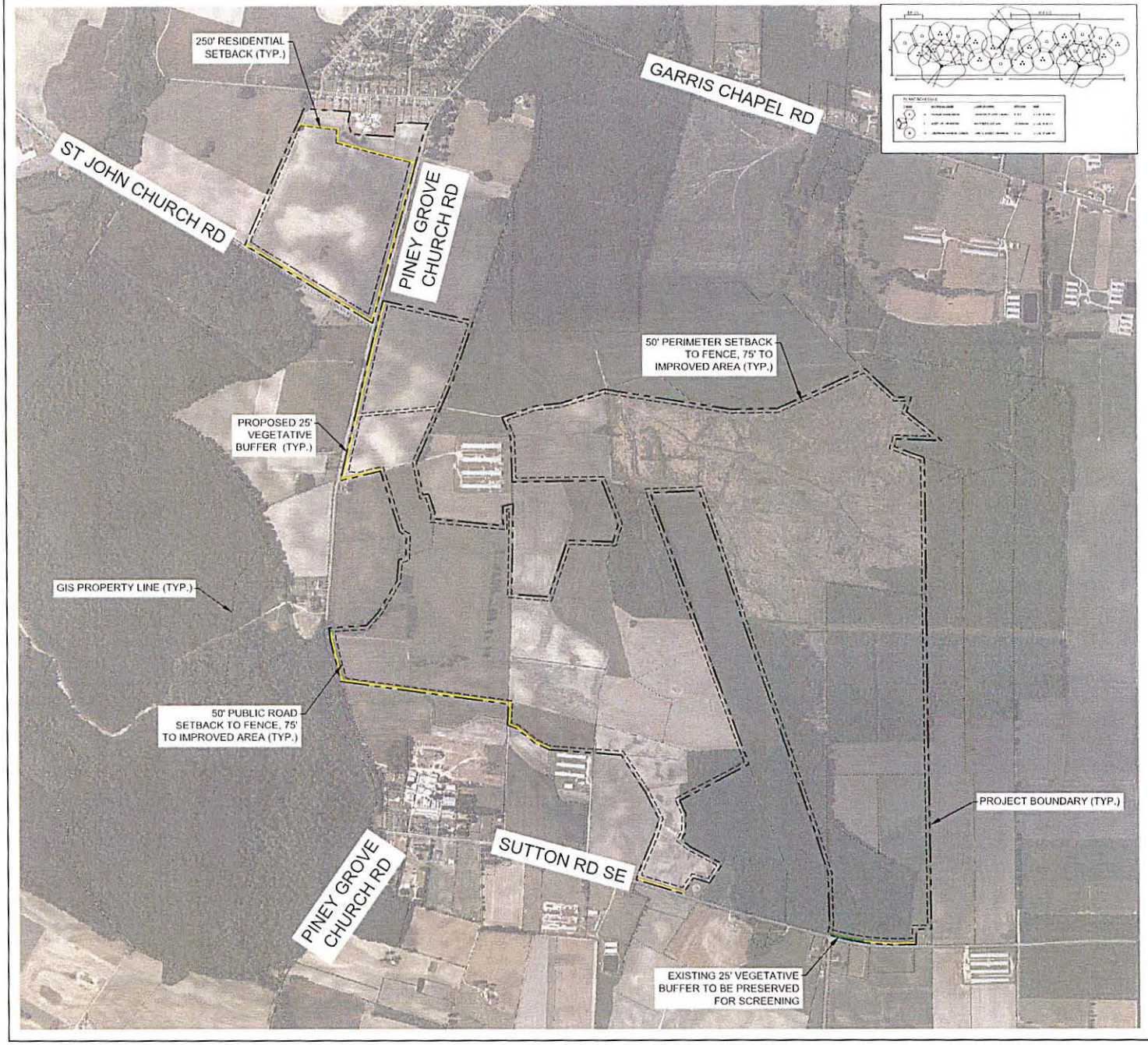


I considered the following battery storage facilities in a variety of states for a comparison of similar battery energy storage systems (BESS) in proximity to residential uses. I have also searched these areas for recent sales to see if there is any impact on property values near these battery storage facilities, which will be addressed in the following section.

The primary use of this larger set is to show compatibility of BESS and residential uses as well as showing typical setbacks between these uses. These measured distances are from the closest point on the home to the closest piece of equipment. Where I have N/A, the facility does not have an aerial image that I can use to measure that distance. These distances were measured using GoogleEarth.

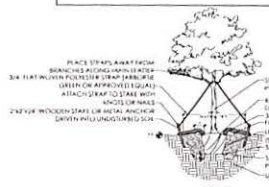
Summary of Battery Data

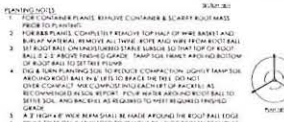
#	Name	City/State	Acres	Capacity	Distance from Closest Home	Average Distance Adjoining Home
1	Ozone Park	Queens, NY	0.35	3 MW	30	203
2	Pomona	Rockland, NY	28.5	N/A	270	1196
3	Asheville	Asheville, NC	12.36	9 MW	130	452
4	East Hampton	E. Hampton, NY	17.58	5 MW	470	733
5	Diablo	Concord, CA	11.45	200 MW	320	361
6	Prospect	W. Columbia, TX	2.3	10 MW	400	400
7	Brazoria	Brazoria, TX	17.58	9.95 MW	130	438
8	Gambit	Angleton, TX	6.24	100 MW	215	243
9	Churchtown	Pennsville, NJ	3.13	10 MW	N/A	N/A
10	West Chicago	Chicago, IL	5	19.8 MW	430	450
11	McHenry	McHenry, IL	2.75	19.8 MW	260	283
12	Plumstead	Hornerstown, NJ	14.39	19.8 MW	155	943
13	Vista	Vista, CA	0.88	40 MW	130	172
14	Chisholm	Ft Worth, TX	21.74	200 MW	840	875
15	Port Lavaca	Prt Lavaca, TX	1.44	9.9 MW	N/A	N/A
16	Magnolia	Houston, TX	0.87	9.95 MW	180	190
				Average	283	496
				Median	238	419
				High	840	1,196
				Low	30	172



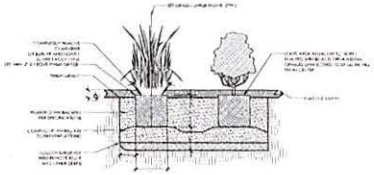
LEGEND

- PROJECT BOUNDARY
- GIS PROPERTY LINE
- EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
- PROPOSED VEGETATIVE BUFFER





1 STANDARD TREE PLANTING DETAIL



2 SHRUB AND ORNAMENTAL GRASS PLANTING DETAIL

NOTES

1. EXISTING VEGETATION IS TO BE PRESERVED AND PROTECTED IN PLACE TO MEET THE INTENT OF THE BUFFER REQUIREMENTS WHENEVER APPLICABLE. THE PROPOSED BUFFER STANDARD IS MEANT TO SUPPLEMENT EXISTING VEGETATION TO MEET THE SCREENING INTENT OF THE CODE REQUIREMENTS FOR SOLAR ARRAY FACILITIES AS NECESSARY.
2. ALL PLANTS MUST BE HEALTHY, VIGOROUS MATERIAL, FREE OF PESTS AND DISEASE.
3. ALL TREES MUST HAVE A STRAIGHT TRUNK AND FULL BEADED AND MEET ALL REQUIREMENTS SPECIFIED.
4. ALL PLANTS ARE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT OR OWNER'S REPRESENTATIVE BEFORE, DURING, AND AFTER INSTALLATION.
5. ALL TREES MUST BE GUYED OR STAKED AS SHOWN IN THE DETAILS.
6. ALL TREE RINGS MUST BE COMPLETELY MULCHED AS SPECIFIED. MULCH TO BE THREE (3) INCHES OF DOUBLE SHREDDED HARDWOOD DESIGNER MULCH IN DARK BROWN.
7. THE CONTRACTOR IS RESPONSIBLE FOR FULLY MAINTAINING ALL PLANTING (INCLUDING BUT NOT LIMITED TO: WATERING, SPRAYING, MULCHING, WEEDING, FERTILIZING, ETC.) OF THE PLANTING AREAS AND LAWN UNTIL SUBSTANTIAL COMPLETION OF PROJECT.
8. THE CONTRACTOR SHALL COMPLETELY WARRANTY ALL PLANT MATERIAL FOR A PERIOD OF ONE (1) YEAR, BEGINNING ON THE DATE OF SUBSTANTIAL COMPLETION. THE CONTRACTOR SHALL PROMPTLY MAKE ALL REPLACEMENTS BEFORE OR AT THE END OF THE WARRANTY PERIOD.
9. ANY PLANT MATERIAL WHICH DIES, TURNS BROWN, OR DEFOLIATES (PRIOR TO SUBSTANTIAL COMPLETION OF THE WORK) SHALL BE PROMPTLY REMOVED FROM THE SITE AND REPLACED WITH MATERIAL OF THE SAME SPECIES, QUANTITY, AND SIZE MEETING ALL PLANT SCHEDULE SPECIFICATIONS.
10. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE CODES & ORDINANCES REGARDING LANDSCAPING. GENERAL CONTRACTOR IS TO CLEAN THE INDICATED BUFFER AREA OF ALL CONSTRUCTION DEBRIS PRIOR TO FINAL INSPECTION.
11. THE CONTRACTOR SHALL INSTALL NON-WOVEN PERMEABLE GEOTEXTILE UNDER PLANTING BED MULCH IN ALL LANDSCAPE BEDS TO PREVENT WEED GROWTH.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING TREES AND SHRUBS THAT WILL MEET BOTH MINIMUM SIZE AND SPACING REQUIREMENTS AS SET FORTH IN THE ORDINANCE REGULATING THE OPERATION AND MAINTENANCE OF SOLAR ENERGY FACILITIES IN WAYNE COUNTY, NC. FAILURE TO INSTALL PLANT MATERIAL PER THIS PLAN WILL JEOPARDIZE ISSUANCE OF FINAL CERTIFICATE OF OCCUPANCY. CONTRACTOR SHALL BE RESPONSIBLE FOR SCHEDULING INSPECTIONS OF PLANT MATERIAL.
13. SURFACE MATERIAL FOR THE GROUNDPLANE APPLICATION WITHIN THE FENCE LIMITS OF THE SOLAR DEVELOPMENT WILL CONSIST OF NATIVE TURF GRASS SEED TO BE ESTABLISHED WITHIN THE WARranty PERIOD AND BE MAINTAINED BENEATH THE PANEL MODULES. FREQUENCY OF MAINTENANCE/MOWING OF THE TURF GRASS WILL BE DONE AS NEEDED TO MAINTAIN A UNIFORM STAND OF VEGETATION THAT DOES NOT EXCEED A MAXIMUM HEIGHT OF 30" FROM GROUNDPLANE TO AVOID INTERFERENCE WITH THE SOLAR ARRAY. MOWING WILL OCCUR APPROXIMATELY 5 TIMES PER YEAR OR ON AN AS NEEDED BASIS.

NORTH

GRAPHIC SCALE IN FEET
0 300 600 1200

RF

Kimley»Horn

© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919 677 2000 FAX: 919 677 2050
WWW.KIMLEY-HORN.COM

PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT 019458006
DATE 09/07/2023
SCALE AS SHOWN
DESIGNED BY SHF
DRAWN BY SSW
CHECKED BY

LANDSCAPE PLAN

PINEY GROVE SOLAR

NORTH CAROLINA

WAYNE COUNTY

SHEET NUMBER
EX1.0

DEPARTMENT OF THE AIR FORCE
4TH FIGHTER WING (ACC)
SEYMOUR JOHNSON AIR FORCE BASE NC

OCT 2 5 2023

Mr. Brian W. Joyner, P.E.
Deputy Base Engineer
1095 Peterson A venue
Seymour Johnson AFB NC 27531-2468

Mr. Berry Gray, Planning Director
Wayne County Planning Department
134 North John Street
Goldsboro, NC 27530-3633

Dear Mr. Gray

On September 8, 2023, we received a solar energy facility proposal "Piney Grove Solar" from Mr. Tom Delafield. According to the Zoning Site Plan (attached) he provided, the project area spans 15 parcels totaling approximately 865 acres of land located in Wayne County, NC. Below is a summary of the three areas of concern as described in the Seymour Johnson AFB 2011 Air Installation Compatible Use Zone (AICUZ) report as related to the proposal.

A. Airspace Control Surfaces (Hazards to Aircraft Flight Zone): The subject property is within the Outer Horizontal Surface.

(1) Height – Structures or vegetation on the property is limited in height to 599 feet above mean sea level. The proposal is **compatible** with this protocol.

(2) Visual – The proposed development does not generate smoke, dust, steam or other visual interfering operations. The proposal is **compatible** with this protocol.

(3) Light Emissions – We completed a review of the Solar Glare and Glint Analysis Report provided by the proponent on September 25. In comparing the yellow and green glare within the report, with and without anti-reflective coating (ARC) on the smooth glass photovoltaic solar panels, we concluded that the ARC panels significantly reduced the amount of yellow glare. Therefore, we highly recommend such materials be installed to reduce the glint and glare exposed to the Seymour Johnson AFB and transient aircrews. Reducing this exposure will contribute considerably to the safety of flying operations; protect the training airspace from encroachment that may jeopardize the military mission, and promote public health, safety, and general welfare of the community. The proposal will be considered **compatible with this protocol per the recommended mitigation above.**

(4) Bird/Wildlife Aircraft Strike Hazard (BASH) – Bird activity and strikes in proximity to solar farms have raised concerns as to whether solar arrays attract various types of birds

and wildlife. The primary hazards are soaring birds, which due to their size and flight pattern pose a risk to aircraft. The proximity of this project to the traffic pattern at Seymour Johnson AFB, the unknown impacts to bird/wildlife activity, and the overall size of this project has raised uncertainty about potential increased risk to bird strikes. If it is determined that the proposed solar project must be allowed on these properties, it is considered **compatible with implementation (coordinated with USAF) with the following recommendations:**

a. The project owner partner with the United States Department of Agriculture (USDA) and USAF representatives at Seymour Johnson AFB to allow USDA access to the project to observe hazardous wildlife conditions and advise on mitigation strategies to reduce bird strike attractants

b. The project owner implement long-term wildlife mitigation efforts on-site as part of the development plan.

(5) Radio Frequency/Electromagnetic Interference (RF/EMI) – We do not anticipate the proposed development to create a RF/EMI concern with our aircraft operations. The proposal is **compatible** with this protocol.

B. Noise Due to Aircraft Operations: The subject property is not located in a Noise Zone and therefore is not applicable for this proposal.

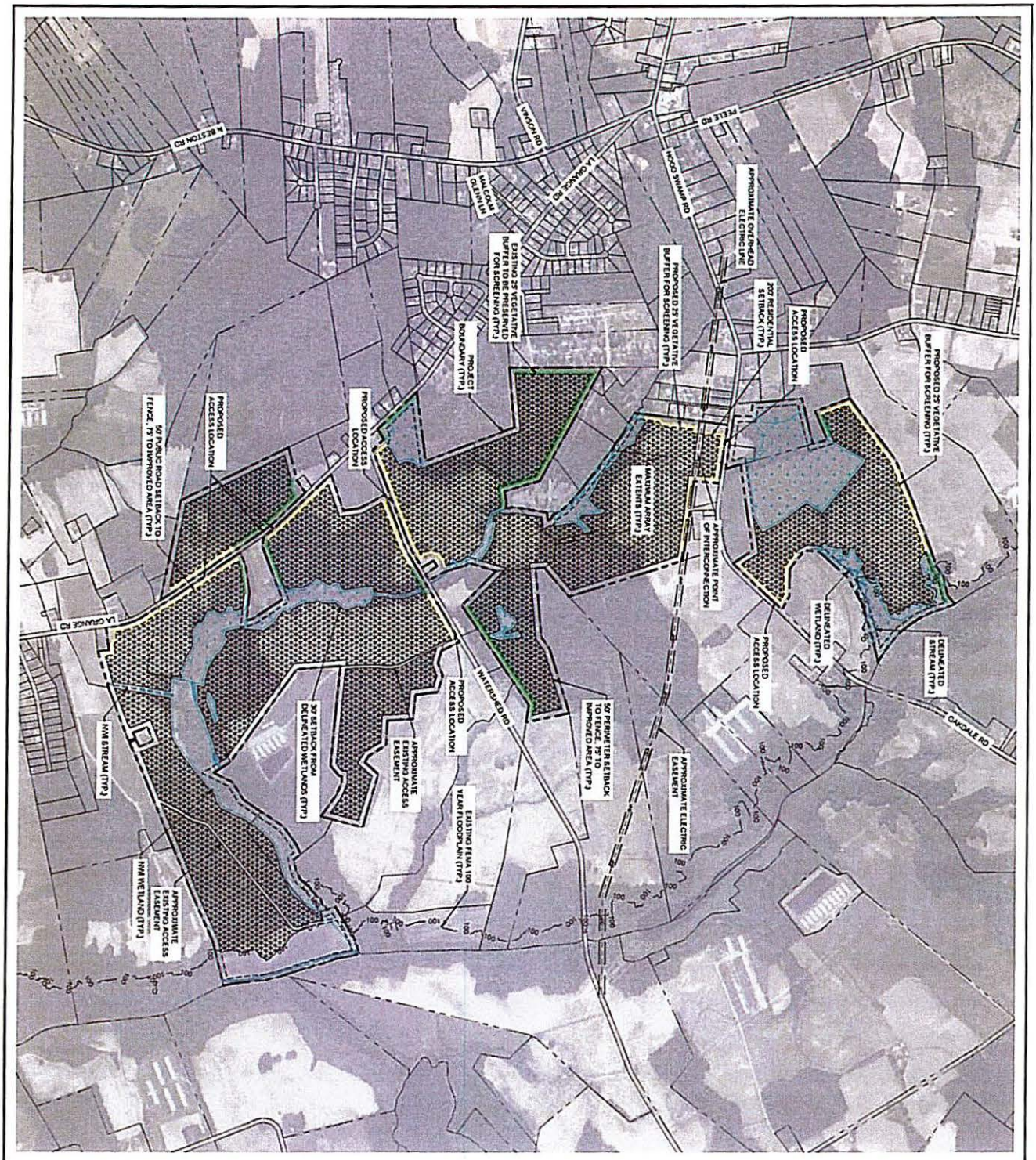
C. Clear Zones and Accident Potential Zones: The subject property is not located in a Clear Zone or Accident Potential Zone and therefore is not applicable for this proposal.

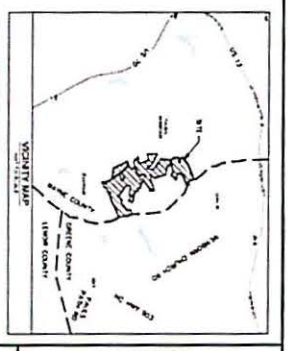
We appreciate the opportunity to assess this request and comment on it. If additional information or clarification is required, please contact me at (919) 722-5142.

Sincerely

BRIAN W. JOYNER, P.E.

Attachment:
Zoning Site Plan





SITE DATA TABLE

PROJECT AREA	
PARCEL ID #	
ZONING JURISDICTION	
CURRENT ZONING	
ADJACENT PROPERTY ZONING	
CURRENT LANDUSE	
ADJACENT PROPERTIES LANDUSE	
PROPERTY SETBACKS	
REQUIRED BUFFERS	
LANDSCAPE REQUIREMENTS	

LEGEND

PROJECT BOUNDARY
PROPERTY LINE
PROPERTY SETBACK
APPROXIMATE ELECTRIC EASEMENT
OVERHEAD ELECTRIC LINE
100 FEMA 100 YEAR FLOODPLAIN
DELINEATED STREAMS
DELINEATED WETLANDS
NWI STREAMS
NWI WETLANDS
MAXIMUM ARRAY EXTENTS
EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
PROPOSED VEGETATIVE BUFFER

NOTES

1. PROJECT BOUNDARY SHOWN IS BASED ON FIELD SURVEY PERFORMED BY KIMLEY-HORN AND ASSOCIATES, INC. AND DEED INFORMATION FOR PARCEL(S) OWNED BY SEPHA'S LLC ON INFORMATION AND BELIEF.
2. ALL EXISTING FEATURES SHOWN ARE APPROXIMATE IN LOCATION BASED ON PUBLICLY AVAILABLE GIS DATA ACCESSED ON [illegible].
3. ALL EXISTING TOPOGRAPHIC INFORMATION IS BASED ON PUBLICLY AVAILABLE LIDAR DATA ACCESSED ON [illegible].
4. [illegible] BASED ON PUBLICLY AVAILABLE LIDAR DATA.
5. [illegible] ON THE PROJECT SITE WILL BE DELINEATED PRIOR TO CONSTRUCTION.
6. [illegible] WETLAND BOUNDARY AND POINT ACCESSED ON [illegible].
7. THIS PLAN IS PRELIMINARY AND WILL NOT BE RELEASED FOR CONSTRUCTION.
8. THE PROJECT SITE WILL BE ENCLOSED BY A MINIMUM 6' HIGH SECURITY FENCE.
9. ACCESS POINTS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SURVEY, ENGINEERING, AND PERMITTING REQUIREMENTS. DETAILED DESIGN, EQUIPMENT LAYOUT, AND ACCESS POINTS WILL BE DETERMINED DURING THE PERMITTING PROCESS.
10. TOPOGRAPHY UTILITIES, ACCEPT PERMITTING OR ENVIRONMENTAL FEATURES.
11. THE POINT OF INTERCONNECTION IS APPROXIMATE AND MAY INCLUDE AN ELECTRICAL SUBSTATION.

NORTH

GRAPHIC SCALE IN FEET
0 300 600 1200

PRELIMINARY NOT FOR CONSTRUCTION

RES

Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919-677-2000 FAX: 919-677-2050
WWW.KIMLEY-HORN.COM
#-0102

KHA PROJECT 016400002
DATE 09/07/2023
SCALE AS SHOWN
DESIGNED BY SW
DRAWN BY BCB
CHECKED BY JSL

ZONING SITE PLAN

TURTLE COVE SOLAR
WAYNE COUNTY NORTH CAROLINA

SHEET NUMBER EX1.0

MEMORANDUM

To: Wayne County Board of Adjustment

From: Berry Gray, Planning Director

Date: November 1, 2023

Re: Special Use Permit for Proposed Solar Energy Facility Located in the Airspace Control Surface Area for Seymour Johnson AFB and Partial RA 20 Zoning

Item: Turtle Cove Solar
Parcel ID#: 3650023058, 3650046762, 3640933373, 3650202418, 3650311092, 3559094370, 3650140810, 3650042930, 3640956757, 3650222187, 3650330486, 3650171652, 3559483738, 3650506214
Property Owner: Cobb Farms LLC, Robert Exum Jr, Sarah E Edwards, Kermit A. Thompson III, Carl Lancaster etal, Michael Bruce Gray, Weslea Gray, Billy Gerald Smith, Wallace Ledwell Creech, Terry Parks Creech
Developer: Renewable Energy Services
Surveyor/Engineer: Kimley Horn
Saulston Township
Hood Swamp Road, Water Shed Road, La Grange Road

Background: The Wayne County Planning Board approved the site plan for Turtle Cove Solar Energy Facility at its October 2023 meeting. The site plan was reviewed by staff and has been determined to meet the minimum requirements of the Wayne County Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities.

Discussion: The proposed solar energy facility is a 60 MWac facility that will be located on 750 acres with 594 built upon acres. The site is currently agricultural and wooded. It is located in the vicinity of Hood Swamp Road, Water Shed Road, La Grange Road. The property is zoned Outer Horizontal Overlay District (OH), Approach Area Overlay District (AA), and RA-20. The site is located within the airspace control surface area for Seymour Johnson Air Force Base which requires Special Use approval by the Board of Adjustment. Additionally, the RA-20 area covers an area at the southern end of the facility which also requires a Special Use approval. Surrounding land uses include a residential lots, agriculture, vacant, church and wooded. The site plan meets the requirements as outlined in the Wayne County Ordinance Regulating Solar Energy Facilities for setbacks and fencing.

Seymour Johnson Air Force Base has reviewed the request and does have concerns regarding glare and that the project may create a hazard with aircraft bird strikes. If approved, SJAFB recommends the conditions outlined in the following Recommendation.

The property is within the following service areas:
Fire –New Hope
EMS – Station 5
Water Supply Watershed – No

Voluntary Agriculture District – Within ½ mile
Wetlands – Yes but none within built area
Board of Commissioners District – 5

Section 5B of the Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities in Wayne County, NC requires that solar facilities within the Airspace Control Surface Area be considered by the Wayne County Board of Adjustment as a Special Use. Additionally, a small part of the facility is within the RA 20 Zoning District which also requires a Special Use Permit approval.

Sections 54.1 and 54.2 of the Wayne County Zoning Ordinance, as it relates to special uses, states that permission may be granted for the establishment of special uses as shown in the district regulations if the Board of Adjustment finds from the evidence produced after a study of the complete records that:

A. The proposed use does not affect adversely the general plans for physical development of the county and will not be contrary to the purposes stated in these regulations;

B. The proposed use will not adversely affect the health and safety of the county residents and will not be detrimental to the use or development of adjacent properties or other neighborhood uses;

C. The proposed use will not be affected adversely by existing uses, and will be placed on a lot of sufficient size to satisfy the space requirements of said use;

D. The proposed use will not constitute a nuisance or hazard because of the number of persons who will use such a facility, the vehicular movement or the noise or fume generation; and

E. The proposed use shall be subject to the minimum dimensional requirements of the district in which it is to be located, and shall conform to the off-street parking and loading regulations.

Additional Restrictions.

A. The Board of Adjustment may issue a special use permit if its findings are favorable. As an additional safeguard, the board may impose or require as conditions such additional restrictions and standards as may be necessary to protect the health and safety of the community, and to protect the value and use of property in the general neighborhood.

Recommendation: The Wayne County Board of Adjustment should consider a Public Hearing to receive comments on the proposed Special Use Permit Request and then consider taking action on the Special Use request. Staff recommends the following conditions of approval to address comments received from the Seymour Johnson Air Force Base, 4th Fighter Wing:

1) In comparing the yellow and green glare within the report, with and without anti-reflective coating (ARC) on the smooth glass photovoltaic solar panels, we concluded that the ARC panels significantly reduced the amount of yellow glare. Therefore, we highly recommend

such materials be installed to reduce the glint and glare exposed to the Seymour Johnson AFB and transient aircrews;

2) The project owner should partner with the United States Department of Agriculture (USDA) representatives at Seymour Johnson AFT to allow USDA access to the project to observe hazardous wildlife conditions and advise on mitigation strategies to reduce bird attractants; and
3) The project owner should implement long term wildlife mitigation efforts on-site as part of the development plan;

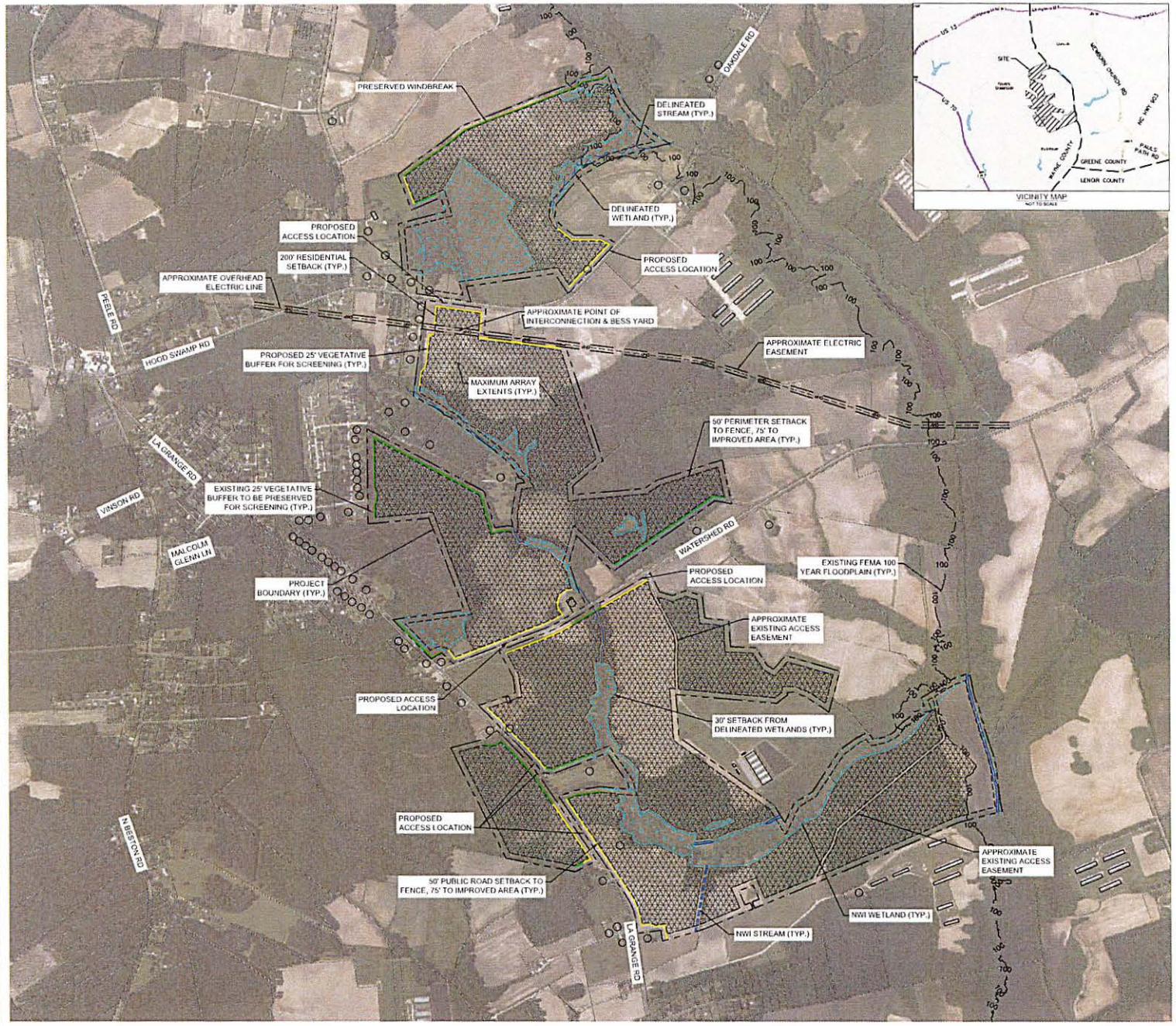
Supporting documents attached as evidence:

Area Map
Approved Site Plan
Special Use Permit Application
Findings of Fact Response
Buffer Plan
Decommissioning Plan
Health and Safety Assessment
Property Impact Study
Landscape Plan
Comments from Seymour Johnson AFB

Turtle Cove Solar S-23-03



Areas in red denote solar facility location.



SITE DATA TABLE	
PROJECT AREA	750 +/- ACRES
PARCEL ID #	3650023358, 3650048782, 3649033373, 3650220418, 3650311092, 3650909370, 3650740416, 3650942930, 3649086757, 3650926486, 3650171632, 3650983738
ZONING JURISDICTION	WAYNE COUNTY
CURRENT ZONING	OH - OUTER HORIZONTAL HEIGHT DISTRICT AA - APPROACH AREA HEIGHT DISTRICT RA 20 - RESIDENTIAL/AGRICULTURAL 20
ADJACENT PROPERTY ZONING	OH - OUTER HORIZONTAL HEIGHT DISTRICT AA - APPROACH AREA HEIGHT DISTRICT RA 20 - RESIDENTIAL/AGRICULTURAL 20
CURRENT LAND USE	FORESTED / AGRICULTURAL
PROPOSED LAND USE	SOLAR ENERGY
REQUIRED SETBACKS	PERIMETER: 50' TO IMPROVED AREA PUBLIC ROADWAY: 50' TO IMPROVED AREA ADJACENT RESIDENTIAL/CHURCH: 100' FROM PRINCIPAL BUILDING
PROPOSED SETBACKS	PERIMETER: 50' TO FENCE, 75' TO IMPROVED AREA PUBLIC ROADWAY: 50' TO FENCE, 75' TO IMPROVED AREA ADJACENT RESIDENTIAL/CHURCH: 200' FROM PRINCIPAL BUILDING TO IMPROVED AREA
REQUIRED RIPARIAN BUFFERS	30' FROM STREAM BANKS 30' FROM JURISDICTIONAL WETLANDS
LANDSCAPE REQUIREMENTS	25' WHERE ADJOINING RESIDENTIAL AND ALONG ROADWAYS
PROPOSED LANDSCAPE BUFFER	25' WHERE ADJOINING RESIDENTIAL AND ALONG ROADWAYS

LEGEND

- PROJECT BOUNDARY
- GIS PROPERTY LINE
- PERIMETER SETBACK
- APPROXIMATE ELECTRIC EASEMENT
- APPROXIMATE EXISTING OVERHEAD TRANSMISSION LINE
- 100 FEMA 100 YEAR FLOODPLAIN
- DELINEATED STREAMS
- DELINEATED WETLANDS
- NWI STREAMS
- NWI WETLANDS
- MAXIMUM ARRAY EXTENTS
- EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
- PROPOSED VEGETATIVE BUFFER
- PRESERVED WINDBREAK
- RESIDENTIAL BUILDING
- INDUSTRIAL BUILDING

NOTES

1. PROJECT BOUNDARY SHOWN IS BASED ON FILES RECEIVED FROM RENEWABLE ENERGY SERVICES, LLC ON 08/23/2023 AND 09/06/2023.
2. PARCEL BOUNDARIES SHOWN ARE BASED ON PUBLICLY AVAILABLE NORTH CAROLINA GIS DATA ACCESSED ON 08/24/2023 AND 09/06/2023.
3. ALL EXISTING TRANSMISSION LINES SHOWN ARE APPROXIMATE LOCATIONS BASED ON PUBLICLY AVAILABLE GIS DATA ACCESSED ON 08/24/2023.
4. 100-YR FLOODPLAIN LINEWORK IS BASED ON PUBLICLY AVAILABLE FEMA GIS DATA ACCESSED ON 08/24/2023.
5. WETLANDS AND WATERS ARE BASED ON FILES RECEIVED FROM RENEWABLE ENERGY SERVICES, LLC ON 08/24/2023, AND PUBLICLY AVAILABLE DATA FROM THE NATIONAL WETLANDS INVENTORY (NWI) ACCESSED ON 09/06/2023.
6. THE LOCATION OF PROPOSED EQUIPMENT INCLUDING BUT NOT LIMITED TO: ACCESS LOCATIONS, FENCING, SOLAR ARRAY RACKING, ELECTRICAL EQUIPMENT, VEGETATIVE BUFFER, AND OVERHEAD POLES & LINE, ETC. SHOWN ARE APPROXIMATE AND MAY BE SUBJECT TO MODIFICATIONS DUE TO SITE CONDITIONS, ADDITIONAL PERMITTING REQUIREMENTS, DETAILED DESIGN, EQUIPMENT AND/OR OTHER CONSTRAINTS.
7. THIS PLAN IS PRELIMINARY AND WILL NOT BE RELEASED FOR CONSTRUCTION.
8. THE PROJECT SITE WILL BE ENCLOSED BY FENCING IN COMPLIANCE WITH THE NATIONAL ELECTRIC CODE.
9. ACCESS POINTS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SURVEYED TOPOGRAPHY, UTILITIES, NCDOT PERMITTING, OR ENVIRONMENTAL FEATURES.
10. THE POINT OF INTERCONNECTION IS APPROXIMATE AND MAY INCLUDE AN ELECTRICAL SUBSTATION. THE POINT OF INTERCONNECTION MAY ALSO INCLUDE A BATTERY ENERGY STORAGE SYSTEM (BESS).
11. APPROVAL OF THIS PLAN ESTABLISHES A VESTED RIGHT UNLESS TERMINATED AT AN EARLIER DATE. THE ZONING VESTED RIGHT SHALL BE VALID UNTIL 10/10/28.
12. ON SITE POWER LINES BETWEEN SOLAR PANELS AND INVERTERS WILL BE PLACED UNDERGROUND OR ABOVE GROUND, SUBJECT TO FINAL DESIGN.

RENEWABLE ENERGY SERVICES

Kimley»Horn

© 2023 KIMLEY-HORN AND ASSOCIATES, INC.

421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919-677-2000
WWW.KIMLEY-HORN.COM

PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT 019455002
DATE 10/09/2023
SCALE AS SHOWN
DESIGNED BY SRF
DRAWN BY BCB
CHECKED BY

TURTLE COVE SOLAR

ZONING SITE PLAN

NORTH CAROLINA
WAYNE COUNTY

SHEET NUMBER
EX1.0

Wayne County, North Carolina

Petition for Special Use Permit

Date Sep 14, 2023

Applicant Name: Turtle Cove Solar, LLC Telephone (919) 637-1139
Address: 5315 Highgate Dr, Suite 202, Durham, NC 27713

Property Owner Name: See "Turtle Cove Solar Landowner Info Table" Telephone: ""
Address: ""

1. Property address or location: Off Hood Swamp Road, Water Shed Road, and La Grange Road; Exact 911 address to be finalized closer to construction

2. Zoning classification: Outer Horizontal Area (OH) of Seymour Johnson AFB

3. Requested special use permit: Solar Energy Facility in OH Zoning

4. Property legal description (metes and bounds, or if subdivided, lot, block, subdivision plat book and page number): Legal description of the facility to be established by an ALTA Survey closer to construction

5. Owner's intended use of the property in question if it is reclassified: Solar Energy Facility

6. Explain in detail why you think this petition should be approved: See "Turtle Cove Solar_SUP_Findings of Fact vF.pdf"

7. Name and addresses of owners whose property abuts the property in question: See "Turtle Cove Solar Adjoiner List.xlsx"

I certify that I, the applicant, have the consent of the owner and act on his behalf in applying for a Special Use Permit.

Date: Sep 14, 2023 Signature: _____
Applicant

Report of the Zoning Enforcement Officer on the property in question: _____

Fee Paid $ _____ Date _____

Date Public Hearing Scheduled _____ Time _____

Dates Public Hearing Advertised _____

Petition: Approved _____ Petition No. _____
Denied

Turtle Cove Solar_Wayne County NC_Special Use Permit Application (Draft)

Final Audit Report 2023-09-14

Created:	2023-09-14
By:	Erika Shinpaugh (eshinpaugh@r-e-services.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAC7LIexL9vBs6m1yxjs-56LLTo1G7q9Dk

"Turtle Cove Solar_Wayne County NC_Special Use Permit Application (Draft)" History

Document created by Erika Shinpaugh (eshinpaugh@r-e-services.com)
2023-09-14 - 5:12:55 PM GMT

Document emailed to Matt Delafield (mdelafield@r-e-services.com) for signature
2023-09-14 - 5:15:29 PM GMT

Email viewed by Matt Delafield (mdelafield@r-e-services.com)
2023-09-14 - 5:23:11 PM GMT

Document e-signed by Matt Delafield (mdelafield@r-e-services.com)
Signature Date: 2023-09-14 - 5:23:20 PM GMT - Time Source: server

Agreement completed.
2023-09-14 - 5:23:20 PM GMT

Turtle Cove Solar – Special Use Permit Findings of Fact

09/15/2023

1. **The proposed use does not affect adversely the general plans for physical development of the county and will not be contrary to the purposes stated in these regulations:**

Turtle Cove Solar is in general conformity with "The Wayne County Comprehensive Plan" (WCCP 2009). The Growth Strategy Map included at the end of this document shows that the project site, the location of which is marked in red, falls predominantly within the Rural Area of the County, as well as borders some Rural Enclave areas. Solar is a good partner to rural adjacent uses as it is not a permanent development, allowing the land to be returned to agriculture or timber at the end of facility's usable life, after decommissioning has occurred (WCCP 2009 Policy 4.1). Additionally, allowing the land to lay fallow with only native grasses growing on it, allows the fertility of the soil to be restored over time, preserving the long-term productivity of the land as farmland (WCCP 2009 Policy 4.1). Solar development onsite will occur at an appropriate density for surrounding uses, with only 30 - 40% of the site being covered by modules, and the majority the remaining land left as open space (WCCP 2009 Policy 4.6). This practice of spacing arrays out is required to avoid them shading one another as the sun moves to different angles in the sky throughout the day, which would reduce electricity production. Additionally, other urban services or features, such as sewer service, street lighting, sidewalks, or increased traffic capacity will not experience increased demand from the solar facility, further maintaining the rural nature of the area (WCCP 2009 Policy 4.1, 4.2, 4.3, 4.4, 4.5). Finally, Turtle Cove will also be a good neighbor to the rural-residential Enclaves, as there will no personnel onsite, no increased traffic generation, and no noise, light, or odor generation. A minimum of twenty-five feet (25 ft.) of preserved or planted vegetation will be maintained where the facility borders residences, preserving homeowners' privacy and viewshed.

Additionally, it is a common concern that solar is or will take a large portion of agricultural land out of use in the county & state. As the "North Carolina Solar Land Use and Agricultural" (2022) report, which will be entered into the record at public hearing, points out, solar PV currently only occupies 0.12% of total land area in the state, and only 0.28% of agricultural land. To emphasize this, this is a total of less than 1/3 of 1% of agricultural land that is taken up by solar farms. Transmission-scale projects such as Turtle Cove Solar can only be sited where transmission line access is available. With only a handful of transmission lines running through each county, solar development is naturally constrained to corridors of parcels with transmission lines running across them and the parcels that adjoin them. This means that the vast majority of the county will not qualify for similar solar facilities to be built, and individual solar development will not deter overall goals for rural and agricultural preservation in the county (WCCP 2009 Policy 4.1). Additionally, solar development is further constrained by which transmission lines have the capacity to take on the additional load created by the solar facility. Duke Energy Progress, which owns and operates the transmission lines in Wayne County, has strict regulations which safeguard lines from becoming over-constrained. Although lines can be upgraded, this process is very expensive, incentivizing projects to spread throughout the grid and minimizing excessive solar burden in specific counties. For these reasons, and in line with

ratified, bi-partisan-supported House Bill 951, solar can be considered as one of the highest and best uses for the parcels optioned to Turtle Cove Solar. Since Duke Energy has been legally mandated to decarbonize its grid, it must move towards diversified energy sources including solar, resulting in county & state benefits including increased grid stability and reliability, as well as decreasing cost to ratepayers over time.

Additionally, the project is near a Conservation Area on the Growth Strategy Map. Turtle Cove Solar will be a good fit for this area as it will avoid development in any 100-year floodplain and will go through a required stormwater permitting process with NC DEQ, resulting in any necessary stormwater features being installed and maintained. These features will include preserving ditches and riparian buffers. Additional control measures that may be installed include, but are not limited to, sediment basins, silt fencing, enhanced drainage swales, and bioretention areas. These closely regulated measures control runoff, minimizing any potential impact to adjacent properties and the nearby Bear Creek wetlands areas. This is harmonious with the WCCP 2009 as it meets the goal of conservation in this area through carefully regulated protection measures and avoiding direct development in the most environmentally sensitive of areas.

Finally, the project will provide economic benefit and contribute significantly to the county tax base without drawing on public resources provided by the county such as sewage services, emergency services, or schools (WCCP 2009 Policy 2.5). In fact, the project will encourage a diverse tax base in the county while providing public funding for the county including for infrastructure improvements, educational programs, and quality of life and beautification efforts such as historical preservation and public parks (WCCP 2009 Policy 2.1, 2.3, 2.4, 2.9, 2.10, 2.12). Additionally, Turtle Cove Solar will take approximately one year to construct, and during that time, an estimated 150 construction workers will work on the facility. In addition to the construction labor, the extended construction schedule will foster significant spending in Wayne County, increasing the local economy (WCCP 2009 Policy 2.1 & 2.8). Turtle Cove Solar is committed to working with the Wayne County Development Alliance and the Wayne County Chamber of Commerce to ensure local contractors have the opportunity to bid on work throughout the construction process, including in the fuel, equipment maintenance and parts, grading and site preparation, fencing, solid waste, lodging, food and beverage, and landscape materials industries.

2. **The proposed use will not adversely affect the health and safety of the county residents and will not be detrimental to the use or development of adjacent properties or other neighborhood uses:**

When completed, the Turtle Cove Solar facility will be built in accordance with the building codes of North Carolina and Wayne County, using UL approved equipment. The system will be built to the wind rating of the region. There will be a perimeter fence securing the facility. Solar panels have been studied extensively by the Environmental Protection Agency (EPA) and the North Carolina State Clean Energy Center and have been deemed landfill safe due to the absence of hazardous materials. The electric and magnetic fields (EMF) from facilities have also been measured and have been deemed indistinguishable from Earth's magnetic fields at the project fence line. If the final site design includes batteries, adequate design will be provided to ensure all local, state and federal requirements regulating outdoor battery storage have been met.

Several hundred solar farms have been approved in North Carolina after the local county or municipality found, based on evidence, that health & safety standards were met, and there is no evidence, based on constructed solar farms, that the finding was incorrect. A Health & Safety Assessment Report was prepared for this project by a licensed North Carolina engineer, in which additional information and evidence is provided showing that the operation of the facility will not result in any negative impacts to public health or safety for residents of Wayne County. This report is included as a part of this application.

A property values impact study by Kirkland Appraisals, a licensed North Carolina appraiser, was conducted for this project. It is included in this application and will be entered into the record at the applicant's public hearing. The impact study was conducted using the matched-pairs appraisal analysis technique and found that there is no measurable difference in price or time on the market for properties adjoining a solar facility compared with similar properties not adjacent to solar farms, provided that there are sufficient setbacks and buffering as identified in the analysis. Solar facilities do not exhibit any typical public nuisance characteristics that would harm adjacent property values since they do not produce emissions, noise, glare, hazardous chemicals or measurable traffic. These data and facts demonstrate that the facility will not substantially injure the value of adjoining or abutting properties and is therefore a harmonious use for existing adjoining uses or possible future development. The applicant will also present evidence at the hearing that NC Courts have determined that subjective feelings of how something looks is not evidence that it is inharmonious with an area.

3. **The proposed use will not be affected adversely by existing uses, and will be placed on a lot of sufficient size to satisfy the space requirements of said use:**

Turtle Cove Solar will not affect, nor be affected by, existing uses. The solar energy system will be remotely monitored, with no full-time personnel onsite. Therefore, no adjoining or nearby uses, including subdivisions, agriculture, animal husbandry, or similar uses, will cause nuisances that would detract from the ability of solar facility to operate. Similarly, since the facility will be completely enclosed by a perimeter security fence, the activities occurring on adjoining parcels will not have the ability to physically interfere with the facility.

Although the facility has 750 acres under site control, modules are likely to only cover about 225 to 300 acres of the site, with a ground coverage ratio of between 30 - 40%. Additionally, over 90% of the site will be covered with native grasses and vegetation, including underneath the arrays. The project will also meet or exceed all setbacks required by the county from adjoining property lines and uses. For these reasons, there will plenty of open space within the site and between adjacent uses.

4. **The proposed use will not constitute a nuisance or hazard because of the number of persons who will use such a facility, the vehicular movement or the noise or fume generation:**

During the life of the facility, Turtle Cove Solar will be operated and maintained by a licensed and insured management firm in accordance with the Landscaping Maintenance Plan submitted as a part of this application. The operations and maintenance (O&M) provider will be responsible for overseeing the maintenance and upkeep of all elements of the facility, which

include, but are not limited to, driveway/roads, stormwater management, landscaping, fencing, electrical connections, modules, inverters, and transformers. There will be no full-time on-site personnel, negating any concerns about the number of persons onsite, and instead the Project and associated electrical equipment will be remotely operated and monitored 24/7 via supervisory control and data acquisition (SCADA) equipment. A phone number will be posted at the site entrance to enable community members to contact the site manager if they have any questions or concerns about the facility.

Additionally, long-term impact to roads or traffic are negligible from the operation of the facility. Turtle Cove Solar will take any steps needed to maintain and repair roads both during and after construction if any issues occur. Temporary traffic control measures will also be implemented during construction if needed. Once constructed, internal access roads will be utilized as much as possible to minimize impacts to neighbors and the local road network. During the life of the facility, the average solar farm generates one or two vehicle trips per month, as contrasted with an average single-family home that generates 9.52 vehicle trips per day (Institute of Transportation Engineers, Trip Generation Manual, 9th ed.).

Similarly, one home (or a group of new homes, such as a new subdivision) would generate traffic and suburban noise in the form of lawn mowers, leaf blowers, and common noises created whenever people gather. Farming and timber uses could cause noises via farming equipment or gunshots. In contrast, the inverters are the only components of a solar farm that produce a noise. When standing directly next to one you might hear a hum similar to an air conditioner. From outside the facility, they are impossible to hear over ambient noises created by wind, birds, background traffic, etc. For this reason, there will be no noise-related nuisances created by the facility, and other noisier uses will be precluded.

Finally, solar farms do not emit any light and only operate during the day. There will be no lighting at night. Additionally, the facility produces no odors, and use as a solar farm precludes other uses associated with odors such as hog or turkey houses. In sum, there will be no impact to neighbors from the operation of the facility, as there will be no personnel onsite, no increased traffic generation, and no noise, light, or odor generation.

5. **The proposed use shall be subject to the minimum dimensional requirements of the district in which it is to be located, and shall conform to the off-street parking and loading regulations:**

Turtle Cove Solar will meet all dimensional & design requirements of a Solar Energy Facility that falls within the Outer Horizontal Area (OH), one of the Seymour Johnson AFB Airspace Control Surfaces as defined in the 2011 Air Installation Compatible Use Zone (AICUZ) report or subsequent reports. The facility will provide any studies requested during correspondence with the Air Force Base. Additionally, pre-existing vegetation will be maintained or a landscape buffer will be installed with a minimum width of twenty-five feet (25 ft.) where the project directly adjoins public roadways or residential parcels.

The facility will also be enclosed by a security fence that is at least six feet (6 ft.) in height, and the project is exploring the possibility of using a wild-life friendly, fixed-knot fence that is at least seven feet (7 ft.) in height as an alternative option. Finally, the facility proposes setbacks of

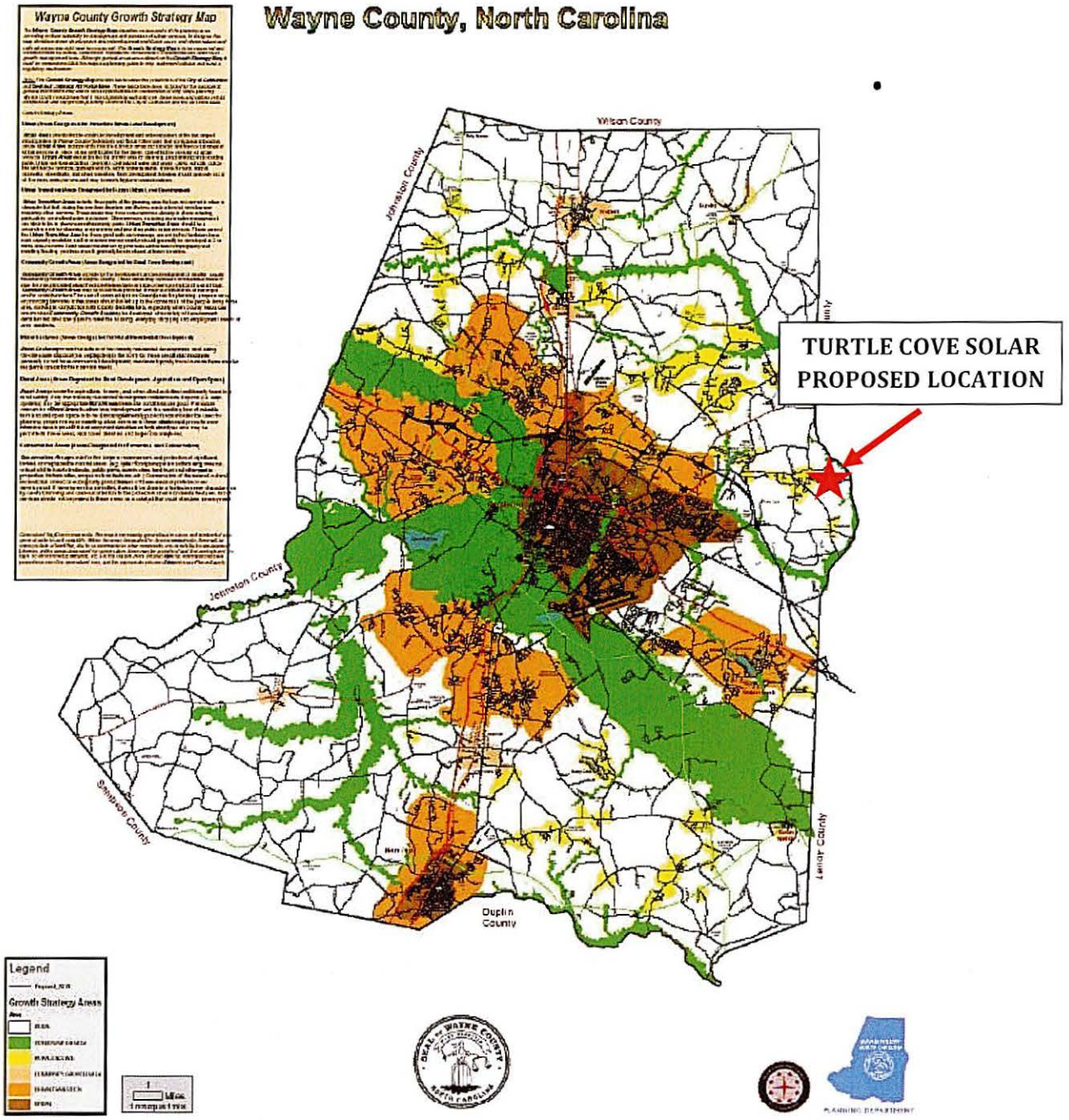
at least 50 feet from roadways and adjoining property lines to the facility fence line, unless where adjoining residential properties, in which case the project proposes setbacks of at least 200 feet from the principal building to the improved areas, starting with internal access roads. These design specifications meet and generally exceed the requirements set by the county.

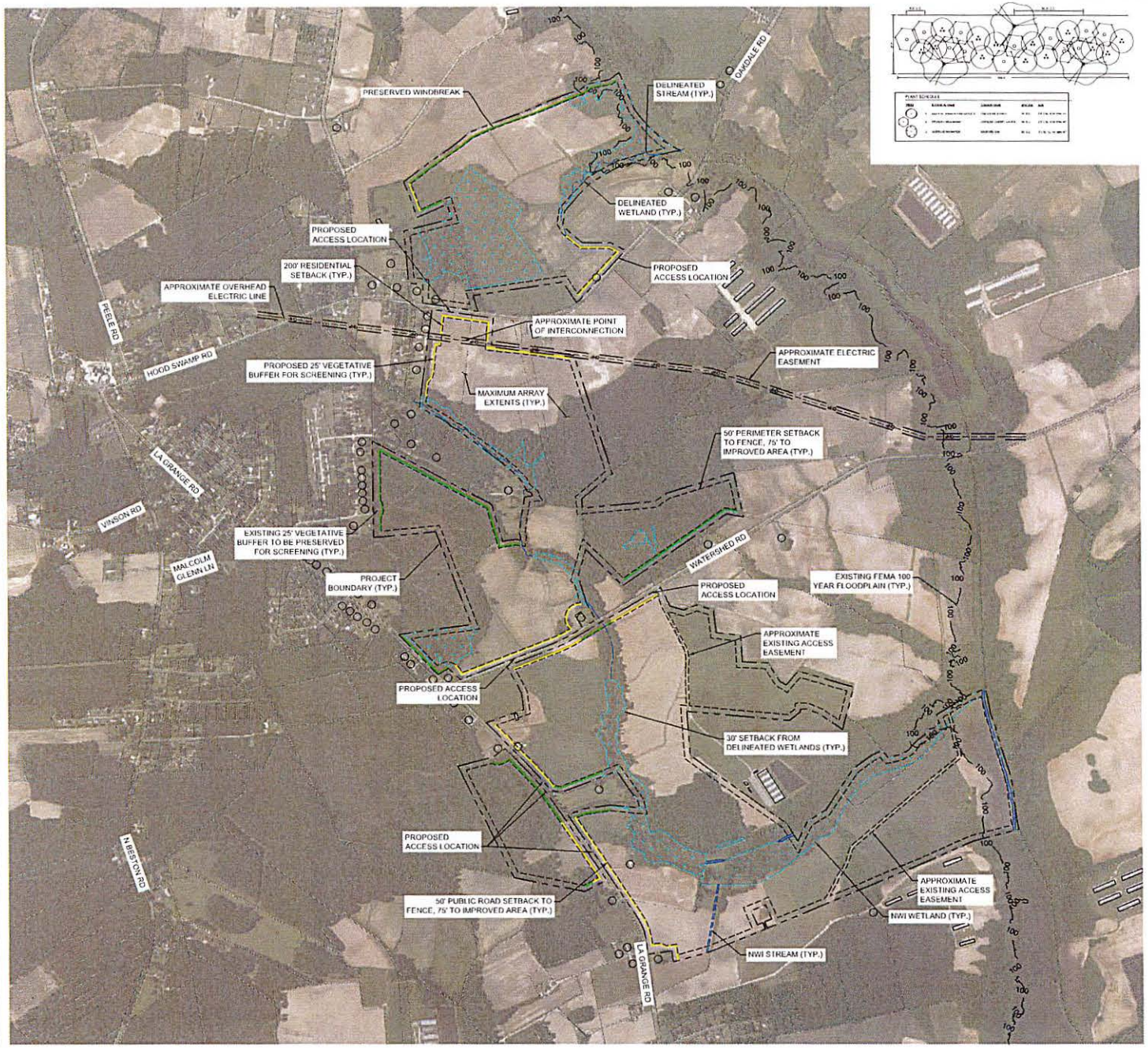
There will be no off-street parking or loading required. The security fence around the perimeter of the property will be the first improvement constructed, after which will come the internal access road. Designated internal loading and equipment pads off this access road will be denoted as part of the engineering process, where any unloading of equipment for the facility will occur.

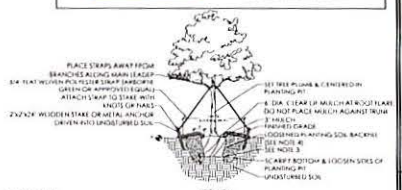
As a part of its special use permit application, the proposed facility will submit all required deliverables defined in the "Ordinance Regulating the Operation and Maintenance of Solar Energy Facilities in Wayne County NC" (Amended, 2016), as well as few additional volunteered deliverables. Turtle Cove Solar will submit a Site Plan, Decommissioning Plan, and Landscape Buffer Visualization. The Site Plan will show an overview of the project design including the setbacks, panel sizes, and location of property lines, buildings and road right of ways, as outlined by the ordinance. The Decommissioning Plan will define the decommissioning process, how often the plan will be updated, and the decommissioning cost estimate. The Landscape Buffer Visualization will outline the layout of all proposed landscaping, with property buffers between the facility fence line and bordering residential uses and public roads, and the scheduled maintenance of the property. The Landscape Buffer Visualization will also provide visual simulations of the proposed vegetative buffers.

Growth Strategy Areas

Wayne County, North Carolina

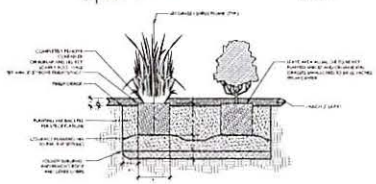






PLANTING NOTES
1. FOR CONTAINER PLANTS: REMOVE CONTAINER & SCARIFY ROOT MASS PRIOR TO PLANTING.
2. FOR B&B PLANTS, COMPLETELY REMOVE TOP HALF OF WIRE BASKET AND BURLAP MATERIAL. REMOVE ALL TWINE, ROPE AND WIRE FROM ROOT BALL.
3. SET ROOT BALL ON UNDISTURBED SOIL/BASE SO THAT TOP OF ROOT BALL IS 2-3" ABOVE FINISHED GRADE. TAMP SOIL FIRMLY AROUND BOTTOM OF ROOT BALL TO SET THE PLUMB.
4. DIG & TURN PLANTING SOIL TO REDUCE COMPACTION. LIGHTLY TAMP SOIL AROUND ROOT BALL IN 6" LIFTS TO BRACE THE TREE. DO NOT OVER COMPACT. HAVE COMPLETED BACKFILL AT BACKFILL AS RECOMMENDED IN SOIL REPORT. POUR WATER AROUND ROOT BALL TO SETTLE SOIL AND BACKFILL AS REQUIRED TO MEET REQUIRED FINISHED GRADE.
5. A 2" RAISED 6" WIDE BERM SHALL BE MADE AROUND THE ROOT BALL EDGE.
6. PRUNE TREES ONLY AS NEEDED TO REMOVE DEAD OR BROKEN BRANCHES.

1 STANDARD TREE PLANTING DETAIL



PLANTING NOTES
1. ALL PLANT MATERIAL PRICING SHALL INCLUDE MULCH BED PREPARATION AND STAKING.
2. ALL PLANTING BEDS SHALL RECEIVE 3" (THREE INCHES) OF MULCH.
3. MULCH TYPE FOR PROJECT: DOUBLE SHREDDED HARDWOOD HARDWOOD DESIGNER MULCH IN DARK BROWN.
4. PLANT MATERIAL SPACING SHOWN ON LANDSCAPE PLANS SHALL OVERRIDE TYPICAL PLANT SPACING INDICATED ON PLANT SCHEDULE. LANDSCAPE CONTRACTOR RESPONSIBLE FOR VERIFYING ALL PLANT SPACING AND MAKING IMPORTANT ADJUSTMENTS DUE TO UTILITY CONFLICTS.
5. ALL SHRUBS SHALL CONFORM TO THE STANDARDS SET FORTH IN THE MOST RECENT AMERICAN STANDARDS FOR NURSERY STOCK PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN (A.A.N.)
6. SOIL ANALYSIS SHALL BE OBTAINED PRIOR TO PLANTING. SOIL SHALL BE AMENDED AS RECOMMENDED BY CERTIFIED TESTING AGENCY.
7. SEE PLAN FOR SPACING.

2 SHRUB AND ORNAMENTAL GRASS PLANTING DETAIL

LEGEND

- PROJECT BOUNDARY
- G.S. PROPERTY LINE
- EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
- PROPOSED VEGETATIVE BUFFER

NOTES

1. EXISTING VEGETATION IS TO BE PRESERVED AND PROTECTED IN PLACE TO MEET THE INTENT OF THE BUFFER REQUIREMENTS WHEREVER APPLICABLE. THE PROPOSED BUFFER STANDARD IS MEANT TO SUPPLEMENT EXISTING VEGETATION TO MEET THE SCREENING INTENT OF THE CODE REQUIREMENTS FOR SOLAR ARRAY FACILITIES AS NECESSARY.
2. ALL PLANTS MUST BE HEALTHY, VIGOROUS MATERIAL, FREE OF PESTS AND DISEASE.
3. ALL TREES MUST HAVE A STRAIGHT TRUNK AND FULL HEADED AND MEET ALL REQUIREMENTS SPECIFIED.
4. ALL PLANTS ARE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT OR OWNER'S REPRESENTATIVE BEFORE, DURING AND AFTER INSTALLATION.
5. ALL TREES MUST BE GUYED OR STAKED AS SHOWN IN THE DETAILS.
6. ALL TREE RINGS MUST BE COMPLETELY MULCHED AS SPECIFIED. MULCH TO BE THREE(3) INCHES OF DOUBLE SHREDDED HARDWOOD DESIGNER MULCH IN DARK BROWN.
7. THE CONTRACTOR IS RESPONSIBLE FOR FULLY MAINTAINING ALL PLANTING (INCLUDING BUT NOT LIMITED TO: WATERING, SPRAYING, MULCHING, WEEDING, FERTILIZING, ETC.) OF THE PLANTING AREAS AND LAWN UNTIL SUBSTANTIAL COMPLETION OF PROJECT.
8. THE CONTRACTOR SHALL COMPLETELY WARRANTY ALL PLANT MATERIAL FOR A PERIOD OF ONE (1) YEAR BEGINNING ON THE DATE OF SUBSTANTIAL COMPLETION. THE CONTRACTOR SHALL PROMPTLY MAKE ALL REPLACEMENTS BEFORE OR AT THE END OF THE WARRANTY PERIOD.
9. ANY PLANT MATERIAL WHICH DIES, TURNS BROWN, OR DEFOLIATES (PRIOR TO SUBSTANTIAL COMPLETION OF THE WORK) SHALL BE PROMPTLY REMOVED FROM THE SITE AND REPLACED WITH MATERIAL OF THE SAME SPECIES, QUANTITY, AND SIZE, MEETING ALL PLANT SCHEDULE SPECIFICATIONS.
10. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE CODES & ORDINANCES REGARDING LANDSCAPING. GENERAL CONTRACTOR IS TO CLEAN THE INDICATED BUFFER AREA OF ALL CONSTRUCTION DEBRIS PRIOR TO FINAL INSPECTION.
11. THE CONTRACTOR SHALL INSTALL NON-WOVEN PERMEABLE GEOTEXTILE UNDER PLANTING BED MULCH IN ALL LANDSCAPE BEDS TO PREVENT WEED GROWTH.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING TREES AND SHRUBS THAT WILL MEET BOTH MINIMUM SIZE AND SPACING REQUIREMENTS AS SET FORTH IN THE ORDINANCE REGULATING THE OPERATION AND MAINTENANCE OF SOLAR ENERGY FACILITIES IN WAYNE COUNTY, NC. FAILURE TO INSTALL PLANT MATERIAL PER THIS PLAN WILL JEOPARDIZE ISSUANCE OF FINAL CERTIFICATE OF OCCUPANCY. CONTRACTOR SHALL BE RESPONSIBLE FOR SCHEDULING INSPECTIONS OF PLANT MATERIAL.
13. SURFACE MATERIAL FOR THE GROUNDPLANE APPLICATION WITHIN THE FENCE LIMITS OF THE SOLAR DEVELOPMENT WILL CONSIST OF NATIVE TURF GRASS SEED TO BE ESTABLISHED WITHIN THE WARANTY PERIOD AND BE MAINTAINED BENEATH THE PANEL MODULES. FREQUENCY OF MAINTENANCE/MOWING OF THE TURFGRASS WILL BE DONE AS NEEDED TO MAINTAIN A LOW GRM STAND OF VEGETATION THAT DOES NOT EXCEED A MAXIMUM HEIGHT OF 30" FROM GROUNDPLANE TO AVOID INTERFERENCE WITH THE SOLAR ARRAY. MOWING WILL OCCUR APPROXIMATELY 5 TIMES PER YEAR OR ON AN AS NEEDED BASIS.

NORTH

GRAPHIC SCALE IN FEET
0

RE

Kimley»Horn
421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919-677-2000 FAX: 919-677-2050
WWW.KIMLEY-HORN.COM

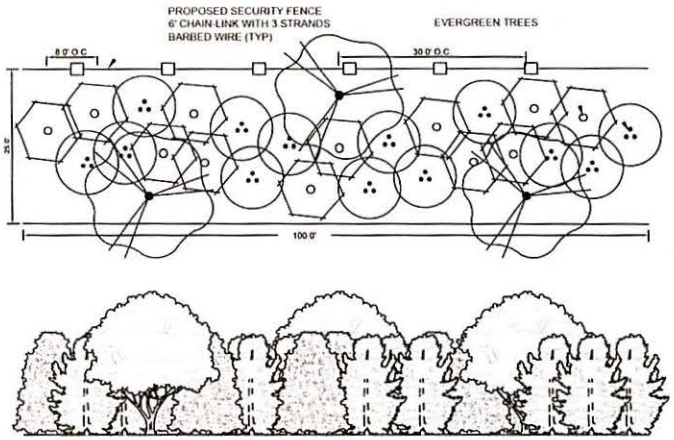
PRELIMINARY NOT FOR CONSTRUCTION

KHA PROJECT	019402
DATE	09/15/2023
SCALE	AS SHOWN
DESIGNED BY	SKF
DRAWN BY	BCB
CHECKED BY	JS

TURTLE COVE SOLAR — LANDSCAPE PLAN

WAYNE COUNTY, NORTH CAROLINA

SHEET NUMBER
EX1.0



GRAPHIC SCALE IN FEET
0 10 20 40

PLANT SCHEDULE

TREES		BOTANICAL NAME	COMMON NAME	SPACING	SIZE
	12	PRUNUS CAROLINIANA	CAROLINA CHERRY LAUREL	8' O.C.	2" CAL; 6' MIN. HT.
	3	QUERCUS VIRGINIANA	SOUTHERN LIVE OAK	AS SHOWN	2" CAL; 8-10' HT.
	13	VIBURNUM AWABUKI 'CHINDO'	CHINDO SWEET VIBURNUM	8' O.C.	2" CAL; 6' MIN. HT.

GENERAL NOTES:

1. THE PROPOSED VEGETATIVE BUFFER SHOWN IN THIS EXHIBIT IS BASED ON SECTION 18-195 IN THE WAYNE COUNTY, NC ZONING ORDINANCE. ALL SOLAR ENERGY FACILITIES LOCATED IN A RESIDENTIAL AREA SHALL HAVE A MINIMUM LANDSCAPE BUFFER OF 25 FEET. THE BUFFER SHALL CONTAIN EVERGREEN TREES OR SHRUBS PLANTED NO MORE THAN 8 FEET APART AND AT LEAST 4 FEET TALL AT TIME OF PLANTING. THE BUFFER SHALL OBTAIN A HEIGHT OF 10 FEET WITHIN 3 GROWING SEASONS. THE TREES OR SHRUBS MAY BE TRIMMED BUT NO LOWER THAN A HEIGHT OF 10 FEET.
2. THE DESIGN OF THE SOLAR ENERGY FACILITIES BUFFERS SHALL USE MATERIALS, COLORS, TEXTURES, SCREENING AND LANDSCAPING, THAT WILL BLEND THE FACILITY INTO THE NATURAL SETTING AND EXISTING ENVIRONMENT.
3. THE PURPOSE OF THIS ILLUSTRATION IS TO DEPICT AN ESTIMATE OF THE OPAQUENESS, LAYERING, AND SIZE OF PROPOSED VEGETATION AT 1-5 YEARS OF GROWTH FROM PLANTING.
4. PROPOSED BUFFER PLANTINGS ALONG ROAD FRONTAGE TO BE LOCATED SO AS TO NOT CONFLICT WITH EXISTING OVERHEAD POWERLINES.

1-YEAR GROWTH



3-YEAR GROWTH



5-YEAR GROWTH



LANDSCAPE BUFFER
September 2023

Turtle Cove Solar
WAYNE COUNTY, NORTH CAROLINA

Kimley»Horn

Kimley»Horn

TURTLE COVE SOLAR
DECOMMISSIONING PLAN
SEPTEMBER 2023

Purpose

This decommissioning plan is provided by Turtle Cove Solar, LLC (the "Project Company") and will detail the projected decommissioning demands associated with the proposed project.

The purpose of this decommissioning plan is to provide procedures and an opinion of probable construction cost for partial or full closure of the solar facility. A decommissioning plan and estimate are being provided to satisfy the specific guidelines set in the Ordinance Regulating The Operation and Maintenance Of Solar Energy Facilities In Wayne County NC Section Nine, Page 4, Requirement B. This decommissioning plan details general provisions for facility deconstruction and site restoration. This decommissioning plan shall take effect upon facility abandonment, discontinuation of operation, or expiration of the use permit as defined by Wayne County Code.

Site Location

Turtle Cove Solar proposes to build a photovoltaic (PV) solar facility ("Solar Facility") in Wayne County, NC. The Facility is located on La Grange Rd and within tax parcel identification numbers 3650023058, 3650046762, 3640933373, 3650202418, 3650311092, 3559094370, 3650140810, 3650042930, 3640956757, 3650222187, 3650330486, 3650171652, 3640956757, 3559483738, 3650506214 ("Property").

Anticipated Service Life of the Project

At the end of its project life, the Solar Facility shall be decommissioned in accordance with this Decommissioning Plan ("Plan"), restoring the site to as close to its agreed-upon post-decommissioned state as practicably possible upon expiration or termination of the Power Purchase Agreement. The Solar Facility carries an expected useful lifetime of 40 years, including potential replacement or upgrades to equipment during that time.

Decommissioning responsibilities include the removal of perimeter fences, any concrete or steel foundations, all metal structures (mounting racks and trackers), all photovoltaic (PV) modules, aboveground and underground cables, transformers, inverters, fans, switch boxes, substation and otherwise restoring the premises to its original condition or mutually-agreed upon state. Other Plan activities include the management of materials and waste, associated erosion & sedimentation control, and a decommissioning fund agreement overview.

Decommissioning Risk Over the Lifecycle of a Project

The probability of an event that would lead to abandonment or long-term interruption is extremely low during the first 25 to 30 years of the Project life. Accordingly, the risk of decommissioning the Project is extremely low during this time frame because:

- Project owners have sophisticated financing structures that allow the lender or tax equity partner to step in and rectify the event that may lead to abandonment.
- Most critical solar components have original equipment manufacturer (OEM) warranties with long terms that include labor and parts. A warranty is an agreement or guarantee outlined by a manufacturer to a customer that defines performance requirements for a product or service. Warranties give customers a form of insurance if the purchased product or service does not adhere to quality standards. These warranties assure the Project owner, financing parties, and other stakeholders, that equipment will perform as expected which minimizes the risk of a decommissioning event. Average warranty lengths for critical solar components range from 5 to 10 years, with production warranties on solar panels extending to 25 years.
- Solar projects consist of many networked components designed to absorb solar energy and convert to electrical energy. The failure of any single component will not result in a substantial reduction of energy generation that could lead to a decommissioning event.
- Solar projects are required to maintain replacement value property damage insurance coverage and business interruption insurance coverage. Business interruption insurance covers the loss of income that a business suffers after a disaster or equipment failure. Typical solar business interruption insurance covers income loss for twelve months from the date of the event triggering the loss.
- The replacement costs of solar components will typically decline over time, and accordingly, costs to replace failed or damaged equipment after lapsed OEM warranties will not create large financial hurdles for the Project.
- In the early stages of the Project, the resale value of the equipment is significantly higher than the decommissioning costs, resulting in a net positive (revenue).

Considering the reasons stated above, a decommissioning bond early in the life of a solar project life is not required to assure the coverage facility removal and site restoration costs.

Solar power is an increasingly popular form of renewable energy around the world and as an alternative to the burning of fossil fuels, solar ranks alongside wind and hydropower as essential energy options for the future of the planet. Solar also offers the additional benefit of being easier to build, operate, and decommission with minimal environmental risks. Recent rises in popularity and use can be linked to lower installation and operation costs and it is expected that this pattern will continue, further reducing the risk of a decommissioning event.

Decommissioning Risks Over Time

As previously noted, the probability of a decommissioning event that would lead to abandonment or long-term financial interruption is extremely low during the first 15 to 20 years of the Project life and accordingly, the financial risk to decommission the Project is also extremely low. A risk analysis approach is presented here for informational purposes only and has not been considered in the decommissioning cost estimates present in this Plan.

It is important to note that there are two aspects to consider when evaluating the risk for decommissioning the Project:

1. The risk of the need to decommission the Project as a whole (Project termination risk), and
2. The risk of failing to recuperate the cost of the decommissioning activities (decommissioning funding).

The most important concern for the Wayne County is the ability to recuperate the cost of decommissioning and restoration of the land to pre-Project conditions. The presence of a Power Purchase Agreement (PPA) in the first 40 years of the Project makes the likelihood of decommissioning very low during that time.

Risks over the expected life of the project include, but were not limited to:

- Years 1-5 – Minimal Project termination or financial risk due to presence of PPA with guarantee to purchase power, resale of value components, component warranties, value of facility.
- Years 5-15 – Similar consideration of previous period, except minimal increased financial risk due to the decrease in resale value of used components and rise in technological improvements of new equipment in market.
- Years 15-25 – Similar consideration of previous period, with slightly increased risk as warranties start to expire. Value of equipment is still substantial but decreasing.
- Years 25-30 – Similar consideration of previous period, warranties continue to expire; value of equipment diminishes with age and technological improvements in market.
- Years 30-40 – PPA expires, Project termination and funding risks increase, value of equipment diminishes, and technological improvements in market. A rise in salvage value of removed equipment due to diminishing natural resources and improvements in the efficiency of recycling/extraction technologies will offset the cost of decommissioning.

Commencement of Decommissioning

This Plan assumes that the Facility will be decommissioned under any of the following conditions:

1. The land lease (including the exercise of any extension options) ends and will either not be renewed or a new lease will not be entered into for the Project.
2. The system does not produce power for sale for a consecutive 12-month period, except in the instance of a force majeure event in which the Project is being repaired and/or restored.

3. The system is damaged and will not be repaired or replaced.

Removal of Nonutility Owned Equipment

To decommission the Solar Facility, the Project will include at a minimum:

- Disconnection from the utility power grid
- Removal of all Facility components: panels, inverters, wire, cable, combiner boxes, transformers, racks, trackers, tracker motors, weather monitoring, control system apparatus, etc.
- Removal of all non-utility owned equipment (at point of interconnection), conduits, structures, fencing, and foundations to a depth of at least three feet below grade.
- In order to minimize impacts to vegetated areas and prevent erosion at the time of decommissioning, it is not anticipated that the site will be re-graded.
- Plant vegetation suitable for the location, native to the region, and which matches surrounding vegetation.

The owner of the leased property may request in writing for certain items to remain, e.g., access roads.

This decommissioning plan is based on current best management practices and procedures. This Plan may be subject to revision based on new standards and emergent best management practices at the time of decommissioning. Permits will be obtained as required and notification will be given to necessary stakeholders prior to decommissioning.

The decommissioning process will maximize the recycling, reuse and salvage of applicable facility components, which are outlined in the opinion of probable construction costs. Based on the extent of decommissioning, prior to beginning construction activities, the developer will submit applicable demolition and construction plans and permit applications which will outline the schedule and extents of demolition. Decommissioning activities will not begin prior to issuance of approved permits by local regulatory agencies with appropriate jurisdiction.

Restoration of Property

At the time of decommissioning, the Project Company will restore the Solar Facility to a meadow-like or other agreed upon condition. All waste and excess materials will be disposed of in accordance with municipal, provincial, and federal regulations. Waste that can be recycled under municipal programs will be recycled accordingly. Provided, however, the Project Company shall not be required to replace any structures that were removed to build the Solar Facility.

The restoration will consist of de-compaction of the topsoil by disking or tilling and re-vegetation of the property. At the end of the project the area will be seeded and fertilized with native vegetation as needed to return the site to as close as practicable to original or initially agreed-upon condition. Landscaping and entrance will remain following site restoration. The future use of the land will be determined at the time of decommissioning. Deciding factors will be influenced by County land use and comprehensive plans and regulations at such time in the future.

The developer will coordinate with the County to monitor vegetation and drainage following restoration until permanent vegetation is established. Erosion and sediment control, re-seeding, soil stabilization, weed control and fertilization will be provided by the developer as needed until the site is stabilized and approved to be completed by the County.

Upon completion of the site restoration, a final report of activities will be submitted to the County documenting the process and results.

Time Period to Complete Decommissioning

The Project Company will have twelve (12) months from the date decommissioning commences to complete decommissioning. Provided, however, the Project Company shall be able to request an extension of an additional six (6) month intervals if it is in good faith diligently decommissioning and is delayed due to weather conditions or other items outside its control.

Party Responsible for Decommissioning

The Project Company is responsible for this decommissioning, provided however that the Project Company may contract with a third-party to perform the decommissioning on its behalf. Nothing in this plan relieves any obligation that the real estate property owner may have to remove the Facility as outlined in the Conditional Use Permit in the event the operator of the Facility does not fulfill this obligation.

Decommissioning Cost Estimate and Bonding

An engineer's opinion of probable construction cost and analysis of material salvage value were prepared as part of this decommissioning plan. Exhibit A summarizes the probable costs and salvage values associated with decommissioning. Exhibit B summarizes probable costs associated with decommissioning exclusive of salvage values. Exhibit C summarizes probable costs associated with trucking panels to approved recycling facilities.

Turtle Cove Solar, LLC will be required to submit detailed engineering plans at the time of decommissioning, and obtain construction permits as required by appropriate authorities.

Expenses associated with decommissioning the Project will be dependent on labor costs at the time of decommissioning. For the purposes of this report, current RSMeans data was used to estimate labor, material, and equipment expenses. Fluctuation and inflation of the labor costs were not factored into the estimates.

The total probable cost of decommissioning excluding a salvage but including a 1.5% inflation factor is **$3,607,000**. Inflation accounts for approximately $889,000 over a 20-year period.

Resale/Salvage Value Estimate

There is a robust secondary market for resale of solar PV panels worldwide and a network of facilities available for recycling panels. Solar PV panels are estimated to degrade less than 0.5% per year, meaning they're expected to operate at 90% of capacity after 20 years. Panel manufacturers will

guarantee the performance for each individual module and replace defective modules per the terms of warranty. Panels can therefore be sold for a price higher than their scrap value.

In general, the highest component value would be expected at the time of construction with declining value over the life of the Project. Over most of the Project's life, components such as the solar panels could be sold in the wholesale market for reuse or refurbishment. As panel efficiency and power production decrease due to aging and/or weathering, the resale value will decline accordingly. Secondary markets for used solar components include other utility scale solar facilities with similar designs that may require replacement equipment due to damage or normal wear over time; other buyers (e.g., developers, consumers) that are willing to accept a slightly lower power output in return for a significantly lower price point when compared to new equipment. The solar facility's additional supporting components, such as inverters, transformers, racking and piles, can be dismantled and resold for scrap value. Inverters and transformers are comprised of salvageable materials such as copper, aluminum, and silver. Piles and other steel components can likewise be recovered and salvaged. Resale values at the end of Year 20 for equipment of significant value were calculated with straight-line depreciation after an instant depreciation of the original material cost.

A current sampling of reused solar panels indicates a wide range of pricing depending on age and condition ($0.10 to $0.50 per watt). Future pricing of solar panels is difficult to predict currently, due to the relatively young age of the market, changes to solar panel technology, and the ever-increasing product demand. Using straight line depreciation, a conservative estimation of the value of solar panels in Year 20 at $0.005 per watt would yield approximately $560,907. Increased costs of removal, for resale versus salvage, would be expected to preserve the integrity of the panels; however, the net revenue would still be substantially higher than the estimated salvage value.

The resale value of components such as trackers, may decline more quickly; however, the salvage value of the steel that makes up a larger portion of the tracker is expected to stay at or above the value used in this report.

The price used to value the steel in this report is $152.18 per ton. The price used to value copper in this report is $2.13 per lb.

The cost estimate for Year 20 shows that the net cost to decommission the site is (Salvage Value ($4,333,000.00) – Decommissioning Cost ($2,718,000.00) = Net Surplus ($1,615,000.00)). Additionally, was assumed inflation of 1.5% per year over the next 20 years, the net surplus would increase (Net Surplus with Inflation valued at $2,143,000.00).

EXHIBIT A

DECOMMISSIONING COST ESTIMATE

Turtle Cove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma At Year 1
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Estimated Salvage Value	Total Cost (incl. markups)	Total Net Price
Mobilization	1	LS			($123,840)	($123,840)
Administration	500	HR	($113.72)		($56,859)	($56,859)
Temporary Facilities	1	LS			($15,320)	($15,320)
Safety	1	LS			($10,380)	($10,380)
Legal Expenses	1	LS			($2,720)	($2,720)
General Liability Insurance	1	LS			($11,120)	($11,120)
Contractor's G&A	1	LS			($21,000)	($21,000)
SWPPP, Erosion Control Measures (Disturbed Area)	498	Ac	($670.00)		($333,660)	($333,660)
Seeding	25	Ac	($1,331.42)		($33,152)	($33,152)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	25	Ac	($687.71)		($17,124)	($17,124)
Remove and Recycle Chain link Fence, 6' High	76,091	LF	($3.63)	$12,783	($276,381)	($263,598)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	$15,585	($77,925)	($62,340)
Removal and Recycle AC Cables	103,500	LF	($0.20)	$7,275	($20,927)	($13,652)
Removal and Recycle Above Ground DC Cables	8,222,592	LF	($0.10)	$577,966	($818,672)	($240,706)
Removal and Recycle Under Ground DC Cables	230,000	LF	($0.11)	$16,167	($25,446)	($9,279)
Backfill AC and DC trenches	333,500	LF	($0.19)		($64,101)	($64,101)
Removal and Recycle of Combiner boxes	230	EA	($245.80)		($56,533)	($56,533)
Remove and Recycle Inverters	23	EA	($7,147.31)	$1,934,818	($164,388)	$1,770,429
Removed and Recycle Photovoltaic Modules	174,104	EA	($1.97)	$24,051,082	($342,941)	$23,708,141
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	42,826	EA	($3.60)	$228,104	($154,071)	$74,033
Remove and Recycle Support Assemblies	4,227,538	LB	($0.02)	$211,377	($84,379)	$126,998
Contaminated Soils Testing	1	LS			($2,000)	($2,000)
Reclamation Monitoring and Maintenance	1	LS			($5,000)	($5,000)
			Year 1 cost	**$ 27,055,000**	**($2,718,000)**	**$24,337,000**

General Notes:
1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

Salvage Notes:
1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Turtle Cove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma At Year 20
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Estimated Salvage Value	Total Cost (incl. markups)	Total Net Price
Mobilization	1	LS			($123,840)	($123,840)
Administration	500	HR	($113.72)		($56,859)	($56,859)
Temporary Facilities	1	LS			($15,320)	($15,320)
Safety	1	LS			($10,380)	($10,380)
Legal Expenses	1	LS			($2,720)	($2,720)
General Liability Insurance	1	LS			($11,120)	($11,120)
Contractor's G&A	1	LS			($21,000)	($21,000)
SWPPP, Erosion Control Measures (Disturbed Area)	498	Ac	($670.00)		($333,660)	($333,660)
Seeding	25	Ac	($1,331.42)		($33,152)	($33,152)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	25	Ac	($687.71)		($17,124)	($17,124)
Remove and Recycle Chain link Fence, 6' High	76,091	LF	($3.63)	$12,783	($276,381)	($263,598)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	$15,585	($77,925)	($62,340)
Removal and Recycle AC Cables	103,500	LF	($0.20)	$7,275	($20,927)	($13,652)
Removal and Recycle Above Ground DC Cables	8,222,592	LF	($0.10)	$577,966	($818,672)	($240,706)
Removal and Recycle Under Ground DC Cables	230,000	LF	($0.11)	$16,167	($25,446)	($9,279)
Backfill AC and DC trenches	333,500	LF	($0.19)		($64,101)	($64,101)
Removal and Recycle of Combiner boxes	230	EA	($245.80)		($56,533)	($56,533)
Remove and Recycle Inverters	23	EA	($7,147.31)	$14,351	($164,388)	($150,038)
Removed and Recycle Photovoltaic Modules	174,104	EA	($1.97)	$3,248,944	($342,941)	$2,906,004
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	42,826	EA	($3.60)	$228,104	($154,071)	$74,033
Remove and Recycle Support Assemblies	4,227,538	LB	($0.02)	$211,377	($84,379)	$126,998
Contaminated Soils Testing	1	LS			($2,000)	($2,000)
Reclamation Monitoring and Maintenance	1	LS			($5,000)	($5,000)
Year 20 cost in current dollars				**$ 4,333,000**	**($2,718,000)**	**$1,615,000**
Projected inflation (1.5%)				**$ 1,417,000**	**($889,000)**	**$528,000.00**
Year 20 cost in future dollars				**$ 5,750,000**	**($3,607,000)**	**$2,143,000**

General Notes:
1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

Salvage Notes:
1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Kimley»Horn

EXHIBIT B

DECOMMISSIONING COST ESTIMATE EXCLUDING SALVAGE

Turtle Cove Solar
Wayne County, NC
Decommissioning Estimate Pro Forma
28-Sep-23

Kimley»Horn

The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs. LS = Lump Sum, HR = Hours, EA = Each, LF = Linear Feet.

Item	Quantity	Unit	Unit Price	Total Cost (incl. markups)
Mobilization	1	LS		($123,840)
Administration	500	HR	($113.72)	($56,859)
Temporary Facilities	1	LS		($15,320)
Safety	1	LS		($10,380)
Legal Expenses	1	LS		($2,720)
General Liability Insurance	1	LS		($11,120)
Contractor's G&A	1	LS		($21,000)
SWPPP, Erosion Control Measures (Disturbed Area)	498	Ac	($670.00)	($333,660)
Seeding	25	Ac	($1,331.42)	($33,152)
Tilling 6" topsoil/scarifying access road and rough grading existing soil	25	Ac	($687.71)	($17,124)
Remove and Recycle Chain link Fence, 6' High	76,091	LF	($3.63)	($276,381)
Disconnection and Demolition of Switchyard/Substation Equipment	1	EA	($77,925.22)	($77,925)
Removal and Recycle AC Cables	103,500	LF	($0.20)	($20,927)
Removal and Recycle Above Ground DC Cables	8,222,592	LF	($0.10)	($818,672)
Removal and Recycle Under Ground DC Cables	230,000	LF	($0.11)	($25,446)
Backfill AC and DC trenches	333,500	LF	($0.19)	($64,101)
Removal and Recycle of Combiner boxes	230	EA	($245.80)	($56,533)
Remove and Recycle Inverters	23	EA	($7,147.31)	($164,388)
Removed and Recycle Photovoltaic Modules	174,104	EA	($1.97)	($342,941)
Remove and Recycle Piles (10' W6x7 piles @ 25' OC assumed)	42,826	EA	($3.60)	($154,071)
Remove and Recycle Support Assemblies	4,227,538	LB	($0.02)	($84,379)
Contaminated Soils Testing	1	LS		($2,000)
Reclamation Monitoring and Maintenance	1	LS		($5,000)
			Year 20 cost	**($2,718,000)**
			Projected inflation (1.5%)	**($889,000)**
			Year 20 cost in future dollars	**($3,607,000)**

General Notes:
1. Similarly sized sites were used to derive potential quantities for erosion and sediment control. Quantities were determined by comparing "unit/MW" quantities directly.
2. Labor productivity and unit rates were derived from BLS 2023.
3. Labor, material, and equipment rates are based on the nearest available RS Means City Cost Index (CCI).
4. Equipment rental rates were determined from local rental facilities.
5. Assumption of module quantity from preliminary layout.

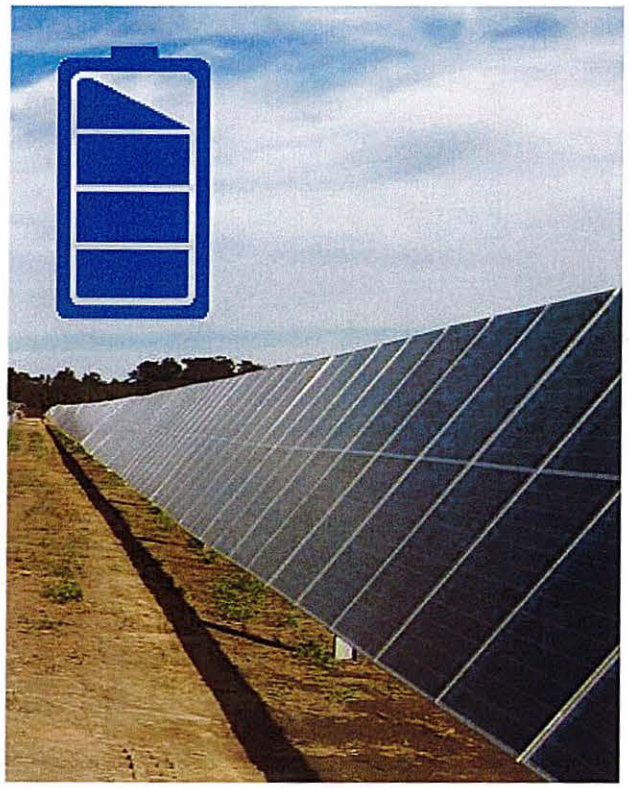
Salvage Notes:
1. Material salvage values were based off of current US salvage exchange rates.
2. Photovoltaic Module material salvage rate is based on straight-line depreciation of modules.
3. For PV Module Removal/Recycle labor and equipment costs are computed at present values, while salvage value is computed at 20 year depreciated values.
4. Material salvage values were determined using the most prevalent salvageable metal in each component.

Kimley»Horn

EXHIBIT C

TRUCKING COST BREAKDOWN

Turtle Cove Solar **Wayne County, NC** **Panel Trucking Costs**		
$/mo/truck rental	$	4,000
$/mo/truck labor (FT+benefits)*	$	5,000
$/mo/truck maintenance	$	500
$/mo/truck insurance	$	1,000
Total $/mo/truck cost	$	10,500.00
$/gallon gas	$	3.80
miles /gallon		8
Mileage (Wayne, NC to Raleigh, NC) roundtrip		120
Total fuel cost per trip	$	57.00
Capacity in tons per trip		20
total number of panels		174,132
panel weight (tons)		5,224
Misc. Waste (tons)		20
Total trips		263
Loading/unloading hours per trip		1
road hours per trip		3.0
hours per day		10
days/month		21
trips per month per truck		52.5
Total truck months		6
Subtotal of Truck and Labor Cost	$	63,000
Fuel Cost	$	14,991
Total Trucking Cost	**$**	**77,991**
*Assumes truck labor only works half of the month at standard heavy truck operator rates		



HEALTH AND SAFETY ASSESSMENT REPORT

Turtle Cove Solar
60 MW_{AC} Photovoltaic Facility with
~24 MW_{AC} / 4-hour Battery
Wayne County, NC

ABSTRACT

This is an assessment of the potential health and safety impacts of the proposed 60 MW_{AC} Turtle Cove Solar photovoltaic facility with battery energy storage (BES) in Wayne County, NC. Considering the project design and location, the assessment evaluates the potential positive and negative impacts of the project on public health and safety. Most of the project area will be covered by solar equipment, which produces valuable electricity without producing any air, water, or soil emissions. The primary health and safety risk of the system equipment is toxicity, which is considered in detail in this assessment. The battery equipment will occupy a tiny portion of the site's footprint and will provide many benefits to the electric grid. The primary health and safety risk of the battery equipment is fire, which is minimized by advanced battery technologies, 24/7 monitoring, new battery regulations, and the long distance between the equipment and the public. The conclusion of the assessment is that the Turtle Cove Solar facility will not create negative health and safety impacts. The clean electricity the project will produce will reduce the burning of fossil fuels, which will reduce pollution and provide millions of dollars' worth of local public health benefits as a result, based on U.S. Environmental Protection Agency estimates.

Tommy Cleveland, PE
Consulting Engineer
Solar Health and Safety Expert

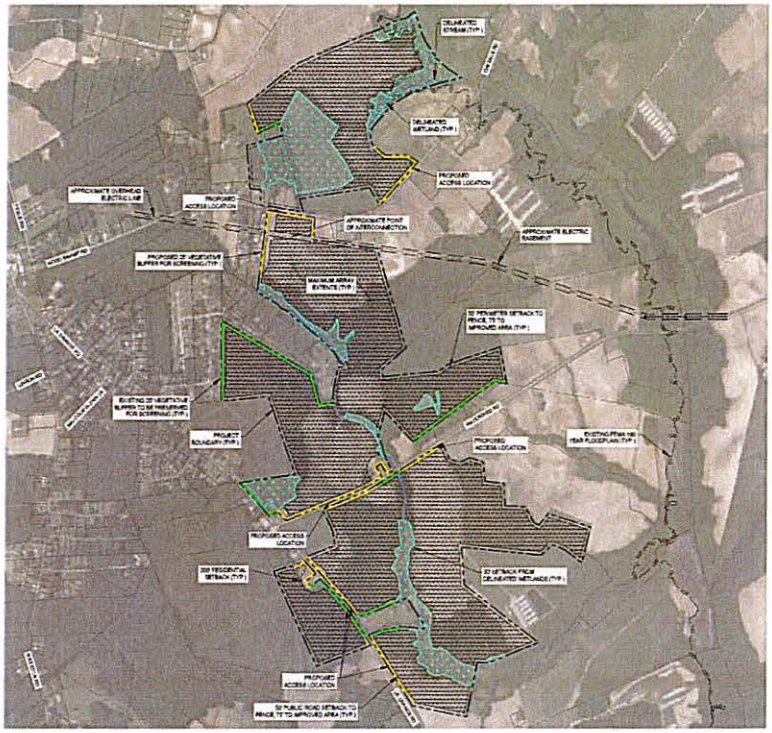
August 31, 2023

Health & Safety Assessment Report

Turtle Cove Solar (with batteries) – Wayne County, NC

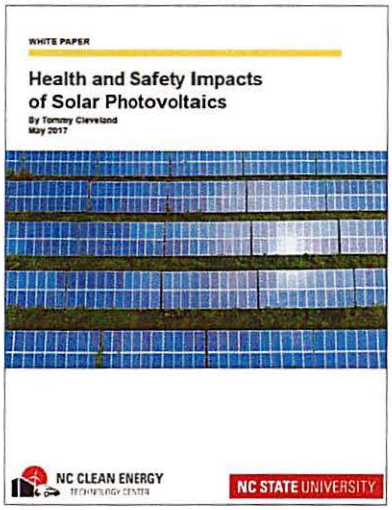
Project Overview:

- **Project Name:** Turtle Cove Solar
- **Developer**: Renewable Energy Services
- **Project Area (inside fence)**: ~594 acres
- **PV Capacity**: 60 MW_{AC} (~78 MW_{DC})
- **Solar Panels**: bi-facial crystalline silicon: Hanwha Q Cells 570W or equivalent
- **Structure**: single-axis trackers (north-south rows, 60° E to 60° W)
- **Inverters**: central station type: SMA Sunny Central 4000 (4.0 MW) or equivalent
- **Battery Energy Storage (BES):** 21 to 27 MW_{AC} with 4-hour duration (~96 MWh), AC-coupled
- **Battery Type:** lithium-ion batteries, manufactured by a Duke Energy approved battery cell vendor
- **Point of Interconnection to Grid**: Duke Energy Progress 115 kV transmission line passing E-W through northern half of project area
- **Interconnection Equipment**: Duke Energy Progress 115 kV switchyard and project's 34.5kV/100kV substation adjacent to the transmission line, internal to areas of PV modules



Report Author

The author of this report is **Tommy Cleveland, PE**, (the "Author") a consulting engineer licensed as a professional engineer in NC since 2007. Mr. Cleveland graduated from North Carolina State University ("NC State") with undergraduate and master's degrees in mechanical engineering, where he focused on energy. His solar career started with his master's thesis, which led to working over 12 years at the North Carolina Clean Energy Technology Center at NC State University. While at the university, Tommy worked on nearly every aspect of solar energy; from teaching, to testing equipment, to research & development, to leading a statewide stakeholder group in the development of a template solar ordinance. During his time at NC State, North Carolina installed more photovoltaic ("PV") capacity than any state other than California, mostly in the form of 2-5 MW_{AC} utility-scale solar facilities covering around 40 acres each. Utility-scale solar was unfamiliar to the hundreds of communities around the state where the systems were proposed, and many of those communities had questions about the technology and its potential to harm public health or the environment in their community. Many of those questions found their way to Mr. Cleveland and he expanded his already broad knowledge of PV to research and find answers to the questions being asked. Over time he became an expert on the potential health and safety impacts of PV and was the lead author of the 2017 NC State white paper on the topic (pictured to the left). Since mid-2017 Mr. Cleveland has worked as a solar engineer at an energy engineering firm conducting interconnection commissioning of utility-scale solar and battery facilities for utilities in North and South Carolina. In this role Mr. Cleveland was the engineer responsible for (interconnection) commissioning over 60 PV sites and 4 battery sites.



Executive Summary



This report assesses the potential health and safety impacts of the proposed Turtle Cove Solar 60 MW_{AC} solar photovoltaic with battery energy storage project. The Turtle Cove Solar facility, located in Wayne County, North Carolina, will install crystalline silicon solar panels on single-axis tracking racks that slowly rotate each row of panels to follow the sun across the sky. Large central station inverters will convert the DC solar electricity generated by the solar panels into grid-synced AC electricity. Containerized battery systems, capable of storing and discharging energy, will be located at the system substation at the point of interconnection to the grid. Transformers will boost the voltage of the PV and battery inverters for connection to an onsite substation that connects to a transmission power line running through the project.

Photovoltaic (PV) panels are not new. They have been used and studied for over 40 years and are well understood by the scientific community. Utility-scale solar facilities are newer, but they too have been installed and studied for over a decade, and scientists also have a clear understanding of their function and impacts.

Utility-scale battery energy storage systems are newer still but have been maturing very quickly in the last few years. Turtle Cove Solar will use a leading lithium-ion battery technology from a top manufacturer.

Photovoltaic systems produce emission-free electricity. This replaces electricity production from fossil fuel power plants that produce harmful emissions. The health benefits of clean solar electricity are hard to put a dollar figure on, but the EPA's best attempt at doing just that puts the value in the Carolinas between 1.7 and 3.8 cents per kWh produced. Even at the bottom end of this range, this equates to approximately $2.3 million of public health benefit per year for the Turtle Cove Solar project, and over $69 million in 30 years.

The only identifiable risks to health and safety of the PV aspects of the Turtle Cove Solar project are not unique to solar but exist for any source or use of electricity. These are electric shock, arc flash, and fire. Due to world-class safety regulations in the U.S. and an experienced solar industry, these risks are extremely low, and the secure and isolated nature of ground-mounted PV facilities, including Turtle Cove Solar, results in minimal risk to the general public.

Common concerns about toxicity and EMF from solar facilities are understandable, but the operating characteristics and materials present in the equipment means that neither toxicity nor EMF pose a material risk to public health or safety. Research and experience regarding heat island effect and solar glare shows that, like other utility-scale PV projects, the Turtle Cove Solar project will not create either of these potential impacts. The single-axis trackers at Turtle Cove Solar that will keep the panels facing in the direction of the sun minimizes the potential for the project to create any glare.



Modern US battery codes and standards minimize the risk of fire, effectively removing the risk of explosion. A battery fire would damage equipment but due to the distance between the batteries and the public, a fire would not negatively impact public health or safety.

Based on my knowledge of engineering and science, personal experience with PV and battery technology, review of academic research, and review of project materials provided by Renewable Energy Services my findings and opinions are summarized as follows:

- The Turtle Cove Solar project will result in a significant reduction of regional air pollution.
- The Turtle Cove Solar project will not result in any negative impacts to public health or safety.
- The Turtle Cove Solar facility will not increase the temperature of the area surrounding the site.
- The Turtle Cove Solar facility is not expected to create any glare hazards or other negative glare impacts for aviation.
- The Turtle Cove Solar project is not expected to create bothersome noise for any neighbors.

Introduction

Purpose:

This report assesses the potential health and safety impacts of the proposed Turtle Cove Solar ("Turtle Cove") 60 MW_{AC} solar with battery energy storage (BES) project. It also seeks to educate readers on the health and safety impacts of photovoltaic and battery energy storage systems using accurate scientific sources of information, including providing resources for further reading.

Battery Assessment

FOLLOW THE BATTERY ICON FOR ASSESSMENT OF BATTERIES

System Overview: Solar with Batteries

The proposed Turtle Cove Solar facility is a utility-scale photovoltaic generation facility with lithium-ion battery energy storage. The energy storage is in the form of containerized battery systems with inverters separate from the PV inverters, which is referred to as "AC-coupled" batteries. The batteries will all be located in a single area near the point of interconnection to the grid. In general, the batteries are charged by solar during peak hours and discharged when there is little or no sun shining but grid electricity is in high demand, and it repeats this cycle daily.

Overview of Potential Impacts:

The proposed solar photovoltaic (PV) and BES system is likely to remain in operation at least 30 years, and this report considers its potential impacts in Wayne County from the start of construction onward, including decommissioning of the project and restoration of the land. This assessment considers all aspects of the project but focuses on those unique to solar with battery energy storage projects.

*Potential **Positive** Health and Safety Impacts:*

Every utility-scale PV project significantly reduces pollution by producing emission-free electricity that replaces electricity that otherwise would have been largely produced by burning coal and natural gas. Burning these fossil fuels for electricity production is a significant source of air, water, and soil pollution, so reducing their use is a clear public health benefit.

The US Environmental Protection Agency (EPA) conducted a study to determine how much pollution PV systems save and to estimate the public health value of the cleaner air, water, and soil they provide. These experts calculated that in the Carolinas, based on the sunshine available, the way electricity is produced, and the public health impacts of fossil fuel-fired electricity, every kilowatt-hour (kWh) of solar electricity produced provides 1.7 to 3.8 cents of public health benefit.[1] At this rate of benefit, **the Turtle Cove Solar project will produce $2.3 - $5.1 million of public health benefits every year**, which would add up to **$69 - $155 million over the life of the project**. The public health benefits of generating pollution-free electricity with PV are very significant.

It is relatively simple to replace a small amount of grid energy with utility-scale solar energy, but as the portion of grid energy provided by solar becomes more significant it becomes increasingly challenging to integrate more solar without sacrificing reliability or power quality. Energy storage is a simple solution to overcome most of these challenges, and recent cost reductions and increased experience makes it feasible to integrate significant energy storage into solar facilities. While many types of energy storage are technically possible, battery energy storage has proven to be most practical. So, the inclusion of battery energy storage in projects like Turtle Cove Solar improve the economics of the projects, such that some projects may not be feasible without the benefits of the batteries.

The positive benefits of photovoltaics are widely understood and well documented, so this report will not address them further. Furthermore, the positive public health impacts of the Turtle Cove Solar project significantly outweigh any health and safety risks, as described below. The ability of energy storage to facilitate increased solar energy on the grid is widely understood and well documented, but direct analysis of the positive benefits of a battery system is less common. A life

[1] US Environmental Protection Agency, Public Health Benefits-per-kWh of Energy Efficiency and Renewable Energy in the US: A Technical Report. 2nd Ed, May 2021, www.epa.gov/statelocalenergy/public-health-benefits-kwh-energy-efficiency-and-renewable-energy-united-states

cycle environmental impacts assessment of utility-scale battery energy storage in California found that when the positive and negative carbon impacts of batteries are considered, that the batteries reduce the carbon footprint of the grid due to the storage's ability to store and release solar energy that otherwise would have gone unproduced due to curtailment.[2]

Potential Negative Health and Safety Impacts:

All electricity generating facilities, including photovoltaics and batteries, provide some potential for negative health and safety impacts, however the Turtle Cove project does not present negative health and safety risks to the general public due to its location or technology (photovoltaic generation with battery energy storage). The only aspect of the PV portion of the system at Turtle Cove Solar that presents risk of physical harm is the potential for electrical shock, arc flash, or fire, which are hazards present with any electrical system and not unique to solar. There are several other aspects of PV systems that often raise public health and safety concerns, but no other aspect of PV systems poses any material risk of negative public health or safety impacts.

Like PV systems, battery systems also produce a limited electrical shock and arc flash hazard, however unlike PV systems, batteries also have the potential for toxicity, fire, and explosion hazards. While it is possible for lithium-ion batteries to catch fire, release toxic gases, and even explode, these hazards at the Turtle Cove Solar site do not pose any risk to the general public because the battery systems are outdoors and hundreds of feet from the closest neighbor.

The major health and safety risk of the project is not due to the solar or battery technologies but is standard construction hazards for construction workers building the site, which does not pose any safety risk to the general public.

Utility-scale PV is becoming a mature industry, but still rapidly growing. The underlying PV technologies of silicon and cadmium telluride have been studied in the laboratory and in the field for well over 30 years. So, the products, practices, regulations, and policies in the PV industry have a well-established base to build upon. Also, research literature on potential negative impacts of PV goes back decades. Modern utility-scale battery energy storage is a rapidly emerging industry, largely building on the success of lithium-ion batteries in consumer products and electric vehicles. So, the products, practices, regulations, and polices in the BES industry are changing extremely rapidly, often with technology change leading policy and regulations. Even though there have been years of experience with batteries in laptops and phones, stationary multi-megawatt battery systems are still somewhat new. The industry is only a handful of years old, with equipment to be installed in 2023 or later being much more mature than technology installed just 3 or 4 years ago. In that time, codes and standards have gone from being designed for small lead-acid battery emergency back-up power to being robust regulations built on several years of early BES experience with input from a wide array of battery stakeholders and experts. Just 3-4 years ago the regulations for stationary battery left system safety to the equipment manufacturers. During this "wild west" period of utility-scale BES development many valuable safety lessons were learned. See below for several publications on the potential health and safety impacts of battery energy storage systems.

Sources for Further Reading on Battery Impacts:

- Sandia National Lab: Grid-scale Energy Storage Hazard Analysis & Design Objectives for System, August 2020
- Energy Response Solutions, Inc.: Energy Storage System Safety: Comparing Vanadium Redox Flow and Lithium-Ion Based Systems, Aug 2017
- National Fire Protection Association (NFPA): Energy Storage Systems Safety Fact Sheet, June 2020
- New York State Energy Research and Development Authority: New York Battery Energy Storage System Guidebook for Local Governments, December 2020
- Electric Power Research Institute (EPRI): Energy Storage Integration Council (ESIC) Energy Storage Implementation Guide, March 2019
- Electric Power Research Institute (EPRI): Lessons Learned: Lithium Ion Battery Storage Fire Prevention and Mitigation – 2021, June 2021

[2] Balakrishnan, Brutsch, Jamis, et al, Environmental Impacts of Utility-Scale Battery Storage in California, 2019 IEEE 46th Photovoltaic Specialists Conference (PVSC), June 2019, www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/Environmental-Impacts-of-Utility-Scale-Battery-Storage-in-California.ashx

Evidence for the lack of any significant environmental, health, or safety impact of the proposed Turtle Cove project is provided by the required State Environmental Review Clearinghouse (the "State Clearinghouse") review, which is required as a part of the project's Certificate of Public Convenience and Necessity ("CPCN") application process. The North Carolina Environmental Policy Act of 1971 (G.S. 113A 1-13), also known as the State Environmental Policy Act ("SEPA"), defines the state policy designed to maintain and protect the state's environment. The statute requires state agencies to the fullest extent possible identify significant environmental effects of their actions and to implement measures to minimize negative effects. The State Clearinghouse consists of all applicable state agencies, who review and comment on every request for a CPCN. The State Clearinghouse includes the North Carolina Department of Natural and Cultural Resources, NC Wildlife Resources Commission, The Division of Waste Management, North Carolina Department of Agriculture and Consumer Services, and others. The Turtle Cove project has not yet applied for a CPCN, but before this required certificate is granted by the NC Utilities Commission, the State Clearinghouse must review the proposed project and find it to be in compliance with the North Carolina Environmental Policy Act.

In addition to the State Clearinghouse review, the Project has many environmental regulations and permitting processes that it must comply with. One notable environmental protection regulation is the Sedimentation Pollution Control Act of 1973.[3] This act requires construction projects, including utility-scale solar facilities, to meet requirements designed to keep sediment from entering our natural watercourses (e.g. streams, rivers, lakes, etc.) and to keep sediment from washing onto adjacent property. The North Carolina Department of Environmental Quality (DEQ) enforces the act through their local offices spread around the state, which includes requiring DEQ approval of a site-specific erosion and sedimentation control plan before disturbing any soil. The approved Erosion and Sedimentation Control plan must be adhered to throughout construction and until adequate groundcover to stabilize the soil is established.

This assessment report will address all the potential health and/or safety risks of the Turtle Cove project, including common concerns that have no potential for public health impact. Specifically, this report addresses the following possible negative impacts/concerns:

- Electrical Shock and Arc Flash
- Fire and Emergency Response
- Toxicity / Chemical
- Electromagnetic Fields (EMF)
- Heat Island Effect
- Glare and noise

To meet the Wayne County solar ordinance, Turtle Cove Solar will provide a 25ft-deep evergreen vegetative buffer between the project and adjacent residential areas. The project fence will be setback at least 50ft from the project's property line and from roads. This is a larger buffer than many existing solar facilities and most other land uses. This combination of setback and vegetative screening will largely separate the public from this project and minimize its impacts, including the visual/aesthetic impact of seeing the equipment.

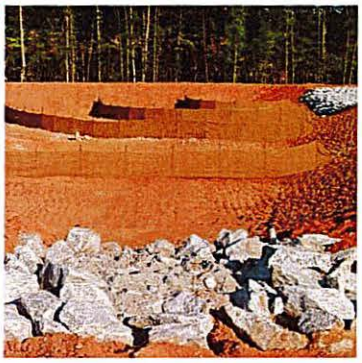
Before addressing each of these impact categories, this report provides an overview of utility-scale photovoltaic and battery energy storage equipment and facility construction and operations. These photos should help introduce utility-scale PV and batteries to any reader who has not toured a facility during construction or operation.

[3] North Carolina Environmental Quality webpage: Erosion and Sediment Control Laws and Rules, retrieved 2/8/2023, https://deq.nc.gov/about/divisions/energy-mineral-and-land-resources/erosion-and-sediment-control/erosion-and-sediment-control-laws-and-rules

Equipment, Construction, and Operations[4]

To understand the potential impacts of a utility-scale PV and battery system it is helpful to understand the components of the facility, as well as how a facility is constructed and maintained. The components and practices in this overview are typical of the industry and representative of the proposed Turtle Cove Solar project. The initial site work occurs first, but the order of the other construction steps is flexible and may occur concurrently.

Initial Site Work (construction entrance/driveway, sedimentation and erosion control installation, clearing and grubbing, potentially some grading, perimeter fence, and internal roads)


Underground Work (trenching for wires from PV combiner boxes to inverters, inverter pad installation, medium voltage cables to interconnection equipment)





PV Panel Structure/Racking (driving of steel piles, installation of racking "tables", installation of PV panels)

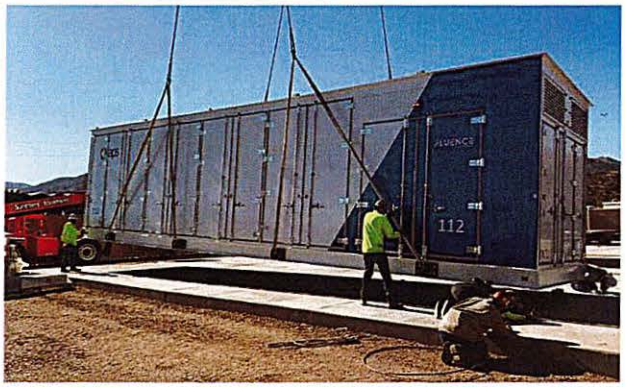


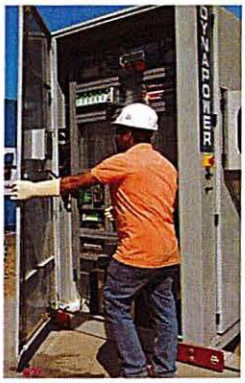


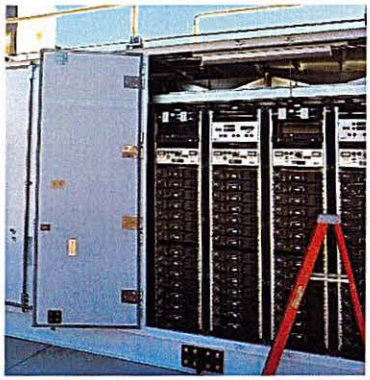
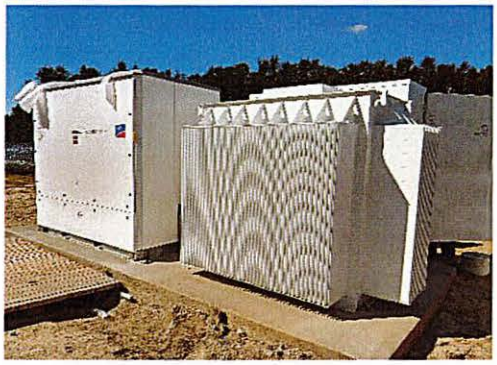
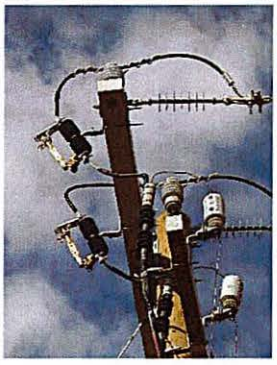
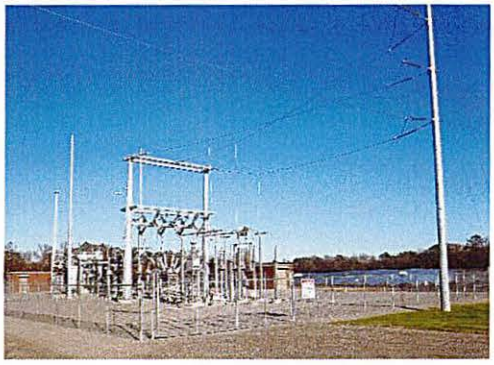
[4] Photo sources: author, ncre-usa.com, NC DEQ, blueoakenergy.com, solarbuildermag.com, hbc-inc.com, solarprofessional.com, enr.com, dynapower.com, ie-corp.com, ccrenew.com, and landiscontracting.com

Electrical Work (connection of PV module wiring, combiner boxes, inverters, batteries, transformers, interconnection facilities)

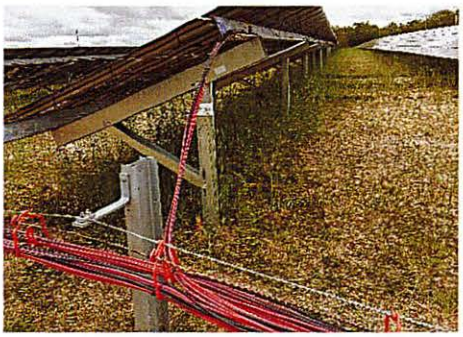




Establishment of Ground Cover (required to close out sedimentation and erosion control permit)




Operations and Maintenance (24/7 monitoring, vegetation maintenance, preventative maintenance)





Electrical Shock and Arc Flash

Any electricity over 50 volts presents an electrical shock hazard, including the electricity in PV and battery facilities. However, like electrical systems in buildings, the solar and battery facility must adhere to the National Electrical Code (NEC) and the equipment must be certified to the appropriate UL safety standards. Unlike buildings, members of the public are restricted from entering a utility-scale solar facility. To help ensure that only qualified people have access to the equipment, the NEC requires a secure perimeter security fence with electrical warning signs. The lack of public access coupled with the high U.S. electrical safety standards essentially eliminates the risk of electric shock for the public.



Figure 1. Perimeter Fence with Warning Signs

In circuits with significant available fault current there is another electrical hazard, called arc flash, which is an explosion of energy that can occur due to a short circuit. This explosive release of energy causes a flash of light and heat, creating a shockwave that can knock someone off their feet. The risk of arc flash in a solar and battery facility is no different than the risk at commercial or industrial buildings, except that solar facilities are much less accessible. Equipment with an arc flash risk require arc flash warning labels, and only trained personnel wearing the proper personal protective equipment are allowed in it. Due to the secure perimeter and the high U.S. electrical safety standards there is essentially no arc flash risk to the public.

Fire Risk and Emergency Response

Every electrical system has some risk of starting a fire, including electrical systems in residential, commercial, and industrial buildings. It is this hazard that motivated creation of the National Electrical Code over 100 years ago. Due to the high standard required by the NEC, modern electrical systems rarely start fires. Like electrical systems in buildings, ground-mounted photovoltaic systems and battery energy storage systems must also adhere to the NEC, including sections of the NEC with specific rules for PV and for batteries.

Fire Risk: Solar

In the rare case that a PV system has a fault that starts a fire, there is very little combustible material present for it to ignite. The only flammable portions of PV panels are the few thin plastic layers, the plastic junction box, and the insulation on its wires. The inverters are also capable of igniting, however like PV modules, they consist primarily of non-flammable materials.

The inverters and transformers are located on concrete pads or raised steel platforms that are isolated from other equipment and vegetation, so a fire in this equipment poses little treat of spreading.

Heat from a small flame is not adequate to ignite a PV panel, but an intense fire or an electrical fault can ignite a PV panel. One real-world example illustrating the low flammability of PV panels occurred during July 2015 in an arid area of California. Three acres of grass under a utility-scale PV facility burned without igniting the panels mounted just above the grass.[5] Another example occurred recently (2022) in Florida, where there was a 5-acre grass fire under a portion of a 400-acre PV facility that did not ignite any modules.[6]

Fire Risk: Transformers

The most significant fire hazard at a utility-scale solar facility may be the oil in the transformers. There are medium voltage transformers dispersed throughout the site located by each inverter, called inverter step-up ("ISU") transformers, and there is a large transformer in the interconnection substation, known as the generator step-up ("GSU") transformer. Traditionally these types of transformers are filled with a non-PCB mineral oil, which is derived from petroleum, and is electrically insulating but flammable. A popular alternative to mineral oil is a transformer fluid made of biodegradable vegetable oil, such as FR3 by Cargill or VG-100 by GE. This type of oil not only has several performance benefits over mineral oil, but it is also dramatically reduces the fire hazard of transformers. These vegetable oils' flash point of 330°C is dramatically hotter than mineral oil transformer fluid (160°C). Unlike mineral oil, FR3 and VG-100 are classified as a K-class, "high-fire-point", "fire-resistant", and "less-flammable" fluid. Also classified as "nonpropagating", it is self-extinguishing, and will not continuously burn if ignited. Mineral oil, however, will keep burning for hours when ignited, with no feasible way to stop it until all the oil is consumed. However, neither mineral oil- or vegetable oil-filled transformers create a fire hazard for the community or property surrounding the solar facility because even in a worst-case scenario of a transformer fire, this equipment is located in the middle of a field, far from other flammable materials and far from neighboring properties. Typically, the only thing at risk of being ignited by a transformer fire in a utility-scalar facility is the groundcover (i.e. grass, clover, etc.), which is only a risk in particularly dry conditions. A grass fire is relatively easy to control and poses negligible fire risk to the community.

There are best practices for how to prepare for and conduct an emergency response at a transformer. For example, see the NERC lessons learned document in the Sources for Further Reading at the end of this section.

Fire Risk: Batteries



Batteries can store a lot of energy, which makes them valuable but can also mean they have the potential to unintentionally release that energy very quickly, which can cause a fire or even lead to an explosion. The degree of fire risk varies greatly not only between battery chemistries but also between different battery systems. There have been some fires at utility-scale batteries in recent years in the US and around the world, however newer battery systems have learned from these experiences and have corrected many of problems that led to these early fires.[7] Our understanding of battery fires and how to avoid them has rapidly increased the last few years as experience has grown from near zero to many thousands of systems. With this experience has come improved battery systems and improved codes and standards.

Generally, all utility-scale batteries are packaged in outdoor-rated containerized enclosure with a battery management system (BMS) and any needed HVAC capabilities. By far the most common type of utility-scale battery is lithium-ion. While there are several different lithium-ion chemistries, all the varieties on the market today consist of cells that each contain a solid anode and cathode separated by liquid electrolyte, which is generally flammable. Many of these cells are connected into a module, several modules are connected in a rack, and several racks are connected in the containerized battery system. Each level has physical barriers and a protective battery management system.

The fire risk starts at the cell level, where if a cell faults or is abused in some way it often produces heat. It is possible for the heating to continue until the cell is generating heat more quickly than it can dissipate the heat, resulting in a rapid, accelerating rise in temperature, which is known as thermal runaway. When the cell reaches high temperatures, it vents

[5] Matt Fountain. The Tribune. Fire breaks out at Topaz Solar Farm. July 2015. www.sanluisobispo.com/news/local/article39055539.html
[6] WBMM News 13, Fire breaks out at Jackson Co. solar farm. August 2022, www.youtube.com/watch?v=byE_BpUX2mc
[7] EPRI, Lessons Learned: Lithium Ion Battery Storage Fire Prevention and Mitigation – 2021, June 2021
https://www.epri.com/research/products/000000003002021208

gases that are often flammable and toxic. The heat from a single cell in thermal runaway could cause nearby cells to also go into thermal runaway, causing more heat and the potential to drive more cells into thermal runaway. However, there are early warning signs of problems before there is any smoke or fire, allowing for automatic protection systems to act early enough to avoid the worst impacts and potentially avoid thermal runaway all together. The national electrical code (NEC) requires that the battery be certified to UL 1973, the battery safety standard for stationary batteries, which includes a requirement that the battery module does not allow fire outside of the module or any explosion. The NEC also requires the battery system to be certified to UL 9540 that addresses the safety of the entire battery system.

In addition to updated equipment standards, there are new installation standards, notability the (National Fire Protection Association) NFPA 855 Standard for the Installation of Stationary Energy Storage Systems which covers the "design, construction, installation, commissioning, operation, maintenance, and decommissioning of stationary ESS." This standard addresses everything from hazard assessment to emergency response planning, and determines when large scale fire testing per UL 9540A is required. UL 9540A is the U.S.'s "Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems", which was first published in late 2017 and has recently had a significant impact on the safety of battery systems. The test starts with a cell level test and only proceeds to module, unit, and installation level tests if the lower-level tests find a fire risk. The UL 9540A test for the cell level consists of attempts to cause the battery to burn or emit flammable gas. The abuse tests include driving a 2.5-inch nail through the battery, overcharging the battery to 200% of nominal charge, and short circuiting the positive and negative terminals of the battery. Any off gassing is captured and analyzed to determine the gases released, and the tests are videoed, with all this data included in the test results.

With lithium-ion batteries there is always some risk of fire, however when built and installed in compliance with the modern US battery safety codes and standards the risk of fire is extremely small and the risk of explosion is practically zero. Due to the isolation of the Turtle Cove Solar batteries from the public due to being located inside of the solar facility and proper emergency response planning and training, even a battery explosion would not impact the public. In a worst-case scenario of a large fire in a battery enclosure that destroys the entire unit, the only potential impact to the public is due to the smoke emitted by the fire. The smoke from a lithium-ion battery fire is very similar to the smoke from a fire of a similar mass of common plastics[8], which is more toxic than wood smoke and likely more toxic than the smoke from a burning building. However, at Turtle Cove Solar the significant distance from each battery enclosure to the nearest neighbors makes the potential health impact from smoke from a battery fire insignificant.[9]

Thus, there is very little chance of a fire in the batteries at Turtle Cove Solar, and even the worst-case situation of a fire in a single battery enclosure would not produce enough smoke for long enough to have a material impact on public health.

Emergency Response: Solar

No special equipment is required to respond to a fire incident at a utility-scale PV facility. The most important thing for first responders to know is that as long as the sun is shining on the PV panels they will produce voltage that is dangerous to touch, but there is no danger in touching undamaged panels. There are multiple electrical disconnect switches in PV systems which allows problem areas to be electrically isolated quickly.

Risks of fire associated with vegetative ground cover are reduced by landscaping plans that keep this vegetation low. Local emergency responders typically have access to open locked gates and training on the electrical hazards within the site. So, they are able to safely extinguish grass fires inside of the facility, or monitor and protect the areas surrounding the facility, to ensure the fire does not spread to surrounding areas. The solar facility is remotely monitored around the clock, and responding personnel are available for emergencies. The International Association of Fire Fighters (IAFF) provides online training on responding to fires at photovoltaic facilities at www.iaff.org/solar-pv-safety.

[8] Sandia National Laboratories, Grid-scale Energy Storage Hazard Analysis & Design Objectives for System Safety, August 2020, https://www.osti.gov/servlets/purl/1662020

[9] An example of toxic smoke impact analysis for a project using Tesla MegaPack lithium-ion battery with a church and residences approximately 200 feet from the batteries: Hazards Assessment Final Report Orni 34 LLC Battery Energy Storage System Prepared for Santa Barbara County, Nov. 2019, https://files.ceqanet.opr.ca.gov/257908-2/attachment/lD6EjpwCFrLAn_Z0Z-SNkEMFUIsW7hhYR-5owwCukaV4k_p5sk_bEIvYOC3UYKgeBtfprFm-FaYmK0eu0

Emergency Response: Batteries



No special equipment is needed to respond to a battery fire. In fact, many facilities direct firefighters to not fight the battery fire at all but to allow the fire to burn itself out. In this case, the site's emergency response plan likely calls for a defensive firefighting approach in which firefighters may spray adjacent equipment with water to ensure the fire doesn't spread beyond a single battery enclosure. When the plan calls for actively fighting the battery, the best method is to douse the fire with large volumes of water. The NFPA 855 installation standard requires that the facility create an emergency response plan and provide the plan and training to the local fire department. The appropriate first responders' actions will vary depending on the type of battery at the site, so it is vital that the facility create an emergency response plan specific to the equipment and procedures of that facility and educate the local fire departments on the equipment and the response plan. The National Fire Protection Association (NFPA) provides on-line training on PV and Energy Storage: https://catalog.nfpa.org/Energy-Storage-and-Solar-Systems-Safety-Online-Training-P20882.aspx

Sources for Further Reading on Fire and Emergency Response:

- Duke Energy: Fire Safety Guidelines for Rooftop- and Ground-Mounted Solar Photovoltaic (PV) Systems, September 2015
- North American Electric Reliability Corporation (NERC): Lessons Learned, Substation Fires: Working with First Responders, February 2019
- Sandia National Lab: Grid-scale Energy Storage Hazard Analysis & Design Objectives for System, August 2020
- Energy Storage Association (ESA), Operational Risk Management in the U.S. Energy Storage Industry: Lithium-Ion Fire and Thermal Event Safety, September 2019
- Electric Power Research Institute (EPRI): Energy Storage Integration Council (ESIC) Energy Storage Implementation Guide, March 2019
- Electric Power Research Institute (EPRI): Proactive First Responder Engagement for Battery Energy Storage System Owners and Operators, September 2021
- Tesla: Lithium-Ion Battery Emergency Response Guide, 2022 (Version 2.6)
- also see *Sources for Further Reading on Battery Impacts* on page 5 of this report



Toxicity (Equipment and Operations)

Toxicity is probably the most common health and safety concern about photovoltaic systems, although as detailed below the systems do not pose a material toxicity risk to the public or the environment. This report examines all possible sources of toxicity, from site construction to decommissioning at the end of the project life. The potential sources of toxicity are organized into two categories: equipment and operations and maintenance (O&M).

Toxicity: Equipment

The main equipment at a solar facility is PV modules (a.k.a. solar panels or PV panels), metal structures for mounting the solar panels, and wiring to collect the electricity they produce. The other major components are inverters and transformers. Inverters are enclosed power electronic equipment that do not contain liquids and are treated like other electronic waste at the end of their life. Transformers contain non-toxic mineral oil or vegetable oil and are no different than the typical transformers outside of most residences, schools, and shopping centers. Solar panels have raised the most public concerns related to toxicity, so they are covered in depth below, but since transformers contain liquid they are also addressed. The other components in the facility include the steel racking, the conduits (PVC plastic and galvanized steel), and copper and aluminum wires. The conduit and wires are normal construction materials. The racking for the PV panels is generally galvanized steel posts with galvanized steel or aluminum cross members. None of these supporting materials (wire, conduit, and racking) create a toxicity concern. The galvanized coating on the steel is a zinc coating, and zinc is a vital mineral for human health. PVC plastic and galvanized steel conduits and all types of copper and aluminum wiring have been building staples for many decades. These materials have not caused a toxicity concern in buildings where people are close to this

equipment day and night so there is no reason to think they have any risk of creating a toxicity concern when used at a utility scale solar facility.

Contents of PV Panels

The Turtle Cove Solar project will install top of the line silicon-based PV panels sourced from a reputable manufacturer meeting established criteria including third-party ratings for performance, reliability, and bankability (Bloomberg Tier I, the highest rating[10]). Specifically, the project plans to use a bi-facial monocrystalline silicon module. The project plans are designed based on 580 watt modules manufactured by Hanwha Q Cells, but other manufacturers make equivalent modules that could be used instead with no change in quality, should the project be unable to source that specific module. The PV panels are the most expensive and most important component in a solar facility, so the owner performs due diligence to ensure that the panels selected and delivered to the project are properly manufactured, certified, and tested.

The diagram below shows the components of a typical single-glass silicon PV panel, including a closeup of the solar cells and the electrical connections. Over 80% of the weight of a PV panel is the tempered front glass cover (or, front and back heat-strengthened glass) and the structural aluminum frame, which work together to create a strong, durable panel that outlasts its typical 25 to 30-year performance warranty. The encapsulation films are clear plastic lamination layers that protect the cells and electrical contacts from moisture for the life of the panel. These layers also maintain the panel as a single unit in the event of breakage of the glass cover(s), similar to the film in auto windshields that keeps them watertight and from fragmenting if the windshield shatters.

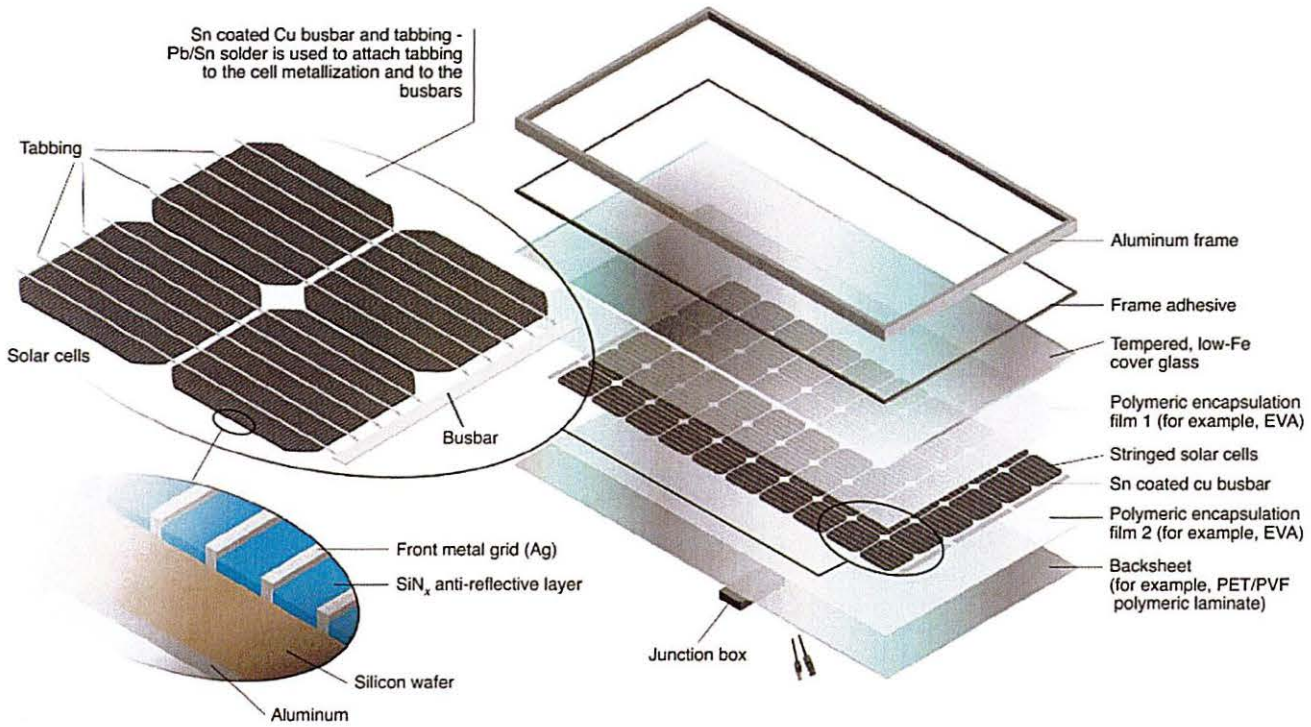


Figure 2. Contents of Framed Crystalline Silicon Panels (Source: NREL)

As can be seen in the above diagram, there are no liquids to leak from a broken panel. The plastic layers are inert. The silicon PV cells are nearly 100% silicon, which is harmless and is the second most common element in the Earth's crust. The only components of a PV panel that have any potential of toxic impact is the solder used to connect the solar cells together and to the busbars at the end of the panel, and the thin strips of silver that collect electricity from each cell. The solder, which is the

[10] The financial information firm Bloomberg has developed a tiering system for PV module makers based on bankability that is the standard the PV industry uses to differentiate between the hundreds of manufacturers of solar modules on the market. Tier 1 is the highest of three tiers, which are determined by banks' confidence in a manufacturer's PV panels as demonstrated by their willingness to supply project financing backed only by the assets of the project. The details are described by BloombergNEF in this document: PV Module Tier 1 List Methodology https://data.bloomberglp.com/bnef/sites/4/2012/12/bnef_2012-12-03_PVModuleTiering.pdf

same tin-lead solder standard in the electronic industry, is 36% lead. The tiny amount of silver in a panel does not create a toxicity hazard, but it does add potential recycling value.

Even though there is only a tiny amount of lead in each panel, the total amount of lead in all the PV modules in a utility-scale project adds up to a considerable amount of lead. However, these PV panels are spread out over a large area and when the amount of lead in the PV panels is compared to the amount of lead naturally occurring in the soil under the PV array, it is obvious that even if all the lead somehow leached out of every module (which as explained below is impossible), the increase in total lead in the soil would be less than the naturally occurring difference between different soils. Across the US soils naturally have between about 10 and 50 mg of lead per kg of soil, with the average being somewhere in the 20s. Across 83 USGS survey locations across N.C., the values ranged from 5 to 46 with an average of 20 and a median of 18.[11] For a location that naturally has 15 mg of lead per kg of soil, all the lead in all the PV modules in the facility would have the same amount of lead as just the top 4 inches of soil at the site.[12]



Figure 3. Contents of Cadmium Telluride Panels (Source: NREL); Front and Rear Photo of First Solar Series 7 CdTe Panels (Source: First Solar)

The leading alternative PV technology to silicon-based PV is Cadmium telluride (CdTe), which is by far the most common thin film PV technology. **While Turtle Cove Solar plans to use silicon modules and not any CdTe modules, this assessment report is still providing a basic introduction to CdTe modules in case a switch is necessary and because it is not uncommon for stakeholders to have confusion about the differences in the two technologies.** CdTe is referred to as thin film because the active layers are less than 1/10th the thickness of a human hair. Figure 3 above contains two images, on the left is a not-to-scale diagram of the layers for a CdTe PV module (thickness dimension provided in image), and the right image is a photo of two First Solar CdTe modules showing the back of one module and the front of another. The PV cells consist of an incredibly thin layer of cadmium telluride with an even thinner coating of cadmium sulfide (roughly 1/60th the thickness of the CdTe film). Above these active layers is a transparent conducting metal oxide, commonly tin oxide (SnO_2), and below the active layers is a layer of metal to conduct away the electricity. This thin stack is sandwiched between two sheets of heat-strengthened glass that provides electrical insulation and physical protection. Like silicon modules there is no liquid to leak. The only aspect of CdTe modules that raises toxicity concern is the cadmium in the cadmium telluride and cadmium sulfide. Cadmium is a toxic heavy metal, but when cadmium is chemically bonded to tellurium in the crystalline cadmium telluride compound, it has only 1/100th toxicity to humans of cadmium on its own (i.e. not bonded to another element in a compound, also known as free cadmium).[13] The compound cadmium telluride is very stable, so it does not easily break down into cadmium and tellurium.

---

[11] Smith, D.B., Cannon, W.F., Woodruff, L.G., Solano, Federico, Kilburn, J.E., and Fey, D.L., 2013, Geochemical and Mineralogical Data for Soils of the Conterminous United States: U.S. Geological Survey Data Series 801, 19 p., http://pubs.usgs.gov/ds/801/

[12] PV: 12 g of lead (per panel) per 65 ft^2 (panel footprint of 21.5 ft^2 / ground coverage ratio of 0.40) = 0.223 g of lead/ft^2
Soil: 15 mg of lead per kg of soil * 45 kg of soil per ft^3 * 4 inches (0.333 ft) soil depth * 65 ft^2 = 14.61 g of lead / 65 ft^2 = 0.225 g of lead/ft^2

[13] C. Miller, I.M. Peters, and S. Zaveri, Thin Film CdTe Photovoltaics and the U.S. Energy Transition in 2020, https://qesst.org/resources/thin-film-pv-report-2020/, June 2020

Cadmium telluride PV panels have been in use for decades, and their potential for creating a health hazard has been studied as long. As shown in the sections below and the some of the reading resources linked at the end of this section, CdTe panels are extremely safe and do not pose any risk to public health and safety, including when installed in large numbers.

Broken PV Panels

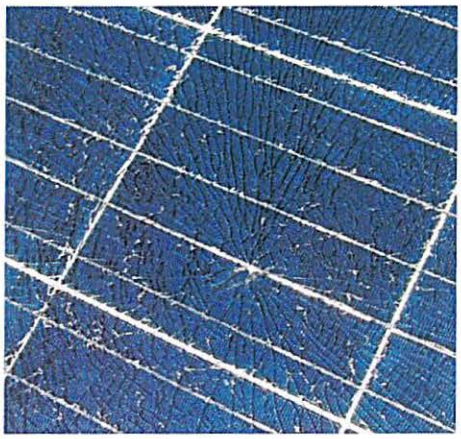


Figure 4. Close-up photo of impact point that broke the glass front of this PV panel

There is zero risk of toxicity escape from undamaged PV panels because any lead is sealed from air and water exposure. Individual panels damaged during the life of the solar facility are identified in days to months through either remote monitoring of system performance or from visual inspections during maintenance by onsite staff. In 2019 an international team of experts conducted an International Energy Agency - Photovoltaic Power Systems Programme (IEA-PVPS) study to assess if there is a public health hazard caused by lead leaching from the broken PV panels during the life of a utility-scale solar facility utilizing conservative assumptions to evaluate extreme scenarios.[14] The study examined worst-case exposure routes of soil, air, and ground water for a typical 100 MW_{AC} PV facility. For example, the worst-case residential groundwater exposure assumed that all broken panels from the entire array were within 25 feet of the groundwater well, and the chemicals released from every broken panel transported to the same groundwater well. The study found that worst-case lead exposure via air, soil, and water were each orders of magnitude less than the levels defined by the US Environmental Protection Agency (EPA) to have no adverse health effects. In the case of water, the health-screening level is the same as the maximum concentration level (MCL) set by the EPA for water quality in public water systems. This study demonstrates that there is no risk to public health from lead leached from broken PV panels.

PFAS

Some solar opponents have raised questions about the possibility of per- and poly-fluoroalkyl substances ("PFAS") chemicals being emitted by solar panels. PFAS chemicals are a group of man-made chemicals informally known as "forever chemicals" due to their durability in the environment. These chemicals have been used in many industrial and consumer products for over 60 years, including food packaging materials, firefighting foam, waterproof clothing, stain resistant carpet treatments, and thousands more.

As explained in a fact sheet from the University of Michigan entitled "Facts about solar panels: PFAS contamination", PV panels do not contain PFAS materials.[15] Neither the self-cleaning coating on top of the solar panel, the adhesives in the panel, nor the front or rear covers/substrates contain PFAS. The "backsheet", or traditional rear substrate of a silicon PV panel, is the thin opaque plastic layer on the rear of a single-glass PV panel that provides electrical insulation and physical protection for the rear of the PV cells. Polyvinyl fluoride (PVF) is the base material for the most common backsheet material (Tedlar), but several other materials have also been used as backsheets, some consisting of multiple layers. Depending on which definition of PFAS that is used, PVF may be classified as PFAS, however the most recent and applicable definition of what is and is not a PFAS material was created by the Organization for Economic Co-operation and Development (OECD)[16] in 2021 and PVF does not meet this modern PFAS definition[17].

---

[14] P. Sinha, G. Heath, A. Wade, K. Komoto, 2019, Human health risk assessment methods for PV, Part 2: Breakage risks, International Energy Agency (IEA) PVPS Task 12, Report T12-15:2019. ISBN 978-3-906042-87-9, September 2019

[15] "Clean Energy in Michigan" Series, Number 12, Facts about solar panels: PFAS contamination, By Dr. Annick Anctil, https://graham.umich.edu/media/pubs/Facts-about-solar-panels--PFAS-contamination-47485.pdf

[16] OECD is an intergovernmental organization with representatives of 38 industrialized countries. OCED developed the updated definition in response to an international call for "programmes and regulatory approaches to reduce emissions and the content of relevant perfluorinated chemicals of concern in products..." OECD Portal on Per and Poly Fluorinated Chemicals: www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/

[17] OECD (2021), Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance, OECD Series on Risk Management, No. 61, OECD Publishing, Paris. www.oecd.org/chemicalsafety/portal-perfluorinated-chemicals/terminology-per-and-polyfluoroalkyl-substances.pdf

However, not all PV panels even have a backsheet, in fact the trend in PV module design is to replace the backsheet with a thin sheet of glass so that the module has thinner front and rear sheets of glass instead of a thicker sheet of front glass and a thin plastic backsheet. Bi-facial modules like those planned for Turtle Cove Solar, require a clear glass covering on their back to allow light to reach the rear of the PV cells and therefore do not have a backsheet. Thus, the bi-facial modules at Turtle Cove Solar should not contain any PFAS, by any definition of PFAS.

PV Panel End-of-Life

PV panels last a very long time, but they do not last forever. Their output declines slightly each year, but panels rarely fail in less than 40 years. The expected economic life of utility-scale PV panels is 25-40 years, at which point they may be replaced by new panels or the entire project may be decommissioned, bringing the land back to how it was before the solar facility was installed. In both instances, the original PV panels are removed from the site. Although not required by the county, the project lease agreement with each landowner requires that the project provide a decommissioning security equal to 125% of the decommissioning cost (gross decommissioning cost minus salvage value) to ensure funds are available if needed for decommissioning the project. There are three possible fates for solar panels at the end of their economic life at a project:

- **Reuse**: When the PV panels at the Turtle Cove Solar project are decommissioned they will most likely still produce at least 75% of their original output and have another decade of productive life, making them most valuable to be reused as solar panels on rooftops or ground-mounted applications. Markets for used solar panels exist today and are likely to be much more mature and widely available in 30-40 years when the Turtle Cove Solar PV panels near the end of their life.
- **Recycling**: Any panels that are not reused as working panels could be recycled. Currently in the US, it is possible to recycle the largest constituents of silicon PV panels (glass, aluminum frame, copper wires) using the existing glass and metal recycling infrastructure. Today this recycling comes at a cost premium to disposing the panels in a landfill. However, as PV recycling technology improves and the number of panels reaching end-of-life increases dramatically, it is possible that in the future recycling PV panels will more than pay for itself. Recycling plants built specifically to recycle PV panels can recycle nearly 100% of the panel, including the valuable silver and refined silicon they contain, and can be optimized for the task, significantly reducing the cost to recycle each panel. In 2018 the first industrial-scale PV-specific recycling plant was built, in France, and in 2022 the first large scale PV recycling plant in the US was built. These initial PV recycling plants will not have the capacity to recycle the millions of installed PV panels, but in the coming decades it is expected that PV-specific recycling plants will become much more commonplace. PV recycling technology is clearly still in its infancy. However, it is expected that when the Turtle Cove PV panels reach the end of their useful life in 30+ years, the US PV recycling infrastructure will be robust, such that reuse or recycling of the PV panels will be the preferred options or required by new U.S. regulations, as it has been for years in Europe.

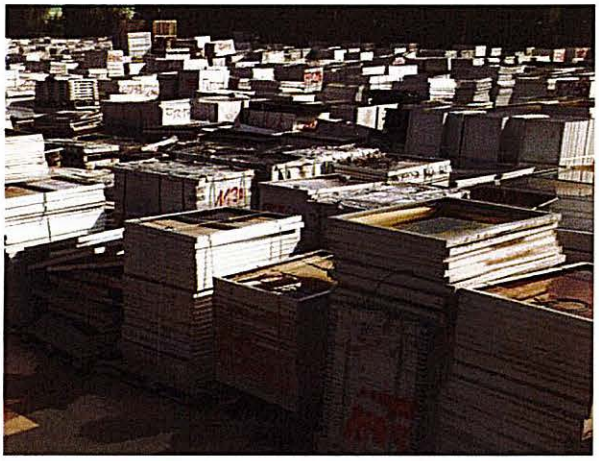


Figure 5. PV Panels Waiting to be Recycled (Source: LuxChemtech GmbH)

  The Solar Energy Industries Association (SEIA) started the SEIA National PV Recycling Program several years ago to accelerate PV recycling in the US. Currently the program aggregates the services offered by recycling vendors and PV manufacturers, making it easier for the industry to select a cost-effective and environmentally responsible end-of-life management solution. **The program identifies Preferred Recycling Partners through an evaluation process. These partners are capable of recycling PV modules, inverters, and other related equipment today**. The current SEIA PV Recycling Partners are listed on the program's website, and full access to the program and the Preferred Recycling Partners is available to SEIA members.

- **Disposal**: If panels are not reused or recycled, federal waste management laws (Resource Recovery and Conservation Act, RCRA) require that PV panels, like any other commercial/industrial waste, be disposed of properly, which would typically be in a landfill. In order to determine the proper disposal method, RCRA requires that all commercial/industrial waste be identified as either hazardous or non-hazardous waste, which is generally determined for PV panels using the

Toxic Characteristic Leaching Procedure (TCLP) test developed by the U.S. EPA. This test seeks to simulate landfill conditions and check for leaching of 8 toxic metals and 32 organic compounds. Limited data has been published about the TCLP test results of solar panels, but it is known that some older silicon panels that contain more lead than modern panels exceed the TCLP test limits for lead. Researchers at Arizona State University's Photovoltaic Reliability Laboratory have done the most robust investigation of methods for conducting accurate TCLP test on PV panels, and their latest research found that all three of the modern crystalline silicon PV panels tested passed the TCLP test, classifying them as non-hazardous waste.[18]

A worst-case scenario would be tons of PV panels being disposed of in a non-sanitary landfill, which is essentially a huge pile of garbage with little to no effort to minimize leaching from the waste. This type of landfill is illegal in many world regions, including in North Carolina. A recent IEA-PVS research study on PV panels disposal risks used this worst-case situation to evaluate the potential for cancer and non-cancer hazards through comparison of predicted exposure-point concentrations in soil, air, groundwater, and surface water with risk-based screening levels created by the EPA and the World Health Organization (WHO).[19] One the report's authors, Gavin Heath with the US Department of Energy's National Renewable Energy Laboratory (NREL), summarized their findings about lead in silicon PV panels this way: "under the worst-case conditions, none of them exceeded health-screening thresholds, meaning they're not deemed to potentially have significant enough risk that you'd want to do a more detailed health risk assessment."[20] The worst-case scenario defined in the research has many conservative assumptions, and thus likely overestimates the risk of disposal in a *non-sanitary* landfill. It is important to stress that North Carolina only allows solid waste disposal in sanitary landfills, which are engineered facilities with plastic liners, leachate collection systems, and covers, all of which dramatically reduce the potential for human exposure compared to the non-sanitary landfill assumed in the study. This and other research show that if the Turtle Cove Solar PV panels are disposed of in a landfill they will not create any negative public health impact.

In 2019 the North Carolina legislature passed HB 329 (S.L. 2019-132), requiring the NC Department of Environmental Quality ("DEQ") to prepare a report to guide rulemaking regarding decommissioning of solar PV and other renewable energy facilities and proper disposal of their equipment. The report issued January 1, 2021 and titled *Final Report on the Activities Conducted to Establish a Regulatory Program for the Management and Decommissioning of Renewable Energy Equipment*, provides a thorough discussion addressing many questions landowners and communities may have about solar decommissioning. DEQ compiled the input and commentary of numerous stakeholders, including the renewable energy industry, environmental organizations, and academia, including the author and NC State University's Clean Energy Technology Center. The report is well researched and very informative. DEQ provides several key findings and recommendations, but no recommendations for changes in NC regulations of solar facilities. **One of the report's key findings is that "According to Division of Waste Management experts, if every end-of-life PV module is disposed of in landfills, landfill capacities will not be negatively impacted."**

In South Carolina in 2021, the South Carolina legislature required the SC Department of Health and Environmental Control (DHEC) to prepare a report similar in scope to the NC DEQ report published 2021. While this report does not have any impact on regulations at Turtle Cove, stakeholders may find value in the report. SC DHEC was required to prepare a report on research and recommendations on End-of-Life Management of Photovoltaic Modules and Energy Storage Systems, addressing six specific issues laid out by the legislature. The 50-page report titled *Final Report on the Activities Conducted to Establish a Program for End-of-Life Management of Photovoltaic Modules and Energy Storage Systems* was issued June 30, 2022. **The report describes end-of-life of PV modules topics that align with the content of this health and safety assessment, including the following conclusions: "The Department of Health and Environmental Control believes it is in the best interest of South Carolina to continue to promote the use of solar energy in our state to decrease energy costs, promote economic development, increase consumer choice in energy consumption and hopefully reduce pollution and emissions."** The report continues, "We must also be sure not to compromise human and environmental health in the process

[18] Tamizhmani, G., et al. (2019). Assessing Variability in Toxicity Testing of PV Modules. In 2019 IEEE 46th Photovoltaic Specialists Conference (pp. 2475-2481). Institute of Electrical and Electronics Engineers Inc.. https://doi.org/10.1109/PVSC40753.2019.8980781
Publicly-accessible version: dev-pvreliability.ws.asu.edu/sites/default/files/93_assessing_variability_in_toxicity_testing_of_pv_modules.pdf
[19] P. Sinha, G. Heath, A. Wade, K. Komoto, Human health risk assessment methods for PV, Part 3: Module disposal risks, International Energy Agency (IEA) PVPS Task 12, Report T12-16:2020. ISBN 978-3-906042-96-1, May 2020
[20] Green Tech Media, Landfilling Old Solar Panels Likely Safe for Humans, IEA Research Suggests, April 2020, www.greentechmedia.com/articles/read/solar-panel-landfill-deemed-safe-as-recycling-options-grow

of installing and decommissioning solar energy facilities." Throughout the report DHEC suggests commonsense approaches to ensuring the long-term safety of utility-scale solar based on state and federal regulations.

Transformer Oil

While PV modules and inverters do not have any liquids that could leak into the environment, the generator step-up (GSU) transformer in the substation and the inverter step-up (ISU) transformers located with each inverter do contain an oil. Several types of oil can be used in transformers to provide the needed electrical insulation and cooling, but the most common type of transformer oil is mineral oil, which has been used in transformers since transformers were first manufactured in the 1890s. Due to the large volume of oil contained in a GSU transformer, they are installed with a secondary containment structure under them to contain any oil leaked or spilled. The smaller ISU transformers are approximately the same size as the transformers located throughout every community; behind schools, shopping centers, apartments, etc., and they typically do not provide secondary containment. However, ongoing monitoring of transformer temperature and pressure, and regular preventative maintenance, is likely to find the rare leak when it is still small before it has a chance to leak much oil.

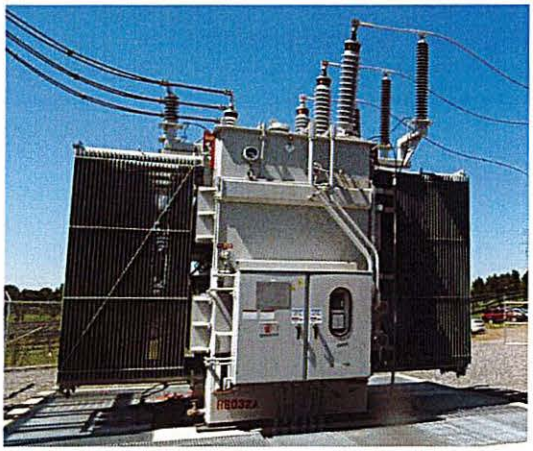


Figure 6. GSU Transformer with Secondary Containment to Capture any Leaked Oil

There was a time when most transformer oil was toxic. From 1929 to 1977 polychlorinated biphenyls (PCBs), a man-made alternative to mineral oil, was commonly used as transformer oil instead of mineral oil. However, the toxicity of PCBs was eventually understood, leading to PCBs being banned in the US in 1979. Today, transformers either use mineral oil or vegetable oil, both of which are free of PCBs. Mineral oil is non-toxic to humans, in fact "baby oil" that is commonly used to soothe babies' skin is a scented mineral oil. Although non-toxic to humans, mineral oil is an environmental contaminate and harmful to aquatic ecosystems, so any release to the environment should be avoided. The potential for negative environmental impact from spilled vegetable oil is much less because these oils are biodegradable, so the time they impact the environment is short-lived. Federal regulations dating back to the Clean Water Act of 1973 require that facilities with significant quantities of oil prevent pollution of water.[21] The current EPA regulations require that facilities with over 1,320 gallons oil, and with the potential for spilled oil to impact surface water, develop and implement an oil spill prevention, control and countermeasure (SPCC) plan. While the risk of negative environmental impact from a transformer oil spill/leak cannot be eliminated entirely, these regulations along with standard industry practices result in a low probability for a substantial spill and a high probability for a quick clean-up response to minimize impact if a spill were to ever occur.

Contents of Batteries

The components of lithium-ion batteries vary because there are many different battery chemistries in use and several different cell construction types. And while lithium itself is non-toxic, some lithium-ion batteries do include some toxic heavy metals such as cobalt, nickel, or manganese. During the operational life of the batteries any metals in the cells are sealed inside of the batteries and thus have no impact on human health. The solvent-based liquid electrolyte in each cell is very difficult to get to leak out of a cell and will quickly evaporate if it does. In addition to the battery cells, the battery system also includes a battery management system that consists of sensors, switches, and similar controls equipment. The battery enclosure is typically an outdoor-rated steel enclosure.

Batteries End-of-Life

The performance of stationary batteries slowly degrades, eventually resulting in enough reduction of energy capacity that the battery is considered to have reached the end of its life. The expected lifespan of lithium-ion batteries is on the order of 10 to 20 years.

[21] Environmental Protection Agency, webpage: Overview of the Spill Prevention, Control, and Countermeasure (SPCC) Regulation, www.epa.gov/oil-spills-prevention-and-preparedness-regulations/overview-spill-prevention-control-and

At the end of its life the batteries will be safely decommissioned, which will involve de-energizing the batteries to a low voltage, disconnecting each battery module from the system, removing battery modules and associated components, preparing the list of materials and components for removal, disposal, or recycling, and then shipping them to their next location. Transport of some battery components, including shipping via a shipping provider, is regulated by the United States Department of Transportation (U.S DOT).

Most of the non-battery components of the system have readily available scrap markets, such as steel, aluminum, and copper. Much like end-of-life PV modules, end-of-life batteries can be repurposed for second life applications, recycled, or landfilled.

- **Recycling** – Lithium-ion batteries are recyclable. Currently only a small percentage of lithium-ion batteries are recycled, but that is changing very quickly. The US is just starting to build facilities that can fully recycle lithium-ion batteries into battery constituents ready to build new lithium-ion batteries. While there are many challenges to creating a robust, cost-effective collection and recycling industry for lithium-ion batteries, it does appear to be technically possible. The US Department of Energy as well as several industry groups and private companies are investing in research and development that they hope will lead to widespread recycling of lithium-ion batteries in the US.

- **Disposal –** When batteries are not repurposed or recycled, batteries are disposed as waste. Battery disposal is governed by EPA Universal Waste rules, which require waste handlers to separate hazardous materials for disposal under federal laws but allow the disposal of the remaining non-hazardous waste per state and local requirements. Once the fire risk is removed from the batteries (either by mechanical or chemical means), non-hazardous materials not recovered for reuse or recycling can be disposed of through municipal waste streams. While some lithium chemistries are considered non-hazardous, many batteries have toxic constituents that require treatment as hazardous materials. The potential toxicity of Li-ion battery materials varies widely by chemistry; for example, where nickel, cobalt, or lead are present in battery chemistries in significant quantities, precautions must be taken at disposal or incineration sites in line with the hazards of those individual materials.[22]

Toxicity: Operations & Maintenance

The operations and maintenance (O&M) activities for a solar and battery energy storage site are rather limited. Often the most significant effort is maintenance of the vegetation on the site. The PV equipment and the battery equipment require some, but limited, scheduled and unscheduled maintenance.

Site and Solar Operations & Maintenance

The only two aspects of operations and maintenance (O&M) of solar system that have raised concerns about toxicity are the fluids used to wash PV panels and herbicides used to maintain vegetation.

- **Panel Washing** – Across North Carolina there is ample rain to keep the panels clean. If the panels need to be washed, it would occur infrequently and typically with use of only deionized water and cleaning brushes.

- **Herbicides** – The industry standard practice for maintaining the vegetation at solar facilities is similar to how most cities maintain their city parks, which is they primarily rely on mowing and string trimmers for vegetation management, and use herbicides along fences, in roads, and around some equipment. Parks and solar facilities also use herbicides to strategically remove problem weeds, especially woody weeds, to maintain a healthy cover of the desired species of grasses and other low-growing vegetation. This mode of herbicide use applies significantly less herbicide volume than is commonly applied in NC agriculture. For example, Round-Up-Ready crops are common row crops that have been engineered for the entire field, including the crops, to be sprayed with Round-Up (glyphosate) several times each season. Additionally, farmers applying most types of herbicides to their fields are not required to be certified or licensed, but a NC commercial pesticide applicators license is required to apply any herbicide to a solar facility.

[22] Energy Storage Association (ESA), End-of-Life Management of Lithium-ion Energy Storage Systems, April 2020, https://energystorage.org/wp/wp-content/uploads/2020/04/ESA-End-of-Life-White-Paper-CRI.pdf

Batteries Operation and Maintenance

Battery operation does not produce any emissions, and they require very little maintenance during their operating lifetime. The battery systems require some scheduled maintenance for things like cleaning HVAC air filters and annual or semi-annual visual checks of electrical connections. Some systems use an anti-freeze liquid coolant that might require replacement during the life of the system, but this does not pose a health or safety hazard.

Sources for Further Reading on Toxicity/End-of-Life:

- International Renewable Energy Agency (IRENA): End-of-Life management: Solar Photovoltaic Panels, June 2016
- Electric Power Research Institute (EPRI): Environmental and Economic Considerations for PV Module End-of-Life Management, December 2018
- EPRI: Feasibility Study on Photovoltaic Module Recycling in the United States, April 2018
- EPRI: Solar Photovoltaics End of Life Management Infographic, March 2021
- National Renewable Energy Laboratory (NREL): A Circular economy for PV system materials, April 2021
- North Carolina Department of Environmental Quality: Final Report on the Activities Conducted to Establish a Regulatory Program for the Management and Decommissioning of Renewable Energy Equipment, January 2021
- Energy Storage Association (ESA): End-of-Life Management of Lithium-ion Energy Storage Systems, April 2020
- EPRI: Lithium Ion Battery Energy Storage End of Life Management Infographic, April 2021
- ReCell Center: A national collaboration of industry, academia and national laboratories working together to advance recycling technologies along the entire battery life-cycle for current and future battery chemistries (website)
- NAATBatt: Laws, Regulations and Best Practices for Lithium Battery Packaging, Transport and Recycling in the United States and Canada (webpage)

Electromagnetic Fields (EMF)

Exposure to EMF, or electric and magnetic fields, is a fact of everyday modern life. Electromagnetic fields come in many different frequencies, ranging from grid electricity with a frequency of 60 hertz to x-rays and gamma rays that are billions of billions of times faster. The faster the frequency the stronger the EMF. The EMF coming from grid electricity, including from the inverters, transformers, and AC wires to be used at the Turtle Cove Solar facility, has much lower frequency and therefore much lower energy than the EMF from cell phones, wireless internet, and even radio and TV towers. The solar panels, the batteries, and the wires connecting both of them to the inverters carry direct current (DC) electricity, which has a frequency of zero hertz, and thus produces static electric and magnetic fields. The voltage and current of these circuits are both relatively low, so the electric and magnetic fields they produce are both rather weak. The static magnetic fields the PV panels generate are much weaker than the Earth's natural static magnetic field, which can be demonstrated by a compass still pointing north when placed near the panels.

Electric fields are created around wires and equipment wherever a voltage exists, however it is easily blocked with common materials such as metal, wood, and soil. The World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to electric fields (0 to 100,000 Hz) at levels generally encountered by members of the public.[23] The proposed solar project does not produce any voltages higher than the existing power lines, and therefore does not produce any electric fields not generally encountered by members of the public.

Magnetic fields are the other aspect of EMF, and they are created by electric current. Typical Americans are exposed to about 1 milligauss of magnetic field from grid electricity (60 Hz) on average during their day, primarily from sources at homes and work[24]. The primary source of magnetic fields in a solar facility are the inverters and the short section of wires between each central inverter and its step-up transformer. To convert direct current to alternating current, inverters use a series of solid-

[23] WHO factsheet: Electromagnetic fields and public health, Exposure to extremely low frequency fields, June 2007, www.who.int/peh-emf/publications/facts/fs322/en/

[24] World Health Organization (WHO), webpage: Electromagnetic Fields – Typical exposure levels at home and in the environment, www.who.int/peh-emf/about/WhatisEMF/en/index3.html

state switches that turn off and on several thousand times a second, creating EMF in the range of 5 kHz to 100 kHz, which is much faster than the 60 Hz of grid electricity but still much slower than even the lowest frequency radio signals. The highest electrical current of any portion of the solar facility occurs in the inverters, ISU transformers, and the few feet of wire between them, making this the source for the strongest magnetic fields in the facility.

Since the strength of a magnetic field decreases dramatically with increasing distance from the source, these magnetic fields only extend about 50-300 feet from the inverter and ISU transformer, at which point the magnetic fields would be expected to measure less than 0.5 milligauss, which is less than half the typical American's average 60 Hz EMF exposure over a day.[25, 26] The locations of the inverters and ISU transformers at the Turtle Cove project have not yet been identified, although the location of these equipment pads are generally located closer to the interior of the project than perimeter of the project, so they are likely to be closer than 300 feet from nearby homes. Similarly, the magnetic fields from substations generally do not extend far enough to leave the fence around the substation, so the same can be expected for the Project's substation.[27]

The bottom line is that the EMF from the Turtle Cove Solar PV system is unlikely to leave the solar site boundary, and thus is not expected to increase the EMF exposure of any neighbors. Even if some EMF from the PV facility were to extend beyond the fenced perimeter of the site, there would still be no public health impact because low levels of extremely low frequency (ELF) EMF exposure are not harmful to humans. After extensive study of the potential health impacts of EMF from grid electricity the World Health Organization (WHO) concludes:

> *"Despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health."*[28]

Sources for Further Reading on EMF:

- Electric Power Research Institute: EMF and Your Health: 2019 Update, December 2019
- World Health Organization: Electromagnetic Fields (accessed September 2022)

Heat Island Effect

The localized effects of large-scale PV facilities on temperature and moisture are not yet well understood. However, the localized micro-climate effects of large-scale PV facilities are understood well enough to determine that they do not create a heat island effect similar to the well-documented urban heat island effect from dark, massive, surfaces in urban environments, such as asphalt paved streets and parking lots, that cause urban areas to be significantly warmer than the surrounding rural area during the day and night. The changes that solar panels may make to the way land absorbs, reflects, and emits the energy from sunlight are minimal compared to the changes created by buildings, vehicles, and many miles of concrete and asphalt. By comparison, solar panels absorb and reflect a similar amount of solar energy as vegetation and soil. Solar panels are lightweight and cannot store large amounts of thermal energy, and the ground remains covered in vegetation with its natural exposure to air and water.

Initial research into the potential for PV systems to cause a heat island effect have used a variety of techniques, including conceptual energy flow calculations, advanced fluid dynamic computer simulations, and field measurements of

[25] Study of Acoustic and EMF Levels from Solar Photovoltaic Projects. Tech Environmental, Inc., December 2012, https://www.masscec.com/resources/study-acoustic-and-emf-levels-solar-photovoltaic-projects
[26] EPRI technical report, Electric and Magnetic Field Exposure Levels (0 to 3 GHz) in Occupational Environments near Photovoltaic Energy Generation Facilities, November 2012, https://www.epri.com/research/products/1023797
[27] www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf
[28] World Health Organization (WHO), webpage: Electromagnetic Fields – Summary of health effects, www.who.int/peh-emf/about/WhatisEMF/en/index1.html

temperature.[29, 30, 31] This research found a range of different effects on temperature, but none indicate that a large PV system could affect the temperature of the surrounding community. Most found that compared to similar undeveloped land the air temperature in a solar facility increases during the day, but the nighttime results were mixed. Some studies found PV sites to be cooler than non-PV sites at night, but others found them to be warmer. Much of this variation is likely explained by the different climates studied but may also be due to the different methods of the studies. Much of the research on solar heat island effect occurred in arid regions of the U.S. southwest where the results are unlikely to translate perfectly to wetter climates in the southeast. In a written statement of evidence Greg Barron-Gafford, leading solar heat island effect researcher, says that he expects that when the area under the PV array is vegetated with grass that the localized heat island effect his research found in dry climates will be greatly reduced.[32]

The available studies agree that the slight increase of air temperature in the PV site dissipates quickly with height and distance from the panels as natural processes remove and spread the heat. As a result, any temperature increase that may occur at the Turtle Cove Solar project during the day will be limited to the site and will not increase the temperature of any of the surrounding community.

Sources for Further Reading on Heat Island Effect:

- EPA: Learn About Heat Islands, (accessed September 2022)

Glare

Photovoltaic panels are designed to absorb, and thus not reflect, the solar energy that they receive. However, when sunlight strikes the glass front of a solar panel at a glancing angle a significant portion of the solar radiation is reflected, which can potentially lead to solar glint (a brief flash) or glare. Glint or glare can temporarily impact a person's vision, including pilots landing aircraft, or motorists driving vehicles. However, the conditions required for a PV project to create glare rarely occur. PV facilities, such as Turtle Cove Solar, that utilize single axis trackers to slowly rotate the solar panels to follow the sun have even less potential to create glare because the trackers help avoid a situation where sunlight hits the panels at a glancing angle. Most modern trackers implement an advanced control strategy known as "backtracking" that increases the electricity production of the site by flattening the tilt of the panels early and late in the day to keep the rows of solar panels from shading one another. Backtracking can result in brief periods near sunrise and sunset where the sun strikes the panels at a glancing angle, creating a situation that could result in a few minutes of visible glare at sunrise and sunset. For anyone to see this glare they must be looking across the solar panels in the direction of the rising or setting sun, which is a situation where the sun obviously will create significant glare for the viewer with or without the solar project.



Figure 7. 20 MW PV System at Indianapolis International Airport (Photo source: inhabitat.com)

A clear indication of the ability to avoid glare problems from large ground-mounted PV systems are the PV systems installed on airports across the U.S., including Denver International and Indianapolis International. While there is the potential for a PV

[29] Broadbent, Ashley & Krayenhoff, Eric & Georgescu, Matei & Sailor, David. (2019). The Observed Effects of Utility-Scale Photovoltaics on Near-Surface Air Temperature and Energy Balance. Journal of Applied Meteorology and Climatology. 58. 10.1175/JAMC-D-18-0271.1.
[30] Barron-Gafford, G. A. et al. The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures. Sci. Rep. 6, 35070; doi: 10.1038/srep35070 (2016).
[31] V. Fthenakis and Y. Yu, "Analysis of the potential for a heat island effect in large solar farms," 2013 IEEE 39th Photovoltaic Specialists Conference (PVSC), Tampa, FL, 2013, pp. 3362-3366, doi: 10.1109/PVSC.2013.6745171.
[32] G. Barron-Gafford, Statement of Evidence by Greg Barron-Gafford on Solar Heat Islanding Issues, May 2018, www.planning.vic.gov.au/__data/assets/pdf_file/0024/126555/301-Expert-Witness-Statement-of-G-Barron-Gafford-PVHI-May-2018-Lemnos.pdf

system to create glare, there is also the ability to predict when and where a system may create glare and incorporate any needed mitigation before construction. The Federal Aviation Administration (FAA) and the U.S. Department of Energy (DOE) developed specialized solar glare analysis software to predict when and where a PV project may produce glint or glare for sensitive receptors nearby. That original software technology has been licensed to a 3rd firm (Forge Solar) that continues to improve and refine the software, which has been validated to accurately predict solar glare.

In May of 2021, the FAA replaced the long-standing interim solar glare policy with a (final) policy that no longer restricts solar developed on airport property from creating glare visible to pilots. The policy explains that the new acceptance of glare visible to pilots is in recognition that pilots often experience glare during landing from bodies of water and that glare from solar is not meaningfully different.[33] The new policy does still prohibit on-airport PV systems from creating any glare visible in an air traffic control tower. While the FAA policy only applies to PV developed on airport property, it is reasonable to follow the same policy for PV plants sited near airport property.

The two closest airports in the National Plan of Integrated Airport Systems (NPIAS)[34] are the Wayne Executive Jetport (GWW) and Kinston Regional Jetport (ISO). Wayne Executive Jetport is approximately 8 miles northwest of the closest solar panel and Kinston Regional Jetport is over 11 miles southeast of the closest solar panel. Kinston Regional Jetport has an air traffic control tower, but Wayne Executive Jetport does not have a control tower. Previous conservative FAA guidance was to conduct a software glare hazard analysis when a PV facility is proposed within 5 nautical miles (5.75 miles) of an airport.[35] With both airports being over 8 miles away from the project and the closer airport, Wayne Executive Jetport, not having an air traffic control tower, there is no chance for Turtle Cove to create a glare hazard at these airports. However, there is a military air base, Seymour Johnson Air Force Base, located somewhat closer, approximately 7 miles southwest of the closest solar panel. Due to the proximity of this air base, the Turtle Cove project plans to have a third-party engineer conduct a software glare hazard analysis of the project, however the result of this glare study are not yet available. Due to the distance from the air base, and the tracking design of the solar array, the author expects that the study will find no potential for Turtle Cove to create a glare hazard for aviation.

Sources for Further Reading on Solar Glare:

- National Renewable Energy Laboratory (NREL): Research and Analysis Demonstrate the Lack of Impacts of Glare from Photovoltaic Modules, July 2018
- ForgeSolar: PV Planning and glare analysis software help documentation, (accessed September 2022)

Noise

Solar panels are silent, but some of the other components of a PV system produce some sound, although they are rarely heard by anyone outside of the project fence. The loudest equipment is the inverters, but the transformers and tracking systems also make some sound. These numerous sources of sound are dispersed throughout the facility, but the physics of sound are such that these dispersed sources of sound are non-additive. For example, if there are 50 inverters spaced across a utility-scale solar facility and you are close enough to hear some inverter noise, you could turn off the 49 inverters farthest from you and you likely wouldn't notice the difference between the sound from 1 inverter and the sound from 50 inverters. Even if two inverters are right next to each other and an even distance from you, the perceived volume of the sound coming from the two inverters is very similar to the sound from just one inverter. So, the potential for someone offsite to hear any sound generated inside a utility-scale PV project is determined by the closest and loudest source of sound. Thus, some simple

[33] "Federal Aviation Administration Policy: Review of Solar Energy System Projects on Federally-Obligated Airports", https://www.federalregister.gov/documents/2021/05/11/2021-09862/federal-aviation-administration-policy-review-of-solar-energy-system-projects-on-federally-obligated

[34] The National Plan of Integrated Airport Systems (NPIAS) identifies nearly 3,310 existing and proposed airports that are included in the national airport system. The NPIAS contains all commercial service airports, all reliever airports, and selected public-owned general aviation airports. www.faa.gov/airports/planning_capacity/npias

[35] NC Template Solar Ordinance, Appendix F: Airports. https://nccleantech.ncsu.edu/wp-content/uploads/2018/06/NC-Template-Solar-Ordinance.pdf

analysis of the sound coming from the closest sources to a point of interest, such as a home, can effectively estimate the level of sound from the PV project at that location.

Before providing site-specific analysis of the potential for noise impacts from the Turtle Cove project, it is useful to put the sound from the PV project in context. Our world is full of sounds, day and night, even in quiet rural areas, and any sounds from the PV project would be in concert with the existing sounds. The appropriate analysis metric is not if the sounds are audible, but if they are noticeable or bothersome, and US and international organizations have published guidance on this topic based on research on how sound impacts the public.

In 1972, the US passed the Noise Control Act, which required the EPA to define criteria for protecting the public health and wellbeing from noise interference. In response, the EPA developed guidance that included recommended sound levels limits at residential structures (or places in which quiet is a basis for use)[36]. This guidance recommends that noises at residences be limited to 55 dBA L_{dn}, where L_{dn} is the average sound level of a 24-hour period with the inclusion of a 10-dB penalty during the nighttime hours of 10PM to 7AM. So, the 55 dBA L_{dn} limit could be met with 55 dBA daytime noise and 45 dBA nighttime noise, or a 24-hour noise (L_{eq}) of 48.6 dBA. In addition to the EPA guidance, the United Nations WHO published "Guidelines for Community Noise" (1999) which suggested daytime and nighttime protective noise levels, which are to be applied outside the bedroom window.[37] During the day (7AM to 11PM), the equivalent continuous sound level threshold to protect against serious annoyance is 55 dBA L_{eq}, and 50 dBA L_{eq} to protect against moderate annoyance. During the night (11PM to 7AM), the averaged equivalent continuous sound level threshold is 45 dBA L_{eq}. So, the EPA and the WHO recommend similar daytime noise limits (~55 dBA and 55 to 50 dBA, respectively), and similar nighttime limits as well (~45 dBA and 45 dBA, respectively). Without local noise regulations or recommendations, these recommended noise limits from EPA and WHO provide well-established criteria for acceptable noise in rural residential areas.

At this stage of project development, the location of the inverters and substation have not been defined, so only a very preliminary screening-level noise impact assessment is possible. Available sound power data from representative equipment is used in this assessment, so the installed equipment could have somewhat different noise generation, but the difference is expected to be insignificant. Both the PV panels and the batteries require inverters, which is the loudest piece of equipment in the facility. The PV inverters are planned to be a 4.0 MW central model, and this assessment used sound data from one of the most common central inverters on the market today, with a capacity of 3.6 MW. The battery inverters are not yet specified, but will not be any larger or louder than the PV inverters.

Generally, the difference in sound from different transformers of a similar capacity is minimal, so like the inverter, the representative sound data for the substation transformer is expected to be very similar to the equipment installed at Turtle Cove. The third and final component that makes some noise is the motor in the tracker system, which is often located in the center of some rows of solar panels. There is a wide variety of tracker system systems with varying numbers, sizes, and styles of motors. Due to the uncertainty about the tracker that will be installed, a very conservative sound power level is used for the tracker motors in this assessment. The ISU transformers located with each inverter also makes some noise but is significantly quieter than the inverter, so it has negligible impact on the sound level heard some distance from the inverter/transformer pair, so for simplicity the ISU transformers are not included in this screening level noise impact assessment.

The following analysis starts with the sound power level of the equipment, which is measured in decibels but is different than sound pressure level, which is also measured in decibels and is used to describe how loud a sound is to humans. The sound power level of the equipment is a measure of the total acoustic energy emitted from a source of noise. The sound power level value and the distance between the equipment and the person is all that is needed to calculate the loudness of the sound in the person's ears, which is the sound pressure level. The sound power levels of representative equipment are as follows[38]: 3.6 MW inverter: 101 dBA, substation transformer: 88 dBA, and tracker motors: 90 dBA. Currently the location of

[36] US Environmental Protection Agency (EPA), "Information on Levels of Environmental Loise Requisite to Protect Public Health and Welfare With An Adequate Margin of Safety", 1974, https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF

[37] World Health Organization (WHO), "Guidelines for Community Noise", 1999, https://apps.who.int/iris/handle/10665/66217

[38] Inverter and substation transformer sound data provided in *Speedway Solar Sound Study Report*, Revision 1 dated 10/29/2020. Produced by Burns McDonnell for Duke Energy project in Cabarrus County, NC. Tracker motor data and inverter data provided in Kaliski, et. al. Noise-Con 2020 Conference paper titled "An Overview of Sound From Commercial Photovoltaic Facilities", https://rsginc.com/wp-content/uploads/2021/04/Kaliski-et-al-2020-An-overview-of-sound-from-commercial-photovolteic-facilities.pdf

this equipment at Turtle Cove Solar have not been defined, so conservative distance estimates have been used to calculate the potential for sound at nearby residences. The distance used in this sound assessment is an estimation of the closest distance between that equipment and a residence, which will provide an estimation of the worst-case noise at the homes closest to the project. 300-ft is used as a conservative distance for the inverters and 150-ft is used for the tracker motors. The substation transformer is located in the substation, which is modeled to be 500 feet from the closest residence. The battery inverters will be located near the substation and assumed to also be at least 500 feet from the closest residence. The sound pressure level (in dBA) can be calculated from the sound power level (in dBA) and the distance from the source as follows:

- Sound pressure level = sound power level – 20 x log (distance in feet)
  - PV Inverters: 101 dBA – 20 x log (300 feet) = 51.5 dBA
  - Battery Inverters: 101 dBA – 20 x log (500 feet) = 47.0 dBA
  - Substation transformer: 88 dBA – 20 x log (500 feet) = 34.0 dBA
  - Tracker motors: 90 dBA – 20 x log (150 feet) = 46.5 dBA

These worst-case sound estimates for the PV system meet, or nearly meet, the EPA and WHO recommended guidelines for daytime noise in a residential setting (~50 dBA), which is the only time the PV inverters and tracker motors are expected to make any noise. The battery inverters may operate at night, and these inverters slightly exceed the EPA and WHO recommended guidelines for daytime noise in a residential setting (45 dBA). It is important to note that this analysis assumes a clear line-of-sight area between the equipment and the residence, so any vegetation or other obstacles between the PV equipment and the residence will reduce the sound reaching the residence compared to these estimates. It is also important to note that the tracker motors only operate for short periods of time throughout the day and the inverters only produce their maximum sound when operating at maximum power. While this simplified noise impact assessment is limited in capability compared to noise analysis software, this analysis reflects the physics of sound propagation and uses noise data from representative equipment, allowing for a simple yet accurate estimate of worst-case sound impacts. Considering that the surrounding vegetation and solar panels will block some of this sound, this noise estimates should not cause significant concern about noise impacts. Once the site plan is available, this simple noise analysis will be updated based on expected equipment locations, and is likely to find that the Turtle Cove project is not expected to create noise interference or be bothersome to any neighbors.

Sources for Further Reading on Noise:

- World Health Organization (WHO), Guidelines for Community Noise, 1999

Conclusions

Based on my knowledge of engineering and science, personal experience with PV and battery technology, review of academic research, and review of materials provided by Renewable Energy Services about the proposed Turtle Cove Solar PV and battery energy storage facility in Wayne County, North Carolina, my findings and opinions are summarized as follows:

- The Turtle Cove Solar project will result in a significant reduction of regional air pollution.
- The Turtle Cove Solar project will not result in any negative impacts to public health or safety.
- The Turtle Cove Solar facility will not increase the temperature of the area surrounding the site.
- The Turtle Cove Solar facility is not expected to create any glare hazards or other negative glare impacts for aviation.
- The Turtle Cove Solar project is not expected to create bothersome noise for any neighbors.

Kirkland Appraisals, LLC

Richard C. Kirkland, Jr., MAI
9408 Northfield Court
Raleigh, North Carolina 27603
Phone (919) 414-8142
rkirkland2@gmail.com
www.kirklandappraisals.com

October 12, 2023

Mr. Tom Delafield
Turtle Cove Solar, LLC
5315 Highgate Drive, Suite 202
Durham, NC 27713

RE: Proposed Turtle Cove Solar Farm, Hood Swamp Road, Goldsboro, Wayne County, NC

Mr. Delafield

At your request, I have considered the impact of a proposed 55-60 MW solar farm with a Battery Energy Storage System (BESS) with a 23-26 MW 4-hour capacity, proposed to be constructed on a portion of a 594.00-acre assemblage of land on Hood Swamp Road, Goldsboro, Wayne County, North Carolina. Specifically, I have been asked to give my professional opinion on whether the proposed solar farm will have any impact on adjoining property value and whether "the location and character of the use, if developed according to the plan as submitted and approved, will be in harmony with the area in which it is to be located."

To form an opinion on these issues, I have researched and visited existing and proposed solar farms in North Carolina, researched articles through the Appraisal Institute and other studies, and discussed the likely impact with other real estate professionals. I have not been asked to assign any value to any specific property.

This letter is a limited report of a real property appraisal consulting assignment and subject to the limiting conditions attached to this letter. My client is Turtle Cove Solar, LLC, represented to me by Mr. Tom Delafield. My findings support the application. The effective date of this consultation is October 12, 2023.

Conclusion

The matched pair analysis in the attached report shows no impact in home values due to abutting or adjoining a solar farm as well as no impact to abutting or adjacent vacant residential or agricultural land where there are sufficient setbacks and buffering as identified in the analysis. The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all indicate that a solar farm is a compatible use for rural/residential transition areas and that it would function in a harmonious manner with this area.

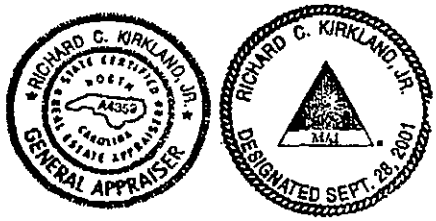
Very similar solar farms in very similar areas have been found by hundreds of towns and counties not to have a substantial injury to abutting or adjoining properties, and many of those findings of no impact have been upheld by N.C. Courts or overturned by N.C. Courts when a board found otherwise (see for example *Dellinger. v. Lincoln County*). Similar solar farms have been approved adjoining agricultural uses, schools, churches, and residential developments. Industrial uses rarely absorb negative impacts from adjoining uses. This same pattern of development has been identified in this report showing that this is not a local phenomenon, but found in Virginia, North Carolina, Maryland, Tennessee, and Florida as representative of the Mid-Atlantic and Southeastern U.S.

Based on the data and analysis in this report, it is my professional opinion that the solar farm proposed at the subject property will have no impact on the value of adjoining or abutting property and that the proposed use is in harmony with the area in which it is located. I note that some of the positive implications of a solar farm that have been expressed by people living next to solar farms include protection from future development of residential developments or other more intrusive uses, reduced dust, odor and chemicals from former farming operations, protection from light pollution at night, it is quiet, and there is no traffic.

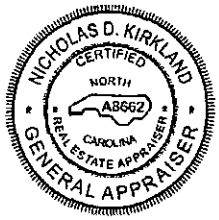
Similarly, the paired sales data on BESS systems in this report show no impact at distances much as close as 180 feet and while the exact location of the batteries has not been provided to me, they are necessarily a minimum of 200 feet from the nearest home, which supports a finding of no impact on the adjoining property value.

If you have any questions please call me any time.

Sincerely,



Richard C. Kirkland, Jr., MAI
State Certified General Appraiser



Nicholas D. Kirkland
State Certified General Appraiser

Table of Contents

Conclusion 1
I. Proposed Project and Adjoining Uses 4
II. Methodology and Discussion of Issues 12
III. Research on Solar Farms 14
A. Appraisal Market Studies 14
B. Articles 17
C. Broker Commentary 18
IV. University Studies 18
A. University of Texas at Austin, May 2018 18
B. University of Rhode Island, September 2020 19
C. Georgia Institute of Technology, October 2020 20
D. Master's Thesis: ECU by Zachary Dickerson July 2018 21
E. Lawrence Berkeley National Lab, March 2023 22
V. Assessor Surveys 28
VI. Solar Farms Identified in Wayne and Adjoining Counties 31
VII. Market Analysis of the Impact on Value from Solar Farms 33
A. North Carolina Data 34
B. Southeastern USA Data – Over 5 MW 71
C. Summary of National Data on Solar Farms 73
VIII. Scope of Research 75
IX. Specific Factors Related To Impacts on Value 76
X. Battery Energy Storage System (BESS) 79
A. BESS Paired Sales Analysis/Market Research 80
XI. Conclusion 97
XII. Certification 98
Professional Experience 99
Professional Affiliations 99
Education 99
Continuing Education 99

I. Proposed Project and Adjoining Uses

Proposed Use Description

This 55-60 MW solar farm with a Battery Energy Storage System (BESS) with a 23-26 MW 4-hour capacity is proposed to be constructed on a portion of a 594.00-acre assemblage of land on Hood Swamp Road, Goldsboro, Wayne County, North Carolina. Adjoining land is primarily a mix of residential and agricultural uses, which is very typical of solar farm sites.

The BESS will be a 23-26 MW system with a 4-hour duration. The BESS is to located at the point of interconnection. The map I have does not include an identification of where this POI will be, though it will necessarily be at least 200 feet from the nearest home based on the layout provided.

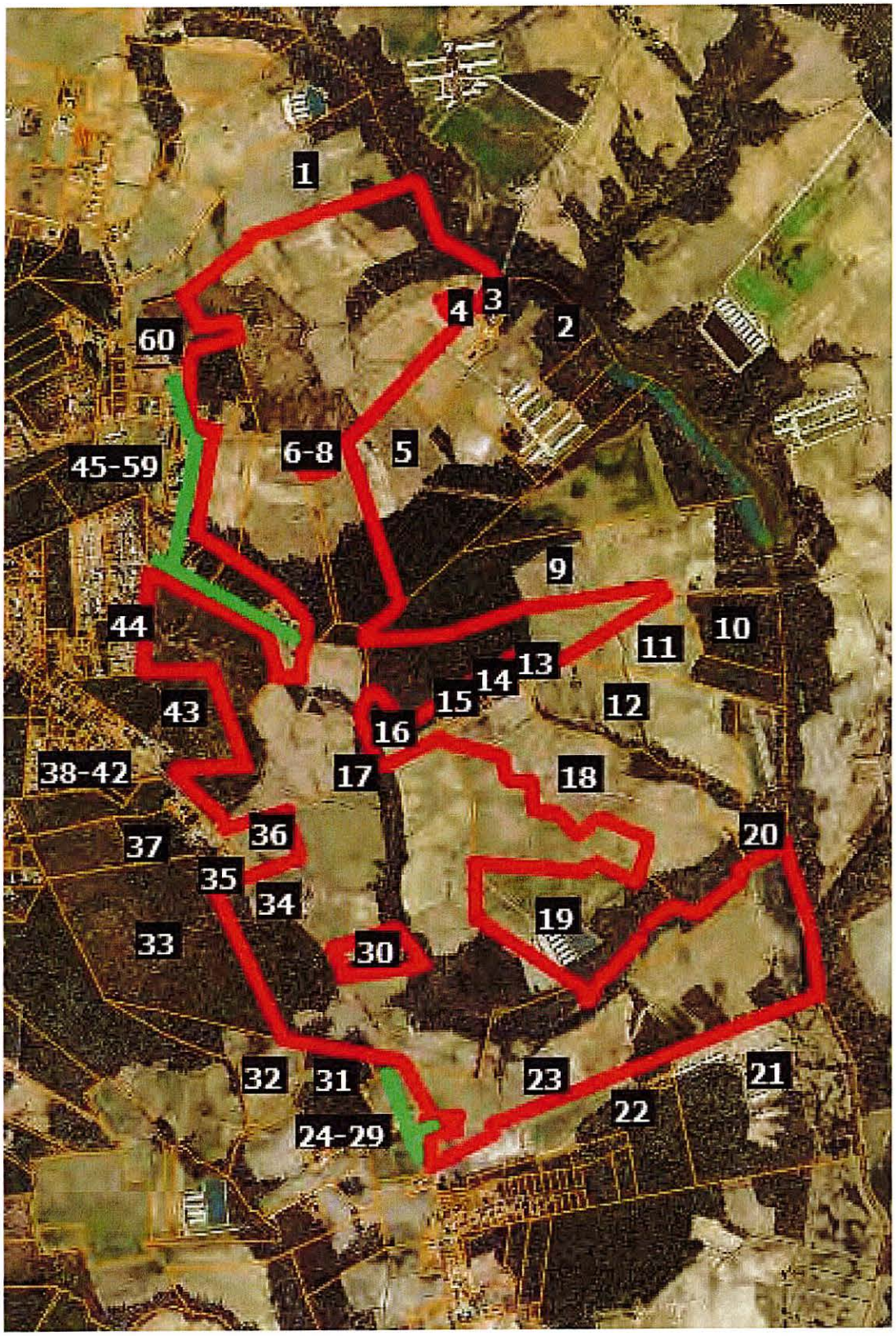
Adjoining Properties

I have considered adjoining uses and included a map to identify each parcel's location. The closest adjoining home is proposed to be 200 feet from the closest solar panel, the average distance is 421 feet.

The breakdown of those uses by acreage and number of parcels is summarized below.

Adjoining Use Breakdown

	Acreage	**Parcels**
Residential	17.34%	68.33%
Agri/Res	19.24%	6.67%
Religious	0.27%	5.00%
Agricultural	63.14%	20.00%
Total	**100.00%**	**100.00%**


1
2
3
4
5
6-8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24-29
30
31
32
33
34
35
36
37
38-42
43
44
45-59
60

Surrounding Uses

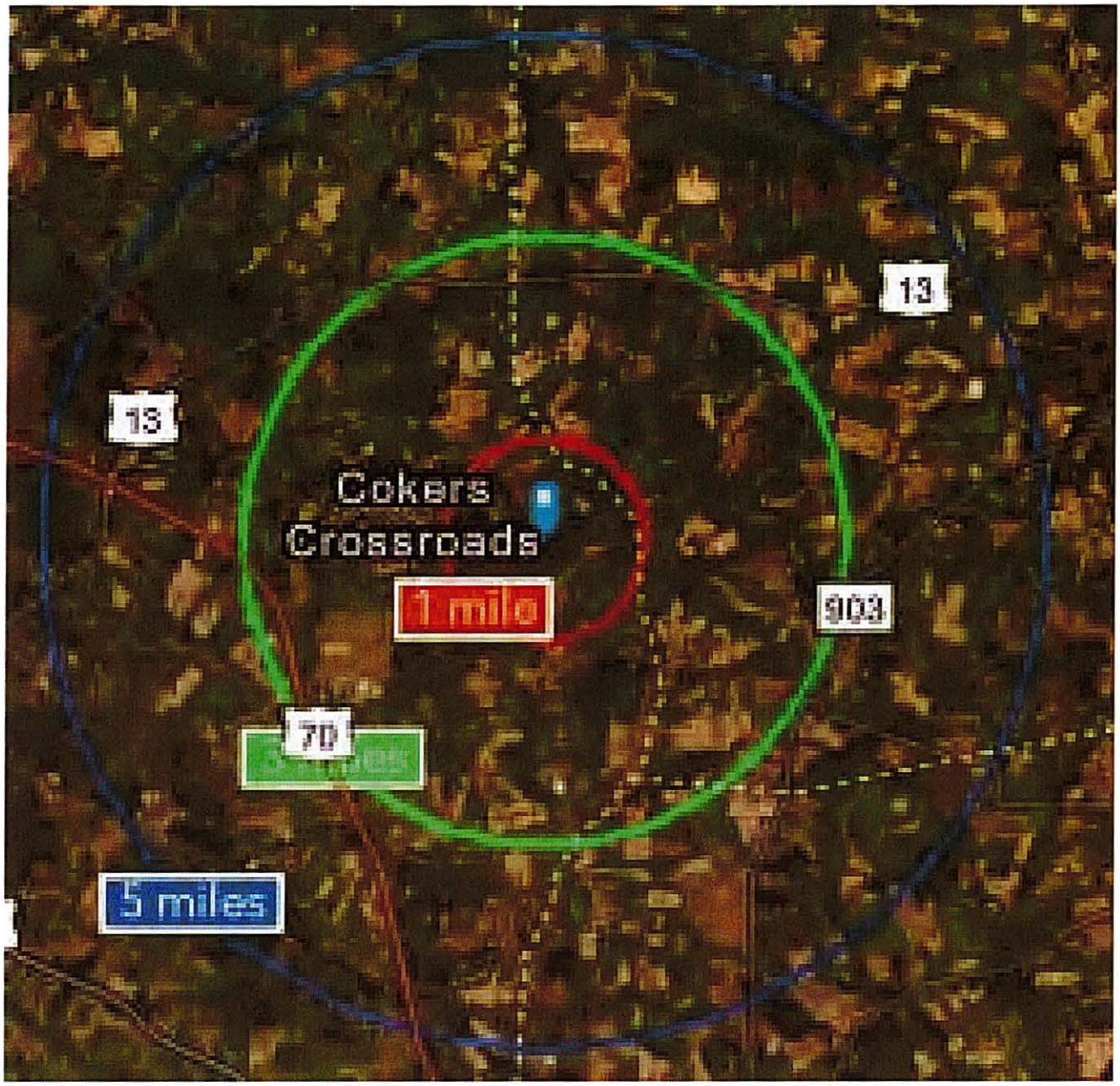
#	MAP ID	Owner	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Panel
1	3640989890	Creech	71.68	Agricultural	6.98%	1.67%	N/A
2	3650269830	Smith	47.69	Agricultural	4.64%	1.67%	N/A
3	3650277334	Smith	2.19	Residential	0.21%	1.67%	1,195
4	3650273389	Cruse	0.87	Residential	0.08%	1.67%	885
5	3650250426	Smith	75.70	Agri/Res	7.37%	1.67%	260
6	3650056570	Bethel	1.58	Religous	0.15%	1.67%	N/A
7	3650056694	Bethel	0.95	Religous	0.09%	1.67%	200
8	3650055635	Bethel	0.29	Religous	0.03%	1.67%	N/A
9	3650445129	Whitted	96.54	Agricultural	9.40%	1.67%	N/A
10	3650445129	Whitted	22.40	Agricultural	2.18%	1.67%	N/A
11	3650530253	Gray	28.57	Agricultural	2.78%	1.67%	N/A
12	3650427413	Gray	60.70	Agri/Res	5.91%	1.67%	580
13	3650427413	Gray	3.38	Residential	0.33%	1.67%	N/A
14	3650228842	Hill	2.59	Residential	0.25%	1.67%	210
15	3650223584	Hill	3.64	Residential	0.35%	1.67%	200
16	3650202418	Thompson	9.27	Residential	0.90%	1.67%	N/A
17	3650112856	Best	0.53	Residential	0.05%	1.67%	200
18	3650413621	Gray	84.77	Agricultural	8.26%	1.67%	N/A
19	3650308019	Gray	54.61	Agricultural	5.32%	1.67%	N/A
20	3650611738	Creech	23.89	Agricultural	2.33%	1.67%	N/A
21	3559672945	Select	92.25	Agricultural	8.98%	1.67%	N/A
22	3559471752	Goldsboro	56.07	Agricultural	5.46%	1.67%	N/A
23	3559375938	Unkown	1.00	Residential	0.10%	1.67%	N/A
24	3559177103	Barnes	8.50	Residential	0.83%	1.67%	305
25	3559272434	Evans	0.98	Residential	0.10%	1.67%	200
26	3559178642	Cooke	1.49	Residential	0.15%	1.67%	260
27	3559179728	Herring	0.06	Residential	0.01%	1.67%	N/A
28	3559175766	Herring	6.33	Residential	0.62%	1.67%	N/A
29	3559185220	Mathews	1.18	Residential	0.11%	1.67%	240
30	3559193691	Baker	7.74	Residential	0.75%	1.67%	200
31	3559075993	Herring	19.31	Residential	1.88%	1.67%	N/A
32	3549983523	Smith	25.24	Agricultural	2.46%	1.67%	N/A
33	3559094370	Thompson	44.68	Agricultural	4.35%	1.67%	N/A
34	3650001126	Head	0.50	Residential	0.05%	1.67%	200
35	3640907575	Whitfield	0.60	Residential	0.06%	1.67%	285
36	3640908886	Johnston	9.07	Residential	0.88%	1.67%	N/A
37	3640805896	Lancaster	16.17	Residential	1.57%	1.67%	635
38	3640911137	Lancaster	0.70	Residential	0.07%	1.67%	N/A
39	3640910228	Lancaster	0.74	Residential	0.07%	1.67%	840

Surrounding Uses

#	MAP ID	Owner	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Panel
40	3640819336	Adams	0.57	Residential	0.06%	1.67%	915
41	3650023058	Cobb Farms	16.20	Residential	1.58%	1.67%	N/A
42	3640813657	Sutton	0.82	Residential	0.08%	1.67%	N/A
43	3649828276	Smith	38.55	Agri/Res	3.75%	1.67%	1,160
44	3640833825	Smith	22.60	Agri/Res	2.20%	1.67%	200
45	3640846295	Torres	0.97	Residential	0.09%	1.67%	230
46	3640847173	Torres	0.70	Residential	0.07%	1.67%	N/A
47	3640849441	Smith	6.11	Residential	0.60%	1.67%	200
48	3640936991	Torres	10.01	Residential	0.97%	1.67%	N/A
49	3650032511	Denton	9.39	Residential	0.91%	1.67%	310
50	3640848352	Young	6.12	Residential	0.60%	1.67%	370
51	3640950075	Scott	2.42	Residential	0.24%	1.67%	N/A
52	3640951230	Scott	0.97	Residential	0.09%	1.67%	200
53	3640951447	Scott	1.17	Residential	0.11%	1.67%	200
54	3640952751	Scott	0.79	Residential	0.08%	1.67%	200
55	3640951743	Scott	0.85	Residential	0.08%	1.67%	310
56	3640859314	Howery	2.37	Residential	0.23%	1.67%	390
57	3640950705	Condon	0.86	Residential	0.08%	1.67%	290
58	3640868155	Tyndall	2.27	Residential	0.22%	1.67%	700
59	3640866540	Lawrence	4.81	Residential	0.47%	1.67%	795
60	3640867757	Cope	13.87	Residential	1.35%	1.67%	540
		Total	**1026.870**		**100.00%**	**100.00%**	421

Demographics Around Subject Property

I have pulled demographic data around a 1-mile, 3-mile and 5-mile radius from the middle of the project as shown on the following pages.



Housing Profile

28551
28551, La Grange, North Carolina
Ring: 1 mile radius

Prepared by Esri
Latitude: 35.30402
Longitude: -77.81077

Population		Households	
2010 Total Population	448	2023 Median Household Income	$42,043
2020 Total Population	372	2028 Median Household Income	$51,048
2023 Total Population	344	2023-2028 Annual Rate	3.96%
2028 Total Population	332		
2023-2028 Annual Rate	-0.71%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	167	100.0%	158	100.0%	154	100.0%
Occupied	152	91.0%	132	83.5%	129	83.8%
Owner	108	64.7%	70	44.3%	70	45.5%
Renter	44	26.3%	62	39.2%	59	38.3%
Vacant	16	9.6%	26	16.5%	25	16.2%

	2023		2028	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	69	100.0%	70	100.0%
<$50,000	5	7.2%	2	2.9%
$50,000-$99,999	10	14.5%	3	4.3%
$100,000-$149,999	3	4.3%	1	1.4%
$150,000-$199,999	25	36.2%	18	25.7%
$200,000-$249,999	15	21.7%	18	25.7%
$250,000-$299,999	0	0.0%	1	1.4%
$300,000-$399,999	11	15.9%	27	38.6%
$400,000-$499,999	0	0.0%	0	0.0%
$500,000-$749,999	0	0.0%	0	0.0%
$750,000-$999,999	0	0.0%	0	0.0%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$183,000		$230,556	
Average Value	$186,232		$247,500	

Census 2010 Housing Units	Number	Percent
Total	167	100.0%
In Urbanized Areas	9	5.4%
In Urban Clusters	0	0.0%
Rural Housing Units	159	95.2%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

©2023 Esri

Housing Profile

28551
28551, La Grange, North Carolina
Ring: 3 mile radius

Prepared by Esri
Latitude: 35.30402
Longitude: -77.81207

Population		Households	
2010 Total Population	3,203	2023 Median Household Income	$52,335
2020 Total Population	2,831	2028 Median Household Income	$63,579
2023 Total Population	2,743	2023-2028 Annual Rate	3.97%
2028 Total Population	2,669		
2023-2028 Annual Rate	-0.55%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	1,330	100.0%	1,273	100.0%	1,248	100.0%
Occupied	1,208	90.8%	1,120	88.0%	1,105	88.5%
Owner	886	66.6%	708	55.6%	713	57.1%
Renter	322	24.2%	412	32.4%	392	31.4%
Vacant	122	9.2%	153	12.0%	142	11.4%

	2023		2028	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	708	100.0%	716	100.0%
<$50,000	51	7.2%	36	5.0%
$50,000-$99,999	145	20.5%	95	13.3%
$100,000-$149,999	61	8.6%	32	4.5%
$150,000-$199,999	183	25.8%	130	18.2%
$200,000-$249,999	106	15.0%	125	17.5%
$250,000-$299,999	65	9.2%	99	13.8%
$300,000-$399,999	51	7.2%	121	16.9%
$400,000-$499,999	32	4.5%	59	8.2%
$500,000-$749,999	14	2.0%	19	2.7%
$750,000-$999,999	0	0.0%	0	0.0%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	0	0.0%	0	0.0%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$176,503		$226,000	
Average Value	$190,007		$238,687	

Census 2010 Housing Units	Number	Percent
Total	1,330	100.0%
In Urbanized Areas	77	5.8%
In Urban Clusters	0	0.0%
Rural Housing Units	1,253	94.2%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

©2023 Esri

Housing Profile

28551
28551, La Grange, North Carolina
Ring: 5 mile radius

Prepared by Esri
Latitude: 35.30400
Longitude: -77.81207

Population		Households	
2010 Total Population	12,791	2023 Median Household Income	$58,930
2020 Total Population	12,155	2028 Median Household Income	$73,683
2023 Total Population	11,893	2023-2028 Annual Rate	4.57%
2028 Total Population	11,648		
2023-2028 Annual Rate	-0.42%		

	Census 2010		2023		2028	
Housing Units by Occupancy Status and Tenure	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	5,207	100.0%	5,214	100.0%	5,145	100.0%
Occupied	4,792	92.0%	4,706	90.3%	4,672	90.8%
Owner	3,565	68.5%	3,430	65.8%	3,467	67.4%
Renter	1,227	23.6%	1,276	24.5%	1,205	23.4%
Vacant	414	8.0%	508	9.7%	473	9.2%

	2023		2028	
Owner Occupied Housing Units by Value	Number	Percent	Number	Percent
Total	3,429	100.0%	3,467	100.0%
<$50,000	255	7.4%	160	4.6%
$50,000-$99,999	514	15.0%	318	9.2%
$100,000-$149,999	431	12.6%	159	4.6%
$150,000-$199,999	908	26.5%	676	19.5%
$200,000-$249,999	614	17.9%	824	23.8%
$250,000-$299,999	317	9.2%	532	15.3%
$300,000-$399,999	195	5.7%	450	13.0%
$400,000-$499,999	119	3.5%	230	6.6%
$500,000-$749,999	46	1.3%	66	1.9%
$750,000-$999,999	26	0.8%	49	1.4%
$1,000,000-$1,499,999	0	0.0%	0	0.0%
$1,500,000-$1,999,999	4	0.1%	3	0.1%
$2,000,000+	0	0.0%	0	0.0%
Median Value	$178,331		$225,516	
Average Value	$193,446		$244,621	

Census 2010 Housing Units	Number	Percent
Total	5,207	100.0%
In Urbanized Areas	1,402	26.9%
In Urban Clusters	54	1.0%
Rural Housing Units	3,751	72.0%

Data Note: Persons of Hispanic Origin may be of any race.
Source: Esri forecasts for 2023 and 2028. U.S. Census Bureau 2010 decennial Census data converted by Esri into 2020 geography.

August 28, 2023

©2023 Esri

II. Methodology and Discussion of Issues

Standards and Methodology

I conducted this analysis using the standards and practices established by the Appraisal Institute and that conform to the Uniform Standards of Professional Appraisal Practice. The analyses and methodologies contained in this report are accepted by all major lending institutions, and they are used in Virginia and across the country as the industry standard by certified appraisers conducting appraisals, market analyses, or impact studies and are considered adequate to form an opinion of the impact of a land use on neighboring properties. These standards and practices have also been accepted by the courts at the trial and appellate levels and by federal courts throughout the country as adequate to reach conclusions about the likely impact a use will have on adjoining or abutting properties.

The aforementioned standards compare property uses in the same market and generally within the same calendar year so that fluctuating markets do not alter study results. Although these standards do not require a linear study that examines adjoining property values before and after a new use (e.g. a solar farm) is developed, some of these studies do in fact employ this type of analysis. Comparative studies, as used in this report, are considered an industry standard.

The type of analysis employed is a Matched Pair Analysis or Paired Sales Analysis. This methodology is outlined in **The Appraisal of Real Estate**, Twelfth Edition by the Appraisal Institute pages 438-439. It is further detailed in **Real Estate Damages**, Third Edition, pages 33-36 by Randall Bell PhD, MAI. Paired sales analysis is used to support adjustments in appraisal work for factors ranging from the impact of having a garage, golf course view, or additional bedrooms. It is an appropriate methodology for addressing the question of impact of an adjoining solar farm. The paired sales analysis is based on the theory that when two properties are in all other respects equivalent, a single difference can be measured to indicate the difference in price between them. Dr. Bell describes it as comparing a test area to control areas. In the example provided by Dr. Bell he shows five paired sales in the test area compared to 1 to 3 sales in the control areas to determine a difference. I have used 3 sales in the control areas in my analysis for each sale developed into a matched pair.

Determining what is an External Obsolescence

An external obsolescence is a use of property that, because of its characteristics, might have a negative impact on the value of adjacent or nearby properties because of identifiable impacts. Determining whether a use would be considered an external obsolescence requires a study that isolates that use, eliminates any other causing factors, and then studies the sales of nearby versus distant comparable properties. The presence of one or a combination of key factors does not mean the use will be an external obsolescence, but a combination of these factors tends to be present when market data reflects that a use is an external obsolescence.

External obsolescence is evaluated by appraisers based on several factors. These factors include but are not limited to:

1) Traffic. Solar Farms are not traffic generators.

2) Odor. Solar farms do not produce odor.

3) Noise. Solar farms generate no noise concerns with noise levels below ambient noise outside of the fence in most layouts and makes even less noise at night.

4) Environmental. Solar farms do not produce toxic or hazardous waste. Grass is maintained underneath the panels so there is minimal impervious surface area.

5) Appearance/Viewshed. This is the one area that potentially applies to solar farms. However, solar farms are generally required to provide significant setbacks and landscaping buffers to address that concern. Furthermore, any consideration of appearance of viewshed impacts has to be considered in comparison with currently allowed uses on that site. For example if a residential subdivision is already an allowed use, the question becomes in what way does the appearance impact adjoining property owners above and beyond the appearance of that allowed subdivision or other similar allowed uses.

6) Other factors. I have observed and studied many solar farms and have never observed any characteristic about such facilities that prevents or impedes neighbors from fully using their homes or farms or businesses for the use intended.

Relative Solar Farm Sizes

Solar farms have been increasing in size in recent years. Much of the data collected is from existing, older solar farms of smaller size, but there are numerous examples of sales adjoining 75 to 80 MW facilities that show a similar trend as the smaller solar farms. This is understandable given that the primary concern relative to a solar farm is the appearance or view of the solar farm, which is typically addressed through setbacks and landscaping buffers. The relevance of data from smaller solar farms to larger solar farms is due to the primary question being one of appearance. If the solar farm is properly screened, then little of the solar farm would be seen from adjoining property regardless of how many acres are involved.

Larger solar farms are often set up in sections where any adjoining owner would only be able to see a small section of the project even if there were no landscaping screen. Once a landscaping screen is in place, the primary view is effectively the same whether adjoining a 5 MW, 20 MW or 100 MW facility.

I have split out the data for the matched pairs adjoining larger solar farms only to illustrate the similarities later in this report.

Steps Involved in the Analysis

The paired sales analysis employed in this report follows the following process:

1. Identify sales of property adjoining existing solar farms.
2. Compare those sales to similar property that does not adjoin an existing solar farm.
3. Confirmation of sales are noted in the analysis write ups.
4. Distances from the homes to panels are included as a measure of the setbacks.
5. Topographic differences across the solar farms themselves are likewise noted along with demographic data for comparing similar areas.

There are a number of Sale/Resale comparables included in the write ups, but most of the data shown is for sales of homes after a solar farm has been announced (where noted) or after a solar farm has been constructed.

III. Research on Solar Farms

A. Appraisal Market Studies

I have also considered a number of impact studies completed by other appraisers as detailed below.

CohnReznick – Property Value Impact Study: Adjacent Property Values Solar Impact Study: A Study of Eight Existing Solar Facilities

Patricia McGarr, MAI, CRE, FRICS, CRA and Andrew R. Lines, MAI with CohnReznick completed an impact study for a proposed solar farm in Cheboygan County, Michigan completed on June 10, 2020. I am familiar with this study as well as a number of similar such studies completed by CohnReznick. I have not included all of these studies but I submit this one as representative of those studies.

This study addresses impacts on value from eight different solar farms in Michigan, Minnesota, Indiana, Illinois, Virginia and North Carolina. These solar farms are 19.6 MW, 100 MW, 11.9 MW, 23 MW, 71 MW, 61 MW, 40 MW, and 19 MW for a range from 11.9 MW to 100 MW with an average of 31 MW and a median of 31.5 MW. They analyzed a total of 24 adjoining property sales in the Test Area and 81 comparable sales in the Control Area over a five-year period.

The conclusion of this study is that there is no evidence of any negative impact on adjoining property values based on sales prices, conditions of sales, overall marketability, potential for new development or rate of appreciation.

Christian P. Kaila & Associates – Property Impact Analysis – Proposed Solar Power Plant Guthrie Road, Stuarts Draft, Augusta County, Virginia

Christian P. Kaila, MAI, SRA and George J. Finley, MAI developed an impact study as referenced above dated June 16, 2020. This was for a proposed 83 MW facility on 886 acres.

Mr. Kaila interviewed appraisers who had conducted studies and reviewed university studies and discussed the comparable impacts of other development that was allowed in the area for a comparative analysis of other impacts that could impact viewshed based on existing allowed uses for the site. He also discussed in detail the various other impacts that could cause a negative impact and how solar farms do not have such characteristics.

Mr. Kaila also interviewed county planners and real estate assessors in eight different Virginia counties with none of the assessor's identifying any negative impacts observed for existing solar projects.

Mr. Kaila concludes on a finding of no impact on property values adjoining the indicated solar farm.

Fred Beck, MAI, CCIM – Impact Analysis in Lincoln County 2013

Mr. Fred Beck, MAI, CCIM completed an impact analysis in 2013 for a proposed solar farm that concluded on a negative impact on value. That report relied on a single cancelled contract for an adjoining parcel where the contracted buyers indicated that the solar farm was the reason for the cancellation. It also relied on the activities of an assessment impact that was applied in a nearby county.

Mr. Beck was interviewed as part of the Christian Kalia study noted above. From that I quote "Mr. Beck concluded on no effect on moderate priced homes, and only a 5% change in his limited

research of higher priced homes. His one sale that fell through is hardly a reliable sample. It also was misleading on Mr. Beck's part to report the lower re-assessments since the primary cause of the re-assessments were based on the County Official, who lived adjacent to the solar farm, appeal to the assessor for reductions with his own home." In that Clay County Case study the noted lack of lot sales after announcement of the solar farm also coincided with the recession in 2008/2009 and lack of lot sales effectively defined that area during that time.

I further note, that I was present at the hearing where Mr. Beck presented these findings and the predominance of his argument before the Lincoln County Board of Commissioner's was based on the one cancelled sale as well as a matched pair analysis of high-end homes adjoining a four-story call center. He hypothesized that a similar impact from that example could be compared to being adjacent solar farm without explaining the significant difference in view, setbacks, landscaping, traffic, light, and noise. Furthermore, Mr. Beck did have matched pairs adjoining a solar farm in his study that he put in the back of his report and then ignored as they showed no impact on property value.

Also noted in the Christian Kalia interview notes is a response from Mr. Beck indicating that in his opinion "the homes were higher priced homes and had full view of the solar farm." Based on a description of screening so that "the solar farm would not be in full view to adjoining property owners. Mr. Beck said in that case, he would not see any drop in property value."

NorthStar Appraisal Company – Impact Analysis for Nichomus Run Solar, Pilesgrove, NJ, September 16, 2020

Mr. William J. Sapio, MAI with NorthStar Appraisal Company considered a matched pair analysis for the potential impact on adjoining property values to this proposed 150 MW solar farm. Mr. Sapio considered sales activity in a subdivision known as Point of Woods in South Brunswick Township and identified two recent new homes that were constructed and sold adjoining a 13 MW solar farm and compared them to similar homes in that subdivision that did not adjoin the solar farm. These homes sold in the $1,290,450 to $1,336,613 price range and these homes were roughly 200 feet from the closest solar panel.

Based on this analysis, he concluded that the adjoining solar farm had no impact on adjoining property value.

Mary McClinton Clay, MAI – McCracken County Solar Project Value Impact Report, July 10, 2021

Ms. Mary Clay, MAI reviewed a report by Kirkland Appraisals in this case and also provided a differing opinion of impact. She cites a number of other appraisal studies and interestingly finds fault with heavily researched opinions, while praising the results of poorly researched studies that found the opposing view.

Her analysis includes details from solar farms that show no impact on value, but she dismisses those.

She cites the University of Texas study noted later in this report, but she cites only isolated portions of that study to conclude the opposite of what that study specifically concludes.

She cites the University of Rhode Island study noted alter in this report, but specifically excludes the conclusion of that study that in rural areas they found no impact on property value.

She cites lot sales near Spotsylvania Solar without confirming the purchase prices with brokers as indicative of market impact and has made no attempt to compare lot prices that are contemporaneous. In her 5 lot sales that she identifies, all of the lot prices decline with time from

2015 through 2019. This includes the 3 lot sales prior to the approval of the solar farm. The decrease in lot values shown in this chart are more indicative of the trend in the market, than of any impact related to the solar farm. Otherwise, how does she explain the drop in price from 2015 to 2017 prior to the solar farm approval.

She considers data at McBride Place Solar Farm and does a sale/resale analysis based on Zillow Home Value Index, which is not a reliable indication for appreciation in the market. She then adjusted her initial sales prior to the solar farm over 7 years to determine what she believes the home should have appreciated by and then compares that to an actual sale. She has run no tests or any analysis to show that the appreciation rates she is using are consistent with the market but more importantly she has not attempted to confirm any of these sales with market participants. I have spoken with brokers active in the sales that she cites and they have all indicated that the solar farm was not a negative factor in marketing or selling those homes.

She has considered lot sales at Sunshine Farms in Grandy, NC. She indicates that the lots next to the solar farm are selling for less than lots not near the solar farm, but she is actually using lot sales next to the solar farm prior to the solar farm being approved. She also ignores recent home sales adjoining this solar farm after it was built that show no impact on property value.

She also notes a couple of situations where solar developers have purchased adjoining homes and resold them or where a neighbor agreement was paid as proof of a negative impact on property value. Given that there are over 2,500 solar farms in the USA as of 2018 according to the U.S. Energy Information Administration and there are only a handful of such examples, this is clearly not an industry standard but a business decision. Furthermore, solar developers are not in the business of flipping homes and are in a position very similar to a bank that acquires a home as OREO (Other Real Estate Owned), where homes are frequently sold at discounted prices, not because of any drop in value, but because they are not a typically motivated seller. Market value requires an analysis of a typically motivated buyer and seller. So these are not good indicators of market value impacts.

The comments throughout this study are heavy in adjectives, avoids stating facts contrary to the conclusion and shows a strong selection bias.

Kevin T. Meeks, MAI – Corcoran Solar Impact Study, June 19, 2017

Mr. Kevin Meeks, MAI reviewed a report by Kirkland Appraisals in this case and also provided a additional research on the topic with additional paired sales. The sales he considered are well presented and show that they were confirmed by third parties and all of the broker commentary is aligned with the conclusion that the adjoining solar farms considered had no impact on the adjoining home values.

Mr. Meeks also researched a 100 MW project in Chisago County, known as North Star Solar Garden in MN. He interviewed local appraisers and a broker who was actively marketing homes adjoining that solar farm to likewise support a finding of no impact on property vaue.

Conclusion of Impact Studies

Of the six studies noted three included actual sales data to derive an opinion of no impact on value. The two studies to conclude on a negative impact includes the Fred Beck study based on no actual sales data, and he has since indicated that with landscaping screens he would not conclude on a negative impact. The other study by Mary Clay shows improper adjustments for time, a lack of confirmation of sales comparables, and exclusion of data that does not support her position.

I have relied on these studies as additional support for the findings in this impact analysis.

B. Articles

I have also considered a number of articles on this subject as well as conclusions and analysis as noted below.

Farm Journal Guest Editor, March 22, 2021 – Solar's Impact on Rural Property Values

Andy Ames, ASFMRA (American Society of Farm Managers and Rural Appraisers) published this article that includes a discussion of his survey of appraisers and studies on the question of property value related to solar farms. He discusses the university studies that I have cited as well as Patricia McGarr, MAI.

He also discusses the findings of Donald A. Fisher, ARA, who served six years at the Chair of the ASFMRA's National Appraisal Review Committee. He is also the Executive Vice President of the CNY Pomeroy Appraiser and has conducted several market studies on solar farms and property impact. He is quoted in the article as saying, "Most of the locations were in either suburban or rural areas, and all of those studies found either a neutral impact, or ironically, a positive impact, where values on properties after installation of solar farms went up higher than time trends."

Howard Halderman, AFM, President and CEO of Halderman Real Estate and Farm Management attended the ASFMRA solar talk hosted by the Indiana Chapter of the ASFMRA and he concludes that other rural properties would likely see no impact and farmers and landowners shown even consider possible benefits. "In some cases, farmers who rent land to a solar company will insure the viability of their farming operation for a longer time period. This makes them better long-term tenants or land buyers so one can argue that higher rents and land values will follow due to the positive impact the solar leases offer."

More recently in August 2022, Donald Fisher, ARA, MAI and myself led a webinar on this topic for the ASFMRA discussing the issues, the university studies and specific examples of solar farms having no impact on adjoining property values.

National Renewable Energy Laboratory – Top Five Large-Scale Solar Myths, February 3, 2016

Megan Day reports form NREL regarding a number of concerns neighbors often express. Myth #4 regarding property value impacts addresses specifically the numerous studies on wind farms that show no impact on property value and that solar farms have a significantly reduced visual impact from wind farms. She highlights that the appearance can be addressed through mitigation measures to reduce visual impacts of solar farms through vegetative screening. Such mitigations are not available to wind farms given the height of the windmills and again, those studies show no impact on value adjoining wind farms.

North Carolina State University: NC Clean Energy Technology Center White Paper: Balancing Agricultural Productivity with Ground-Based Solar Photovoltaic (PV) Development (Version 2), May 2019

Tommy Cleveland and David Sarkisian wrote a white paper for NCSU NC Clean Energy Technology Center regarding the potential impacts to agricultural productivity from a solar farm use. I have interviewed Tommy Cleveland on numerous occasions and I have also heard him speak on these issues at length as well. He addresses many of the common questions regarding how solar farms work and a detailed explanation of how solar farms do not cause significant impacts on the soils, erosion and other such concerns. This is a heavily researched paper with the references included.

North Carolina State University: NC Clean Energy Technology Center White Paper: Health and Safety Impacts of Solar Photovoltaics, May 2017

Tommy Cleveland wrote a white paper for NCSU NC Clean Energy Technology Center regarding the health and safety impacts to address common questions and concerns related to solar farms. This is a heavily researched white paper addressing questions ranging from EMFs, fire safety, as well as vegetation control and the breakdown of how a solar farm works.

C. Broker Commentary

In the process of working up the matched pairs used later in this report, I have collected comments from brokers who have actually sold homes adjoining solar farms indicating that the solar farm had no impact on the marketing, timing, or sales price for the adjoining homes. I have comments from 12 such brokers within this report including brokers from Kentucky, Virginia, Tennessee, and North Carolina.

I have additional commentary from other states including New Jersey and Michigan that provide the same conclusion.

IV. University Studies

I have also considered the following studies completed by four different universities related to solar farms and impacts on property values.

A. University of Texas at Austin, May 2018

An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations

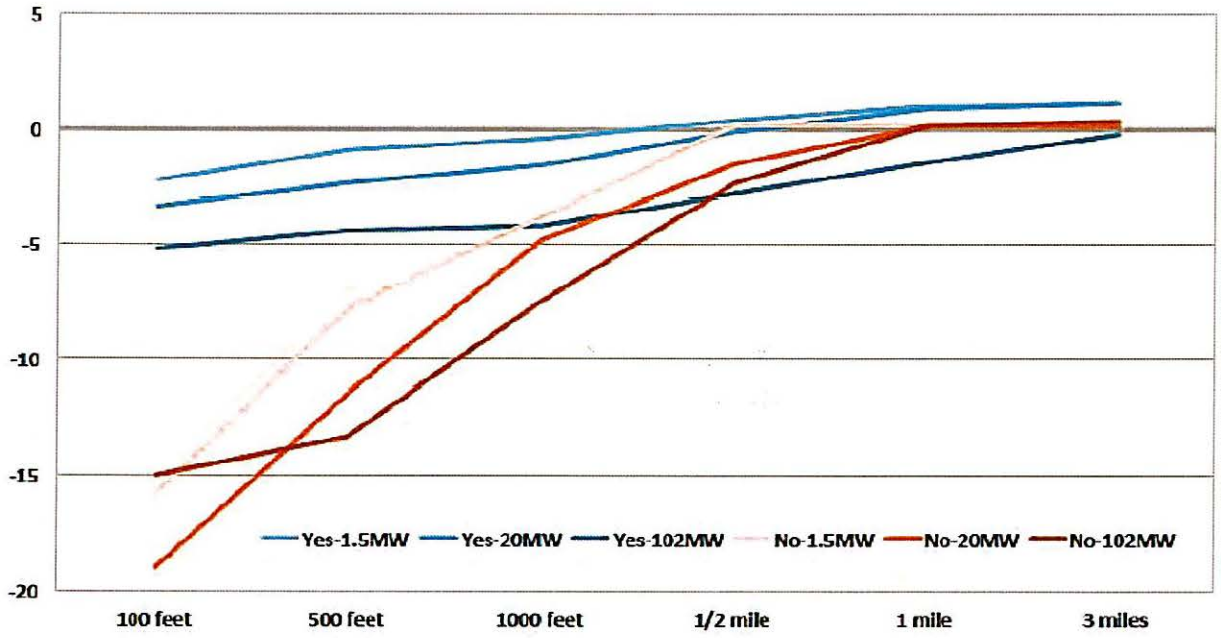
This study considers solar farms from two angles. First it looks at where solar farms are being located and concludes that they are being located primarily in low density residential areas where there are fewer homes than in urban or suburban areas.

The second part is more applicable in that they conducted a survey of appraisers/assessors on their opinions of the possible impacts of proximity to a solar farm. They consider the question in terms of size of the adjoining solar farm and how close the adjoining home is to the solar farm. I am very familiar with this part of the study as I was interviewed by the researchers multiple times as they were developing this. One very important question that they ask within the survey is very illustrative. They asked if the appraiser being surveyed had ever appraised a property next to a solar farm. There is a very noticeable divide in the answers provided by appraisers who have experience appraising property next to a solar farm versus appraisers who self-identify as having no experience or knowledge related to that use.

On Page 16 of that study they have a chart showing the responses from appraisers related to proximity to a facility and size of the facility, but they separate the answers as shown below with appraisers with experience in appraising properties next to a solar farm shown in blue and those inexperienced shown in brown. Even within 100 feet of a 102 MW facility the response from experienced appraisers were -5% at most on impact. While inexperienced appraisers came up with significantly higher impacts. This chart clearly shows that an uninformed response widely diverges from the sales data available on this subject.

Chart B.2 - Estimates of Property Value Impacts (%) by Size of Facility, Distance, & Respondent Type

Have you assessed a home near a utility-scale solar installation?



Furthermore, the question cited above does not consider any mitigating factors such as landscaping buffers or screens which would presumably reduce the minor impacts noted by experienced appraisers on this subject.

The conclusion of the researchers is shown on Page 23 indicated that "Results from our survey of residential home assessors show that the majority of respondents believe that proximity to a solar installation has either no impact or a positive impact on home values."

This analysis supports the conclusion of this report that the data supports no impact on adjoining property values.

B. University of Rhode Island, September 2020

Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island

The University of Rhode Island published a study entitled **Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island** on September 29, 2020 with lead researchers being Vasundhara Gaur and Corey Lang. I have read that study and interviewed Mr. Corey Lang related to that study. This study is often cited by opponents of solar farms but the findings of that study have some very specific caveats according to the report itself as well as Mr. Lang from the interview.

While that study does state in the Abstract that they found depreciation of homes within 1-mile of a solar farm, that impact is limited to non-rural locations. On Pages 16-18 of that study under Section 5.3 Heterogeneity in treatment effect they indicate that the impact that they found was limited to non-rural locations with the impact in rural locations effectively being zero. For the study they defined "rural" as a municipality/township with less than 850 population per square mile.

They further tested the robustness of that finding and even in areas up to 2,000 population per square mile they found no statistically significant data to suggest a negative impact. They have not specifically defined a point at which they found negative impacts to begin, as the sensitivity study stopped checking at the 2,000-population dataset.

Where they did find negative impacts was in high population density areas that was largely a factor of running the study in Massachusetts and Rhode Island which the study specifically cites as being the 2nd and 3rd most population dense states in the USA. Mr. Lang in conversation as well as in recorded presentations has indicated that the impact in these heavily populated areas may reflect a loss in value due to the scarce greenery in those areas and not specifically related to the solar farm itself. In other words, any development of that site might have a similar impact on property value.

Based on this study I have checked the population for the Saulston Township of Wayne County. This township has a population of 7,400 people for 2023 based on hometownlocator.com and a total area of 34.58 square miles for an indication population density of 214 people per square mile. This is well below the threshold indicated by the Rhode Island Study for a finding of no impact on property value.

I therefore conclude that the Rhode Island Study supports the indication of no impact on adjoining properties for the proposed solar farm project.

Township Of Saulston Data & Demographics (As of July 1, 2023)

POPULATION	
Total Population	7,400 (100%)
Population in Households	7,342 (99.2%)
Population in Families	6,331 (85.6%)
Population in Group Quarters[1]	58 (0.8%)
Population Density	214
Diversity Index[2]	63

HOUSING	
Total HU (Housing Units)	3,230 (100%)
Owner Occupied HU	2,124 (65.8%)
Renter Occupied HU	800 (24.8%)
Vacant Housing Units	306 (9.5%)
Median Home Value	$193,901
Average Home Value	$215,702
Housing Affordability Index[3]	150

INCOME	
Median Household Income	$70,465
Average Household Income	$87,769
% of Income for Mortgage[4]	17%
Per Capita Income	$34,692
Wealth Index[5]	65

HOUSEHOLDS	
Total Households	2,924
Average Household Size	2.51000000000
Family Households	2,127
Average Family Size	3

C. Georgia Institute of Technology, October 2020

Utility-Scale Solar Farms and Agricultural Land Values

This study was completed by Nino Abashidze as Post-Doctoral Research Associate of Health Economics and Analytics Labe (HEAL), School of Economics, Georgia Institute of Technology. This research was started at North Carolina State University and analyzes properties near 451 utility-

scale ground-mount solar installations in NC that generate at least 1 MW of electric power. A total of 1,676 land sales within 5-miles of solar farms were considered in the analysis.

This analysis concludes on Page 21 of the study "Although there are no direct effects of solar farms on nearby agricultural land values, we do find evidence that suggests construction of a solar farm may create a small, positive, option -value for land owners that is capitalized into land prices. Specifically, after construction of a nearby solar farm, we find that agricultural land that is also located near transmission infrastructure may increase modestly in value."

This study supports a finding of no impact on adjoining agricultural property values and in some cases could support a modest increase in value.

D. Master's Thesis: ECU by Zachary Dickerson July 2018

A Solar Farm in *My* Backyard? Resident Perspectives of Utility-Scale Solar in Eastern North Carolina

This study was completed as part of a Master of Science in Geography Master's Thesis by Zachary Dickerson in July 2018. This study sets out to address three questions:

1. Are there different aspects that affect resident satisfaction regarding solar farms?

2. Are there variations in satisfaction for residents among different geographic settings, e.g. neighborhoods adjacent to the solar farms or distances from the solar farms?

3. How can insight from both the utility and planning sectors, combined with knowledge gained from residents, fill gaps in communication and policy writing in regard to solar farms?

This was done through survey and interview with adjacent and nearby neighbors of existing solar farms. The positive to neutral comments regarding the solar farms were significantly higher than negative. The researcher specifically indicates on Page 46 "The results show that respondents generally do not believe the solar farms pose a threat to their property values."

The most negative comments regarding the solar farms were about the lack of information about the approval process and the solar farm project prior to construction.

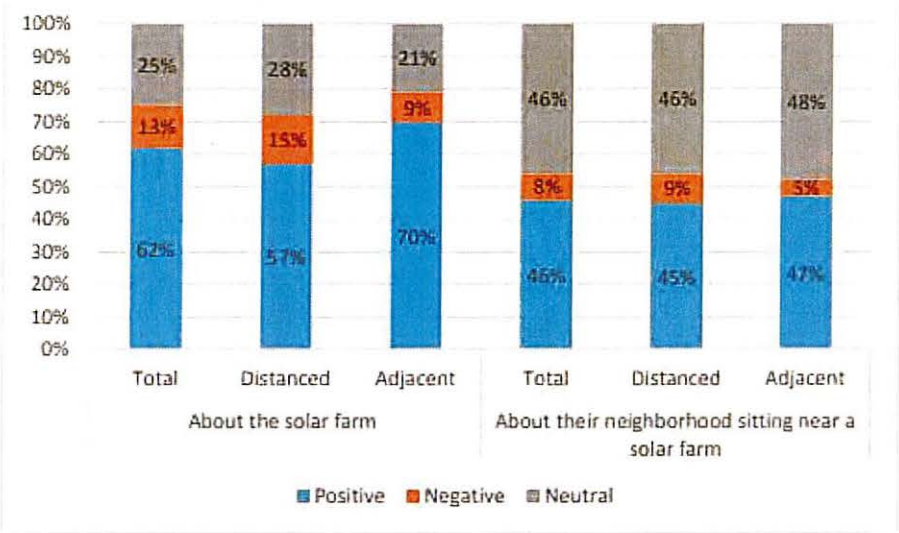
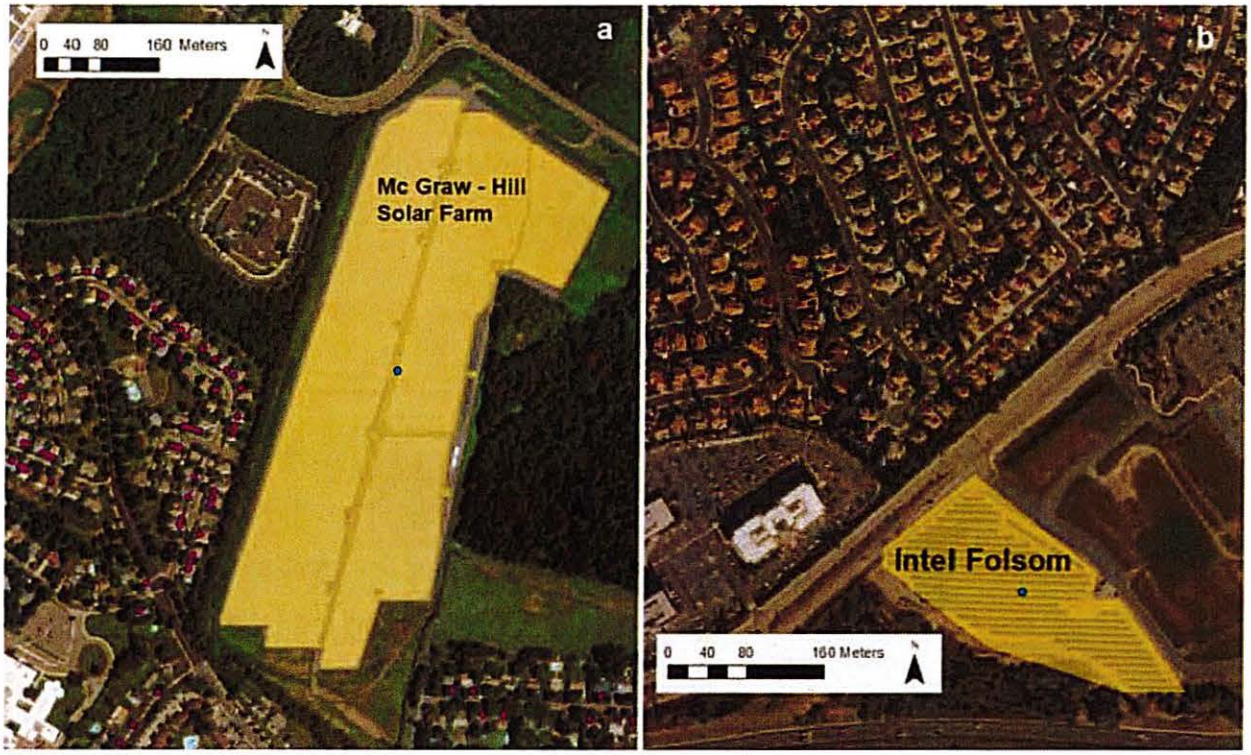


Figure 11: Residents' positive/negative word choices by geographic setting for both questions

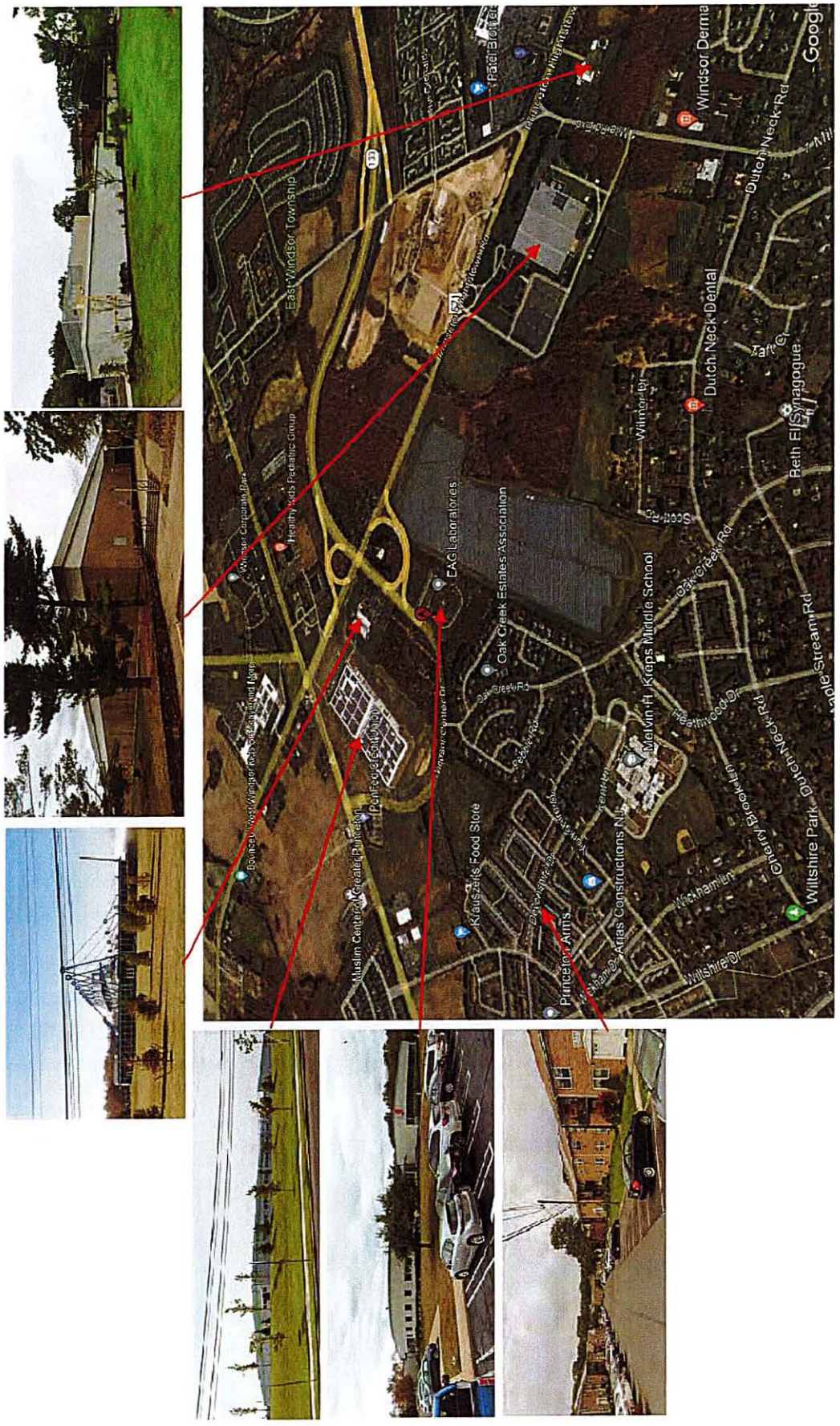
E. Lawrence Berkeley National Lab, March 2023

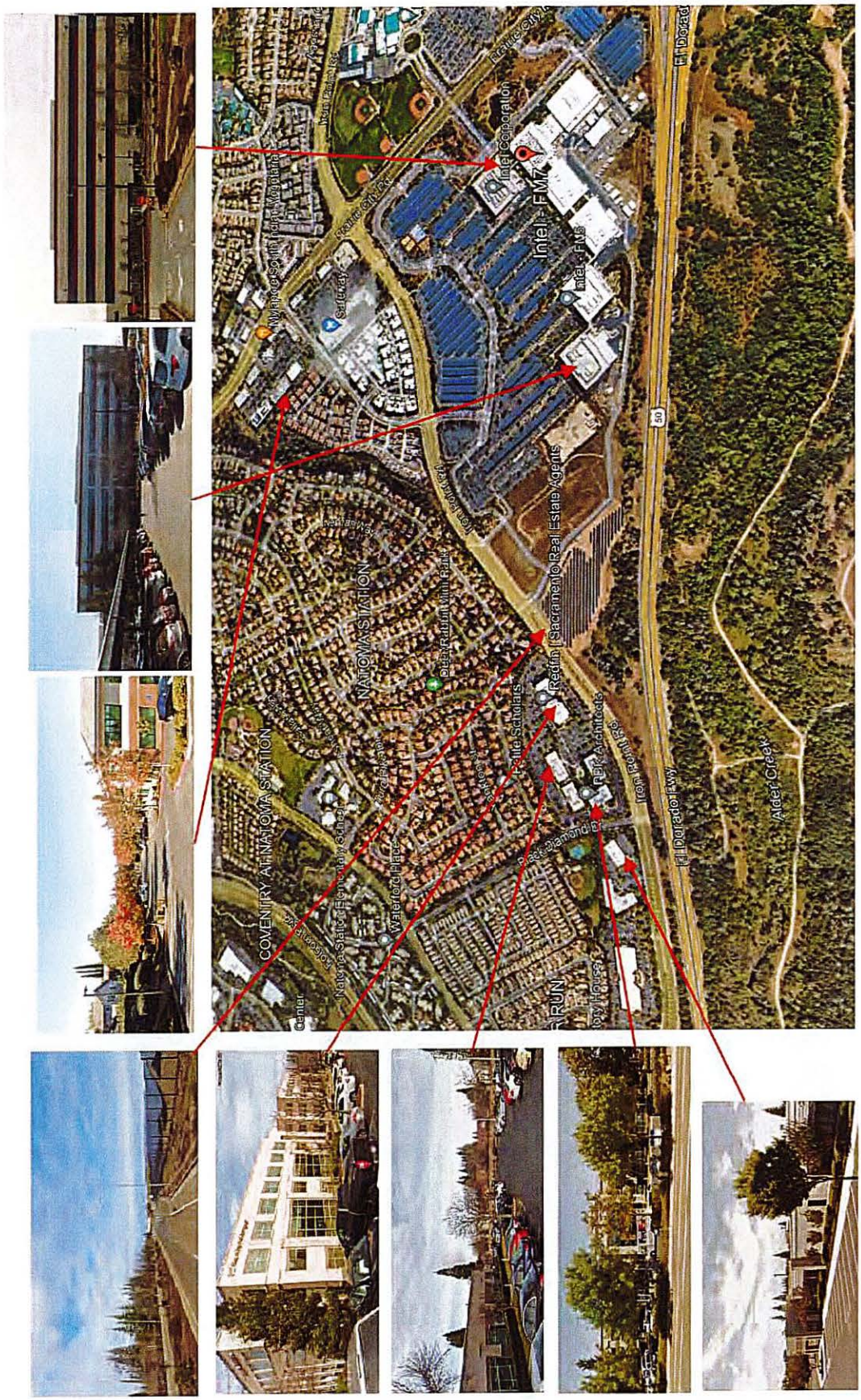
Shedding light on large-scale solar impacts: An analysis of property values and proximity to photovoltaics across six U.S. states

This study was completed by researchers including Salma Elmallah, Ben Hoen, K. Sydny Fujita, Dana Robson, and Eric Brunner. This analysis considers home sales before and after solar farms were installed within a 1-mile radius and compared them to home sales before and after the solar farms at a 2-4 mile radius. The conclusion found a 1.5% impact within 1 mile of a solar farm as compared to homes 2-4 miles from solar farms. This is the largest study of this kind on solar and addresses a number of issues, but also does not address a number of items that could potentially skew these results. First of all, the study found no impact in the three states with the most solar farm activity and only found impacts in smaller sets of data. The data does not in any way discuss actual visibility of solar farms or address existing vegetation screens. This lack of addressing this is highlighted by the fact that they suggest in the abstract that vegetative shading may be needed to address possible impacts. Another notable issue is the fact that they do not address other possible impacts within the radii being considered. This lack of consideration is well illustrated within the study on Figure A.1 where they show satellite images of McGraw Hill Solar Farm in NJ and Intel Folsom in CA. The Folsom image clearly shows large highways separating the solar farm from nearby housing, but with tower office buildings located closer to the housing being considered. In no place do they address the presence of these towers that essentially block those homes from the solar farm in some places. An excerpt of Fig. A.1. is shown below.

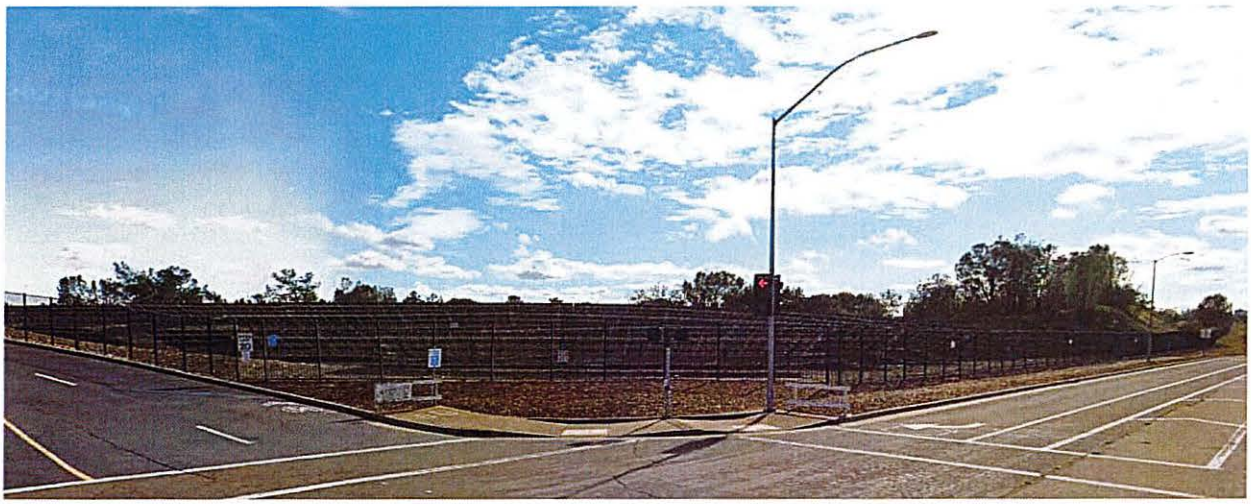


For each of these locations, I have panned out a little further on Google Earth to show the areas illustrated to more accurately reflect the general area. For the McGraw Hill Solar Farm you can see there is a large distribution warehouse to the west along with a large offices and other industrial uses. Further to the west is a large/older apartment complex (Princeton Arms). To the east there are more large industrial buildings. However, it is even more notable that 1.67 miles away to the west is Cranbury Golf Club. Given how this analysis was set up, these homes around the industrial buildings are being compared to homes within this country club to help establish impacts from the solar farm. Even considering the idea that each set is compared to itself before and after the solar farm, it is not a reasonable supposition that homes in each area would appreciate at the same rates even if no solar farm was included. Furthermore the site where the solar farm is located an all of the surrounding uses not improved with residential housing to the south is zoned Research Office (RO) which allows for: manufacturing, preparation, processing or fabrication of products, with all activities and product storage taking place within a completely enclosed building, scientific or research laboratories, warehousing, computer centers, pharmaceutical operations, office buildings, industrial office parks among others. Homes adjoining such a district would likely have impacts and influences not seen in areas zoned and surrounded by zoning strictly for residential uses.


East Windsor Township
Windsor Corporate Park
Healthy Kids Pediatric Group
EAG Laboratories
Oak Creek Estates Association
Dutch Neck Dental
Windsor Dermatology
Reth El Synagogue
Kreps Middle School
Muslim Center of Greater Princeton
Princeton Arms
Wiltshire Park
Wiltshire Dr
Oak Creek Rd
Dutch Neck Rd
Stream Rd
Google


Intel - FM7
Intel - FM8
NATOMA STATION
COVENTRY AT NATOMA STATION
Redfin | Sacramento Real Estate Agents
RBR Architects
Iron Point Rd
Folsom Blvd
Alder Creek
Natoma Station Elementary School
Waterfield Place
Old Folsom Trail Park
Natoma Station Park
Gateway
Intel Corporation
Intel - FM7
Intel - FM8
Folsom Blvd
Iron Point Rd
Alder Creek
50

On the Intel Folsom map I have shown the images of two of the Intel Campus buildings, but there are roughly 8 such buildings on that site with additional solar panels installed in the parking lot as shown in that image. I included two photos that show the nearby housing having clear and close views of adjoining office parking lots. This illustrates that the homes in that 1-mile radius are significantly more impacted by the adjoining office buildings than a solar farm located distantly that are not within the viewshed of those homes. Also, this solar farm is located on land adjoining the Intel Campus on a tract that is zoned M-1 PD, which is a Light Industrial/Manufacturing zoning. Nearby homes. Furthermore, the street view at the solar farm shows not only the divided four-lane highway that separates the office buildings and homes from the solar farm, but also shows that there is no landscaping buffer at this location. All of these factors are ignored by this study. Below is another image of the Folsom Solar at the corner of Iron Point Road and Intel West Driveway which shows just how close and how unscreened this project is.



Compare that image from the McGraw Hill Street view facing south from County Rte 571. There is a distant view and much of the project is hidden by a mix of berms and landscaping. The analysis makes no distinction between these projects.



The third issue with this study is that it identifies impacts following development in areas where they note that "more adverse home price impacts might be found where LSPVPS (large-scale

photovoltaic project) displace green space (consistent with results that show higher property values near green space." The problem with this statement is that it assumes that the greenspace is somehow guaranteed in these areas, when in fact, they could just as readily be developed as a residential subdivision and have the same impacts. They have made no effort to differentiate loss of greenspace through other development purposes such as schools, subdivisions, or other uses versus the impact of solar farms. In other words, they may have simply identified the impact of all forms of development on property value. This would in fact be consistent with the comments in the Rhode Island study where the researchers noted that the loss of greenspace in the highly urban areas was likely due to the loss of greenspace in particular and not due to the addition of solar panels.

Despite these three shortcomings in the analysis – the lack of differentiating landscape screening, the lack of consideration of other uses within the area that could be impacting property values, and the lack of consideration of alternative development impacts – the study still only found impacts between 0 and 5% with a conclusion of 1.5% within a 1-mile radius. As discussed later in this report, real estate is an imperfect market and real estate transactions typically sell for much wider variability than 5% even where there are no external factors operating on property value.

I therefore conclude that the minor impacts noted in this study support a finding of no impact on property value. Most appraisals show a variation between the highest and lowest comparable sale that is substantially greater than 1.5% and this measured impact for all its flaws would just be lost in the static of normal real estate transactions.

V. Assessor Surveys

I have attempted to contact all of the assessor departments in North Carolina to determine how local assessors are handling solar farms and adjoining property values. I have spoken personally with a number of assessors, but much of this data was obtained via email. I have 39 counties in NC that have both responded to these questions on property value and also have solar farms in that county. I have excluded responses from assessors from counties where there are no current solar farms.

As can be seen in the chart below, of the 39 responses all of the responses have indicated that they make no adjustment to properties adjoining solar farms. Several assessors indicated that it would require an adjoining property owner to appeal their property value with data showing a negative impact before they would make any adjustment and to date they have not had that happen.

I also point out specifically Clay County. I spoke with the assessor there specifically about adjustments that were applied to some properties near a solar farm back in 2008/2011. She was unaware of the details of that event as she was not in this position at that time. As discussed earlier in this report the lower re-assessments at that solar farm were based on a County Official, who owned property adjacent to the solar farm, who made an appeal to the assessor for reductions for his own property. The noted lack of lot sales after announcement of the solar farm however coincided with the recession in 2009 and lack of lot sales effectively defined that area during that time, but without relying on any data the assessor made that change in that time frame based on conversations with the assessor. Since then, Clay County has confirmed that they do not currently make any changes to adjoining property values and the current county assessor was not even aware that they had in the past done so.

NC Assessor Survey on Solar Farm Property Value Impacts

County	Assessor's Name	Number of Farms	Change in Adjacent Property Value
Alexander	Doug Fox	3	No
Buncombe	Lisa Kirbo	1	No
Burke	Daniel Isenhour	3, 2 on 1 parcel, 1 on 3 parcels	No
Cabarrus	Justin	less than 10, more in the works	No
Caldwell	Monty Woods	3 small	No, but will look at data in 2025
Catawba	Lori Ray	14	No
Chatham	Jenny Williams	13	No
Cherokee	Kathy Killian	9	No
Chowan	Melissa Radke	3, 1 almost operational	No
Clay	Bonnie L. Lyvers		No
Davidson	Libby	1	No
Duplin	Gary Rose	34, 2 more in planning	No
Franklin	Marion Cascone	11	No
Gaston	Traci Hovis	3	No
Gates	Chris Hill	3	No
Granville	Jenny Griffin	8	No
Halifax	C. Shane Lynch	Multiple	No
Hoke	Mandi Davis	4	No
Hyde	Donnie Shumate	1 to supplement egg processing plant	No
Iredell	Wes Long	2, 3 others approved	No
Lee	Lisa Faulkner	8	No
Lincoln	Susan Sain	2	No
Moore	Michael Howery	10	No
New Hanover	Rhonda Garner	35	No
Orange	Chad Phillip	2 or 7 depending on breakdown	No
Pender	Kayla Bolick Futrell	6	No
Person	Russell Jones	9	No
Pitt	Russell D. Hill	8, 1 in planning	No
Randolph	Mark Frick	19	No
Rockingham	Mark C McClintock	6	No
Rutherford	Kim Aldridge	20	No
Sampson	Jim Johnson	9, 1 in construction	No
Scotland	James Brown	15, 1 in process	No
Stokes	Richard Brim	2	No
Surry	Penny Harrison	4, 2 more in process	No
Union	Robin E. Merry	6	No
Vance	Cathy E. Renn	13	No
Warren	John Preston	7	No
Wayne	Alan Lumpkin	32	No
Wilson	William (Witt) Putney	~16	No, mass appraisal standards applied

Responses: 39
Negative Impact on Adjoining Value = Yes: 0
Negative Impact on Adjoining Value = No: 39

I have a breakdown of assessor surveys from other states as well and those responses are below. I have not had any assessor indicate a negative adjustment due to adjacency to a solar farm in any state. These responses total 188 with 170 definitively indicating no negative adjustments are made to adjoining property values, 18 providing no response to the question, and 0 indicating that they do address a negative impact on adjoining property value.

Summary of Assessor Surveys				
State	Responses	No Impact	Yes Impact	No Comment
North Carolina	39	39		
Virginia	16	16		
Indiana	31	31		
Colorado	15	7		8
Georgia	33	33		
Kentucky	10	6		4
Mississippi	4	2		2
New Mexico	5	5		
Ohio	24	20		4
South Carolina	11	11		
Totals	188	170		18

VI. Solar Farms Identified in Wayne and Adjoining Counties

Solar #	Name	County	City	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre			
									Res	Agri	Agri/Res	Com
1	Goldsboro	Wayne	Goldsboro	6.65	38	38			35%	23%	0%	42%
23	Freemont	Wayne	Freemont	5	55.26	55.26			0%	100%	0%	0%
34	Elizabeth	Johnston	Smithfield	4	34.85	34.85			12%	81%	0%	7%
35	Nitro	Johnston	Smithfield	5	84.5	26.63			1%	82%	17%	0%
40	Sampson	Sampson	Roseboro	2	49.21	14.32			5%	95%	0%	0%
42	Bizzell 1	Johnston	Selma		82.38	55.06	549	159	8%	52%	40%	0%
43	Bizzell 2	Johnston	Selma		103.01	39.63	232	67	27%	71%	0%	2%
45	Candace	Johnston	Princeton		54	54	642	460	24%	76%	0%	0%
46	Happy	Johnston	Benson		44.344	44.344	1,194	1,130	1%	57%	42%	0%
47	Murdock	Johnston	Clayton		31.882	31.882	374	268	0%	46%	53%	1%
49	Princeton 2	Johnston	Princeton		53.539	32.149	493	139	25%	0%	75%	0%
51	Red Toad Cleveland	Johnston	Smithfield	1.99	161.23	15	123	80	1%	99%	0%	0%
53	Buffalo	Johnston	Selma		49.23	15	N/A	N/A	30%	0%	0%	70%
54	Landmark	Johnston	Willow Springs		24.71	24.71	293	176	6%	51%	43%	0%
59	Longleaf	Johnston	Smithfield		158		1,124	125	3%	70%	27%	0%
60	Piper	Johnston	Princeton		73		350	190	4%	89%	7%	0%
61	Sadie	Johnston	Princeton		109		536	250	1%	8%	91%	0%
62	Signature	Johnston	Princeton		69.038		580	580	7%	93%	0%	0%
63	Wellons	Johnston	Smithfield		99.26		3,150	3,150	1%	4%	95%	0%
64	Lynch	Johnston	Selma		125.39	15	2,626	165	8%	85%	7%	0%
65	Stevens Chapel	Johnston	Smithfield		54.009	15	1,421	110	5%	3%	92%	0%
66	5840 Buffalo	Johnston	Selma		40.47	15	637	220	1%	26%	73%	0%
67	Langdon	Johnston	Four Oaks		32.12		239	90	30%	70%	0%	0%
72	Vinson	Johnston	Clayton		44.46		566	148	12%	88%	0%	0%
73	7807 Buffalo	Johnston	Selma		750.9		273	266	2%	98%	0%	0%
101	Narenco	Johnston	Smithfield		241.74	34.85	1,875	380	20%	77%	3%	0%
106	Scarlett	Lenoir	La Grange		17.03	17.03	1,041	530	7%	93%	0%	0%
122	Church Rd	Johnston	Angier	4.998	43.37	26	724	240	48%	52%	0%	0%
123	Page South	Johnston	Willow Springs		19.373		394	200	57%	43%	0%	0%
144	Highwater II	Wayne	Goldsboro		48.3	N/A		N/A	23%	77%	0%	0%
149	Mule Farm	Johnston	Benson	2	20.48	19	152	55	89%	0%	0%	11%
150	Rosewood	Wayne	Goldsboro		27.53		448	100	10%	80%	10%	0%
152	Goldsboro Esa	Wayne	Goldsboro	4.996	42.99	32	321	180	24%	11%	0%	65%
162	Four Oaks	Johnston	Four Oaks	2	41.84		922	790	2%	71%	27%	0%
168	Wilfork	Wayne	Goldsboro	5	39.4		288	250	4%	96%	0%	0%
169	Icarus	Wayne	La Grange	3	27		293	225	2%	98%	0%	0%
170	Robin	Wayne	Dudley	5	112.89		1,120	445	13%	50%	37%	0%
188	Benson	Johnston	Benson	4.996	32.098		506	255	15%	85%	0%	0%
194	Mt. Olive I	Wayne	Mt. Olive	6.8	129.57		1,119	110	13%	72%	12%	2%
195	Mt. Olive II	Wayne	Mt. Olive	6.65	55.69		319	215	20%	60%	20%	0%
196	S Elm City	Wilson	Elm City		38.41	33.93	167	113	22%	78%	0%	0%
197	E Elm City	Wilson	Elm City		39.79	35.79	262	101	94%	0%	0%	6%
199	Mooring 2	Lenoir	La Grange	5	97.21	25.07	575	575	7%	93%	0%	0%
209	Canon	Johnston	Smithfield	5	101.64	27.37	1,146	215	4%	41%	55%	0%
213	Banner	Johnston	Benson		51.92		1,380	440	3%	51%	46%	0%
218	Wendell	Johnston	Wendell	5	75.06		593	215	19%	67%	14%	0%
230	Thanksgiving Fire	Johnston	Zebulon	1.999	20.3		354	175	19%	81%	0%	0%
256	Jordan & C	Sampson	Faison	1.5	95.05		319	185	1%	99%	0%	0%
296	Lane	Wayne	Goldsboro		168.92	30	2,513	1,985	2%	95%	3%	0%
340	Timothy	Sampson	Dunn	0.48	26.83		694	485	9%	90%	0%	1%
344	Belafonte	Duplin	Calypso	3.4	122.55		1,285	1,285	0%	69%	30%	1%
355	Cookstown	Wayne	Goldsboro	5	62.75	37.1	453	145	35%	44%	21%	0%
368	Warsaw	Duplin	Warsaw	87.5	585.97	499	526	130	11%	66%	21%	3%

Solar #	Name	County	City	Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
376	Suncaster	Wayne	Pikeville	5	65.5	39	332	120	15%	85%	0%	0%
377	Ransom	Sampson	Clinton	5	41.52	36	233	185	13%	78%	9%	0%
387	Williams	Johnston	Newton Grove	5	29.33	29.33	393	335	13%	87%	0%	0%
397	McCullen	Sampson	Clinton		53.1	51	225	105	40%	0%	60%	0%
456	Eros	Duplin	Calypso		80.4	31.9	-	-	0%	100%	0%	0%
485	McGrigor	Sampson	Clinton	5	40.99	32.49	315	150	38%	9%	0%	53%
499	Summitt	Wayne	Mt Olive	3	59.67	16.79	761	270	8%	49%	44%	0%
512	Harrison-Van Buren	Sampson	Roseboro	7	200	65.5	1,015	175	7%	84%	9%	0%
515	Truman(NC)	Johnston	Wendell	5	123.27	40.64	1,122	915	19%	28%	53%	0%
553	Overman	Wayne	Goldsboro		242.99	66.6	1,255	580	7%	76%	0%	17%
554	Faraday	Sampson	Dunn	2	136.1	16.08	1,610	450	2%	79%	19%	0%
578	Brick City	Duplin	Wallace	5	47.8	26.5	120	70	26%	21%	0%	53%
587	Ramp	Wayne	Goldsboro	2	15.23	15.23	327	275	100%	0%	0%	0%
588	Wedge	Wayne	Goldsboro	5	32.68	32.68	2,000	2,000	40%	36%	25%	0%
614	HCE Johnston 1	Johnston	Willow Springs	2.6	31.54	13.29	485	335	15%	82%	0%	3%
632	Solar Lee	Wayne	Mount Olive	5	38.06	27	250	88	28%	60%	12%	0%
646	Grifton	Lenoir	Grifton	5	101.51	41.3	1,023	460	5%	59%	35%	1%
647	Highland	Lenoir	Grifton	4.998	117.24	39.24	959	125	5%	25%	52%	18%
648	Exum	Lenoir	Grifton	4.95	55.83	30.19	512	155	13%	87%	0%	0%
652	Overhill	Sampson	Clinton	5	36.8	31.91	435	435	50%	42%	0%	8%
662	South River H4	Sampson	Autryville	0.5	16.73	4.5	506	208	6%	92%	0%	2%
663	Arba	Greene	Snow Hill	5	113.93	32.2	1,278	570	7%	47%	46%	0%
790	Innovative Solar 54	Lenoir	Kinston	50	303.23	303.23	241	115	6%	95%	0%	0%
847	Harding	Greene	Hookerton	3	72.84	72.84	1,719	730	20%	71%	9%	0%
856	Oxbow	Wayne	Brogden	175	1716	1716	524	120	13%	61%	26%	0%
877	Panther Branch	Duplin	Faison	80	1472.5	1472.5	1,135	140	8%	59%	33%	0%
878	Ridgeline	Duplin	Mount Olive	80	498	498	555	300	2%	86%	12%	0%
929	Bear Point	Lenoir	La Grange	73	801	801	553	130	4%	94%	2%	0%
931	Sasser	Wayne	Hopewell	80	1200	1200	425	75	15%	77%	7%	0%
942	Steven Mills	Wayne	Goldsboro	80	1041.5	1041.5	815	115	7%	73%	10%	9%
944	Maple Leaf Solar	Johnston	Selma	79.99	425.99	425.99	573	200	11%	80%	0%	9%

			Output (MW)	Total Acres	Used Acres	Avg. Dist to home	Closest Home	Adjoining Use by Acre Res	Agri	Agri/Res	Com
# of Solar Farms	84	**Average**	18.3	166.9	159.9	749	365	16%	62%	17%	5%
		Median	5.0	55.8	32.6	543	204	9%	71%	3%	0%
		High	175.0	1716.0	1716.0	3150	3150	100%	100%	95%	70%
		Low	0.5	15.2	4.5	120	55	0%	0%	0%	0%

VII. Market Analysis of the Impact on Value from Solar Farms

I have researched hundreds of solar farms in numerous states to determine the impact of these facilities on the value of adjoining property. This research has primarily been in North Carolina, but I have also conducted market impact analyses in Virginia, South Carolina, Tennessee, Texas, Oregon, Mississippi, Maryland, New York, California, Missouri, Florida, Montana, Georgia, Louisiana, and New Jersey.

Wherever I have looked at solar farms, I have derived a breakdown of the adjoining uses to show what adjoining uses are typical for solar farms and what uses would likely be considered consistent with a solar farm use similar to the breakdown that I've shown for the subject property on the previous page. A summary showing the results of compiling that data over hundreds of solar farms is shown later in the Scope of Research section of this report.

I also consider whether the properties adjoining a solar farm in one location have characteristics similar to the properties abutting or adjoining the proposed site so that I can make an assessment of market impact on each proposed site. Notably, in most cases solar farms are placed in areas very similar to the site in question, which is surrounded by low density residential and agricultural uses. In my over 900 studies, I have found a striking repetition of that same typical adjoining use mix in over 90% of the solar farms I have looked at. Matched pair results in multiple states are strikingly similar, and all indicate that solar farms – which generate very little traffic, and do not generate noise, dust or have other harmful effects – do not negatively impact the value of adjoining or abutting properties.

On the following pages I have considered matched pair data specific to Pitt County and adjoining counties. After that I consider solar farm data throughout North Carolina, which repeats some data from the first set.

In the next section I have considered matched pair data throughout the Southeast of the United States as being the most similar states that would most readily compare to North Carolina. This includes data from Florida, Georgia, South Carolina, North Carolina, Tennessee, Virginia and Maryland. I focused on projects of 5 MW and larger though I have significant supplemental data on solar farms just smaller than that in North Carolina that show similar results. This data is available in my files.

I have additional supporting information from other states in my files that show a consistent pattern across the United States, but again, I have focused on the Southeast in this analysis.

across the United States, but again, I have focused on the Southeast in this analysis.

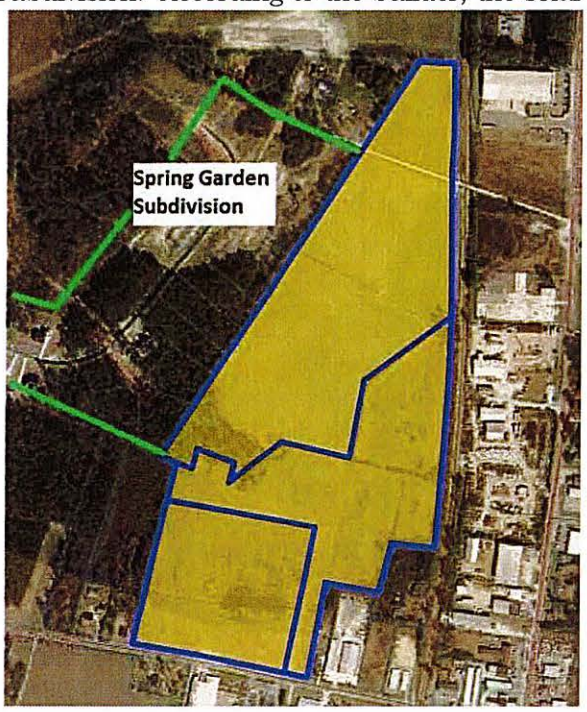
A. North Carolina Data

The following pages detail the matched pairs and how they were derived.

1. Matched Pair – AM Best Solar Farm, Goldsboro, Wayne County, NC

This 5 MW solar farm adjoins Spring Garden Subdivision was built in 2013 and had new homes and lots available for new construction during the approval and construction of the solar farm. The recent home sales have ranged from $200,000 to $250,000. This subdivision sold out the last homes in late 2014. The solar farm is clearly visible particularly along the north end of this street where there is only a thin line of trees separating the solar farm from the single-family homes.

Homes backing up to the solar farm are selling at the same price for the same floor plan as the homes that do not back up to the solar farm in this subdivision. According to the builder, the solar farm has been a complete non-factor. Not only do the sales show no difference in the price paid for the various homes adjoining the solar farm versus not adjoining the solar farm, but there are actually more recent sales along the solar farm than not. There is no impact on the sellout rate, or time to sell for the homes adjoining the solar farm.



I spoke with a number of owners who adjoin the solar farm and none of them expressed any concern over the solar farm impacting their property value.

The data presented on the following page shows multiple homes that have sold in 2013 and 2014 adjoining the solar farm at prices similar to those not along the solar farm. These series of sales indicate that the solar farm has no impact on the adjoining residential use.



The homes that were marketed at Spring Garden are shown below.



The homes adjoining the solar farm are considered to have a light landscaping screen as it is a narrow row of existing pine trees supplemented with evergreen plantings.

Matched Pairs
As of Date: 9/3/2014

Adjoining Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600195570	Helm	0.76	Sep-13	$250,000	2013	3,292	$75.94	2 Story
3600195361	Leak	1.49	Sep-13	$260,000	2013	3,652	$71.19	2 Story
3600199891	McBrayer	2.24	Jul-14	$250,000	2014	3,292	$75.94	2 Story
3600198632	Foresman	1.13	Aug-14	$253,000	2014	3,400	$74.41	2 Story
3600196656	Hinson	0.75	Dec-13	$255,000	2013	3,453	$73.85	2 Story
	Average	1.27		$253,600	2013.4	3,418	$74.27	
	Median	1.13		$253,000	2013	3,400	$74.41	

Adjoining Sales After Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
0	Feddersen	1.56	Feb-13	$247,000	2012	3,427	$72.07	Ranch
0	Gentry	1.42	Apr-13	$245,000	2013	3,400	$72.06	2 Story
	Average	1.49		$246,000	2012.5	3,414	$72.07	
	Median	1.49		$246,000	2012.5	3,414	$72.07	

Adjoining Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600183905	Carter	1.57	Dec-12	$240,000	2012	3,347	$71.71	1.5 Story
3600193097	Kelly	1.61	Sep-12	$198,000	2012	2,532	$78.20	2 Story
3600194189	Hadwan	1.55	Nov-12	$240,000	2012	3,433	$69.91	1.5 Story
	Average	1.59		$219,000	2012	2,940	$74.95	
	Median	1.59		$219,000	2012	2,940	$74.95	

Nearby Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600193710	Barnes	1.12	Oct-13	$248,000	2013	3,400	$72.94	2 Story
3601105180	Nackley	0.95	Dec-13	$253,000	2013	3,400	$74.41	2 Story
3600192528	Mattheis	1.12	Oct-13	$238,000	2013	3,194	$74.51	2 Story
3600198928	Beckman	0.93	Mar-14	$250,000	2014	3,292	$75.94	2 Story
3600196965	Hough	0.81	Jun-14	$224,000	2014	2,434	$92.03	2 Story
3600193914	Preskitt	0.67	Jun-14	$242,000	2014	2,825	$85.66	2 Story
3600194813	Bordner	0.91	Apr-14	$258,000	2014	3,511	$73.48	2 Story
3601104147	Shaffer	0.73	Apr-14	$255,000	2014	3,453	$73.85	2 Story
	Average	0.91		$246,000	2013.625	3,189	$77.85	
	Median	0.92		$249,000	2014	3,346	$74.46	

Nearby Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600191437	Thomas	1.12	Sep-12	$225,000	2012	3,276	$68.68	2 Story
3600087968	Lilley	1.15	Jan-13	$238,000	2012	3,421	$69.57	1.5 Story
3600087654	Burke	1.26	Sep-12	$240,000	2012	3,543	$67.74	2 Story
3600088796	Hobbs	0.73	Sep-12	$228,000	2012	3,254	$70.07	2 Story
	Average	1.07		$232,750	2012	3,374	$69.01	
	Median	1.14		$233,000	2012	3,349	$69.13	

Matched Pair Summary

	Adjoins Solar Farm		Nearby Solar Farm	
	Average	**Median**	**Average**	**Median**
Sales Price	$253,600	$253,000	$246,000	$249,000
Year Built	2013	2013	2014	2014
Size	3,418	3,400	3,189	3,346
Price/SF	$74.27	$74.41	$77.85	$74.46

Percentage Differences

Median Price	-2%
Median Size	-2%
Median Price/SF	0%

I note that 2308 Granville Drive sold again in November 2015 for $267,500, or $7,500 more than when it was purchased new from the builder two years earlier (Tax ID 3600195361, Owner: Leak). The neighborhood is clearly showing appreciation for homes adjoining the solar farm.

The Median Price is the best indicator to follow in any analysis as it avoids outlying samples that would otherwise skew the results. The median sizes and median prices are all consistent throughout the sales both before and after the solar farm whether you look at sites adjoining or nearby to the solar farm. The average size for the homes nearby the solar farm shows a smaller building size and a higher price per square foot. This reflects a common occurrence in real estate where the price per square foot goes up as the size goes down. So even comparing averages the indication is for no impact, but I rely on the median rates as the most reliable indication for any such analysis.

I have also considered four more recent resales of homes in this community as shown on the following page. These comparable sales adjoin the solar farm at distances ranging from 315 to 400 feet. The matched pairs show a range from -9% to +6%. The range of the average difference is -2% to +1% with an average of 0% and a median of +0.5%. These comparable sales support a finding of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	103 Granville Pl	1.42	7/27/2018	$265,000	2013	3,292	$80.50	4/3.5	2-Car	2-Story		385
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	103 Granville Pl								$265,000		-2%
	Not	2219 Granville	$4,382		$1,300	$0				$265,682	0%	
	Not	634 Friendly	-$8,303		-$6,675	$16,721	-$10,000			$258,744	2%	
	Not	2403 Granville	-$6,029		-$1,325	$31,356				$289,001	-9%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	104 Erin	2.24	6/19/2017	$280,000	2014	3,549	$78.90	5/3.5	2-Car	2-Story		315
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	104 Erin								$280,000		0%
	Not	2219 Granville	-$4,448		$2,600	$16,238				$274,390	2%	
	Not	634 Friendly	-$17,370		-$5,340	$34,702	-$10,000			$268,992	4%	
	Not	2403 Granville	-$15,029		$0	$48,285				$298,256	-7%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2312 Granville	0.75	5/1/2018	$284,900	2013	3,453	$82.51	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2312 Granville								$284,900		1%
	Not	2219 Granville	$2,476		$1,300	$10,173				$273,948	4%	
	Not	634 Friendly	-$10,260		-$6,675	$27,986	-$10,000			$268,051	6%	
	Not	2403 Granville	-$7,972		-$1,325	$47,956				$303,659	-7%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	2310 Granville	0.76	5/14/2019	$280,000	2013	3,292	$85.05	5/3.5	2-Car	2-Story		400
	Not	2219 Granville	1.15	1/8/2018	$260,000	2012	3,292	$78.98	4/3.5	2-Car	2-Story		
	Not	634 Friendly	0.96	7/31/2019	$267,000	2018	3,053	$87.45	4/4.5	2-Car	2-Story		
	Not	2403 Granville	0.69	4/23/2019	$265,000	2014	2,816	$94.11	5/3.5	2-Car	2-Story		

	Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
	Adjoins	2310 Granville								$280,000		1%
	Not	2219 Granville	$10,758		$1,300	$0				$272,058	3%	
	Not	634 Friendly	-$1,755		-$6,675	$16,721	-$10,000			$265,291	5%	
	Not	2403 Granville	$469		-$1,325	$31,356				$295,500	-6%	

I have also considered the original sales prices in this subdivision relative to the recent resale values as shown in the chart below. I have used the FHFA House Price Index Calculator to identify the value anticipated for each property in the second sale based on typical appreciation in the Goldsboro market from that national index. I note that these show that the homes are continuing to appreciate at rates consistent with if not more aggressively than the market indicators as both the average and median differences shown below support a 4 to 5% increase over what the FHFA HPI indicates. There were only 2 out of 14 indicators that suggested lower sales prices than anticipated and both of those occurred during the fast runup in values in 2021/2022 where the difference of a month or two could make significant differences and the FHFA HPI only addresses quarterly differences.

This set of 14 sales shows strong appreciation among the homes adjoining the solar farm. I also note that two of the sales shown below were initially sold in 2012 prior to the solar farm and show a Sale/Resale analysis supporting a finding of no impact on adjoining property value.

	Address	Initial Sale Date	Price	Second Sale Date	Price	FHFA HPI Value	$ Diff.	% Diff.
1	103 Granville Pl	4/1/2013	$245,000	7/27/2018	$265,000	$249,000	$16,000	6.43%
2	105 Erin	7/1/2014	$250,000	6/19/2017	$280,000	$247,000	$33,000	13.36%
3	2312 Granville	12/1/2013	$255,000	5/1/2015	$262,000	$244,000	$18,000	7.38%
4	2312 Granville	5/1/2015	$262,000	5/1/2018	$284,900	$283,000	$1,900	0.67%
5	2312 Granville	5/1/2018	$284,900	9/1/2021	$357,000	$349,000	$8,000	2.29%
6	2310 Granville	8/1/2013	$250,000	5/14/2019	$280,000	$264,000	$16,000	6.06%
7	2308 Granville	9/1/2013	$260,000	11/12/2015	$267,500	$255,000	$12,500	4.90%
8	2308 Granville	11/12/2015	$267,500	4/1/2021	$345,000	$332,000	$13,000	3.92%
9	2304 Granville	9/1/2012	$198,000	6/1/2017	$225,000	$193,000	$32,000	16.58%
10	2304 Granville	6/1/2017	$225,000	5/1/2021	$277,000	$278,000	-$1,000	-0.36%
11	2304 Granville	5/1/2021	$277,000	4/1/2022	$330,000	$325,000	$5,000	1.54%
12	102 Erin	8/1/2014	$253,000	11/1/2016	$270,000	$260,000	$10,000	3.85%
13	104 Erin	6/1/2017	$280,000	5/1/2022	$393,000	$433,000	-$40,000	-9.24%
14	2302 Granville	12/1/2012	$240,000	7/1/2022	$410,000	$375,000	$35,000	9.33%

Average	4.76%
Median	4.41%
High	16.58%
Low	-9.24%

2. Matched Pair – Cookstown Solar Farm, Goldsboro, Wayne County, NC



This 5 MW solar farm was built between 2018 and 2019. I identified a series of sales of the home at 411 N Cottowood Drive over the last 8 years that I have researched with the most recent sale being in 2022. This home is 295 feet from the closest panel. I spoke with Natalie Barber with Statewide Realty (919-738-3270) who indicated that the solar farm had no impact on the sales price or marketing of the home. She noted that you could see the panels somewhat, but not much due to the landscaping.

On the chart below, I have included an analysis of the 2015 sale of the property prior to the solar farm to both the 2020 and the 2022 sales of this home. I have compared both of these sales prices to the FHFA HPI indicator of where the sales price should have appreciated to for comparison.

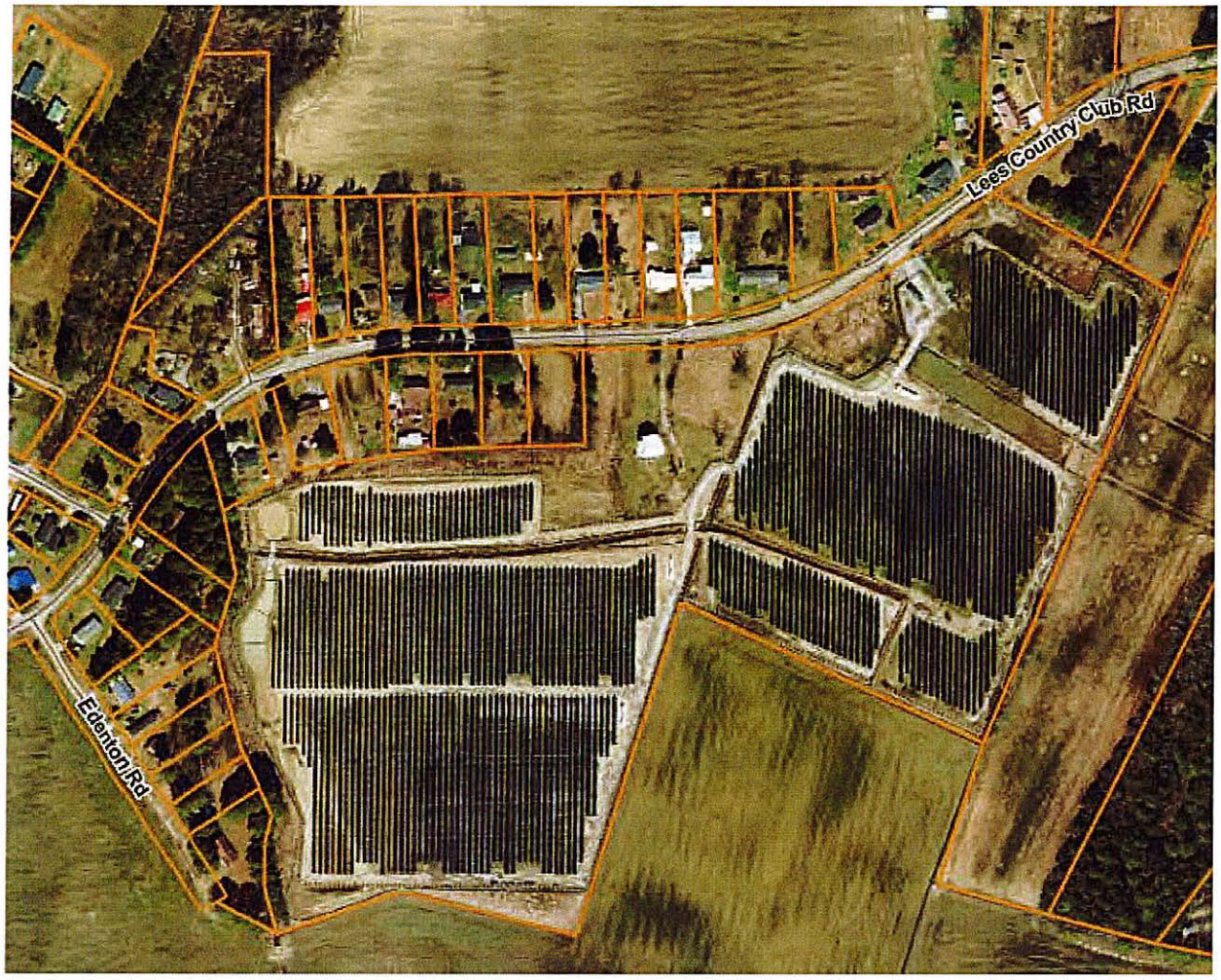
Cookstown Solar Farm

	Initial Sale		Second Sale		FHFA	$	%
Address	**Date**	**Price**	**Date**	**Price**	**HPI Value**	**Diff.**	**Diff.**
1 411 N Cottonwood	6/30/2015	$154,000	7/2/2020	$182,000	$172,000	$10,000	5.81%
2 411 N Cottonwood	6/30/2015	$154,000	10/31/2022	$280,000	$244,000	$36,000	14.75%
3 411 N Cottonwood	7/2/2020	$182,000	10/31/2022	$280,000	$259,000	$21,000	8.11%

Average	9.56%
Median	8.11%
High	14.75%
Low	5.81%

This data shows that in every instance, the home adjoining the solar farm outperformed the expectation and this data strongly suggests a positive relationship between the solar farm and the adjoining home value.

3. Matched Pair – Solar Lee, Mt Olive, Wayne County, NC



This 4.9 MW solar farm was built between 2020 and 2021.

I identified a sale of a home at 296 Lees Country Club Road on April 13, 2022 for $183,900. This home is across the street to the north near the east end of the project and is 185 feet from the closest solar panel.

Solar Lee, Lees Country Club Road, Mt. Olive, Wayne County, NC
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	296 Lees Cntry	0.93	4/13/2022	$183,900	1969	1,975	$93.11	4/2.5	Drive	Br-Rnch		185
	Not	601 Steele	0.41	5/12/2022	$200,000	1964	1,966	$101.73	3/2	2-Carprt	Br-Rnch		
	Not	106 College	0.50	2/11/2022	$191,000	1960	2,050	$93.17	3/2	Drive	Br-Rnch		
	Not	840 N Church	0.60	5/23/2022	$210,000	1953	2,248	$93.42	3/2	Crpt/Gar	Br-Rnch		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	296 Lees Cntry								$183,900		-4%
Not	601 Steele	-$1,466		$5,000	$458	-$5,000		-$10,000	$188,991	-3%	
Not	106 College	$2,945		$8,595	-$3,494	-$5,000			$194,047	-6%	
Not	840 N Church	-$2,124		$16,800	-$12,751	-$5,000		-$15,000	$191,925	-4%	

The paired sales all sold within a very similar time frame and support a difference of -4%, which is within the typical market imperfection and supports a finding of no impact at all.

4. Matched Pair – Gastonia SC Solar, Gastonia, Gaston County, NC





This 5 MW project is located on the south side of Neal Hawkins Road just outside of Gastonia. The property identified above as Parcel 4 was listed for sale while this solar farm project was going through the approval process. The property was put under contract during the permitting process with the permit being approved while the due diligence period was still ongoing. After the permit was approved the property closed with no concerns from the buyer. I spoke with Jennifer Bouvier, the broker listing the property and she indicated that the solar farm had no impact at all on the sales price. She considered some nearby sales to set the price and the closing price was very similar to the asking price within the typical range for the market. The buyer was aware that the solar farm was coming and they had no concerns.

This two-story brick dwelling was sold on March 20, 2017 for $270,000 for a 3,437 square foot dwelling built in 1934 in average condition on 1.42 acres. The property has four bedrooms and two bathrooms. The landscaping screen is light for this adjoining home due to it being a new planted landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	609 Neal Hawkins	1.42	3/20/2017	$270,000	1934	3,427	$78.79	4/2	Open	2-Brick	
Not	1418 N Modena	4.81	4/17/2018	$225,000	1930	2,906	$77.43	3/3	2-Crprt	2-Brick	
Not	363 Dallas Bess	2.90	11/29/2018	$265,500	1968	2,964	$89.57	3/3	Open	FinBsmt	
Not	1612 Dallas Chry	2.74	9/17/2018	$245,000	1951	3,443	$71.16	3/2	Open	2-Brick	Unfin bath

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
609 Neal Hawkins								$270,000			225
1418 N Modena	$7,319		$2,700	$32,271		-$10,000		$257,290	5%		
363 Dallas Bess	$746		-$27,081	$33,179	-$10,000		$53,100	$262,456	3%		
1612 Dallas Chry	$4,110		-$12,495	-$911			$10,000	$235,704	13%		
										7%	

I also considered the newer adjoining home identified as Parcel 5 that sold later in 2017 and it likewise shows no negative impact on property value. This is also considered a light landscaping buffer.

Adjoining Residential Sales After Solar Farm Approved

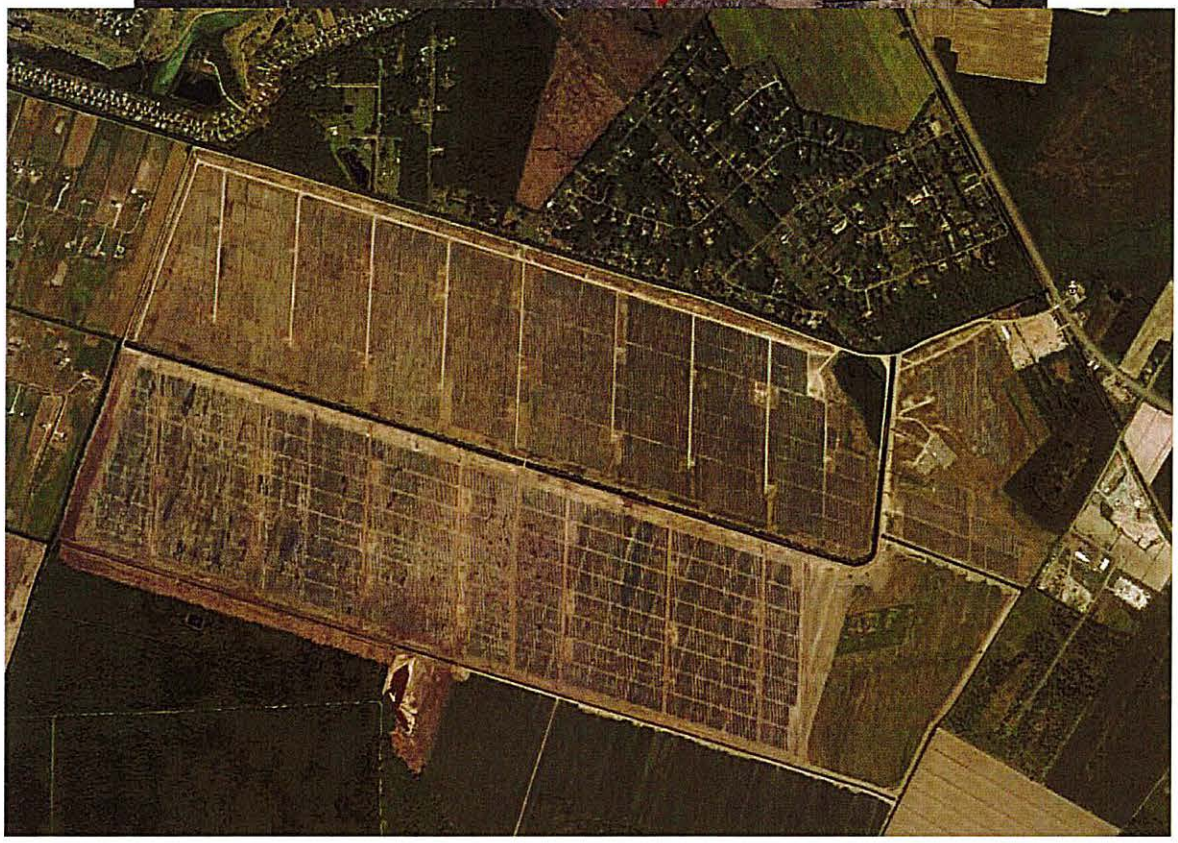
Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style
Adjoins	611 Neal Hawkins	0.78	7/6/2017	$288,000	1991	2,256	$127.66	5/3	2-Gar	1.5 Brick
Not	1211 Still Frst	0.51	7/30/2018	$280,000	1989	2,249	$124.50	3/3	2-Gar	Br Rnch
Not	2867 Colony Wds	0.52	8/14/2018	$242,000	1990	2,006	$120.64	3/3	2-Gar	Br Rnch
Not	1010 Strawberry	1.00	10/4/2018	$315,000	2002	2,330	$135.19	3/2.5	2-Gar	1.5 Brick

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
611 Neal Hawkins								$288,000			145
1211 Still Frst	$1,341		$2,800	$697				$284,838	1%		
2867 Colony Wds	$7,714		$1,210	$24,128				$275,052	4%		
1010 Strawberry	-$4,555		-$17,325	-$8,003	$5,000			$290,116	-1%		
										2%	

5. Matched Pair – Summit/Ranchlands Solar, Moyock, Currituck County, NC





This project is located at 1374 Caritoke Highway, Moyock, NC. This is an 80 MW facility on a parent tract of 2,034 acres. Parcels Number 48 and 53 as shown in the map above were sold in 2016. The project was under construction during the time period of the first of the matched pair sales and the permit was approved well prior to that in 2015.

I looked at multiple sales of adjoining and nearby homes and compared each to multiple comparables to show a range of impacts from -10% up to +11% with an average of +2% and a median of +3%. These ranges are well within typical real estate variation and supports an indication of no impact on property value.

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
48	Adjoins	129 Pinto	4.29	4/15/2016	$170,000	1985	1,559	$109.04	3/2	Drive	MFG		1,060
	Not	102 Timber	1.30	4/1/2016	$175,500	2009	1,352	$129.81	3/2	Drive	MFG		
	Not	120 Ranchland	0.99	10/1/2014	$170,000	2002	1,501	$113.26	3/2	Drive	MFG		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	129 Pinto								$170,000		-3%
Not	102 Timber	$276	$10,000	-$29,484	$18,809				$175,101	-3%	
Not	120 Ranchland	$10,735	$10,000	-$20,230	$4,598				$175,103	-3%	

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	105 Pinto	4.99	12/16/2016	$206,000	1978	1,484	$138.81	3/2	Det G	Ranch	
Not	111 Spur	1.15	2/1/2016	$193,000	1985	2,013	$95.88	4/2	Gar	Ranch	
Not	103 Marshall	1.07	3/29/2017	$196,000	2003	1,620	$120.99	3/2	Drive	Ranch	
Not	127 Ranchland	0.00	6/9/2015	$219,900	1988	1,910	$115.13	3/2	Gar/3Det	Ranch	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
105 Pinto								$206,000			980
111 Spur	$6,747	$10,000	-$6,755	-$25,359				$177,633	14%		
103 Marshall	-$2,212	$10,000	-$24,500	-$8,227		$5,000		$176,212	14%		
127 Ranchland	$13,399	$10,000	-$10,995	-$24,523		-$10,000		$197,781	4%		
										11%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
15	Adjoins	318 Green View	0.44	9/15/2019	$357,000	2005	3,460	$103.18	4/4	2-Car	1.5 Brick		570
	Not	195 St Andrews	0.55	6/17/2018	$314,000	2002	3,561	$88.18	5/3	2-Car	2.0 Brick		
	Not	336 Green View	0.64	1/13/2019	$365,000	2006	3,790	$96.31	6/4	3-Car	2.0 Brick		
	Not	275 Green View	0.36	8/15/2019	$312,000	2003	3,100	$100.65	5/3	2-Car	2.0 Brick		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	318 Green View								$357,000		4%
Not	195 St Andrews	$12,040		$4,710	-$7,125	$10,000			$333,625	7%	
Not	336 Green View	$7,536		-$1,825	-$25,425			-$5,000	$340,286	5%	
Not	275 Green View	$815		$3,120	$28,986	$10,000			$354,921	1%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
29	Adjoins	164 Ranchland	1.01	4/30/2019	$169,000	1999	2,052	$82.36	4/2	Gar	MFG		440
	Not	150 Pinto	0.94	3/27/2018	$168,000	2017	1,920	$87.50	4/2	Drive	MFG		
	Not	105 Longhorn	1.90	10/10/2017	$184,500	2002	1,944	$94.91	3/2	Drive	MFG		
	Not	112 Pinto	1.00	7/27/2018	$180,000	2002	1,836	$98.04	3/2	Drive	MFG	Fenced	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	164 Ranchland								$169,000		-10%
Not	150 Pinto	$5,649		-$21,168	$8,085			$5,000	$165,566	2%	
Not	105 Longhorn	$8,816	-$10,000	-$3,875	$7,175			$5,000	$191,616	-13%	
Not	112 Pinto	$4,202		-$3,780	$14,824			$5,000	$200,245	-18%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Adjoins	358 Oxford	10.03	9/16/2019	$478,000	2008	2,726	$175.35	3/3	2 Gar	Ranch		635
	Not	276 Summit	10.01	12/20/2017	$355,000	2006	1,985	$178.84	3/2	2 Gar	Ranch		
	Not	176 Providence	6.19	5/6/2019	$425,000	1990	2,549	$166.73	3/3	4 Gar	Ranch	Brick	
	Not	1601 B Caratoke	12.20	9/26/2019	$440,000	2016	3,100	$141.94	4/3.5	5 Gar	Ranch	Pool	

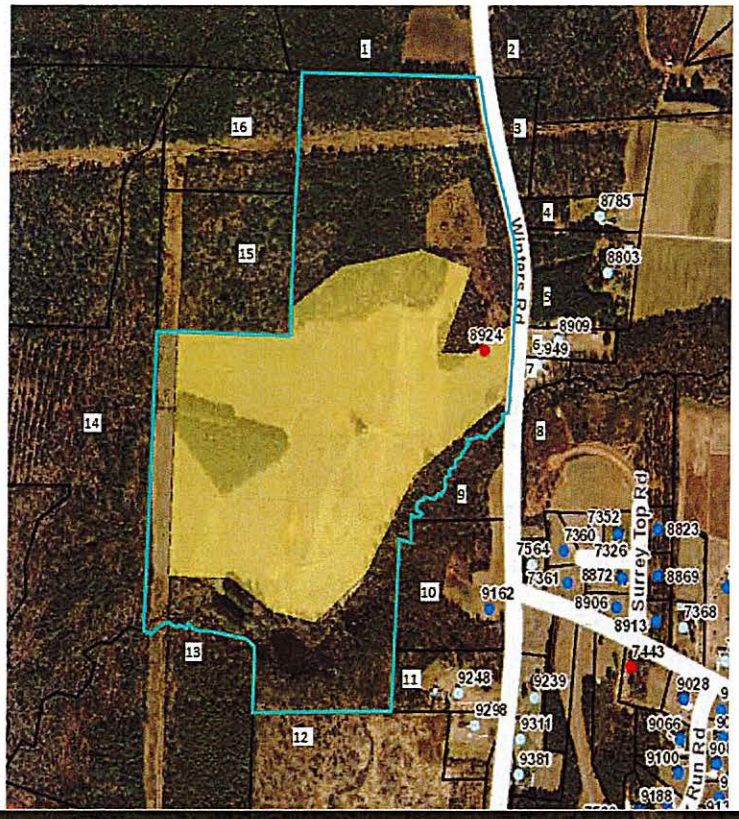
Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	358 Oxford								$478,000		5%
Not	276 Summit	$18,996		$3,550	$106,017	$10,000			$493,564	-3%	
Not	176 Providence	$4,763		$38,250	$23,609		-$10,000	-$25,000	$456,623	4%	
Not	1601 B Caratoke	-$371	$50,000	-$17,600	-$42,467	-$5,000	-$10,000		$414,562	13%	

Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
	Nearby	343 Oxford	10.01	3/9/2017	$490,000	2016	3,753	$130.56	3/3	2 Gar	1.5 Story	Pool	970
	Not	287 Oxford	10.01	9/4/2017	$600,000	2013	4,341	$138.22	5/4.5	8-Gar	1.5 Story	Pool	
	Not	301 Oxford	10.00	4/23/2018	$434,000	2013	3,393	$127.91	5/3	2 Gar	1.5 Story		
	Not	218 Oxford	10.01	4/4/2017	$525,000	2006	4,215	$124.56	4/3	4 Gar	1.5 Story	VG Barn	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	343 Oxford								$490,000		3%
Not	287 Oxford	-$9,051		$9,000	-$65,017	-$15,000	-$25,000		$494,932	-1%	
Not	301 Oxford	-$14,995	-$10,000	$6,510	$36,838				$452,353	8%	
Not	218 Oxford	-$1,150		$26,250	-$46,036		-$10,000	-$10,000	$484,064	1%	

6. Matched Pair – Tracy Solar, Bailey, Nash County, NC





This project is located in rural Nash County on Winters Road with a 5 MW facility that was built in 2016 on 50 acres. A local builder acquired parcels 9 and 10 following construction as shown below at rates comparable to other tracts in the area. They then built a custom home for an owner and sold that at a price similar to other nearby homes as shown in the matched pair data below. The retained woods provide a heavy landscaped buffer for this homesite.

Adjoining Land Sales After Solar Farm Completed

#	Solar Farm	TAX ID	Grantor	Grantee	Address	Acres	Date Sold	Sales Price	$/AC	Other
9 &10	Adjoins	316003 & 316004	Cozart	Kingsmill	9162 Winters	13.22	7/21/2016	$70,000	$5,295	
	Not	6056	Billingsly		427 Young	41	10/21/2016	$164,000	$4,000	
	Not	33211	Fulcher	Weikel	10533 Cone	23.46	7/18/2017	$137,000	$5,840	Doublewide, structures
	Not	106807	Perry	Gardner	Claude Lewis	11.22	8/10/2017	$79,000	$7,041	Gravel drive for sub, cleared
	Not	3437	Vaughan	N/A	11354 Old Lewis Sch	18.73	Listing	$79,900	$4,266	Small cemetery,wooded

Adjoining Sales Adjusted

Time	Acres	Location	Other	Adj $/Ac	% Diff
				$5,295	
$0	$400	$0	$0	$4,400	17%
-$292	$292	$0	-$500	$5,340	-1%
-$352	$0	$0	-$1,000	$5,689	-7%
-$213	$0	$0	$213	$4,266	19%
				Average	7%

Adjoining Residential Sales After Solar Farm Completed

#	Solar Farm	n	Address	Acres	Date Sold	Sales Price	Built	GLA	$/GLA	BR/BA	Style	Other
9 &10	Adjoins	s	9162 Winters	13.22	1/5/2017	$255,000	2016	1,616	$157.80	3/2	Ranch	1296 sf wrkshp
	Not	n	7352 Red Fox	0.93	6/30/2016	$176,000	2010	1,529	$115.11	3/2	2-story	

Adjoining Sales Adjusted

Time	Acres	YB	GLA	Style	Other	Total	% Diff
						$255,000	
$0	$44,000	$7,392	$5,007	$5,000	$15,000	$252,399	1%

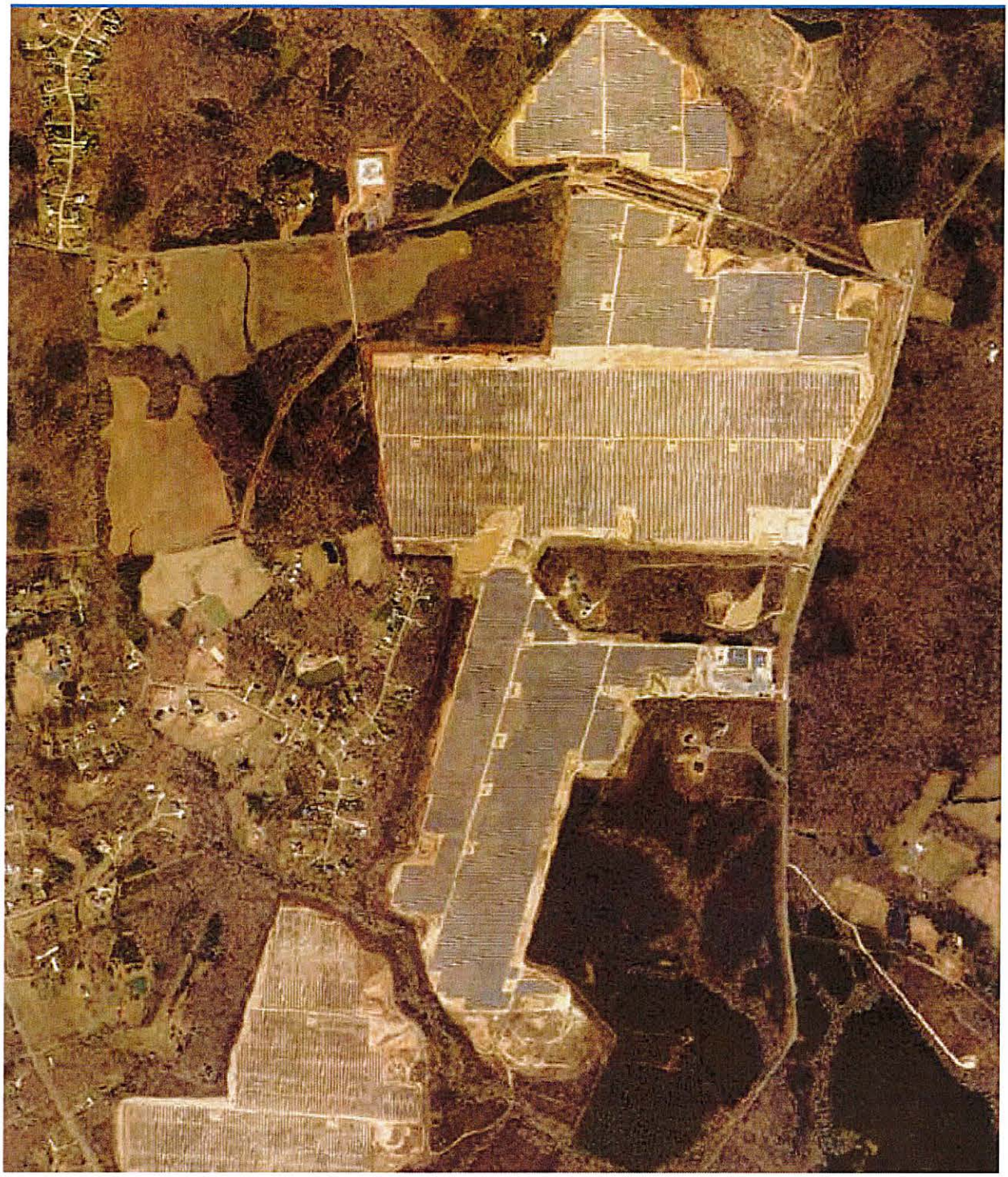
The comparables for the land show either a significant positive relationship or a mild negative relationship to having and adjoining solar farm, but when averaged together they show no negative impact. The wild divergence is due to the difficulty in comping out this tract of land and the wide variety of comparables used. The two comparables that show mild negative influences include a property that was partly developed as a residential subdivision and the other included a doublewide with some value and accessory agricultural structures. The tax assessed value on the improvements were valued at $60,000. So both of those comparables have some limitations for comparison. The two that show significant enhancement due to adjacency includes a property with a cemetery located in the middle and the other is a tract almost twice as large. Still that larger tract after adjustment provides the best matched pair as it required the least adjustment. I therefore conclude that there is no negative impact due to adjacency to the solar farm shown by this matched pair.

The dwelling that was built on the site was a build-to-suit and was compared to a nearby homesale of a property on a smaller parcel of land. I adjusted for that differenced based on a $25,000 value for a 1-acre home site versus the $70,000 purchase price of the larger subject tract. The other adjustments are typical and show no impact due to the adjacency to the solar farm.

The closest solar panel to the home is 780 feet away.

I note that the representative for Kingsmill Homes indicated that the solar farm was never a concern in purchasing the land or selling the home. He also indicated that they had built a number of nearby homes across the street and it had never come up as an issue.

7. Matched Pair – McBride Place Solar Farm, Midland, Cabarrus County, NC



This project is located on Mount Pleasant Road, Midland, North Carolina. The property is on 627 acres on an assemblage of 974.59 acres. The solar farm was approved in early 2017 for a 74.9 MW facility.

I have considered the sale of 4380 Joyner Road which adjoins the proposed solar farm near the northwest section. This property was appraised in April of 2017 for a value of $317,000 with no consideration of any impact due to the solar farm in that figure. The property sold in November 2018 for $325,000 with the buyer fully aware of the proposed solar farm. The landscaping buffer relative to Joyner Road, Hayden Way, Chanel Court and Kristi Lane is considered medium, while the landscaping for the home at the north end of Chanel Court is considered very light.

I have considered the following matched pairs to the subject property.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	4380 Joyner	12.00	11/22/2017	$325,000	1979	1,598	$203.38	3/2	2xGar	Ranch	Outbldg
Not	3870 Elkwood	5.50	8/24/2016	$250,000	1986	1,551	$161.19	3/2.5	Det 2xGar	Craft	
Not	8121 Lower Rocky	18.00	2/8/2017	$355,000	1977	1,274	$278.65	2/2	2xCarprt	Ranch	Eq. Fac.
Not	13531 Cabarrus	7.89	5/20/2016	$267,750	1981	2,300	$116.41	3/2	2xGar	Ranch	

Adjoining Sales Adjusted

Time	Acres	YB	Condition	GLA	BR/BA	Park	Other	Total	% Diff
								$325,000	
$7,500	$52,000	-$12,250	$10,000	$2,273	-$2,000	$2,500	$7,500	$317,523	2%
$7,100	-$48,000	$4,970		$23,156	$0	$3,000	-$15,000	$330,226	-2%
$8,033	$33,000	-$3,749	$20,000	-$35,832	$0	$0	$7,500	$296,702	9%
								Average	3%

The home at 4380 Joyner Road is 275 feet from the closest solar panel.

I also considered the recent sale of a lot at 5800 Kristi Lane that is on the east side of the proposed solar farm. This 4.22-acre lot sold in December 2017 for $94,000. A home was built on this lot in 2019 with the closest point from home to panel at 689 feet. The home site is heavily wooded and their remains a wooded buffer between the solar panels and the home. I spoke with the broker, Margaret Dabbs, who indicated that the solar farm was considered a positive by both buyer and seller as it ensures no subdivision will be happening in that area. Buyers in this market are looking for privacy and seclusion.

The breakdown of recent lot sales on Kristi are shown below with the lowest price paid for the lot with no solar farm exposure, though that lot has exposure to Mt Pleasant Road South. Still the older lot sales have exposure to the solar farm and sold for higher prices than the front lot and adjusting for time would only increase that difference.

Adjoining Lot Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	$/AC	$/Lot
	Adjoins	5811 Kristi	3.74	5/1/2018	$100,000	$26,738	$100,000
	Adjoins	5800 Kristi	4.22	12/1/2017	$94,000	$22,275	$94,000
	Not	5822 Kristi	3.43	2/24/2020	$90,000	$26,239	$90,000

The lot at 5811 Kristi Lane sold in May 2018 for $100,000 for a 3.74-acre lot. The home that was built later in 2018 is 505 feet to the closest solar panel. This home then sold to a homeowner for $530,000 in April 2020. I have compared this home sale to other properties in the area as shown below.

Adjoining Residential Sales After Solar Farm Built

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	5811 Kristi	3.74	3/31/2020	$530,000	2018	3,858	$137.38	5/3.5	2 Gar	2-story	Cement Ext
Not	3915 Tania	1.68	12/9/2019	$495,000	2007	3,919	$126.31	3/3.5	2 Gar	2-story	3Det Gar
Not	6782 Manatee	1.33	3/8/2020	$460,000	1998	3,776	$121.82	4/2/2h	2 Gar	2-story	Water
Not	314 Old Hickory	1.24	9/20/2019	$492,500	2017	3,903	$126.18	6/4.5	2 Gar	2-story	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	5811 Kristi								$530,000		5%
Not	3915 Tania	$6,285		$27,225	-$3,852		-$20,000		$504,657	5%	
Not	6782 Manatee	$1,189		$46,000	$4,995	$5,000			$517,183	2%	
Not	314 Old Hickory	$10,680		$2,463	-$2,839	-$10,000			$492,803	7%	

After adjusting the comparables, I found that the average adjusted value shows a slight increase in value for the subject property adjoining a solar farm. As in the other cases, this is a mild positive impact on value but within the typical range of real estate transactions.

I also looked at 5833 Kristi Lane that sold on 9/14/2020 for $625,000. This home is 470 feet from the closest panel.

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Nearby	5833 Kristi	4.05	9/14/2020	$625,000	2008	4,373	$142.92	5/4	3-Car	2-Brick	
Not	4055 Dakeita	4.90	12/30/2020	$629,000	2005	4,427	$142.08	4/4	4-Car	2-Brick	4DetGar/Stable
Not	9615 Bales	2.16	6/30/2020	$620,000	2007	4,139	$149.79	4/5	3-Car	2-Stone	2DetGar
Not	9522 Bales	1.47	6/18/2020	$600,000	2007	4,014	$149.48	4/4.5	3-Car	2-Stone	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
5833 Kristi								$625,000			470
4055 Dakeita	-$9,220		$5,661	-$6,138		-$25,000		$594,303	5%		
9615 Bales	$6,455		$1,860	$28,042	-$10,000	-$15,000		$631,356	-1%		
9522 Bales	$7,233		$1,800	$42,930	-$5,000			$646,963	-4%		
										0%	

The average difference is 0% impact and the differences are all within a close range with this set of comparables and supports a finding of no impact on property value.

I have also looked at 4504 Chanel Court. This home sold on January 1, 2020 for $393,500 for this 3,010 square foot home built in 2004 with 3 bedrooms, 3.5 bathrooms, and a 3-car garage. This home includes a full partially finished basement that significantly complicates comparing this to other sales. This home previously sold on January 23, 2017 for $399,000. This was during the time that the solar farm was a known factor as the solar farm was approved in early 2017 and public discussions had already commenced. I spoke with Rachelle Killman with Real Estate Realty, LLC the buyer's agent for this transaction and she indicated that the solar farm was not a factor or consideration for the buyer. She noted that you could see the panels sort of through the trees, but it wasn't a concern for the buyer. She was not familiar with the earlier 2017 sale, but indicated that it was likely too high. This again goes back to the partially finished basement issue. The basement has a fireplace, and an installed 3/4 bathroom but otherwise bare studs and concrete floors with different buyers assigning varying value to that partly finished space. I also reached out to Don Gomez with Don Anthony Realty, LLC as he was the listing agent.

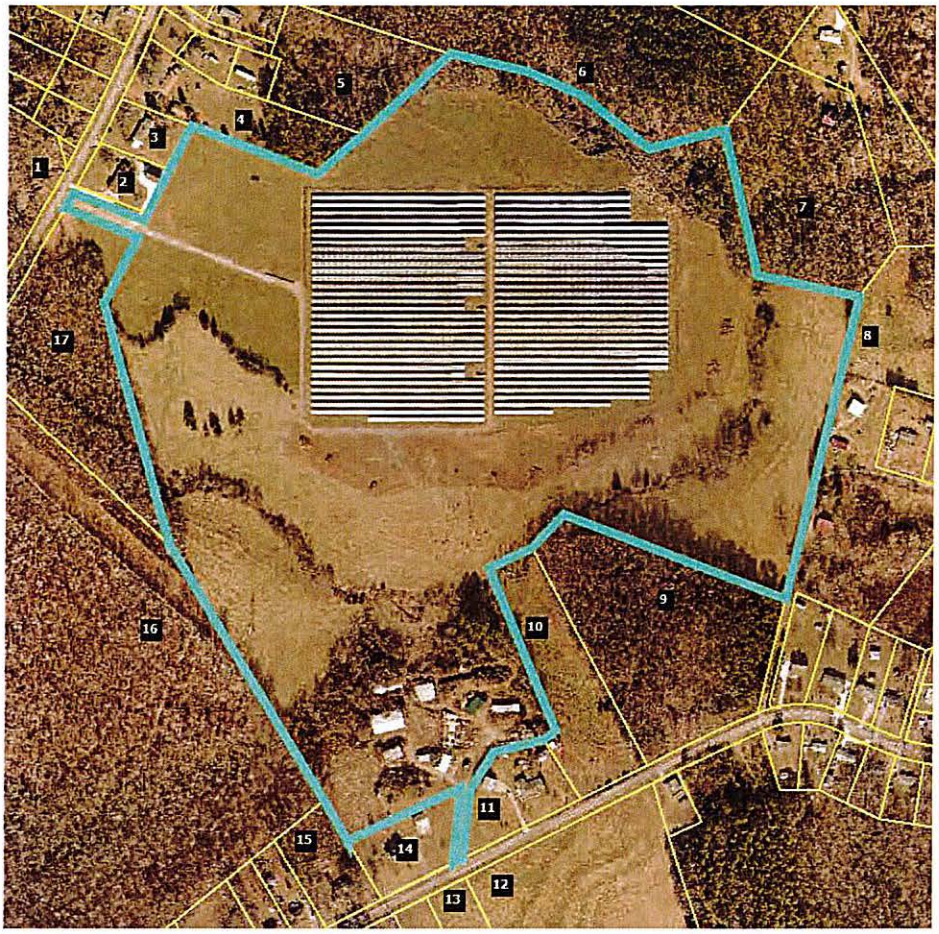
I also looked at the recent sale of 4599 Chanel Court. This home is within 310 feet of solar panels but notably does not have a good landscaping screen in place as shown in the photo below. The plantings appear to be less than 3-feet in height and only a narrow, limited screen of existing hardwoods were kept. The photograph is from the listing.

According to Scott David with Better Homes and Gardens Paracle Realty, this property was under contract for $550,000 contingent on the buyer being able to sell their former home. The former home was apparently overpriced and did not sell and the contract stretched out over 2.5 months. The seller was in a bind as they had a home they were trying to buy contingent on this closing and were about to lose that opportunity. A cash buyer offered them a quick close at $500,000 and the seller accepted that offer in order to not lose the home they were trying to buy. According to Mr. David, the original contracted buyer and the actual cash buyer never considered the solar farm as a negative. In fact Mr. David noted that the actual buyer saw it as a great opportunity to purchase a home where a new subdivision could not be built behind his house. I therefore conclude that this property supports a finding of no impact on adjoining property, even where the landscaping screen still requires time to grow in for a year-round screen.

I also considered a sale/resale analysis on this property. This same home sold on September 15, 2015 for $462,000. Adjusting this upward by 5% per year for the five years between these sales dates suggests a value of $577,500. Comparing that to the $550,000 contract that suggests a 5% downward impact, which is within a typical market variation. Given that the broker noted no negative impact from the solar farm and the analysis above, I conclude this sale supports a finding of no impact on value.



8. Matched Pair – Mariposa Solar, Gaston County, NC



This project is a 5 MW facility located on 35.80 acres out of a parent tract of 87.61 acres at 517 Blacksnake Road, Stanley that was built in 2016.

I have considered a number of recent sales around this facility as shown below.

The first is identified in the map above as Parcel 1, which is 215 Mariposa Road. This is an older dwelling on large acreage with only one bathroom. I've compared it to similar nearby homes as shown below. The landscaping buffer for this home is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000	1958	1,551	$160.54	3/1	Garage	Br/Rnch
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5
Not	1201 Abernathy	27.00	5/3/2018	$390,000	1970	2,190	$178.08	3/2	Crprt	Br/Rnch

Adjoining Residential Sales After Solar Farm Approved					Adjoining Sales Adjusted								
Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	215 Mariposa	17.74	12/12/2017	$249,000								$249,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$5,583	-$17,136	$129,450	-$20,576	-$10,000			$229,154	8%
Not	110 Airport	0.83	5/10/2016	$166,000	$7,927	-$4,648	$126,825	-$47,078	-$10,000			$239,026	4%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$5,621	-$37,345	$95,475	-$68,048	-$10,000	$5,000		$221,961	11%
Not	1201 Abernathy	27.00	5/3/2018	$390,000	-$4,552	-$32,760	-$69,450	-$60,705	-$10,000			$212,533	15%
											Average		9%

The average difference after adjusting for all factors is +9% on average, which suggests an enhancement due to the solar farm across the street. Given the large adjustments for acreage and size, I will focus on the low end of the adjusted range at 4%, which is within the typical deviation and therefore suggests no impact on value.

I have also considered Parcel 4 that sold after the solar farm was approved but before it had been constructed in 2016. The landscaping buffer for this parcel is considered light.

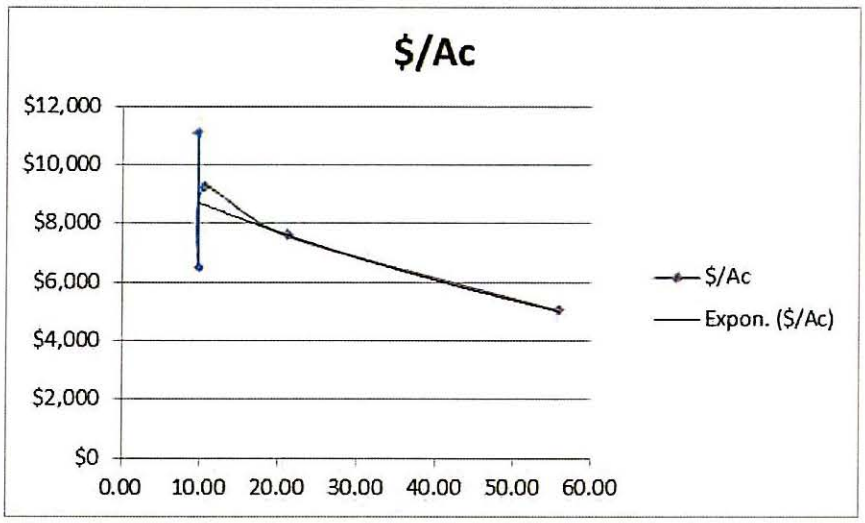
Adjoining Residential Sales After Solar Farm Approved											
Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000	1962	1,880	$95.74	3/2	Carport	Br/Rnch	Det Wrkshop
Not	249 Mariposa	0.48	3/1/2019	$153,000	1974	1,792	$85.38	4/2	Garage	Br/Rnch	
Not	110 Airport	0.83	5/10/2016	$166,000	1962	2,165	$76.67	3/2	Crprt	Br/Rnch	
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	1980	2,156	$112.48	3/2	Drive	1.5	

Adjoining Residential Sales After Solar Farm Approved					Adjoining Sales Adjusted								
Solar	Address	Acres	Date Sold	Sales Price	Time	YB	Acres	GLA	BR/BA	Park	Other	Total	% Diff
Adjoins	242 Mariposa	2.91	9/21/2015	$180,000								$180,000	
Not	249 Mariposa	0.48	3/1/2019	$153,000	-$15,807	-$12,852	$18,468	$7,513		-$3,000	$25,000	$172,322	4%
Not	110 Airport	0.83	5/10/2016	$166,000	-$3,165	$0	$15,808	-$28,600			$25,000	$175,043	3%
Not	1249 Blacksnake	5.01	9/20/2018	$242,500	-$21,825	-$30,555	-$15,960	-$40,942		$2,000	$25,000	$160,218	11%
											Average		6%

The average difference after adjusting for all factors is +6%, which is again suggests a mild increase in value due to the adjoining solar farm use. The median is a 4% adjustment, which is within a standard deviation and suggests no impact on property value.

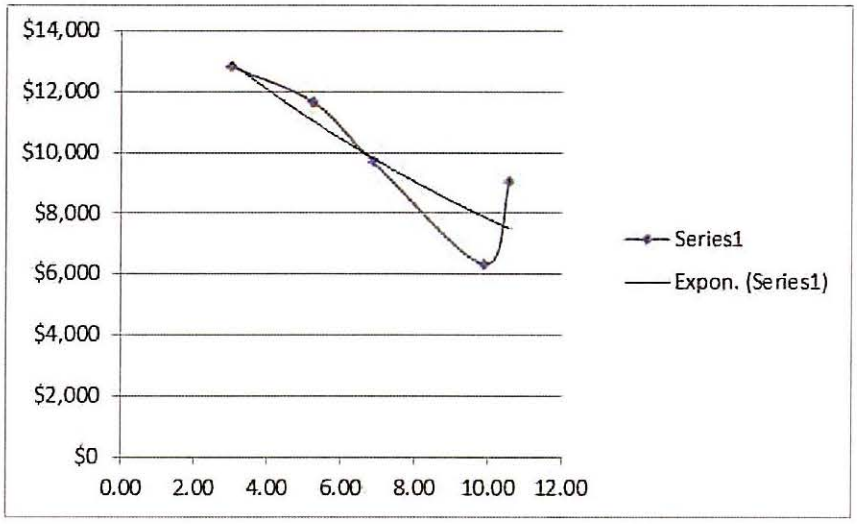
I have also considered the recent sale of Parcel 13 that is located on Blacksnake Road south of the project. I was unable to find good land sales in the same 20-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 20 acres. As can be seen in the chart below, this lines up exactly with the purchase of the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm.

Adjoining Residential Land Sales After Solar Farm Approved						Adjoining Sales Adjusted	
Solar	Tax/Street	Acres	Date Sold	Sales Price	$/Ac	Time	$/Ac
Adjoins	174339/Blacksnake	21.15	6/29/2018	$160,000	$7,565		$7,565
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	$38	$9,215
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$37	$6,447
Not	164243/Alexis	9.75	2/1/2019	$110,000	$11,282	-$201	$11,081
Not	176884/Bowden	55.77	6/13/2018	$280,000	$5,021	$7	$5,027

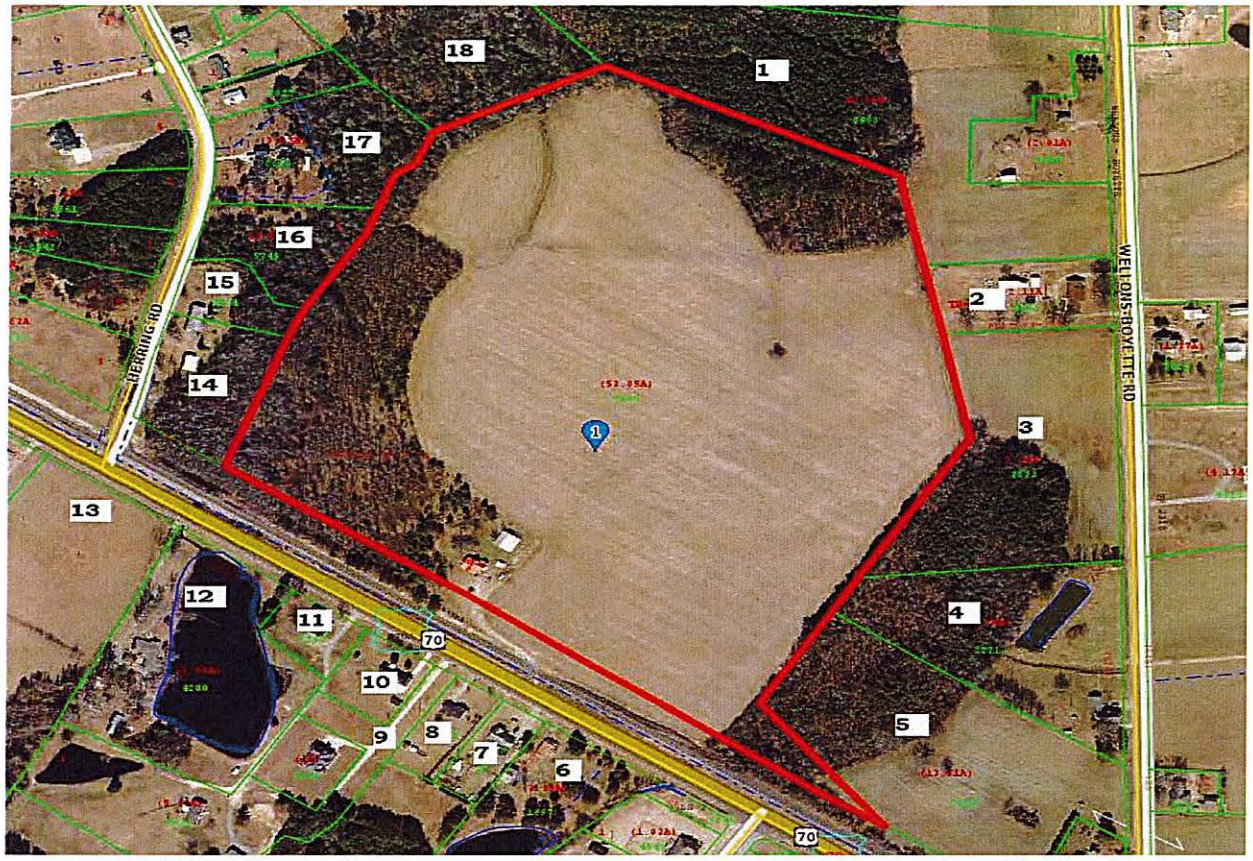


Finally, I have considered the recent sale of Parcel 17 that sold as vacant land. I was unable to find good land sales in the same 7-acre range, so I have considered sales of larger and smaller acreage. I adjusted each of those land sales for time. I then applied the price per acre to a trendline to show where the expected price per acre would be for 7 acres. As can be seen in the chart below, this lines up with the trendline running right through the purchase price for the subject property. I therefore conclude that there is no impact on Parcel 13 due to proximity to the solar farm. I note that this property was improved with a 3,196 square foot ranch built in 2018 following the land purchase, which shows that development near the solar farm was unimpeded.

Adjoining Residential Land Sales After Solar Farm Approved						**Adjoining Sales Adjusted**		
Solar	**Tax/Street**	**Acres**	**Date Sold**	**Sales Price**	**$/Ac**	**Time**	**Location**	**$/Ac**
Adjoins	227039/Mariposa	6.86	12/6/2017	$66,500	$9,694			$9,694
Not	227852/Abernathy	10.57	5/9/2018	$97,000	$9,177	-$116		$9,061
Not	17443/Legion	9.87	9/7/2018	$64,000	$6,484	-$147		$6,338
Not	177322/Robinson	5.23	5/12/2017	$66,500	$12,715	$217	-$1,272	$11,661
Not	203386/Carousel	2.99	7/13/2018	$43,500	$14,548	-$262	-$1,455	$12,832



9. Matched Pair – Candace Solar, Princeton, Johnston County, NC





This 5 MW solar farm is located at 4839 US 70 Highway just east of Herring Road. This solar farm was completed on October 25, 2016.

I identified three adjoining sales to this tract after development of the solar farm with frontage on US 70. I did not attempt to analyze those sales as they have exposure to an adjacent highway and railroad track. Those homes are therefore problematic for a matched pair analysis unless I have similar homes fronting on a similar corridor.

I did consider a land sale and a home sale on adjoining parcels without those complications.

The lot at 499 Herring Road sold to Paradise Homes of Johnston County of NC, Inc. for $30,000 in May 2017 and a modular home was placed there and sold to Karen and Jason Toole on September 29, 2017. I considered the lot sale first as shown below and then the home sale that followed. The landscaping buffer relative to this parcel is considered medium.

Adjoining Land Sales After Solar Farm Approved							**Adjoining Sales Adjusted**				
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Other**	**Time**	**Site**	**Other**	**Total**	**% Diff**
16	Adjoins	499 Herring	2.03	5/1/2017	$30,000					$30,000	
	Not	37 Becky	0.87	7/23/2019	$24,500	Sub/Pwr	-$1,679	$4,900		$27,721	8%
	Not	5858 Bizzell	0.88	8/17/2016	$18,000		$390	$3,600		$21,990	27%
	Not	488 Herring	2.13	12/20/2016	$35,000		$389			$35,389	-18%
									Average		5%

Following the land purchase, the modular home was placed on the site and sold. I have compared this modular home to the following sales to determine if the solar farm had any impact on the purchase price.

Adjoining Residential Sales After Solar Farm Approved

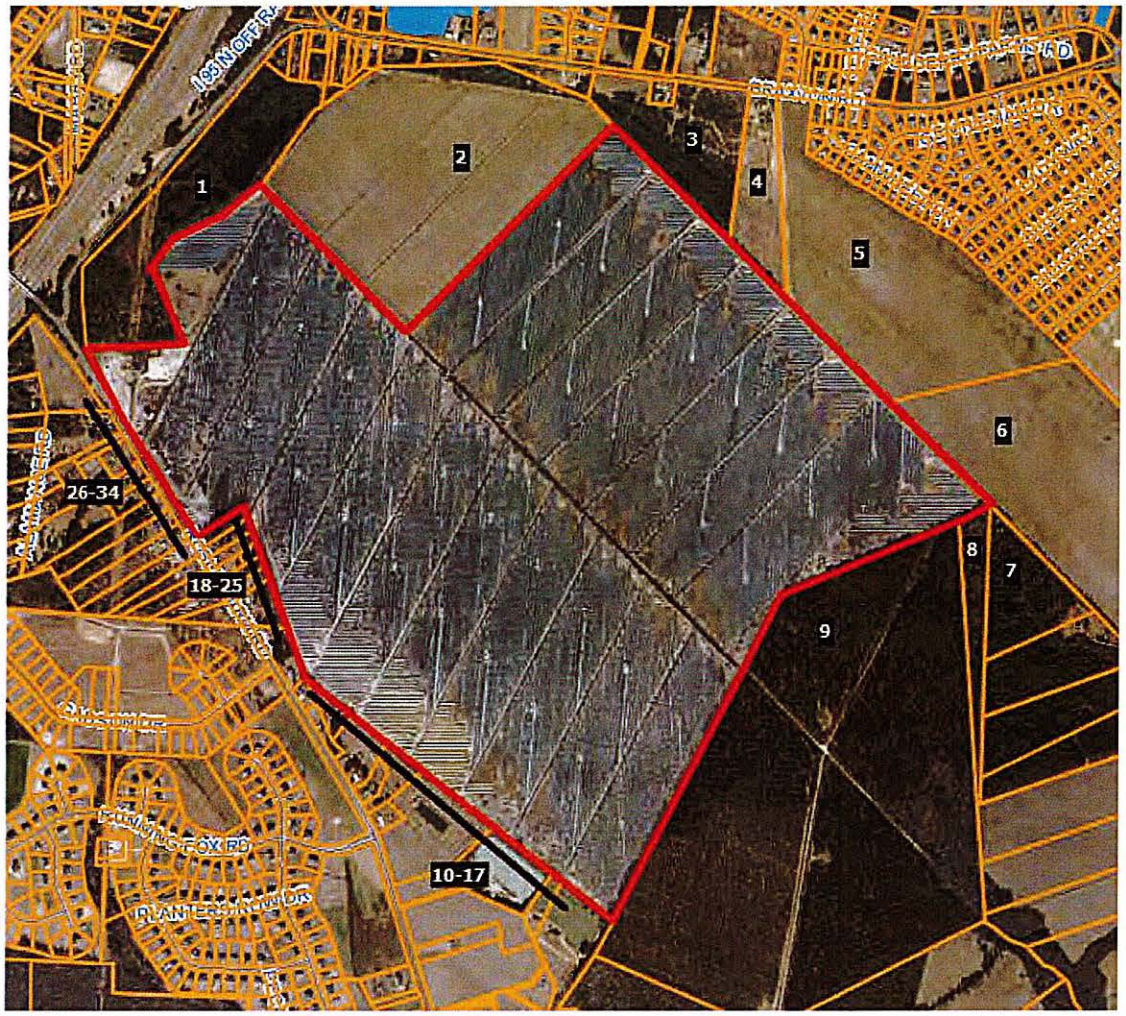
Parcel	**Solar**	**Address**	**Acres**	**Date Sold**	**Sales Price**	**Built**	**GBA**	**$/GBA**	**BR/BA**	**Park**	**Style**	**Other**
16	Adjoins	499 Herring	2.03	9/27/2017	$215,000	2017	2,356	$91.26	4/3	Drive	Modular	
	Not	678 WC	6.32	3/8/2019	$226,000	1995	1,848	$122.29	3/2.5	Det Gar	Mobile	Ag bldgs
	Not	1810 Bay V	8.70	3/26/2018	$170,000	2003	2,356	$72.16	3/2	Drive	Mobile	Ag bldgs
	Not	1795 Bay V	1.78	12/1/2017	$194,000	2017	1,982	$97.88	4/3	Drive	Modular	

Adjoining Residential Sales Af			**Adjoining Sales Adjusted**									**Avg**	
Parcel	**Solar**	**Address**	**Time**	**Site**	**YB**	**GLA**	**BR/BA**	**Park**	**Other**	**Total**	**% Diff**	**% Diff**	**Distance**
16	Adjoins	499 Herring								$215,000			488
	Not	678 WC	-$10,037	-$25,000	$24,860	$37,275	-$5,000	-$7,500	-$20,000	$220,599	-3%		
	Not	1810 Bay V	-$2,579	-$20,000	$11,900	$0				$159,321	26%		
	Not	1795 Bay V	-$1,063		$0	$21,964				$214,902	0%		
												8%	

The best comparable is 1795 Bay Valley as it required the least adjustment and was therefore most similar, which shows a 0% impact. This signifies no impact related to the solar farm.

The range of impact identified by these matched pairs ranges are therefore -3% to +26% with an average of +8% for the home and an average of +4% for the lot, though the best indicator for the lot shows a $5,000 difference in the lot value due to the proximity to the solar farm or a -12% impact.

10. Matched Pair – Innovative Solar 46, Roslin Farm Rd, Hope Mills, Cumberland County, NC



This project was built in 2016 and located on 532 acres for a 78.5 MW solar farm with the closest home at 125 feet from the closest solar panel with an average distance of 423 feet.

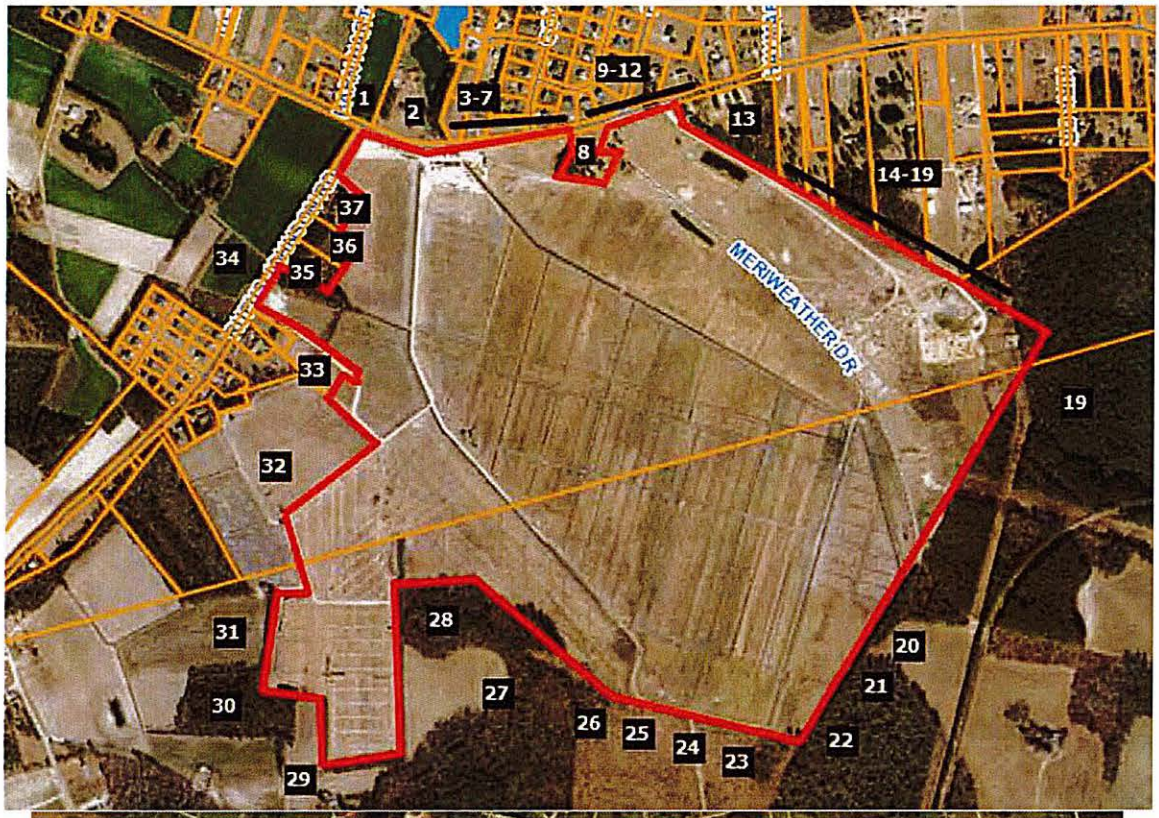
I considered the recent sale of a home on Roslin Farm Road just north of Running Fox Road as shown below. This sale supports an indication of no impact on property value. The landscaping buffer is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	6849 Roslin Farm	1.00	2/18/2019	$155,000	1967	1,610	$96.27	3/3	Drive	Ranch	Brick	435
Not	6592 Sim Canady	2.43	9/5/2017	$185,000	1974	2,195	$84.28	3/2	Gar	Ranch	Brick	
Not	1614 Joe Hall	1.63	9/3/2019	$145,000	1974	1,674	$86.62	3/2	Det Gar	Ranch	Brick	
Not	109 Bledsoe	0.68	1/17/2019	$150,000	1973	1,663	$90.20	3/2	Gar	Ranch	Brick	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	6849 Roslin Farm								$155,000		5%
Not	6592 Sim Canady	$8,278		-$6,475	-$39,444	$10,000	-$5,000		$152,359	2%	
Not	1614 Joe Hall	-$2,407		-$5,075	-$3,881	$10,000	-$2,500		$141,137	9%	
Not	109 Bledsoe	$404	$10,000	-$4,500	-$3,346		-$5,000		$147,558	5%	

11. Matched Pair – Innovative Solar 42, County Line Rd, Fayetteville, Cumberland County, NC





This project was built in 2017 and located on 413.99 acres for a 71 MW with the closest home at 135 feet from the closest solar panel with an average distance of 375 feet.

I considered the recent sales identified on the map above as Parcels 2 and 3, which is directly across the street these homes are 330 and 340 feet away. Parcel 2 includes an older home built in 1976, while Parcel 3 is a new home built in 2019. So the presence of the solar farm had no impact on new construction in the area.

The matched pairs for each of these are shown below. The landscaping buffer relative to these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2923 County Ln	8.98	2/28/2019	$385,000	1976	2,905	$132.53	3/3	2-Car	Ranch	Brick/Pond	340
Not	1928 Shaw Mill	17.00	7/3/2019	$290,000	1977	3,001	$96.63	4/4	2-Car	Ranch	Brick/Pond/Rental	
Not	2109 John McM.	7.78	4/25/2018	$320,000	1978	2,474	$129.35	3/2	Det Gar	Ranch	Vinyl/Pool,Stable	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2923 County Ln								$385,000		3%
Not	1928 Shaw Mill	-$3,055	$100,000	-$1,450	-$7,422	-$10,000			$368,074	4%	
Not	2109 John McM.	$8,333		-$3,200	$39,023	$10,000		$5,000	$379,156	2%	

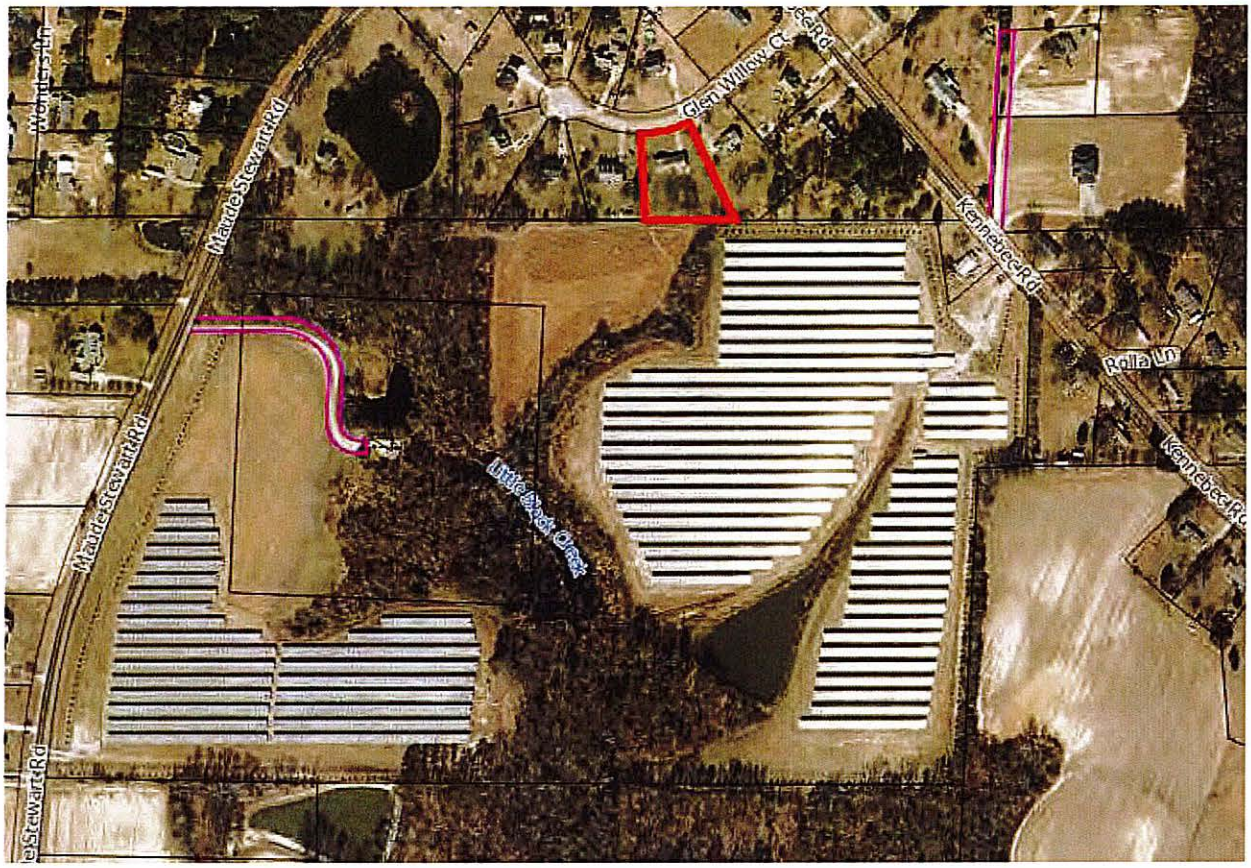
Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other	Distance
Adjoins	2935 County Ln	1.19	6/18/2019	$266,000	2019	2,401	$110.79	4/3	Gar	2-Story		330
Not	3005 Hemingway	1.17	5/16/2019	$269,000	2018	2,601	$103.42	4/3	Gar	2-Story		
Not	7031 Glynn Mill	0.60	5/8/2018	$255,000	2017	2,423	$105.24	4/3	Gar	2-Story		
Not	5213 Bree Brdg	0.92	5/7/2019	$260,000	2018	2,400	$108.33	4/3	3-Gar	2-Story		

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	2935 County Ln								$266,000		3%
Not	3005 Hemingway	$748		$1,345	-$16,547				$254,546	4%	
Not	7031 Glynn Mill	$8,724		$2,550	-$1,852				$264,422	1%	
Not	5213 Bree Brdg	$920		$1,300	$76			-$10,000	$252,296	5%	

Both of these matched pairs adjust to an average of +3% on impact for the adjoining solar farm, meaning there is a slight positive impact due to proximity to the solar farm. This is within the standard +/- of typical real estate transactions, which strongly suggests no impact on property value. I noted specifically that for 2923 County Line Road, the best comparable is 2109 John McMillan as it does not have the additional rental unit on it. I made no adjustment to the other sale for the value of that rental unit, which would have pushed the impact on that comparable downward – meaning there would have been a more significant positive impact.

12. Matched Pair – Sunfish Farm, Keenebec Rd, Willow Spring, Wake County, NC



This project was built in 2015 and located on 49.6 acres (with an inset 11.25-acre parcel) for a 6.4 MW project with the closest home at 135 feet with an average distance of 105 feet.

I considered the 2017 sale identified on the map above, which is 205 feet away from the closest panel. The matched pairs for each of these are shown below followed by a more recent map showing the panels at this site. The average difference in the three comparables and the subject property is +3% after adjusting for differences in the sales date, year built, gross living area, and other minor differences. This data is supported by the comments from the broker Brian Schroepfer with Keller Williams that the solar farm had no impact on the purchase price. The landscaping screen is considered light.

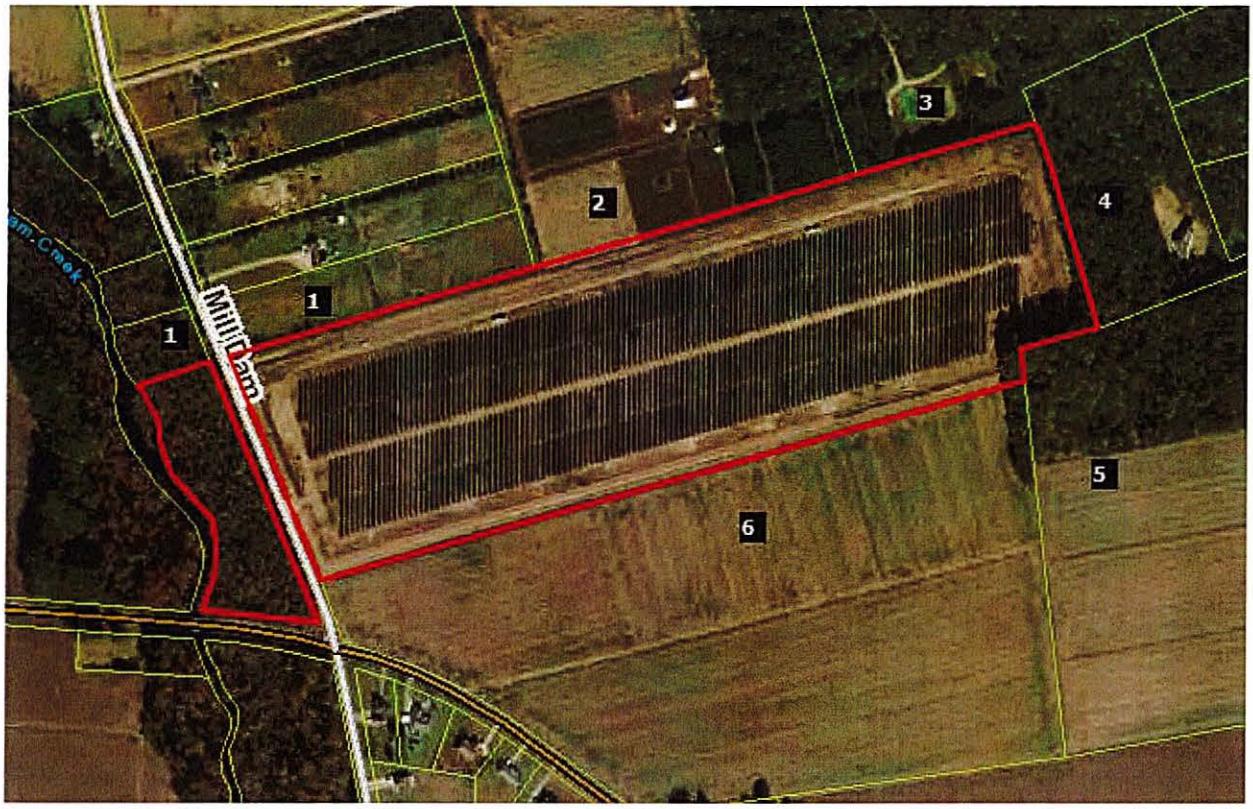
Adjoining Residential Sales After Solar Farm Approved

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style
	Adjoins	7513 Glen Willow	0.79	9/1/2017	$185,000	1989	1,492	$123.99	3/2	Gar	BR/Rnch
	Not	2968 Tram	0.69	7/17/2017	$155,000	1984	1,323	$117.16	3/2	Drive	BR/Rnch
	Not	205 Pine Burr	0.97	12/29/2017	$191,000	1991	1,593	$119.90	3/2.5	Drive	BR/Rnch
	Not	1217 Old Honeycutt	1.00	12/15/2017	$176,000	1978	1,558	$112.97	3/2.5	2Carprt	VY/Rnch

Adjustments

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	7513 Glen Willow								$185,000		
Not	2968 Tram	$601		$3,875	$15,840		$10,000		$185,316	0%	
Not	205 Pine Burr	-$1,915		-$1,910	-$9,688	-$5,000			$172,487	7%	
Not	1217 Old Honeycut	-$1,557		$9,680	-$5,965	-$5,000		$5,280	$178,438	4%	
											3%

13. Matched Pair – Camden Dam, Camden, Camden County, NC



This 5 MW project was built in 2019 and located on a portion of 49.83 acres.

Parcel 1 noted above along with the home on the adjoining parcel to the north of that parcel sold in late 2018 after this solar farm was approved but prior to construction being completed in 2019. I have considered this sale as shown below. The landscaping screen is considered light.

The comparable at 548 Trotman is the most similar and required the least adjustment shows no impact on property value. The other two comparables were adjusted consistently with one showing significant enhancement and another as showing a mild negative. The best indication is the one requiring the least adjustment. The other two sales required significant site adjustments which make them less reliable. The best comparable and the average of these comparables support a finding of no impact on property value.

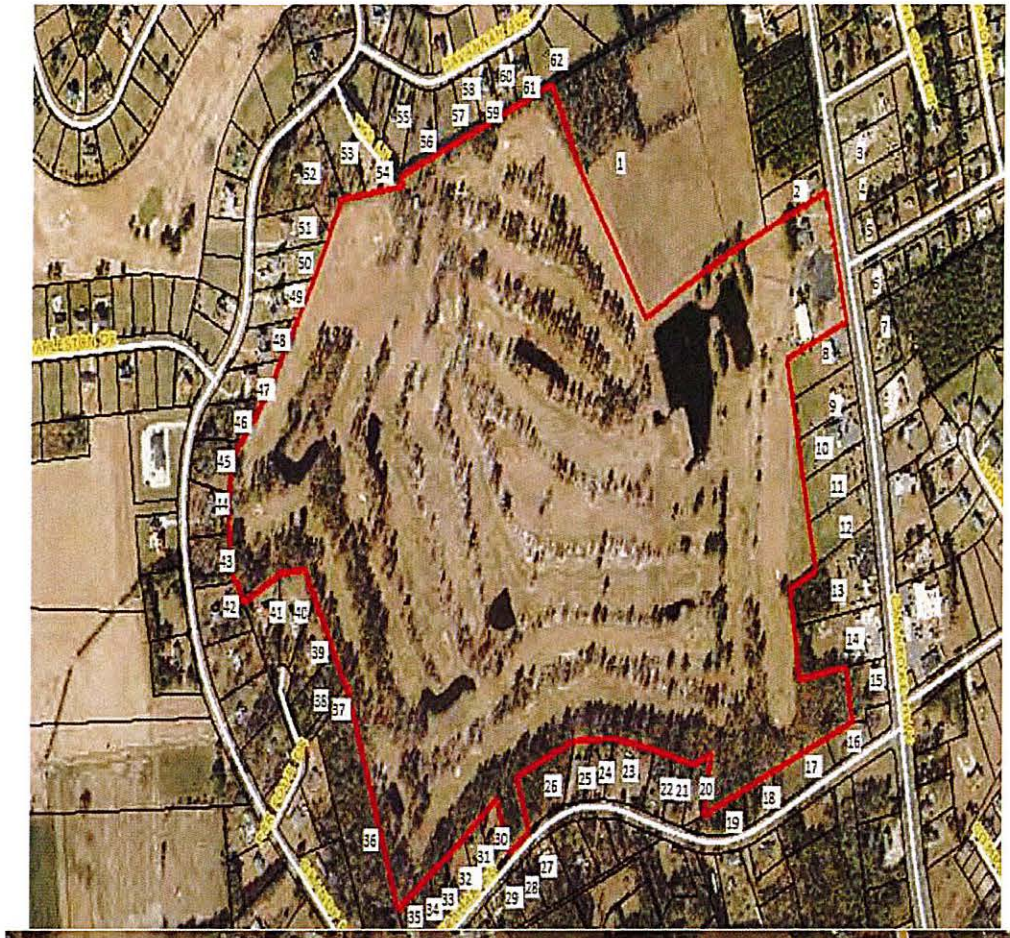
Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	122 N Mill Dam	12.19	11/29/2018	$350,000	2005	2,334	$149.96	3/3.5	3-Gar	Ranch	
Not	548 Trotman	12.10	5/31/2018	$309,000	2007	1,960	$157.65	4/2	Det2G	Ranch	Wrkshp
Not	198 Sand Hills	2.00	12/22/2017	$235,000	2007	2,324	$101.12	4/3	Open	Ranch	
Not	140 Sleepy Hlw	2.05	8/12/2019	$330,000	2010	2,643	$124.86	4/3	1-Gar	1.5 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
122 N Mill Dam								$350,000			342
548 Trotman	$6,163		-$3,090	$35,377	$5,000			$352,450	-1%		
198 Sand Hills	$8,808	$45,000	-$2,350	$607		$30,000		$317,064	9%		
140 Sleepy Hlw	-$9,258	$45,000	-$8,250	-$23,149	$5,000	$30,000		$369,343	-6%		
										1%	

14. Matched Pair – Grandy Solar, Grandy, Currituck County, NC





This 20 MW project was built in 2019 and located on a portion of 121 acres.

Parcels 40 and 50 have sold since construction began on this solar farm. I have considered both in matched pair analysis below. I note that the marketing for Parcel 40 (120 Par Four) identified the lack of homes behind the house as a feature in the listing. The marketing for Parcel 50 (269 Grandy) identified the property as "very private." Landscaping for both of these parcels is considered light.

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	120 Par Four	0.92	8/17/2019	$315,000	2006	2,188	$143.97	4/3	2-Gar	1.5 Story	Pool
Not	102 Teague	0.69	1/5/2020	$300,000	2005	2,177	$137.80	3/2	Det 3G	Ranch	
Not	112 Meadow Lk	0.92	2/28/2019	$265,000	1992	2,301	$115.17	3/2	Gar	1.5 Story	
Not	116 Barefoot	0.78	9/29/2020	$290,000	2004	2,192	$132.30	4/3	2-Gar	2 Story	

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
120 Par Four								$315,000			405
102 Teague	-$4,636		$1,500	$910	$10,000		$20,000	$327,774	-4%		
112 Meadow Lk	$4,937		$18,550	-$7,808	$10,000	$10,000	$20,000	$320,679	-2%		
116 Barefoot	-$12,998		$2,900	-$318			$20,000	$299,584	5%		
										0%	

Adjoining Residential Sales After Solar Farm Approved

Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GLA	BR/BA	Park	Style	Other
Adjoins	269 Grandy	0.78	5/7/2019	$275,000	2019	1,535	$179.15	3/2.5	2-Gar	Ranch	
Not	307 Grandy	1.04	10/8/2018	$240,000	2002	1,634	$146.88	3/2	Gar	1.5 Story	
Not	103 Branch	0.95	4/22/2020	$230,000	2000	1,532	$150.13	4/2	2-Gar	1.5 Story	
Not	103 Spring Lf	1.07	8/14/2018	$270,000	2002	1,635	$165.14	3/2	2-Gar	Ranch	Pool

Adjoining Sales Adjusted

Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff	Distance
269 Grandy								$275,000			477
307 Grandy	$5,550		$20,400	-$8,725	$5,000	$10,000		$272,225	1%		
103 Branch	-$8,847		$21,850	$270				$243,273	12%		
103 Spring Lf	$7,871		$22,950	-$9,908	$5,000		-$20,000	$275,912	0%		
										4%	

Both of these matched pairs support a finding of no impact on value. This is reinforced by the listings for both properties identifying the privacy due to no housing in the rear of the property as part of the marketing for these homes.

15. Matched Pair – HCE Johnston I, LLC, Benson, NC



This 2.6 MW project was built in 2015 and located on 30.55 acres.

There is a new subdivision that was developed in 2019 just north of this solar farm called Reese's Ridge. This location is near the McGees Crossroads near Mount Pleasant Road. As can be seen in the map below, the adjoining land to the north of this solar farm was purchased in 2017 and subdivided as Reese Ridge with 0.49 to 0.53 acre lots. Most of the trees on this site were cleared as part of the development with a single row of pine trees retained as a buffer along the solar farm. The first six lots on the south side of Reese Drive are around 115 feet from the center point in the lot to the nearest solar farm panel. This tract of land was purchased on September 7, 2017 for $925,000 for 42.388 acres, or $21,822 per acre.

The proposed homes will be custom homes starting at $330,000. County water is available and the homes will use individual septic tanks. I spoke with Amanda with The Rodney Carroll Team who is marketing the homes and she indicated that 7 custom home builders had a lottery to purchase all of the lots.

Three different builders have purchased lots adjoining the solar farm for $60,000 each. Similar lots across Reese Drive and further from the solar farm are selling at the same $60,000 each. At $60,000 this indicates a lot-to-home ratio of 18%, which is typical for new home construction in the county where there is no amenity package.



Since then a home was built and then sold at 63 Reese Drive, which is two lots off of NC 50 and backs up to the solar farm. Similarly, 107 Reese Drive which is six lots off of NC 50 and backs up to the solar farm. I have considered both of these for matched pairs as shown below. These homes are as closed as 105 feet from the solar panels.

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	107 Reese Drive	0.69	11/27/2019	$393,000	2019	2,960	$132.77	3/3	2-Car	1.5 Vinyl	
	Not	200 Reese Drive	0.44	2/19/2020	$400,000	2019	3,209	$124.65	3/2.5	2-Car	1.5 Batten/Stone	
	Not	35 Pawnee Pl	0.65	5/30/2018	$325,000	2017	2,609	$124.57	4/3	2-Car	1.5 Vinyl/Stone	
	Not	278 Timber Wolf	0.88	1/24/2020	$367,443	2019	2,983	$123.18	3/3	2-Car	1.5 Vinyl/Stone	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	107 Reese Drive								$393,000		5%
Not	200 Reese Drive	-$2,831		$0	-$24,830	$5,000			$377,338	4%	
Not	35 Pawnee Pl	$14,954		$3,250	$34,979				$378,183	4%	
Not	278 Timber Wolf	-$1,796		$0	-$2,266				$363,381	8%	

Adjoining Residential Sales After Solar Farm Built

Parcel	Solar	Address	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	BR/BA	Park	Style	Other
	Adjoins	63 Reese Drive	0.45	3/24/2020	$410,000	2019	3,240	$126.54	4/3	2-Car	Ranch/Wd	
	Not	200 Reese Drive	0.44	2/19/2020	$400,000	2019	3,209	$124.65	3/2.5	2-Car	1.5 Batten/Stone	
	Not	320 Wolf Den	0.97	9/27/2019	$377,780	2019	3,122	$121.01	4/3	2-Car	1.5 Vinyl/Stone	
	Not	37 Makers Way	0.59	5/29/2019	$373,508	2019	3,122	$119.64	4/3	3-Car	1.5 Vinyl/Stone	

Solar	Address	Time	Site	YB	GLA	BR/BA	Park	Other	Total	% Diff	Avg % Diff
Adjoins	63 Reese Drive								$410,000		3%
Not	200 Reese Drive	$1,146		$0	$2,705	$5,000			$408,851	0%	
Not	320 Wolf Den	$5,699		$0	$9,995				$393,474	4%	
Not	37 Makers Way	$9,443		$0	$9,882		-$5,000		$387,833	5%	

After adjustments, the two sales support a conclusion of no impact on property value due to the solar farm. I spoke with Rodney Carroll the broker marketing the homes and he indicated that the solar farm had zero impact on the sales price and they were marketing it as the best neighbor you could have.

Conclusion – NC Data

Matched Pair Summary						Adj. Uses By Acreage				1 mile Radius (2020-2023 Data)			
	Name	City	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com	Pop.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	AM Best	Goldsboro	38	5.00	2	38%	23%	0%	39%	1,523	$37,358	$148,375	Light
2	Cookstown	Goldsboro	58	5.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light
3	Solar Lee	Mt Olive	38	4.90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Light
4	Gaston SC	Gastonia	35	5.00	48	33%	23%	0%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	2034	80.00	4	4%	94%	0%	2%	382	$79,114	$281,731	Light
6	Tracy	Bailey	50	5.00	10	29%	71%	0%	0%	312	$43,940	$99,219	Heavy
7	McBride	Midland	627	75.00	140	12%	78%	10%	0%	398	$63,678	$256,306	Lt to Med
8	Mariposa	Stanley	36	5.00	96	48%	52%	0%	0%	1,716	$36,439	$137,884	Light
9	Candace	Princeton	54	5.00	22	76%	0%	24%	0%	448	$51,002	$107,171	Medium
10	Innov 46	Hope Mills	532	78.50	0	17%	0%	83%	0%	2,247	$58,688	$183,435	Light
11	Innov 42	Fayetteville	414	71.00	0	41%	0%	59%	0%	568	$60,037	$276,347	Light
12	Sunfish	Willow Spring	50	6.40	30	35%	30%	35%	0%	1,515	$63,652	$253,138	Light
13	Camden Dam	Camden	50	5.00	0	17%	11%	72%	0%	403	$84,426	$230,288	Light
14	Grandy	Grandy	121	20.00	10	55%	0%	24%	21%	949	$50,355	$231,408	Light
15	HCE Johnston	Benson	30	2.60	0	55%	45%	0%	0%	1,169	$65,482	$252,544	Light
	Average		278	24.89	28	35%	33%	24%	8%	1255	$56,094	$198,801	
	Median		50	5.00	10	35%	23%	10%	0%	949	$58,688	$230,288	
	High		2,034	80.00	140	76%	94%	83%	44%	4,689	$84,426	$281,731	
	Low		30	2.60	0	4%	0%	0%	0%	312	$35,057	$99,219	

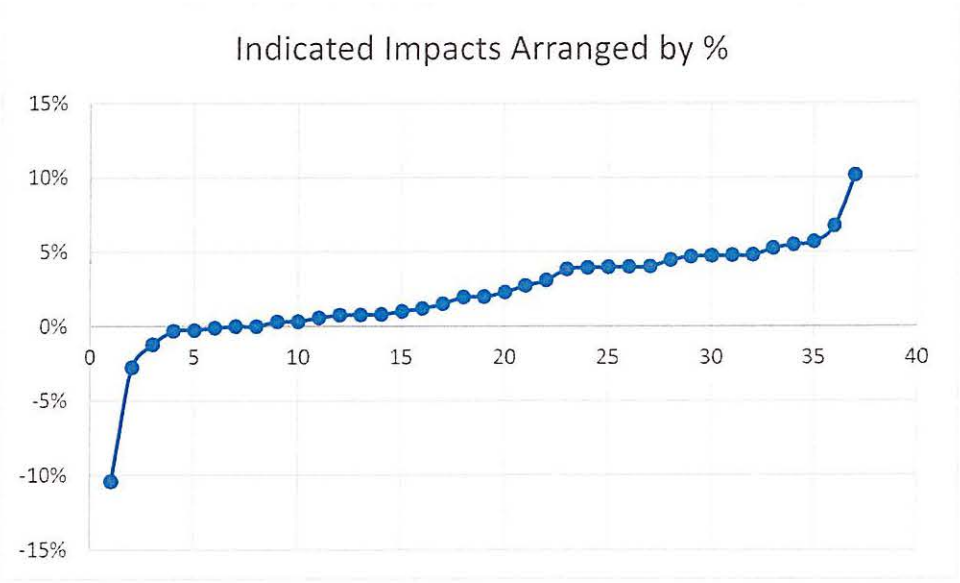
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in farm more urban areas. The median income for the population within 1 mile of a solar farm is $58,688 with a median housing unit value of $230,288. Most of the comparables are under $300,000 in the home price, though I have matched pairs in multiple states over $1,000,000 adjoining solar farms. The adjoining uses show that residential and agricultural uses are the predominant adjoining uses. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for the southeast as shown later in this report.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

I have pulled 37 matched pairs from the above referenced solar farms to provide the following summary of home sale matched pairs and land sales next to solar farms. The summary shows that the range of differences is from -10% to +10% with an average of +2% and median of +2%. This means that the average and median impact is for a slight positive impact due to adjacency to a solar farm. However, this +2% to rate is within the typical variability I would expect from real estate. I therefore conclude that this data shows no negative or positive impact due to adjacency to a solar farm.

While the range is seemingly wide, the graph below clearly shows that the vast majority of the data falls between 0% and +5%. There were only 2 indicators showing an impact below zero and they were -1% and -10%. The other thirty results ranged from zero to +10%.

I therefore conclude that these matched pairs support a finding of no impact on value at the subject property for the proposed project, which as proposed will include a landscaped buffer to screen adjoining residential properties.


Indicated Impacts Arranged by %
15%
10%
5%
0%
-5%
-10%
-15%
0
5
10
15
20
25
30
35
40

B. Southeastern USA Data – Over 5 MW

I have also considered a number of projects throughout the southeast which includes a number of solar farms much larger than those considered in just North Carolina. I have shown the results below. The full write-ups similar to the NC write-ups are available in my files.

Conclusion – Southeast Over 5 MW

Southeast USA Over 5 MW
Matched Pair Summary

							Adj. Uses By Acreage				1 mile Radius (2010-2020 Data)			
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Pop.	Med. Income	Avg. Housing Unit	Veg. Buffer
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375	Light
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746	Lt to Med
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000	Light
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562	Light
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731	Light
6	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219	Heavy
7	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667	Heavy
8	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306	Lt to Med
9	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884	Light
10	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453	Light
11	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922	Medium
12	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171	Medium
13	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076	Light
14	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435	Light
15	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347	Light
16	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138	Light
17	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208	Light
18	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288	Light
19	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408	Light
20	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939	Light
21	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320	Lt to Med
22	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571	Light
23	Spotysivania	Paytes	VA	3,500	617.00	160	37%	52%	11%	0%	74	$120,861	$483,333	Md to Hvy
	Average			485	57.04	38	24%	48%	22%	6%	923	$63,955	$237,700	
	Median			234	20.00	20	17%	59%	11%	0%	467	$60,037	$231,408	
	High			3,500	617.00	160	76%	98%	94%	44%	4,689	$120,861	$483,333	
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$99,219	

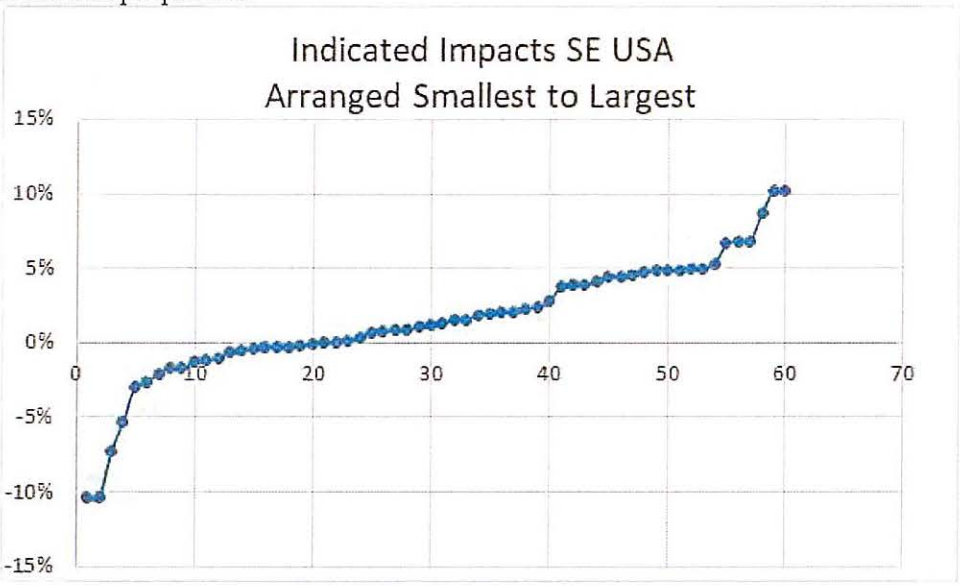
The solar farm matched pairs shown above have similar characteristics to each other in terms of population, but with several outliers showing solar farms in farm more urban areas. The median income for the population within 1 mile of a solar farm is $60,037 with a median housing unit value of $231,408. Most of the comparables are under $300,000 in the home price, with $483,333 being the high end of the set, though I have matched pairs in multiple states over $1,000,000 adjoining solar farms. The adjoining uses show that residential and agricultural uses are the predominant adjoining uses. These figures are in line with the larger set of solar farms that I have looked at with the predominant adjoining uses being residential and agricultural and similar to the solar farm breakdown shown for Virginia and adjoining states as well as the proposed subject property.

Based on the similarity of adjoining uses and demographic data between these sites and the subject property, I consider it reasonable to compare these sites to the subject property.

I have pulled 56 matched pairs from the above referenced solar farms to provide the following summary of home sale matched pairs and land sales next to solar farms. The summary shows that the range of differences is from -10% to +10% with an average of +1% and median of +1%. This means that the average and median impact is for a slight positive impact due to adjacency to a solar farm. However, this +1 to rate is within the typical variability I would expect from real estate. I therefore conclude that this data shows no negative or positive impact due to adjacency to a solar farm.

While the range is seemingly wide, the graph below clearly shows that the vast majority of the data falls between -5% and +5% and most of those are clearly in the 0 to +5% range. This data strongly supports an indication of no impact on adjoining residential uses to a solar farm.

I therefore conclude that these matched pairs support a finding of no impact on value at the subject property for the proposed project, which as proposed will include a landscaped buffer to screen adjoining residential properties.



C. *Summary of National Data on Solar Farms*

I have worked in 24 states related to solar farms and I have been tracking matched pairs in most of those states. On the following pages I provide a brief summary of those findings showing 36 solar farms over 5 MW studied with each one providing matched pair data supporting the findings of this report.

The solar farms summary is shown below with a summary of the matched pair data shown on the following page.

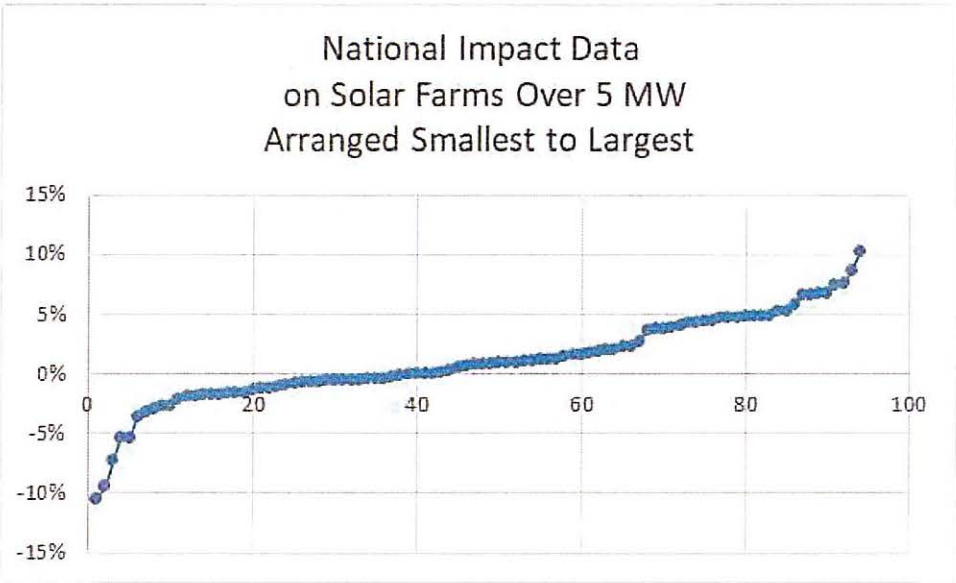
Matched Pair Summary

							Adj. Uses By Acreage				1 mile Radius (2020 Data)		
	Name	City	State	Acres	MW	Topo Shift	Res	Ag	Ag/Res	Com/Ind	Population	Med. Income	Avg. Housing Unit
1	AM Best	Goldsboro	NC	38	5.00	2	38%	0%	23%	39%	1,523	$37,358	$148,375
2	Mulberry	Selmer	TN	160	5.00	60	13%	73%	10%	3%	467	$40,936	$171,746
3	Leonard	Hughesville	MD	47	5.00	20	18%	75%	0%	6%	525	$106,550	$350,000
4	Gastonia SC	Gastonia	NC	35	5.00	48	33%	0%	23%	44%	4,689	$35,057	$126,562
5	Summit	Moyock	NC	2,034	80.00	4	4%	0%	94%	2%	382	$79,114	$281,731
6	Tracy	Bailey	NC	50	5.00	10	29%	0%	71%	0%	312	$43,940	$99,219
7	Manatee	Parrish	FL	1,180	75.00	20	2%	97%	1%	0%	48	$75,000	$291,667
8	McBride	Midland	NC	627	75.00	140	12%	10%	78%	0%	398	$63,678	$256,306
9	Grand Ridge	Streator	IL	160	20.00	1	8%	87%	5%	0%	96	$70,158	$187,037
10	Dominion	Indianapolis	IN	134	8.60	20	3%	97%	0%	0%	3,774	$61,115	$167,515
11	Mariposa	Stanley	NC	36	5.00	96	48%	0%	52%	0%	1,716	$36,439	$137,884
12	Clarke Cnty	White Post	VA	234	20.00	70	14%	39%	46%	1%	578	$81,022	$374,453
13	Flemington	Flemington	NJ	120	9.36	N/A	13%	50%	28%	8%	3,477	$105,714	$444,696
14	Frenchtown	Frenchtown	NJ	139	7.90	N/A	37%	35%	29%	0%	457	$111,562	$515,399
15	McGraw	East Windsor	NJ	95	14.00	N/A	27%	44%	0%	29%	7,684	$78,417	$362,428
16	Tinton Falls	Tinton Falls	NJ	100	16.00	N/A	98%	0%	0%	2%	4,667	$92,346	$343,492
17	Simon	Social Circle	GA	237	30.00	71	1%	63%	36%	0%	203	$76,155	$269,922
18	Candace	Princeton	NC	54	5.00	22	76%	24%	0%	0%	448	$51,002	$107,171
19	Walker	Barhamsville	VA	485	20.00	N/A	12%	68%	20%	0%	203	$80,773	$320,076
20	Innov 46	Hope Mills	NC	532	78.50	0	17%	83%	0%	0%	2,247	$58,688	$183,435
21	Innov 42	Fayetteville	NC	414	71.00	0	41%	59%	0%	0%	568	$60,037	$276,347
22	Demille	Lapeer	MI	160	28.40	10	10%	68%	0%	22%	2,010	$47,208	$187,214
23	Turrill	Lapeer	MI	230	19.60	10	75%	59%	0%	25%	2,390	$46,839	$110,361
24	Sunfish	Willow Spring	NC	50	6.40	30	35%	35%	30%	0%	1,515	$63,652	$253,138
25	Picture Rocks	Tucson	AZ	182	20.00	N/A	6%	88%	6%	0%	102	$81,081	$280,172
26	Avra Valley	Tucson	AZ	246	25.00	N/A	3%	94%	3%	0%	85	$80,997	$292,308
27	Sappony	Stony Crk	VA	322	20.00	N/A	2%	98%	0%	0%	74	$51,410	$155,208
28	Camden Dam	Camden	NC	50	5.00	0	17%	72%	11%	0%	403	$84,426	$230,288
29	Grandy	Grandy	NC	121	20.00	10	55%	24%	0%	21%	949	$50,355	$231,408
30	Champion	Pelion	SC	100	10.00	N/A	4%	70%	8%	18%	1,336	$46,867	$171,939
31	Eddy II	Eddy	TX	93	10.00	N/A	15%	25%	58%	2%	551	$59,627	$139,088
32	Somerset	Somerset	TX	128	10.60	N/A	5%	95%	0%	0%	1,293	$41,574	$135,490
33	DG Amp Piqua	Piqua	OH	86	12.60	2	26%	16%	58%	0%	6,735	$38,919	$96,555
34	Barefoot Bay	Barefoot Bay	FL	504	74.50	0	11%	87%	0%	3%	2,446	$36,737	$143,320
35	Miami-Dade	Miami	FL	347	74.50	0	26%	74%	0%	0%	127	$90,909	$403,571
36	Spotyslvania	Paytes	VA	3,500	500.00	160	37%	52%	11%	0%	74	$120,861	$483,333
	Average			362	38.80	32	24%	52%	19%	6%	1,515	$66,292	$242,468
	Median			150	17.80	10	16%	59%	7%	0%	560	$62,384	$230,848
	High			3,500	500.00	160	98%	98%	94%	44%	7,684	$120,861	$515,399
	Low			35	5.00	0	1%	0%	0%	0%	48	$35,057	$96,555

From these 36 solar farms, I have derived 94 matched pairs. The matched pairs show no negative impact at distances as close as 105 feet between a solar panel and the nearest point on a home. The range of impacts is -10% to +10% with an average and median of +1%.

	MW	Avg. Distance		Indicated Impact
Average	44.80	569	Average	1%
Median	14.00	400	Median	1%
High	617.00	1,950	High	10%
Low	5.00	145	Low	-10%

While the range is broad, the two charts below show the data points in range from lowest to highest. There is only 3 data points out of 94 that show a negative impact. The rest support either a finding of no impact or 9 of the data points suggest a positive impact due to adjacency to a solar farm. As discussed earlier in this report, I consider this data to strongly support a finding of no impact on value as most of the findings are within typical market variation and even within that, most are mildly positive findings.



VIII. Scope of Research

I have researched over 1,000 solar farms and sites on which solar farms are existing and proposed in North Carolina Virginia, Illinois, Tennessee, Kentucky as well as other states to determine what uses are typically found in proximity with a solar farm. The data I have collected and provide in this report strongly supports the assertion that solar farms are having no negative consequences on adjoining agricultural and residential values.

Beyond these references, I have quantified the adjoining uses for a number of solar farm comparables to derive a breakdown of the adjoining uses for each solar farm. The chart below shows the breakdown of adjoining or abutting uses by total acreage.

Percentage By Adjoining Acreage

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	19%	53%	20%	2%	6%	887	344	91%	8%
Median	11%	56%	11%	0%	0%	708	218	100%	0%
High	100%	100%	100%	93%	98%	5,210	4,670	100%	98%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

I have also included a breakdown of each solar farm by number of adjoining parcels to the solar farm rather than based on adjoining acreage. Using both factors provide a more complete picture of the neighboring properties.

Percentage By Number of Parcels Adjoining

	Res	Ag	Res/AG	Comm	Ind	Avg Home	Closest Home	All Res Uses	All Comm Uses
Average	61%	24%	9%	2%	4%	887	344	93%	6%
Median	65%	19%	5%	0%	0%	708	218	100%	0%
High	100%	100%	100%	60%	78%	5,210	4,670	105%	78%
Low	0%	0%	0%	0%	0%	90	25	0%	0%

Res = Residential, Ag = Agriculture, Com = Commercial

Total Solar Farms Considered: 705

Both of the above charts show a marked residential and agricultural adjoining use for most solar farms. Every single solar farm considered included an adjoining residential or residential/agricultural use.

IX. Specific Factors Related To Impacts on Value

I have completed a number of Impact Studies related to a variety of uses and I have found that the most common areas for impact on adjoining values typically follow a hierarchy with descending levels of potential impact. I will discuss each of these categories and how they relate to a solar farm.

1. Hazardous material
2. Odor
3. Noise
4. Traffic
5. Stigma
6. Appearance

1. Hazardous material

A solar farm presents no hazardous waste byproduct as part of normal operation. Any fertilizer, weed control, vehicular traffic, or construction will be significantly less than typically applied in a residential development and even most agricultural uses.

The various solar farms that I have inspected and identified in the addenda have no known environmental impacts associated with the development and operation.

2. Odor

The various solar farms that I have inspected produced no odor.

3. Noise

Whether discussing passive fixed solar panels, or single-axis trackers, there is no negative impact associated with noise from a solar farm. The transformer has a hum similar to an HVAC that can only be heard in close proximity to this transformer and the buffers on the property are sufficient to make emitted sounds inaudible from the adjoining properties in most cases. They make even less noise at night.

The various solar farms that I have inspected were inaudible from adjoining roadways.

4. Traffic

The solar farm will have no onsite employee's or staff. The site requires only minimal maintenance. Relative to other potential uses of the site (such as a residential subdivision), the additional traffic generated by a solar farm use on this site is insignificant.

5. Stigma

There is no stigma associated with solar farms and solar farms and people generally respond favorably towards such a use. While an individual may express concerns about proximity to a solar farm, there is no specific stigma associated with a solar farm. Stigma generally refers to things such as adult establishments, prisons, rehabilitation facilities, and so forth.

Solar panels have no associated stigma and in smaller collections are found in yards and roofs in many residential communities. Solar farms are adjoining elementary, middle and high schools as well as churches and subdivisions. I note that one of the solar farms in this report not only adjoins

a church, but is actually located on land owned by the church. Solar panels on a roof are often cited as an enhancement to the property in marketing brochures.

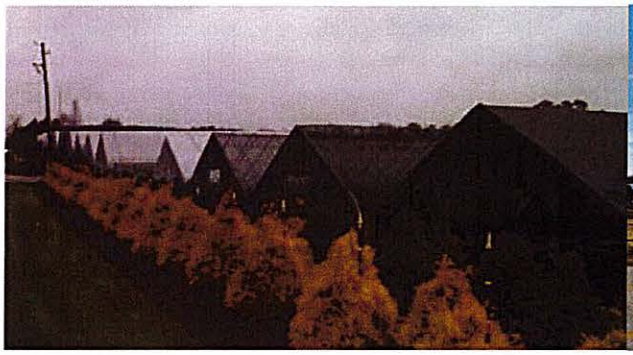
I see no basis for an impact from stigma due to a solar farm.

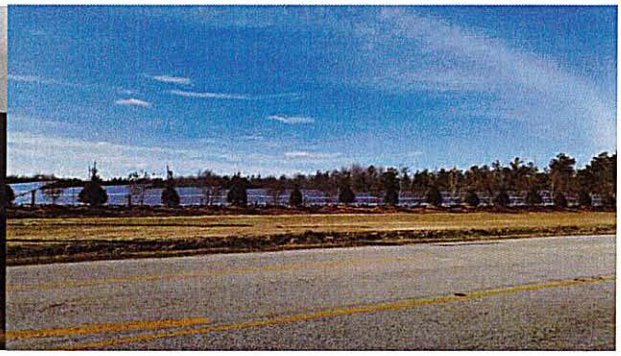
6. Appearance

I note that larger solar farms using fixed or tracking panels are a passive use of the land that is in keeping with a rural/residential area. As shown below, solar farms are comparable to larger greenhouses. This is not surprising given that a greenhouse is essentially another method for collecting passive solar energy. The greenhouse use is well received in residential/rural areas and has a similar visual impact as a solar farm.









The solar panels are all less than 15 feet high, which means that the visual impact of the solar panels will be similar in height to a typical greenhouse and lower than a single-story residential dwelling. Were the subject property developed with single family housing, that development would have a much greater visual impact on the surrounding area given that a two-story home with attic could be three to four times as high as these proposed panels.

Whenever you consider the impact of a proposed project on viewshed or what the adjoining owners may see from their property it is important to distinguish whether or not they have a protected viewshed or not. Enhancements for scenic vistas are often measured when considering properties that adjoin preserved open space and parks. However, adjoining land with a preferred view today conveys no guarantee that the property will continue in the current use. Any consideration of the impact of the appearance requires a consideration of the wide variety of other uses a property already has the right to be put to, which for solar farms often includes subdivision development, agricultural business buildings such as poultry, or large greenhouses and the like.

Dr. Randall Bell, MAI, PhD, and author of the book **Real Estate Damages**, Third Edition, on Page 146 "Views of bodies of water, city lights, natural settings, parks, golf courses, and other amenities

are considered desirable features, particularly for residential properties." Dr. Bell continues on Page 147 that "View amenities may or may not be protected by law or regulation. It is sometimes argued that views have value only if they are protected by a view easement, a zoning ordinance, or covenants, conditions, and restrictions (CC&Rs), although such protections are relatively uncommon as a practical matter. The market often assigns significant value to desirable views irrespective of whether or not such views are protected by law."

Dr. Bell concludes that a view enhances adjacent property, even if the adjacent property has no legal right to that view. He then discusses a "borrowed" view where a home may enjoy a good view of vacant land or property beyond with a reasonable expectation that the view might be partly or completely obstructed upon development of the adjoining land. He follows that with "This same concept applies to potentially undesirable views of a new development when the development conforms to applicable zoning and other regulations. Arguing value diminution in such cases is difficult, since the possible development of the offending property should have been known." In other words, if there is an allowable development on the site then arguing value diminution with such a development would be difficult. This further extends to developing the site with alternative uses that are less impactful on the view than currently allowed uses.

This gets back to the point that if a property has development rights and could currently be developed in such a way that removes the viewshed such as a residential subdivision, then a less intrusive use such as a solar farm that is easily screened by landscaping would not have a greater impact on the viewshed of any perceived value adjoining properties claim for viewshed. Essentially, if there are more impactful uses currently allowed, then how can you claim damages for a less impactful use.

X. Battery Energy Storage System (BESS)

The closest adjoining home to the BESS component of the subject property is unknown but based on the maps would necessarily be at least 200 feet by the current maps. Likely this will be further away once the siteplan is available for me to identify that location.

I considered the following battery storage facilities in a variety of states for a comparison of similar battery energy storage systems (BESS) in proximity to residential uses. I have also searched these areas for recent sales to see if there is any impact on property values near these battery storage facilities, which will be addressed in the following section.

The primary use of this larger set is to show compatibility of BESS and residential uses as well as showing typical setbacks between these uses. These measured distances are from the closest point on the home to the closest piece of equipment. Where I have N/A, the facility does not have an aerial image that I can use to measure that distance. These distances were measured using GoogleEarth.

Summary of Battery Data

#	Name	City/State	Acres	Capacity	Distance from Closest Home	Average Distance Adjoining Home
1	Ozone Park	Queens, NY	0.35	3 MW	30	203
2	Pomona	Rockland, NY	28.5	N/A	270	1196
3	Asheville	Asheville, NC	12.36	9 MW	130	452
4	East Hampton	E. Hampton, NY	17.58	5 MW	470	733
5	Diablo	Concord, CA	11.45	200 MW	320	361
6	Prospect	W. Columbia, TX	2.3	10 MW	400	400
7	Brazoria	Brazoria, TX	17.58	9.95 MW	130	438
8	Gambit	Angleton, TX	6.24	100 MW	215	243
9	Churchtown	Pennsville, NJ	3.13	10 MW	N/A	N/A
10	West Chicago	Chicago, IL	5	19.8 MW	430	450
11	McHenry	McHenry, IL	2.75	19.8 MW	260	283
12	Plumstead	Hornerstown, NJ	14.39	19.8 MW	155	943
13	Vista	Vista, CA	0.88	40 MW	130	172
14	Chisholm	Ft Worth, TX	21.74	200 MW	840	875
15	Port Lavaca	Prt Lavaca, TX	1.44	9.9 MW	N/A	N/A
16	Magnolia	Houston, TX	0.87	9.95 MW	180	190
				Average	283	496
				Median	238	419
				High	840	1,196
				Low	30	172

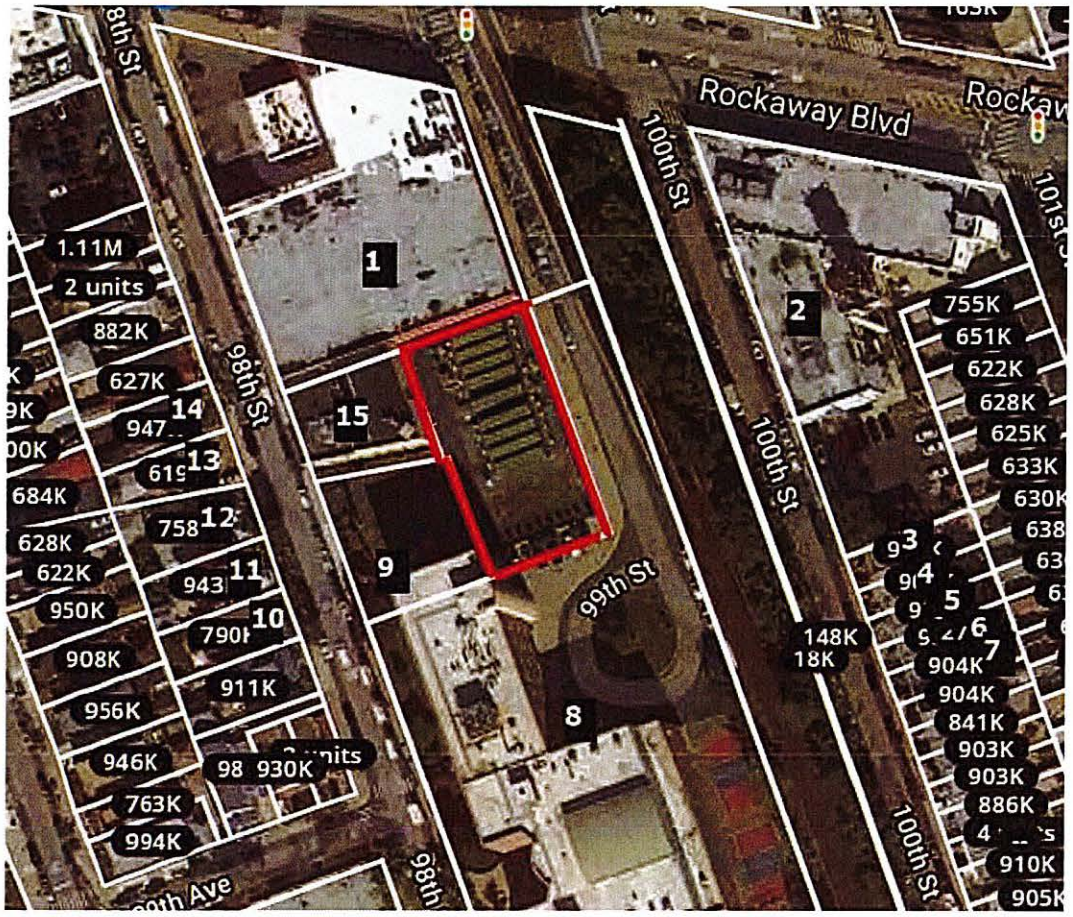
A. BESS Paired Sales Analysis/Market Research

I considered the following battery storage facilities in a variety of states where I was able to identify adjoining residential home sales. These home sales were then compared to similar homes in the area that sold in the same time frame but were not in proximity to the BESS. This is called a paired sales analysis and I have used this to determine if there is any impact that could be attributed to the adjacency/proximity to the BESS.

1 - Ozone Park Batteries

This system is located on 99th Street in Jamaica, Queens, New York. The below image shows the battery pack parcel outlined in red with a bowling alley to the north, a school to the south and homes to the east and west as well as a church to the west. Based on aerial imagery, this site was installed in early to mid-2018.

The two closest structures are the school at 65 feet and a church at 30 feet from the batteries. The nearby homes are on the opposing blocks, but the proximity to the school does illustrate a high confidence in public safety related to the battery facility and acceptance within that community.



Surrounding Uses

#	Address	GIS Data Acres	Present Use	Adjoin Acres	Adjoin Parcels	Distance (ft) Home/Battery
1	98-18 Rockaway	0.76	Bowling	11.69%	6.67%	N/A
2		0.95	Office	14.62%	6.67%	N/A
3	10735 100th St	0.06	Residential	0.92%	6.67%	245
4	10737 100th St	0.06	Residential	0.92%	6.67%	260
5	10739 100th St	0.06	Residential	0.92%	6.67%	275
6	10741 100th St	0.06	Residential	0.92%	6.67%	290
7	10743 100th St	0.06	Residential	0.92%	6.67%	305
8	10915 98th St	3.74	School	57.54%	6.67%	65
9		0.27	School	4.15%	6.67%	N/A
10	10656 98th St	0.06	Residential	0.92%	6.67%	200
11	10654 98th St	0.06	Residential	0.92%	6.67%	195
12	10650 98th St	0.06	Residential	0.92%	6.67%	190
13	10646 98th St	0.06	Residential	0.92%	6.67%	190
14	10636 98th St	0.06	Residential	0.92%	6.67%	195
15	10645 (8th St	0.18	Church	2.77%	6.67%	30
	Total	**6.500**		**100.00%**	**100.00%**	203
					Min	30

The closest recent home sale is 10726 101st Street that sold on October 9, 2018, after the battery storage facility was installed. This home is 345 feet from the closest battery and has a very obstructed view of that area based on the shrubs around the battery storage site as well as a strip of landscape greenery between the two sites. The sales price was $600,000 for this 3 BR/1.5 BA home that was built in 1930 on a 0.06-acre site.

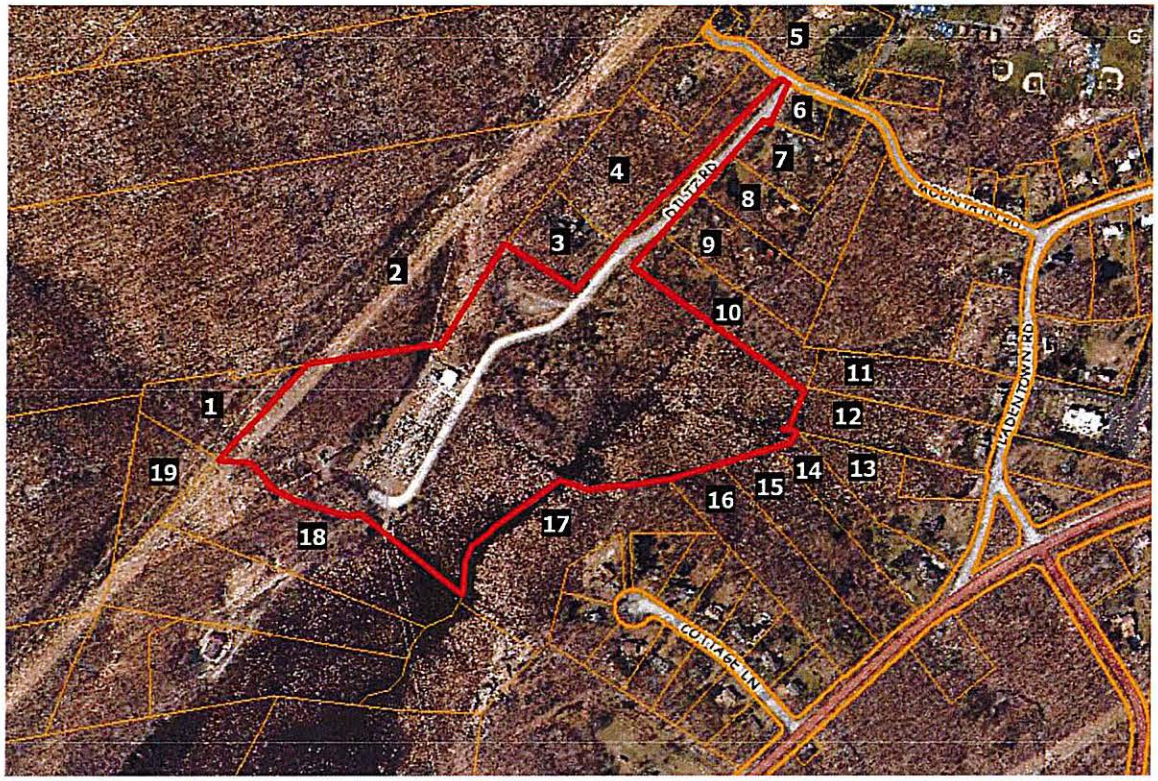
I compared this to a similar home built in 1930 in the same style and same size that sold at 10762 101st Street on October 9, 2018 for $590,000. This home is just down the street but further from the battery storage system and sold on the same day for $10,000 less. The proximity to the battery does not correlate to value impact in this instance as the home further away sold for less. This second home is across the street from the three-story John Adams High School which likely accounts for the lower price for this second property compared to the first which was adjacent to the same school, but not across from the building itself.

The matched pairs support a finding of no impact on value due to proximity to the battery system.

2 - Pomona Batteries

This battery storage system is located at 23 Diltz Road, Pomona, Rockland, New York. This location is more remote than the other system with greater distances separating homes from batteries, but all of the adjoining uses are residential or park. This battery site is located at the end of a road for estate-like homes on large acreage adjoining or in close proximity to Harriman State Park. There are some sales on Dritz Road adjoining the battery site and none of the broker statements identify that as a concern. But given the park, the Mahwah River exposure it is difficult to use these sales for matched pairs as there are too many unique factors and matched pairs require one unique factor.

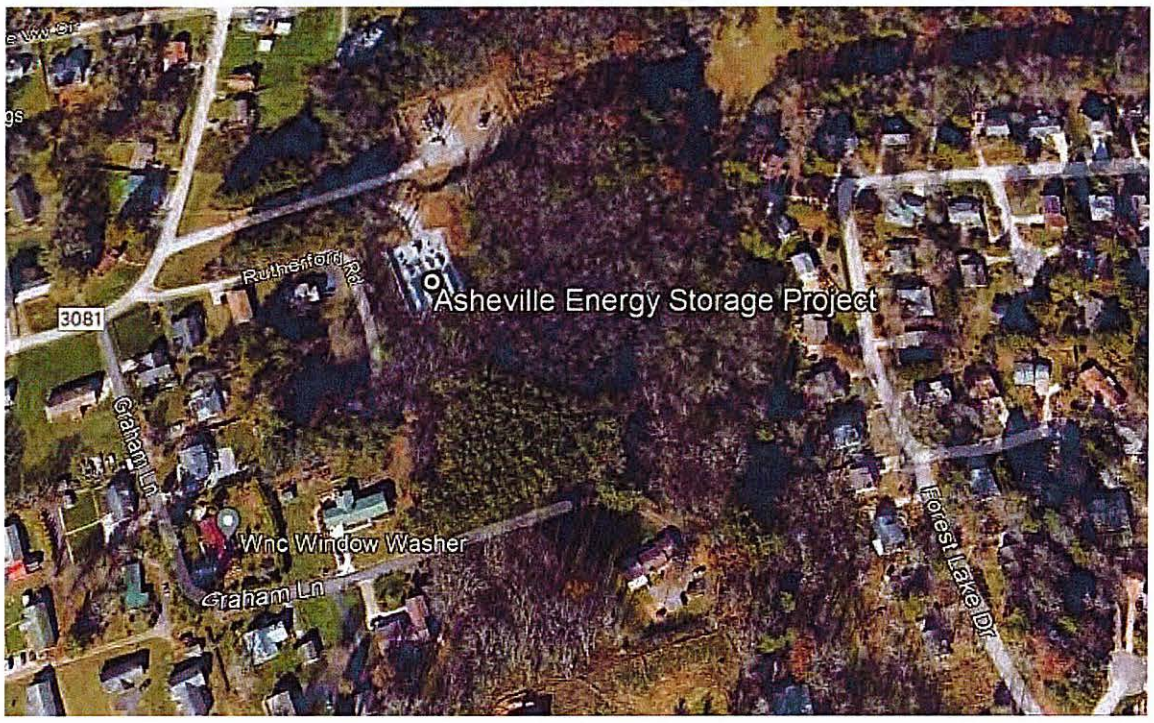
Still, the site shows harmonious use in connection with residential uses. The closest identified home is 270 feet.



3 - Asheville Energy Storage System

This 9 MW battery storage system is located on a parcel with a substation built in 2020 (substation was bult much earlier). This facility has significant residential development around it but no recent sales to consider.



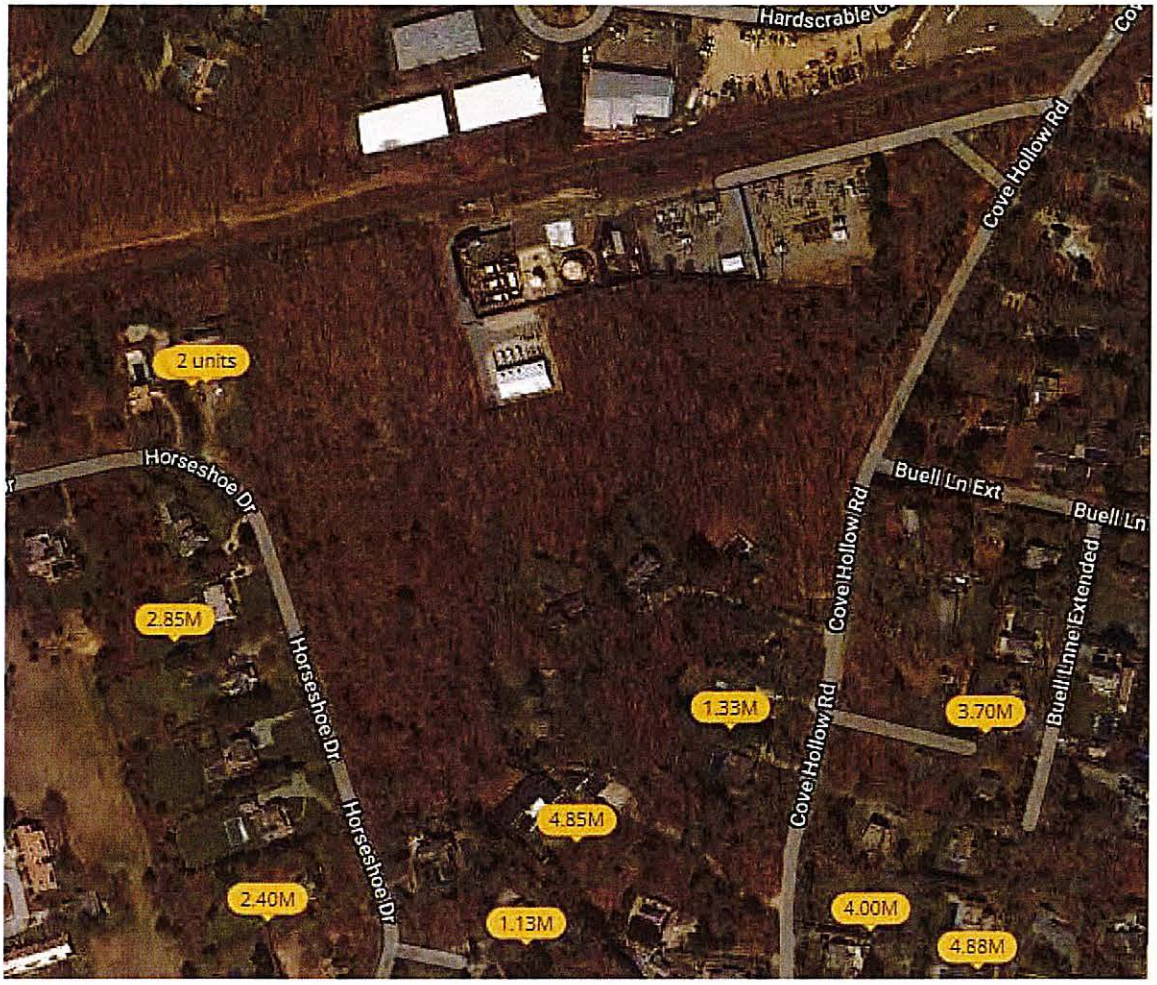


There is a nearby home sale that is located on Tax Parcel 8047 (just below the identifier for Parcel 9). This home is 550 feet from the nearest battery equipment and most of that distance is heavily wooded. This home has a street address of 95 Forest Lake Drive, Asheville, NC and it sold on April 26, 2022 for $510,000 for this 4 BR/3 BA ranch with 1,931 square feet including the daylight basement area. The home also has a 2 car garage. I did not attempt a paired sale as this home has no visibility of the BESS despite the proximity and arguably has a better view with less screening to the substation, which is also closer to the home.

Similarly, new homes are being built to the south on Rangley Drive with prices ranging from $431,000 to $566,000. These homes include those that back up to the Parcels 11 through 14 in the adjacent parcel map.

4 – East Hampton Energy Storage System

This 5 MW battery storage system is located on a parcel with a substation and a natural gas peaker plant. This makes it difficult to use for analysis given the multiple uses on this parcel, but I have included a visual of homes in the general area that have sold recently for reference. There is significant wooded acreage separating this BESS and nearby homes.



5 – Diablo Energy Storage System

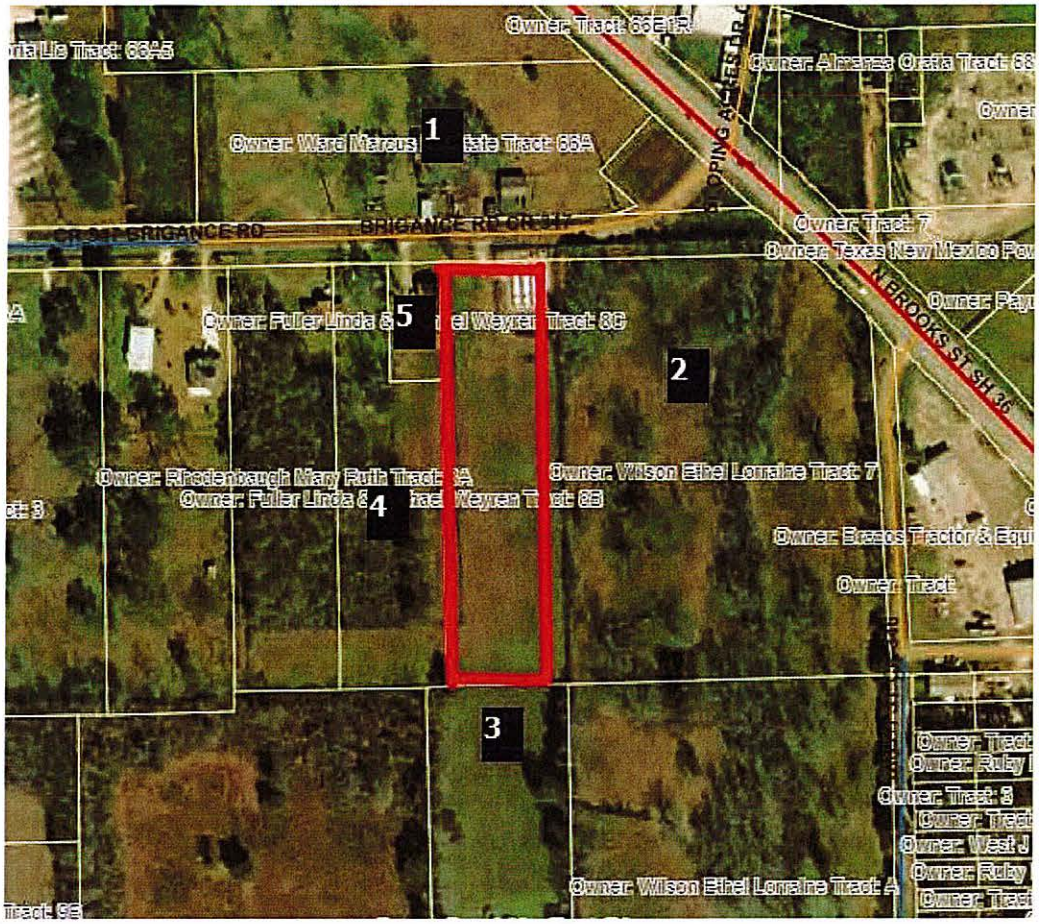
This 200 MW battery storage system is located on a parcel with significant adjacency to industrial uses and residential uses. For these reasons it would be difficult to measure impacts due to the other adjoining industrial uses that might also have an impact. Given that most of the adjoining uses are industrial, I have not dug further on this one.

6 – Prospect Energy Storage System

This 10 MW battery storage system is located on a parcel adjoining a large substation in Brazoria, TX. The only adjoining home is 400 feet away. This home has not sold since the BESS was completed in 2019. Furthermore, this home has an unobstructed view of the substation which would make it a difficult home for impact analysis.

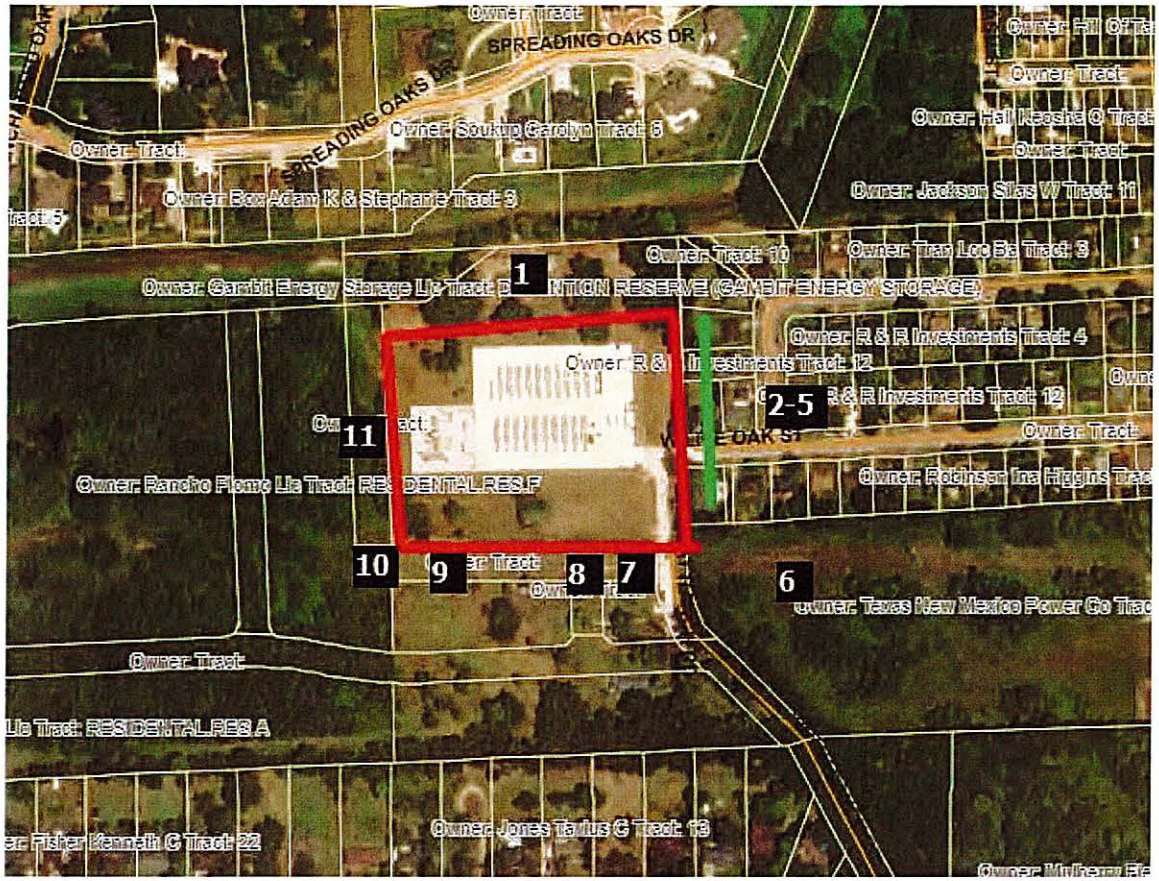
7 – Brazoria Energy Storage System

This 9.95 MW battery storage system is located on a parcel adjoining multiple homes within 150 feet of the battery equipment. There have been no recent sales since this was built in 2020.



8 - Gambit Energy Storage

This 102.4 MW battery storage system is located off W. Live Oak Street, Angleton, Texas. This is a new facility and placed online in June 2021. This system is a good location as there are no other externalities adjoining it to potentially impact the analysis. The substation associated with this is located to the east along N. Walker Street.



While I cannot do any analysis of impact from the most recent adjoining sales as they all occurred before this site was built, but the adjoining homes to the north are selling with new homes ranging from $400,000 to $600,000.

The most recent adjoining home sale to the west was 852 Marshall Road that sold on April 5, 2021 and presumably they were aware of the battery storage facility as it would have been under construction at the time of sale. This brick ranch with 3 BR, 1 BA with 1,220 s.f. of gross living area and built in 1980 on 0.40 acres sold for $165,000, or $135 per s.f.

I have compared that sale to 521 Catalpa Street that sold on September 11, 2020 for $155,000 for a 3 BR, 2 BA brick ranch with 1,220 s.f. built in 1973 with a single car garage. Adjusting this price upward by 9% for growth in the market for time, 3.5% for difference in age, downward by $6,000 for the additional bathroom, and $4,000 for the garage, the adjusted indicated value of this home is $164,375, which is right in line with 852 Marshall Road and supports a finding of no impact on property value.

I have also compared that sale to 521 W Mimosa Street that sold on February 26, 2021 for $150,000 for this brick ranch with 3 BR, 1.5 BA with 1,194 s.f. built in 1976. Adjusting this sale upward by 4% for growth in the market over time, upward 2% for difference in age, and downward

by $5,000 for the additional half bathroom, I derive an adjusted indication of $154,000. This is 7% less than the home price at 852 Marshall Road which suggests an enhancement due to proximity to the battery storage system.

I have also compared this sale to 1164 Thomas Drive that sold on May 20, 2020 for $187,000 for this brick ranch with 2-car garage, 3 BR, 2 BA with 1,259 s.f. and built in 1998. Adjusting this upward by 13% for growth over time, downward by 9% for difference in age of construction, downward by $8,000 for the garage, downward $6,000 for the additional bathroom, I derive an indicated value of $180,480. This is a 9% difference suggesting a negative impact on property value. However, this comparable required the largest amount of adjustments and is not considered as heavily as the other two comparables. This home is 18 years newer and with better bathroom situation as a 1-bathroom house is a significant issue for most buyers.

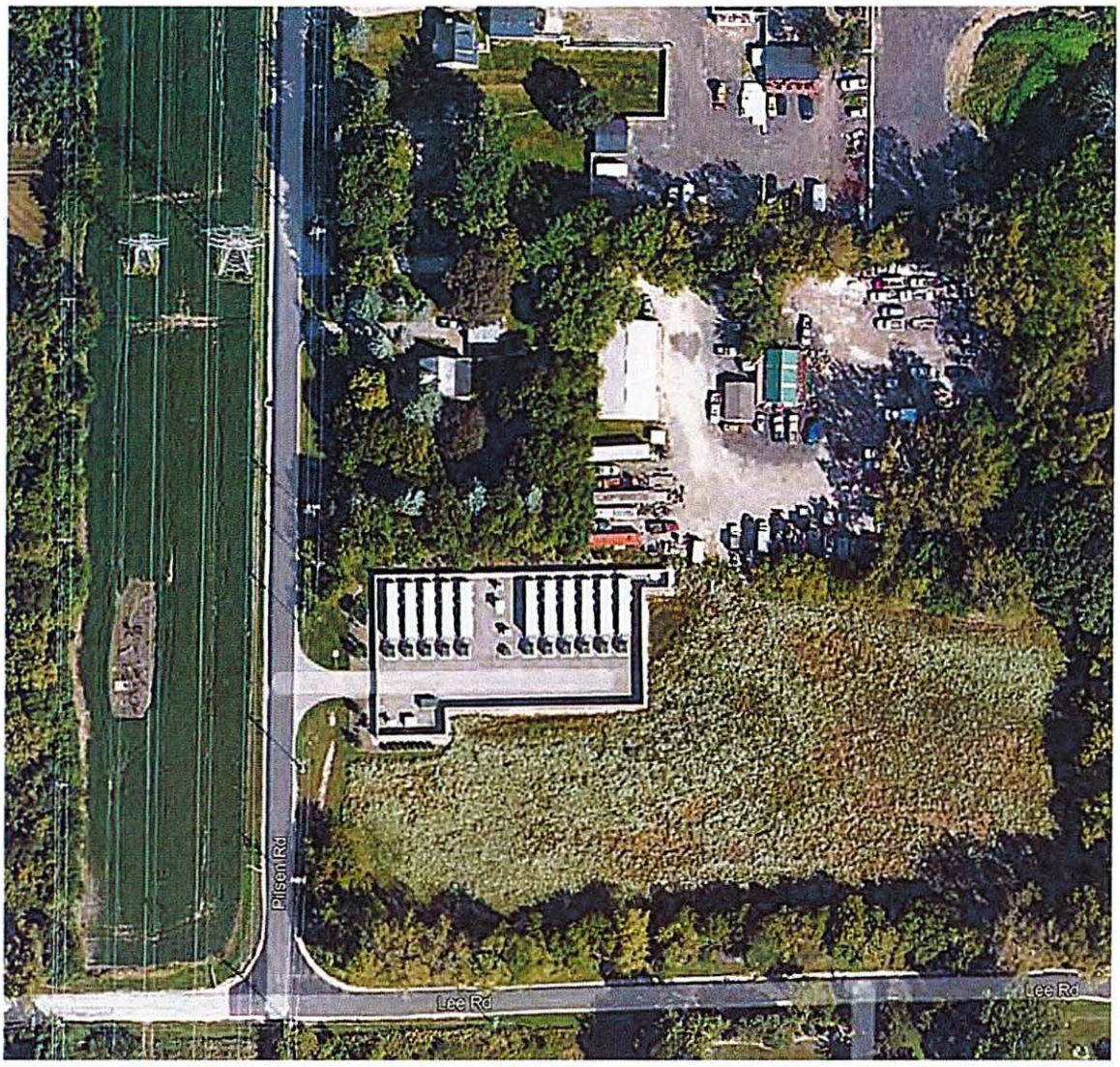
The second comparable considered required the least adjustment and suggests a positive impact on property value. The median indication is the first comparable which shows no impact on property value. Given this data set I conclude that the best indication from these matched pairs supports a finding of no impact on property value. The home at 852 Marshall is 180 feet from the project outline shown.

9 - Churchtown Battery Storage

This 10 MW battery storage system is located off N. Broadway, Pennsville, NJ. The aerial imagery does not show this system yet so I was not able to determine distances to adjoining homes or identify any adjoining homes. Given the large substation, adjoining baseball fields and religious facilities this would be a challenging site for an impact analysis in any case.

10 - West Chicago Battery Storage

This 19.8 MW battery storage system is located off Pilsen Road, Chicago, Illinois. This facility has condominium and single family housing to the north and single family housing nearby to the south, but also adjoining an outdoor storage area and a large powerline easement. I was not able to do any analysis on this site as there have been no recent sales identified.



11 - McHenry Battery Storage

This 19.8 MW battery storage system is located off Illinois Highway 31, McHenry, Illinois that was built around 2016. This is facility fronts on the highway but has rear adjacency to a number of houses.

There were two recent home sales along W. High Street, but they effectively adjoin the small commercial use between the battery storage facility. That complication makes it difficult to determine if the commercial use was the impact or if the commercial use buffered any impact making any finding off of analysis suspect and uncertain.



I have however considered the recent sale of 209 N Dale Avenue that adjoins the battery storage site and is 290 feet from the nearest equipment.

That home sold on June 30, 2021 for $265,000 for a vinyl-siding ranch with 3 BR, 2.5 BA, built in 1960 with a gross living area of 1,437 square feet, or $184.41 per s.f. The property has 5 attached garage spaces. As identified in the listing the home was completely renovated with stainless steel appliances and granite countertops. This was listed by Lynda Steidinger with Berkshire Hathaway HomeServices Starck Real Estate and the buyers agent was Ivette Rodriguez Anderson with Keller Williams.

The home directly across the street, 208 N Dale Avenue, sold on June 16, 2021 for $275,000 for a cedar siding and stone ranch with 3 BR, 2.5 BA, built in 1961, with a gross living area of 1,446 s.f., or $190.18 per s.f. This home also has 1,101 square feet of finished basement space that is

currently used as an office but could be an additional bedroom. This home also has been updated and includes stainless steel appliances and granite counter tops.

The size difference is nominal and the additional 3-car garage bays at the 209 N Dale is considered to be balanced by the finished basement space at 208 N Dale, though the finished office space is somewhat superior to garage space. But balancing those two factors out the difference in price per square foot is 3%. This is considered negligible and attributable to the slightly superior finished basement space and not any impact relative to the battery storage facility.

I also looked at 3802 Clover Avenue, which is two blocks to the north. This stone and siding ranch with 3 BR, 2 BA, built in 1956, with a gross living area of 1,200 s.f. sold on October 21, 2021 for $231,000 or $192.50 per s.f. The property has been updated with a new kitchen and a new bay window and includes a partially finished basement with an additional bathroom in it and the total basement area is an additional 1,200 s.f. This is the smallest home in the neighborhood that I found and it further illustrates that the price per square foot typically goes up as the size goes down. Adjusting this gross sale price upward by $36,498 for the smaller size based on 80% of the price per square foot for this purchase, I derive an adjusted sales price to compare to the subject property of $267,498. I consider the basement to balance out the extra garage space at the subject. This indicates a difference of 1% from the purchase price of the 209 N Dale Avenue, which is attributable to the 4 months difference in time. I consider this comparable to further support a finding of no impact on value.

While I haven't written up the other sales in the neighborhood there are numerous recent home sales ranging from $172,000 to $306,000, but most of these homes are also over 2,000 square feet in size. The subject property sold for more per square foot than most of these other sales partly due to the smaller overall size, partly due to the significant renovations, and partly due to the additional garage space. Still, this shows that the 209 N Dale Avenue sale is not being impacted by the battery storage facility and has in fact been updated above what is typical for the neighborhood, though given the similar updates at 208 N Dale Avenue, this may be the trend for the area.

The two sales compared to the 209 N Dale Avenue sale supports a finding of no impact on property value due to the battery storage facility.

12 - Plumsted Energy Storage

This 19.8 MW battery storage system is located on Monmouth Road, Cream Ridge, New Jersey. There is only one adjoining home as shown in the image to the south, but it is located just 148 feet from the nearest piece of equipment and 96 feet from the fence line. There were existing trees, but they were supplemented with a 12-foot wooden privacy fence with smaller evergreens between the fence and property line. The privacy fence at this location is oversized as the battery units include HVAC units on top of the battery pods that extend the height of the units greater than required at the subject property. The road frontage was not landscaped and chainlink fencing was used on the rest of the property.

The adjoining home at 797 Monmouth Road has not sold recently and no further analysis is possible at this site.



13 - Vista Energy Storage System

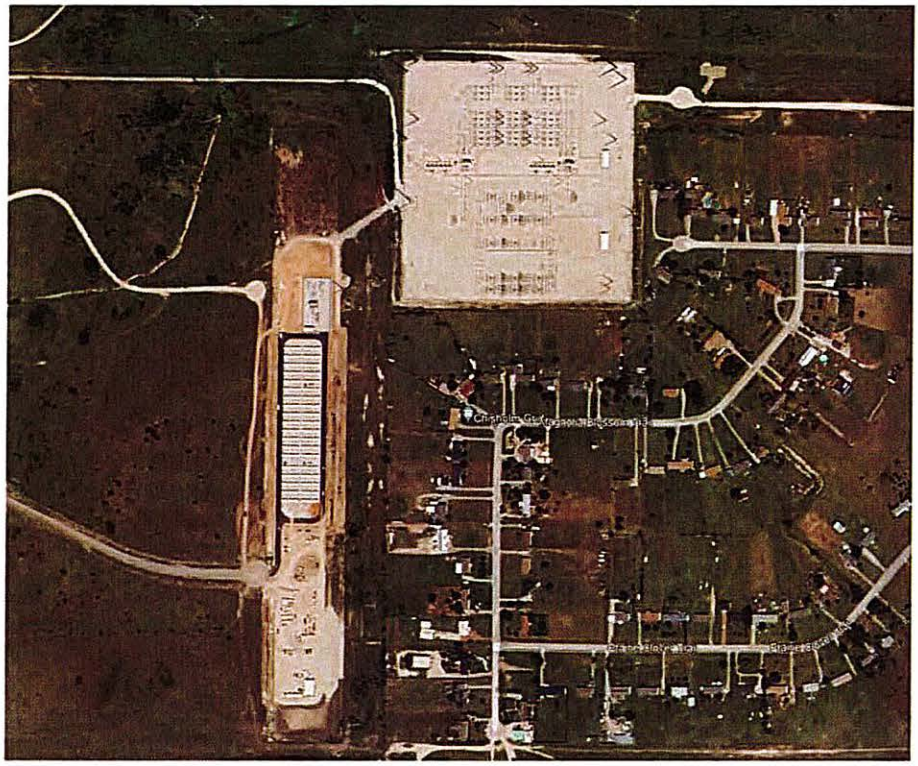
This 40 MW battery storage system is located off Olive Avenue, Vista, California. This facility has significant commercial development around it but also housing to the south as close as 115 feet from the closest equipment as shown in the aerial map below.



14 - Chisholm Grid Energy Storage

This 200 MW battery storage system is located at 9400 Asphalt Drive, Fort Worth, Texas. This is a new facility and in close proximity to those homes near the substation.

The property to the west of the BESS is an asphalt plant with a lot of vacant land separating the homes from the active plant. Still this complicates any analysis of this from an impact analysis standpoint. I therefore have not attempted to do so.

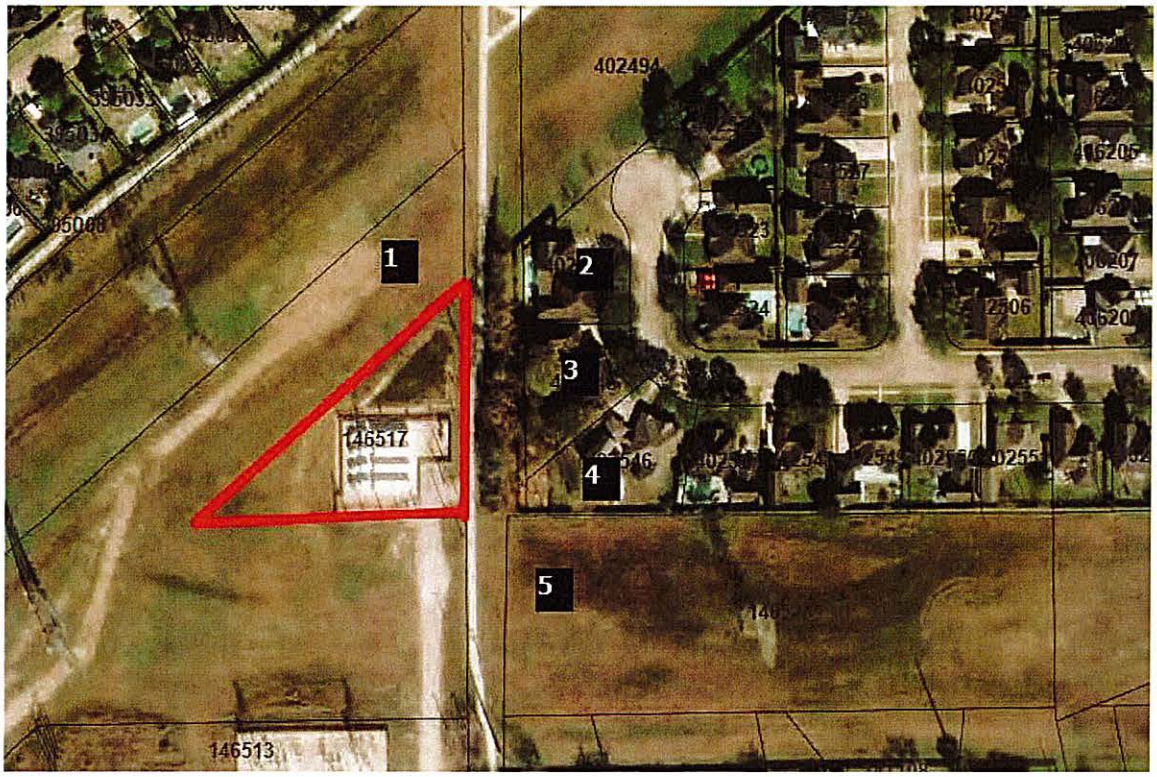


15 - Port Lavaca BESS

This 9.9 MW battery storage system is located in Port Lavaca, Texas. It was built in 2020 and is entirely surrounded by agricultural and utility uses. I have not attempted any impact analysis on this facility.

16 - BRP Magnolia BESS

This 9.95 MW battery storage system is located off Floyd Road, League City, near Houston, Texas. There have not been any adjoining home sales since it was built so no analysis is currently possible. The adjoining homes are between 180 and 200 feet from the BESS equipment.



Summary

I was able to complete paired sales analysis on three of these situations with data coming from Ozone Park in NY, Gambit in TX and McHenry in IL.

The paired sales analysis identifies no impact on adjoining properties based on actual home sales adjoining similar projects.

Most of the situations identified showed homes closer to a BESS than the sales identified. But I can only measure for impacts once a home has sold.

The sales data supports a finding of no impact on property value for homes ranging from 180 to 345 feet from the nearest equipment.

As noted earlier, the exact location of the BESS has not been identified, but will be at least 200 feet away from the closest home and likely much further away than that. At these distances, the paired sales data shows sufficient setbacks to protect property value.

XI. Conclusion

The matched pair analysis shows no negative impact in home values due to abutting or adjoining a solar farm as well as no impact to abutting or adjacent vacant residential or agricultural land. The criteria that typically correlates with downward adjustments on property values such as noise, odor, and traffic all support a finding of no impact on property value.

Very similar solar farms in very similar areas have been found by hundreds of towns and counties not to have a substantial injury to abutting or adjoining properties, and many of those findings of no impact have been upheld by appellate courts. Similar solar farms have been approved adjoining agricultural uses, schools, churches, and residential developments.

I have found no difference in the mix of adjoining uses or proximity to adjoining homes based on the size of a solar farm and I have found no significant difference in the matched pair data adjoining larger solar farms versus smaller solar farms. The data in the Southeast is consistent with the larger set of data that I have nationally, as is the more specific data located in and around North Carolina.

Based on the data and analysis in this report, it is my professional opinion that the solar farm proposed at the subject property will have no negative impact on the value of adjoining or abutting property. I note that some of the positive implications of a solar farm that have been expressed by people living next to solar farms include protection from future development of residential developments or other more intrusive uses, reduced dust, odor and chemicals from former farming operations, protection from light pollution at night, it is quiet, and there is no traffic.

The BESS component will be set at least as far back as 200 feet, which paired sales supports no impacts at that distance.

XII. Certification

I certify that, to the best of my knowledge and belief:

1. The statements of fact contained in this report are true and correct;

2. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, unbiased professional analyses, opinions, and conclusions;

3. I have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to the parties involved;

4. I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment;

5. My engagement in this assignment was not contingent upon developing or reporting predetermined results;

6. My compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of the appraisal;

7. The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute;

8. My analyses, opinions and conclusions were developed, and this report has been prepared, in conformity with the Uniform Standards of Professional Appraisal Practice.

9. The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives;

10. I have not made a personal inspection of the property that is the subject of this report, and;

11. No one provided significant real property appraisal assistance to the person signing this certification.

12. As of the date of this report Richard C Kirkland Jr has completed the continuing education program for Designated Members of the Appraisal Institute; As of the date of this report Nicholas Kirkland has completed the Standards and Ethics Education Requirements for Candidates of the Appraisal Institute.

13. I provided an earlier draft of this report on August 29, 2023. I have not performed services, regarding the property that is the subject of this report within the three-year period immediately preceding acceptance of this assignment.

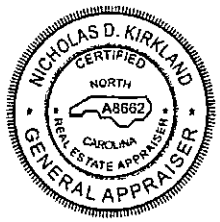
Disclosure of the contents of this appraisal report is governed by the bylaws and regulations of the Appraisal Institute and the National Association of Realtors.Neither all nor any part of the contents of this appraisal report shall be disseminated to the public through advertising media, public relations media, news media, or any other public means of communications without the prior written consent and approval of the undersigned.





Richard C. Kirkland, Jr., MAI
State Certified General Appraiser

Nicholas D. Kirkland
State Certified General Appraiser



Kirkland Appraisals, LLC

Richard C. Kirkland, Jr., MAI
9408 Northfield Court
Raleigh, North Carolina 27603
Mobile (919) 414-8142
rkirkland2@gmail.com
www.kirklandappraisals.com

Professional Experience

Kirkland Appraisals, LLC, Raleigh, N.C. — 2003 – Present
Commercial appraiser

Hester & Company, Raleigh, N.C.
Commercial appraiser — 1996 – 2003

Professional Affiliations

MAI (Member, Appraisal Institute) designation #11796 — 2001
NC State Certified General Appraiser # A4359 — 1999
VA State Certified General Appraiser # 4001017291
SC State Certified General Appraiser # 6209
FL State Certified General Appraiser # RZ3950
GA State Certified General Appraiser # 321885
MI State Certified General Appraiser # 1201076620
PA State Certified General Appraiser # GA004598
OH State Certified General Appraiser # 2021008689
IN State Certified General Appraiser # CG42100052

Education

Bachelor of Arts in English, University of North Carolina, Chapel Hill — 1993

Continuing Education

Uniform Standards of Professional Appraisal Practice Update	2022
Sexual Harassment Prevention Training	2021
Appraisal of Land Subject to Ground Leases	2021
Florida Appraisal Laws and Regulations	2020
Michigan Appraisal Law	2020
Uniform Standards of Professional Appraisal Practice Update	2020
Uniform Appraisal Standards for Federal Land Acquisitions (Yellow Book)	2019
The Cost Approach	2019
Income Approach Case Studies for Commercial Appraisers	2018
Introduction to Expert Witness Testimony for Appraisers	2018
Appraising Small Apartment Properties	2018
Florida Appraisal Laws and Regulations	2018
Uniform Standards of Professional Appraisal Practice Update	2018
Appraisal of REO and Foreclosure Properties	2017
Appraisal of Self Storage Facilities	2017
Land and Site Valuation	2017
NCDOT Appraisal Principles and Procedures	2017
Uniform Standards of Professional Appraisal Practice Update	2016
Forecasting Revenue	2015

Wind Turbine Effect on Value	2015
Supervisor/Trainee Class	2015
Business Practices and Ethics	2014
Subdivision Valuation	2014
Uniform Standards of Professional Appraisal Practice Update	2014
Introduction to Vineyard and Winery Valuation	2013
Appraising Rural Residential Properties	2012
Uniform Standards of Professional Appraisal Practice Update	2012
Supervisors/Trainees	2011
Rates and Ratios: Making sense of GIMs, OARs, and DCFs	2011
Advanced Internet Search Strategies	2011
Analyzing Distressed Real Estate	2011
Uniform Standards of Professional Appraisal Practice Update	2011
Business Practices and Ethics	2011
Appraisal Curriculum Overview (2 Days – General)	2009
Appraisal Review - General	2009
Uniform Standards of Professional Appraisal Practice Update	2008
Subdivision Valuation: A Comprehensive Guide	2008
Office Building Valuation: A Contemporary Perspective	2008
Valuation of Detrimental Conditions in Real Estate	2007
The Appraisal of Small Subdivisions	2007
Uniform Standards of Professional Appraisal Practice Update	2006
Evaluating Commercial Construction	2005
Conservation Easements	2005
Uniform Standards of Professional Appraisal Practice Update	2004
Condemnation Appraising	2004
Land Valuation Adjustment Procedures	2004
Supporting Capitalization Rates	2004
Uniform Standards of Professional Appraisal Practice, C	2002
Wells and Septic Systems and Wastewater Irrigation Systems	2002
Appraisals 2002	2002
Analyzing Commercial Lease Clauses	2002
Conservation Easements	2000
Preparation for Litigation	2000
Appraisal of Nonconforming Uses	2000
Advanced Applications	2000
Highest and Best Use and Market Analysis	1999
Advanced Sales Comparison and Cost Approaches	1999
Advanced Income Capitalization	1998
Valuation of Detrimental Conditions in Real Estate	1999
Report Writing and Valuation Analysis	1999
Property Tax Values and Appeals	1997
Uniform Standards of Professional Appraisal Practice, A & B	1997
Basic Income Capitalization	1996

DEPARTMENT OF THE AIR FORCE
4TH FIGHTER WING (ACC)
SEYMOUR JOHNSON AIR FORCE BASE NC

OCT 25 2023

Mr. Brian W. Joyner, P.E.
Deputy Base Engineer
1095 Peterson A venue
Seymour Johnson AFB NC 27531-2468

Mr. Berry Gray, Planning Director
Wayne County Planning Department
134 North John Street
Goldsboro, NC 27530-3633

Dear Mr. Gray

On September 8, 2023, we received a solar energy facility proposal "Turtle Cove Solar" from Mr. Tom Delafield. According to the Zoning Site Plan (attached) he provided, the project area spans 15 parcels totaling approximately 751 acres of land located in Wayne County, NC. Below is a summary of the three areas of concern as described in the Seymour Johnson AFB 2011 Air Installation Compatible Use Zone (AICUZ) report as related to the proposal.

A. Airspace Control Surfaces (Hazards to Aircraft Flight Zone): The subject property is within the Outer Horizontal Surface.

(1) Height – Structures or vegetation on the property is limited in height to 599 feet above mean sea level. The proposal is **compatible** with this protocol.

(2) Visual – The proposed development does not generate smoke, dust, steam or other visual interfering operations. The proposal is **compatible** with this protocol.

(3) Light Emissions – We completed a review of the Solar Glare and Glint Analysis Report provided by the proponent on September 25. In comparing the yellow and green glare within the report, with and without anti-reflective coating (ARC) on the smooth glass photovoltaic solar panels, we concluded that the ARC panels significantly reduced the amount of yellow glare. Therefore, we highly recommend such materials be installed to reduce the glint and glare exposed to the Seymour Johnson AFB and transient aircrews. Reducing this exposure will contribute considerably to the safety of flying operations; protect the training airspace from encroachment that may jeopardize the military mission, and promote public health, safety, and general welfare of the community. The proposal will be considered **compatible with this protocol per the recommended mitigation above.**

(4) Bird/Wildlife Aircraft Strike Hazard (BASH) – Bird activity and strikes in proximity to solar farms have raised concerns as to whether solar arrays attract various types of birds

and wildlife. The primary hazards are soaring birds, which due to their size and flight pattern pose a risk to aircraft. The proximity of this project to the traffic pattern at Seymour Johnson AFB, the unknown impacts to bird/wildlife activity, and the overall size of this project has raised uncertainty about potential increased risk to bird strikes. If it is determined that the proposed solar project must be allowed on these properties, it is considered **compatible with implementation (coordinated with USAF) with the following recommendations:**

a. The project owner partner with the United States Department of Agriculture (USDA) and USAF representatives at Seymour Johnson AFB to allow USDA access to the project to observe hazardous wildlife conditions and advise on mitigation strategies to reduce bird strike attractants.

b. The project owner implements long-term wildlife mitigation efforts on-site as part of the development plan.

(5) Radio Frequency/Electromagnetic Interference (RF/EMI) – We do not anticipate the proposed development to create a RF/EMI concern with our aircraft operations. The proposal is **compatible** with this protocol.

B. Noise Due to Aircraft Operations: The subject property is not located in a Noise Zone and therefore is not applicable for this proposal.

C. Clear Zones and Accident Potential Zones: The subject property is not located in a Clear Zone or Accident Potential Zone and therefore is not applicable for this proposal.

We appreciate the opportunity to assess this request and comment on it. If additional information or clarification is required, please contact me at (919) 722-5142.

Sincerely

BRIAN W. JOYNER, P.E.

Attachment: Zoning Site Plan

250' RESIDENTIAL SETBACK (TYP.)
MAXIMUM ARRAY EXTENTS (TYP.)
ST JOHN CHURCH RD
PINEY GROVE CHURCH RD
GARRIS CHAPEL RD
DELINEATED POND (TYP.)
APPROXIMATE OVERHEAD ELECTRIC LINE
APPROXIMATE SITE ACCESS LOCATION
PROPOSED 40' WIDE ACCESS EASEMENT
50' PERIMETER SETBACK TO FENCE, 75' TO IMPROVED AREA (TYP.)
PROPOSED 25' VEGETATIVE BUFFER (TYP.)
EXISTING FEMA 100 YEAR FLOODPLAIN (TYP.)
DELINEATED WETLANDS (TYP.)
30' SETBACK FROM DELINEATED WETLANDS (TYP.)
GIS PROPERTY LINE (TYP.)
APPROXIMATE SITE ACCESS LOCATION
APPROXIMATE OVERHEAD ELECTRIC LINE
50' PUBLIC ROAD SETBACK TO FENCE, 75' TO IMPROVED AREA (TYP.)
APPROXIMATE POINT OF INTERCONNECTION
MAXIMUM ARRAY EXTENTS (TYP.)
PROJECT BOUNDARY (TYP.)
SUTTON RD SE
PINEY GROVE CHURCH RD
APPROXIMATE SITE ACCESS LOCATION
EXISTING 25' VEGETATIVE BUFFER TO BE PRESERVED FOR SCREENING
APPROXIMATE SITE ACCESS LOCATION
CLIFFS OF THE NEUSE STATE PARK
WAYNE COUNTY
LENOIR COUNTY
NEUSE RIVER
VICINITY MAP
SITE DATA TABLE
PROJECT AREA
PARCEL ID #
ZONING JURISDICTION
CURRENT ZONING
ADJACENT PROPERTY ZONING
CURRENT LAND USE
PROPOSED LAND USE
REQUIRED SETBACKS
PROPOSED SETBACKS
LANDSCAPE REQUIREMENTS
PROPOSED LANDSCAPE BUFFER
WAYNE COUNTY
OH (OUTER HORIZONTAL HEIGHT DISTRICT)
OH (OUTER HORIZONTAL HEIGHT DISTRICT)
AGRICULTURAL/FORESTED
SOLAR ENERGY
PERIMETER SETBACKS
PROPOSED SETBACKS
LEGEND
PROJECT BOUNDARY
GIS PROPERTY LINE
PERIMETER SETBACK
APPROXIMATE ELECTRIC EASEMENT
APPROXIMATE EXISTING OVERHEAD TRANSMISSION LINE
FEMA 100 YEAR FLOODPLAIN
DELINEATED WETLANDS
DELINEATED PONDS
MAXIMUM ARRAY EXTENTS
EXISTING NATURAL WOODED BUFFER TO BE PRESERVED
PROPOSED VEGETATIVE BUFFER
NOTES
1. PROJECT BOUNDARY SHOWN IS BASED ON FILES RECEIVED FROM RENEWABLE ENERGY SERVICES, LLC ON 09/29/2023.
3. PARCEL BOUNDARIES SHOWN ARE BASED ON PUBLICLY AVAILABLE NORTH CAROLINA GIS DATA ACCESSED ON 09/26/2023.
5. ALL EXISTING TRANSMISSION LINES SHOWN ARE APPROXIMATE LOCATIONS BASED ON PUBLICLY AVAILABLE GIS DATA ACCESSED ON 09/26/2023.
6. 100-YR FLOODPLAIN LIMITS/ORIGIN IS BASED ON PUBLICLY AVAILABLE FEMA GIS DATA ACCESSED ON 09/26/2023.
7. WETLANDS AND WATERS ARE BASED ON ENVIRONMENTAL FIELD DELINEATION LIMITS/DATA PROVIDED BY RENEWABLE ENERGY SERVICES, LLC. DATED 09/29/2023.
8. THE LOCATION OF PROPOSED EQUIPMENT INCLUDING BUT NOT LIMITED TO ACCESS LOCATIONS, FENCING, SOLAR ARRAY RACKING, ELECTRICAL EQUIPMENT, VEGETATIVE BUFFER, AND OVERHEAD POLES & LINE ETC. SHOWN ARE APPROXIMATE AND MAY BE SUBJECT TO MODIFICATIONS DUE TO SITE CONDITIONS, ADDITIONAL PERMITTING REQUIREMENTS, DETAILED DESIGN, EQUIPMENT AND/OR OTHER CONSTRAINTS.
9. THIS PLAN IS PRELIMINARY AND WILL NOT BE RELEASED FOR CONSTRUCTION.
10. THE POINT OF INTERCONNECTION IS APPROXIMATE AND MAY INCLUDE AN ELECTRICAL SUBSTATION.
11. THE PROJECT SITE WILL BE ENCLOSED BY A MINIMUM 6' HIGH SECURITY FENCE.
12. ACCESS POINTS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON SURVEYED TOPOGRAPHY, UTILITIES, ROAD PERMITTING, OR ENVIRONMENTAL FEATURES.
NORTH
GRAPHIC SCALE IN FEET
0 300 600 1200
RES
Kimley»Horn
421 FAYETTEVILLE STREET, SUITE 600, RALEIGH, NC 27601
PHONE: 919-677-2000 FAX: 919-677-2050
WWW.KIMLEY-HORN.COM
C-0102
PRELIMINARY NOT FOR CONSTRUCTION
KHA PROJECT 015405006
DATE 09/06/2023
SCALE AS SHOWN
DESIGNED BY DSF
DRAWN BY DSF
CHECKED BY JCL
ZONING SITE PLAN
PINEY GROVE SOLAR
WAYNE COUNTY NORTH CAROLINA
SHEET NUMBER EX1.0

PUBLIC NOTICE
FARM LEASE OF COUNTY PROPERTY

The County of Wayne intends to award farm leases on several County-owned properties for a period for a period of three years pursuant to the following terms:

240 Airport Road, Pikeville; Farm 6686, Tract 7969
Lessee: Jared Barefoot
Annual Lease Amount: $1,130.25

912 Mt Carmel Church Road, Pikeville; Farm 10502, Tracts 9004, 9006, 8392; Farm 13411, Tract 9058
Lessee: G Howell Farms, LLC
Annual Lease Amount: $16,600.59

Old Mt. Olive Hwy, Goldsboro; Farm 11607, Tract 1876
Lessee: Outlaw Farms
Annual Lease Amount: $7,851.52

Northern Landfill, Hinnant Road, Goldsboro; Farm 389, Tract 3262
Lessee: G Howell Farms, LLC
Annual Lease: $12,173.30

S. US 117 Alternate Hwy, Mt. Olive; Farm 11955, Tract 2497
Lessee: Outlaw Farms
Annual Lease Amount: $5,715.20

Patetown Road, Goldsboro; Goldsboro Business Campus Phase 2; Farm 8818, Tracts 1448, 7678
Lessee: Ronald Waters
Annual Lease Amount: $5,801.40

All persons interested in this lease are invited to attend the meeting of the Wayne County Board of Commissioners to be held on Tuesday, November 7, 2023 at 9:00 A.M. in the Commissioners Meeting Room in the Wayne County Courthouse Annex, 224 E. Walnut St., Goldsboro, NC. At that time, the board intends to authorize the lease of the property described above.

Andrew J. Neal
Staff Attorney, Wayne County

Run Date: October 7, 2023

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and JARED BAREFOOT whose address is 2610 Bizzell Grove Church Road, Selma, NC 27576 ("Lessee").

W I T N E S S E T H:

That Lessor does hereby lease and farm let to the Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

240 Airport Road, Pikeville NC
Being 58.04 acres of that tract of land known more particularly as Farm 6686, Tract 7969 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor via conveyances recorded in Book 2862, Page 310 and Book 2825, Page 54 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2026.

2. RENT. The rent for said land per year is as follows:

5.5 acres at $205.50/Acre = $1,130.25/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. The Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2026, and return said land to the party of the first part in a sightly condition at the end of this lease. The lessee must keep all ditches cut and cleared of debris. The lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessse will not be permitted to sublease under their lease agreement with Wayne County.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2026.

10. INDEMNITY. Lessee shall indemnify and save harmless Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. CROP RESTRICTIONS. Due to FAA regulations, high crops or crops which may attract birds are prohibited (i.e. corn, sorghum and wheat).

12. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

13. ADDITIONAL RESTRICTIONS. If corn is planted on the subject property, said property shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden
Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

Kayla Whitley
Notary Public

KAYLA WHITLEY NOTARY PUBLIC WAYNE COUNTY, NC

My Commission Expires:

March 24, 2024

JARED BAREFOOT

BY: _____ (SEAL)

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that JARED BAREFOOT personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and G HOWELL FARMS, LLC a limited liability company organized under the laws of the State of North Carolina whose address is 212 Stonewood Drive, Goldsboro, NC 27530 ("Lessee").

W I T N E S S E T H:

Lessor does hereby lease and farm let to Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

Northern Landfill, Hinnant Road, Dudley
Being 64.1 acres of that tract of land known more particularly as Farm 389, Tract 3262 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 859, Page 259 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2026.

2. RENT. The rent for said land per year is as follows:

64.07 acres at $190.00/Acre = $12,173.30/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2026, and return said land to the party of the first part in a sightly condition at the end of this lease. Lessee must keep all ditches cut and cleared of debris. Lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson

Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessee will not be permitted to sublease under its this lease.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2026.

10. INDEMNITY. Lessee shall indemnify and save harmless the Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

12. ADDITIONAL RESTRICTIONS. If corn is planted on the subject properties, said properties shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden
Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

KAYLA WHITLEY NOTARY PUBLIC WAYNE COUNTY, NC

Kayla Whitley
Notary Public

My Commission Expires:
March 24, 2024

G HOWELL FARMS, LLC

BY: _____ (SEAL)
Garrett Howell, President

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that the President of G Howell Farms, LLC, Garrett Howell, personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and RONALD WATERS whose address is 165 Perkins Mill Road, Goldsboro, NC 27530 ("Lessee").

W I T N E S S E T H:

Lessor does hereby lease and farm let to Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

Patetown Road, Goldsboro (Goldsboro Business Campus Phase 2)
Being 44 acres of that tract of land known more particularly as Farm 8818, Tracts 1448 & 7678 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 3767, Page 53 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2024. The lease shall automatically renewal for two additional year periods unless Lessor provides Lessee sixty days notice of the then existing term of its intent not to renew.

2. RENT. The rent for said land per year is as follows:

44 acres at $131.85/Acre = $5,801.14/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2027, and return said land to the party of the first part in a sightly condition at the end of this lease. Lessee must keep all ditches cut and cleared of debris. Lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson

Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessee will not be permitted to sublease under its this lease.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2027.

10. INDEMNITY. Lessee shall indemnify and save harmless the Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

12. ADDITIONAL RESTRICTIONS. If corn is planted on the subject properties, said properties shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

Kayla Whitley
Notary Public

My Commission Expires:

March 24, 2024

RONALD WATERS

BY: _____ (SEAL)

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that Ronald Waters personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and ALLEN JERNIGAN FARMS whose address is 793 Thunder Swamp Road, Mt. Olive, NC 28365 ("Lessee").

W I T N E S S E T H:

Lessor does hereby lease and farm let to Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

Old Mt. Olive Highway, Goldsboro
Being 61.3 acres of that tract of land known more particularly as Farm 11607, Tract 1876 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 2576, Page 753 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2026.

2. RENT. The rent for said land per year is as follows:

61.34 acres at $152.00/Acre = $9,323.68/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2026, and return said land to the party of the first part in a sightly condition at the end of this lease. Lessee must keep all ditches cut and cleared of debris. Lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson

Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessee will not be permitted to sublease under its this lease.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2026.

10. INDEMNITY. Lessee shall indemnify and save harmless the Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

12. ADDITIONAL RESTRICTIONS. If corn is planted on the subject properties, said properties shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

Kayla Whitley
Notary Public

My Commission Expires:

March 24, 2024

ALLEN JERNIGAN FARMS

BY: _____ (SEAL)
Allen Jernigan

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that Allen Jernigan personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and JARED BAREFOOT whose address is 2610 Bizzell Grove Church Road, Selma, NC 27576 ("Lessee").

W I T N E S S E T H:

Lessor does hereby lease and farm let to Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

Tract One: Mt. Carmel Church Road, Pikeville NC
Being 47.3 acres of that tract of land known more particularly as Farm 10502, Tracts 9004 & 9006 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 2149, Page 815 of the Wayne County Registry.

Tract Two: 912 Mt. Carmel Church Road, Pikeville NC
Being 35.29 acres of that tract of land known more particularly as Farm 13411, Tracts 9058 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 3481, Page 18 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2026.

2. RENT. The rent for said land per year is as follows:

Tracts One and Two: 82.59 acres at $205.50/Acre = $16,972.25/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2026, and return said land to the party of the first part in a sightly

condition at the end of this lease. Lessee must keep all ditches cut and cleared of debris. Lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessee will not be permitted to sublease under its this lease.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2026.

10. INDEMNITY. Lessee shall indemnify and save harmless the Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

12. ADDITIONAL RESTRICTIONS. If corn is planted on the subject properties, said properties shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

Kayla Whitley
Notary Public

My Commission Expires:
March 24, 2024

JARED BAREFOOT

BY: _____ (SEAL)

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that Jared Barefoot personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

NORTH CAROLINA

WAYNE COUNTY

THIS FARM LEASE, made this 5TH day of DECEMBER, 2023, between the COUNTY OF WAYNE, a body politic and corporate organized under the laws of the State of North Carolina whose address is PO Box 227, Goldsboro, NC 27533, ("Lessor") and ALLEN JERNIGAN FARMS whose address is 793 Thunder Swamp Road, Mt. Olive NC 28365 ("Lessee").

W I T N E S S E T H:

Lessor does hereby lease and farm let to Lessee, its heirs and assigns, all of the certain farm(s) or tract(s) of land situated in Wayne County, North Carolina, and described as follows:

S. US 117 Alternate Hwy., Mt. Olive
Being 44.6 acres of that tract of land known more particularly as Farm 11955, Tract 2497 by the Wayne County Farm Service Agency. Also being the property obtained by Lessor in Deed Book 3063, Page 258 of the Wayne County Registry.

1. TERM. The term of this lease shall be for the period from January 1, 2024, through December 31, 2026.

2. RENT. The rent for said land per year is as follows:

44.65 acres at $152.00/Acre = $6,786.80/year

In addition to the rental costs hereinabove provided, Lessee shall pay all costs due the ASCS Office or any other regulatory agency for the cultivation and marketing of said crop.

3. PAYMENT OF RENTAL. All rental payments shall be submitted to County no later than January 31st of each year of this Lease.

4. CLEARED LANDS. Lessee shall be permitted to cultivate all cleared lands described herein.

5. VISIBILITY AND APPEARANCE. Lessee shall maintain said land free and clear of the storage of equipment and signage. Said land shall only be used for farming purposes. Lessee shall maintain said land in a sightly condition, shall disc and remove all farm products from said land no later than December 31, 2026, and return said land to the party of the first part in a sightly condition at the end of this lease. Lessee must keep all ditches cut and cleared of debris. Lessee must mow any area around the track of land that is not being farmed.

6. COVENANTS AND RESTRICTIONS. The farmland hereinabove described may be subject to the Declaration of Covenants, Conditions and Restrictions for the Seymour Johnson

Air Force Base Buffer Project, CWMTF Project Nos. 2005A and 2004A-007 as recorded in Book 2485, Page 864, Wayne County Registry.

7. SUBLEASES. Lessee will not be permitted to sublease under its this lease.

8. CROP ROTATION REQUIREMENTS. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

9. ASCS. Lessor and Lessee shall execute such instruments or other documents as may be required by the ASCS Office or any other regulatory agency to affect the terms of this lease for the farm years 2024-2026.

10. INDEMNITY. Lessee shall indemnify and save harmless the Lessor from any claim arising out of its occupancy of said land or out of its farm operation, cultivation and marketing of said crop.

11. GOVERNING LAW AND SITUS. This Agreement shall be governed and will be construed in accordance with the laws of the State of North Carolina. Each party agrees that exclusive venue for all actions, relating in any manner to this Agreement will be in the General Court of Justice in Wayne County, North Carolina.

12. ADDITIONAL RESTRICTIONS. If corn is planted on the subject properties, said properties shall be disked in within seven (7) days after harvest. Hunting and fishing are prohibited on the property at all times. The agriculture producer will need to follow Best Management Practices (BMP's) in regards to crop rotation. During the three (3) year lease, the producer shall not grow more than one (1) tobacco crop and one (1) sweet potato crop. It is recommended that the producer not grow the same grain crop two (2) years in a row. The lessee should have the soil tested and lime applied if needed with in the three (3) year period of the lease.

[SIGNATURE PAGE TO FOLLOW]

IN TESTIMONY WHEREOF, said parties have executed this lease in triplicate originals, one of which is retained by each of the parties, the day and year first above written.

COUNTY OF WAYNE

BY: _____ (SEAL)
Chairman

ATTEST:

Carol Bowden, Clerk to the Board

NORTH CAROLINA
WAYNE COUNTY

This the 5th day of December 2023, personally came before me, Kayla Whitley, a Notary Public in and for said State and County, Carol Bowden, who by me duly sworn, says that she knows the common seal of the COUNTY OF WAYNE and is acquainted with Chris Gurley, who is the Chairman of the Board of Commissioners for the County of Wayne; that she, the said Carol Bowden is its Clerk to the Board; and that she saw the Chairman sign the foregoing instrument; and that she, the said Clerk to the Board, saw the said common seal of said corporation affixed thereto, and that she, the said Carol Bowden, signed her name in attestation of said instrument in the presence of said Chairman of the Board of Commissioners of the County of Wayne.

WITNESS my hand and official seal or stamp this the 5th day of December, 2023.

Kayla Whitley
Notary Public

My Commission Expires:
March 24, 2027

ALLEN JERNIGAN FARMS

BY: _____ (SEAL)
Allen Jernigan

NORTH CAROLINA
WAYNE COUNTY

I, _____, a Notary Public in and for said State and County, certify that Allen Jernigan personally appeared before me this day and the foregoing instrument was signed by him.

WITNESS, my hand and Notarial Seal, this the _____ day of _____, 2023.

_____
Notary Public

My Commission Expires:

_____

United States Department of Agriculture

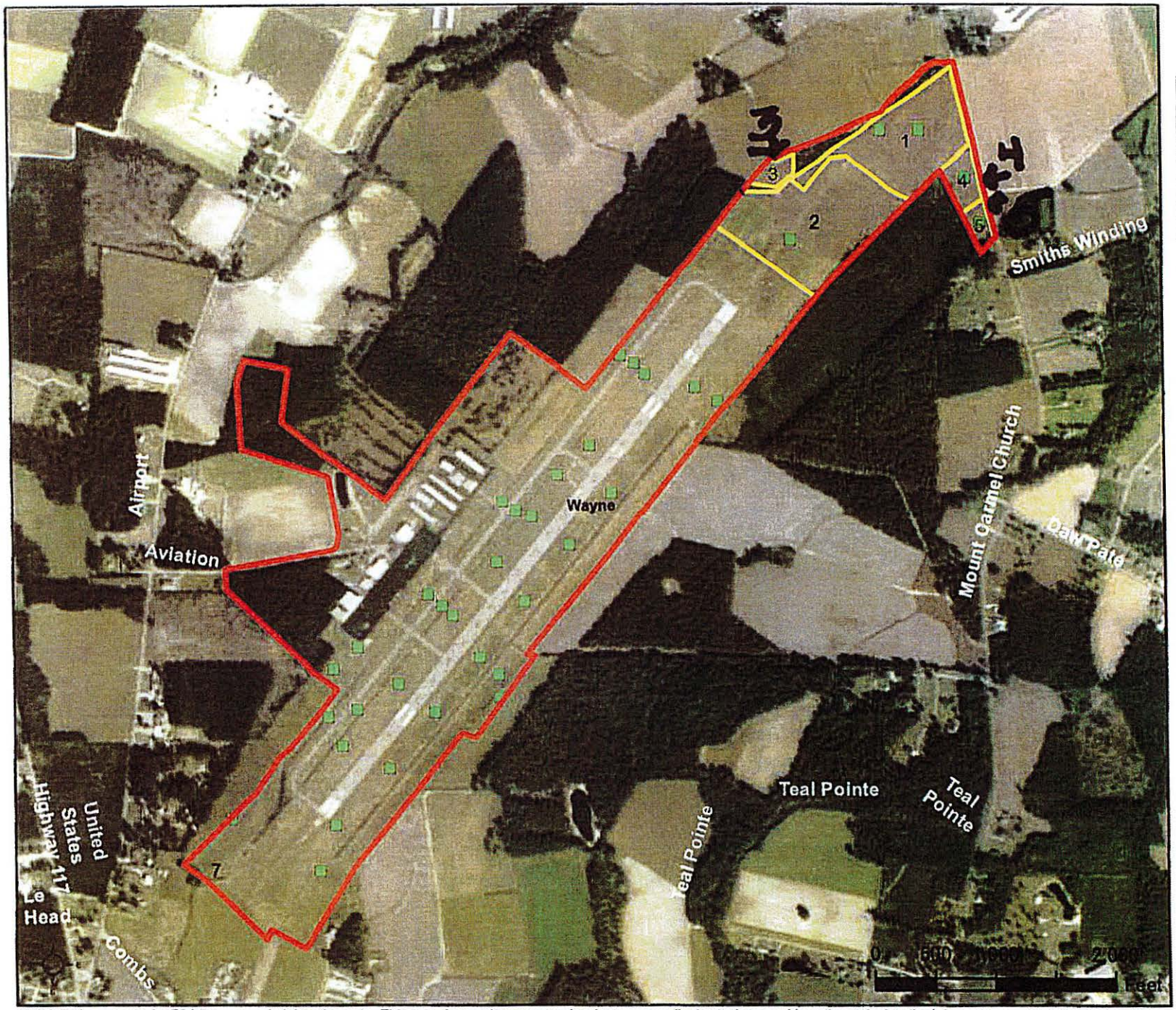
Wayne County, North Carolina

Farm 6686
Tract 7969

2020 Program Year

CLU	Acres	HEL	Crop
1	~~45.42~~	~~UHEL~~	
2	~~29.46~~	~~UHEL~~	
3	1.42	UHEL	
4	2.62	UHEL	
5	1.47	UHEL	
6	~~4.88~~	~~UHEL~~	~~Noncropland~~
7	~~241.42~~	~~UHEL~~	~~Noncropland~~

Page Cropland Total: ~~9.80~~ acres 5.5



Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

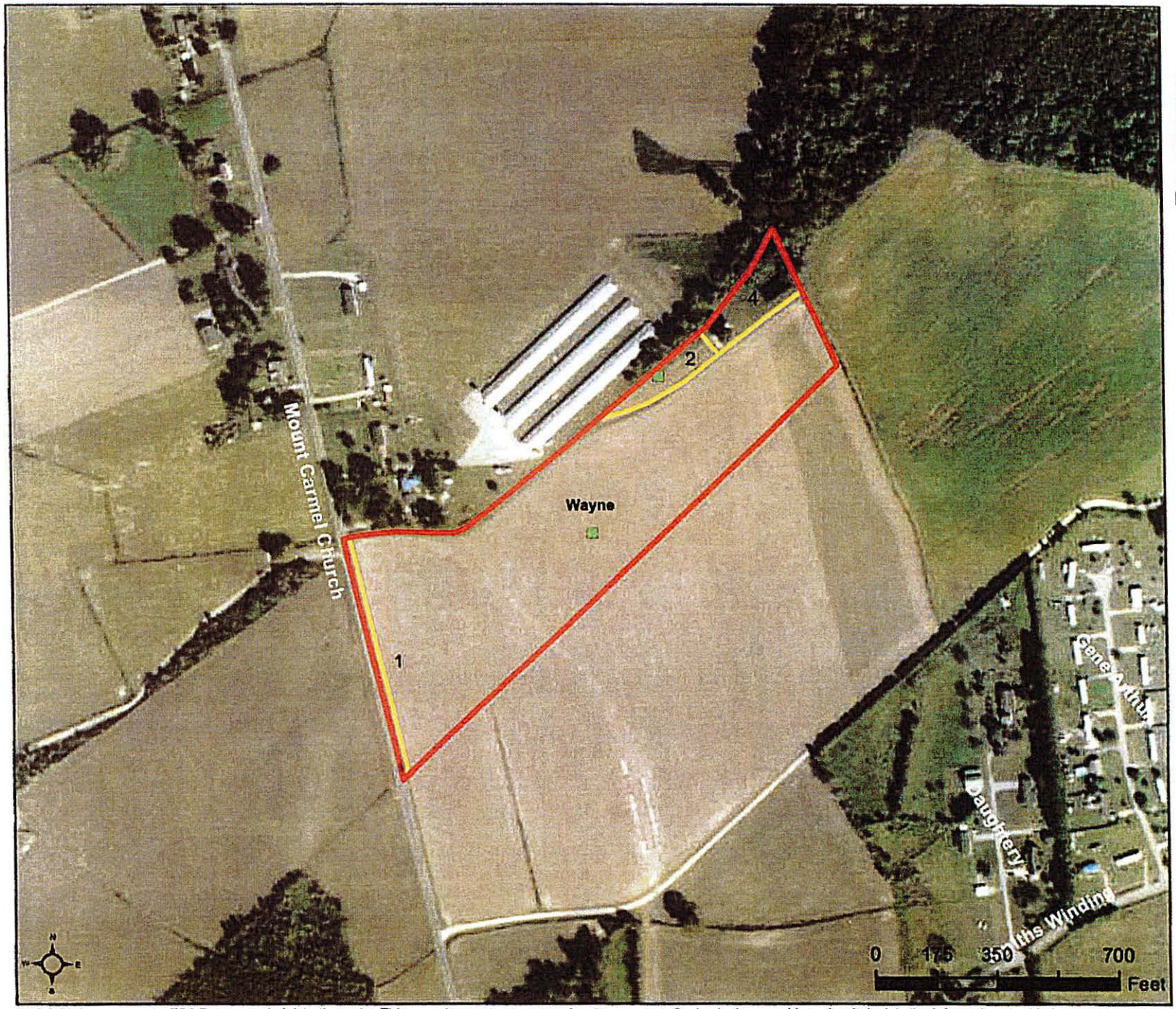
United States Department of Agriculture

Wayne County, North Carolina

Farm 10502
Tract 9004
2020 Program Year

CLU	Acres	HEL	Crop
1	13.91	NHEL	
2	0.53	NHEL	
3	0.31	UHEL	Noncropland
4	0.91	UHEL	Noncropland

Page Cropland Total: 14.44 acres



Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

United States Department of Agriculture

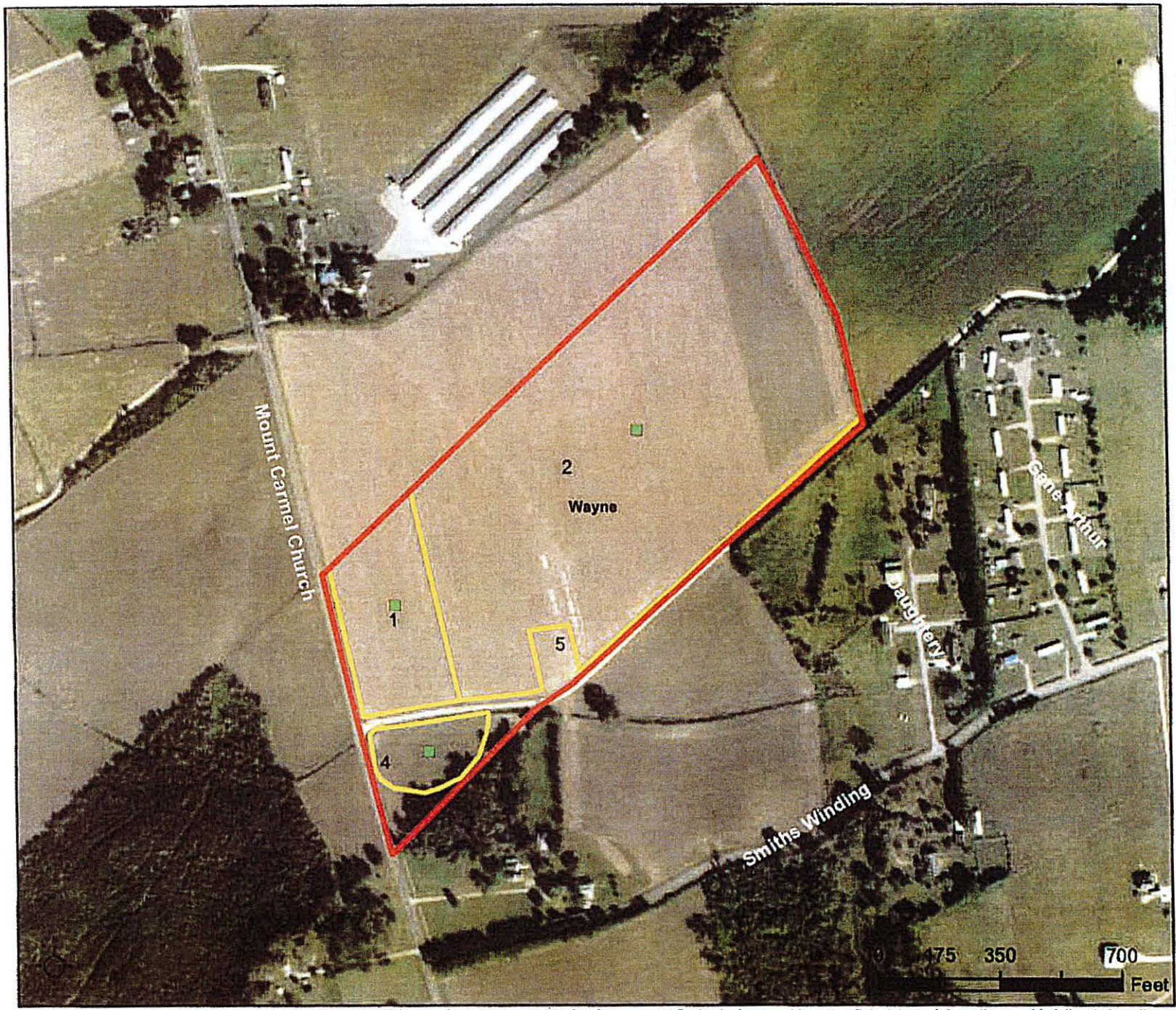
Wayne County, North Carolina

Farm 10502
Tract 9006

2020 Program Year

CLU	Acres	HEL	Crop
1	3.42	NHEL	
2	23.36	NHEL	
4	1.28	NHEL	
5	2.42	UHEL	Noncropland

Page Cropland Total: 28.06 acres



Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

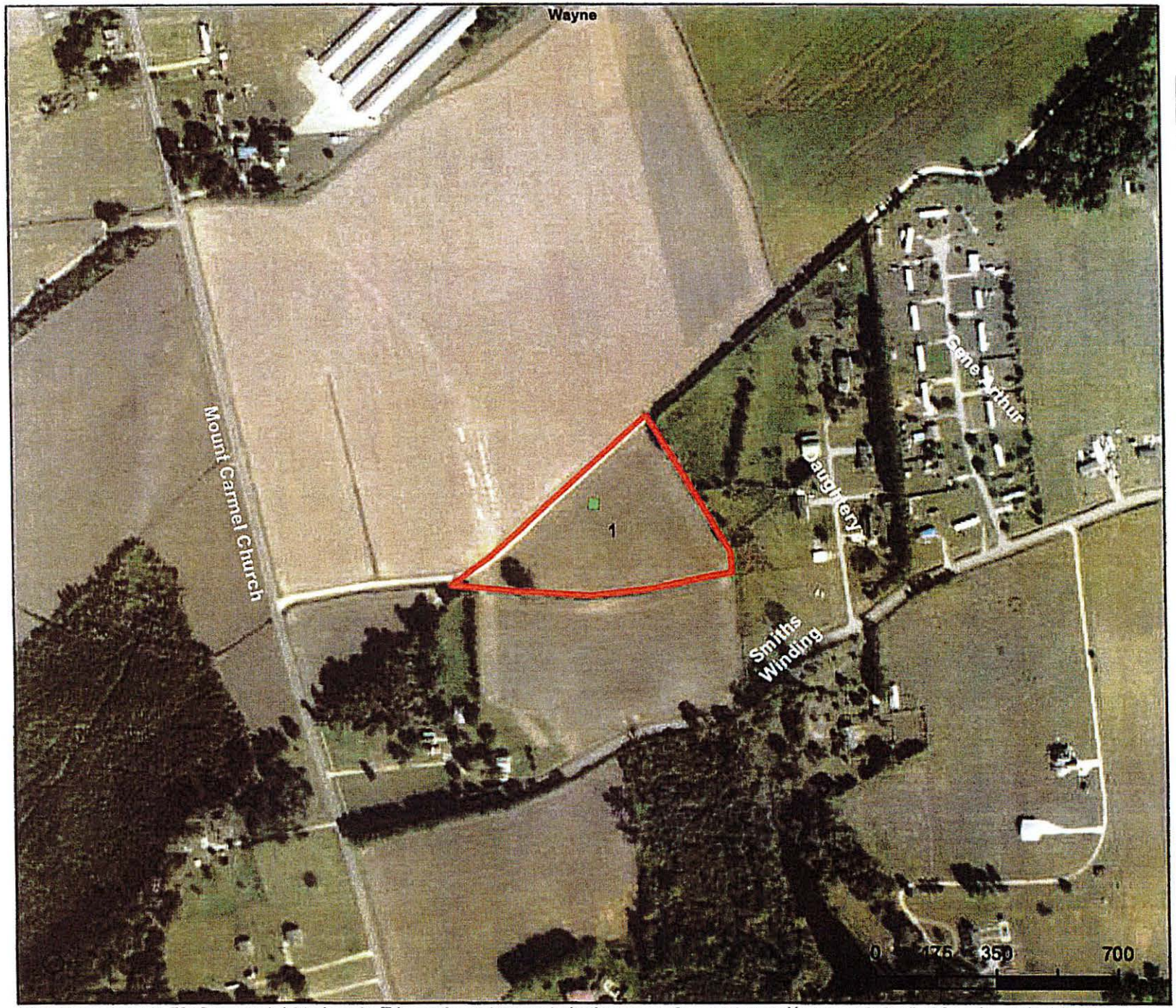
United States Department of Agriculture

Wayne County, North Carolina

Farm 10502
Tract 8392
2020 Program Year

CLU	Acres	HEL	Crop
1	4.82	NHEL	

Page Cropland Total: 4.82 acres



Map Created April 28, 2020

Base Image Layer flown in 2018

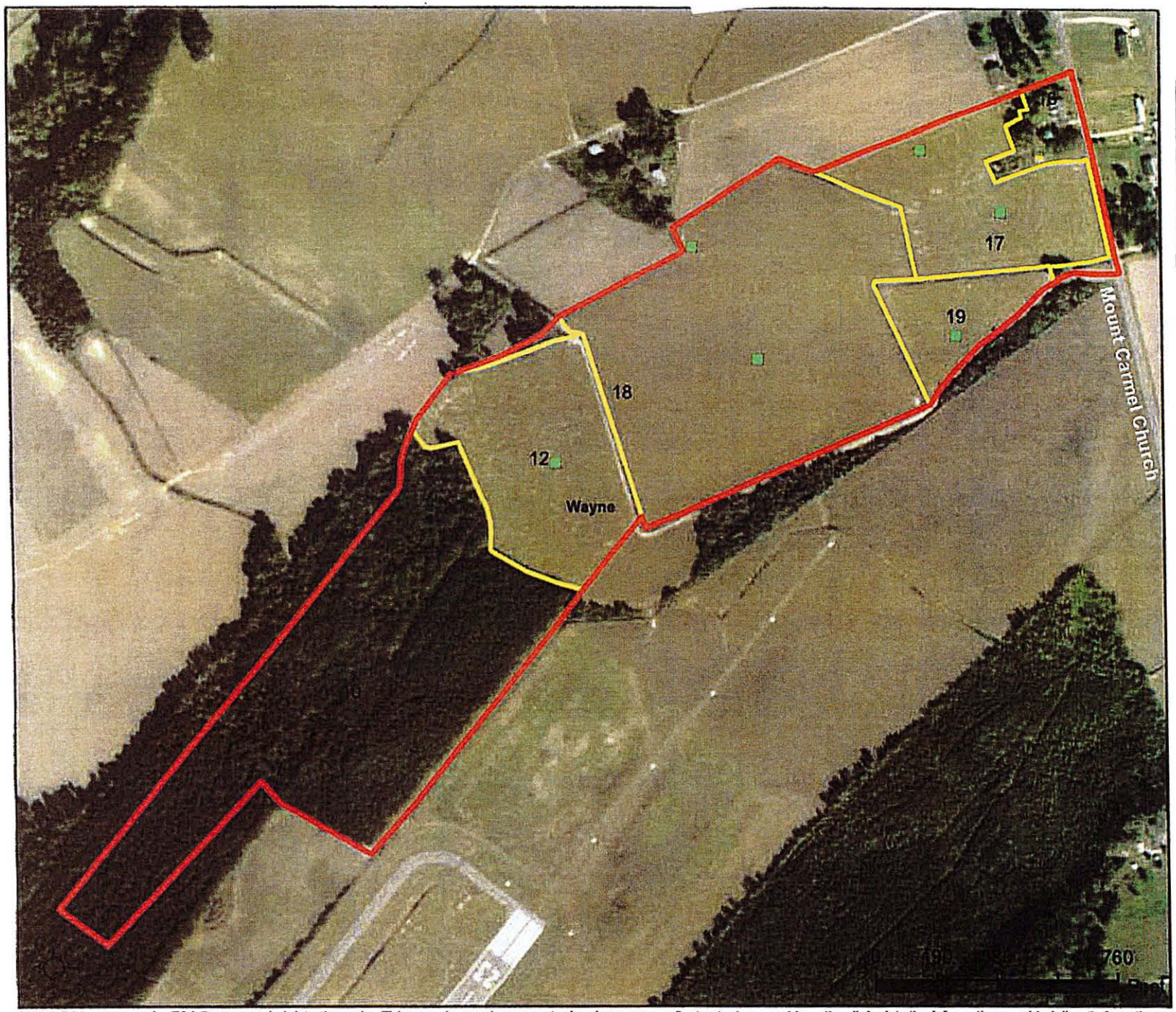
Common Land Unit
- Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

Department of Agriculture

Wayne County, North Carolina



Farm 13411
Tract 9058
2020 Program Year

CLU	Acres	HEL	Crop
7	0.21	UHEL	Noncropland
10	20.04	UHEL	Noncropland
12	7.72	NHEL	
16	1.79	UHEL	Noncropland
17	6.59	UHEL	
18	18.31	UHEL	
19	2.67	UHEL	

Page Cropland Total: 35.29 acres

Attachment D Page 3 of 3

Map Created April 28, 2020

Base Image Layer flown in 2018

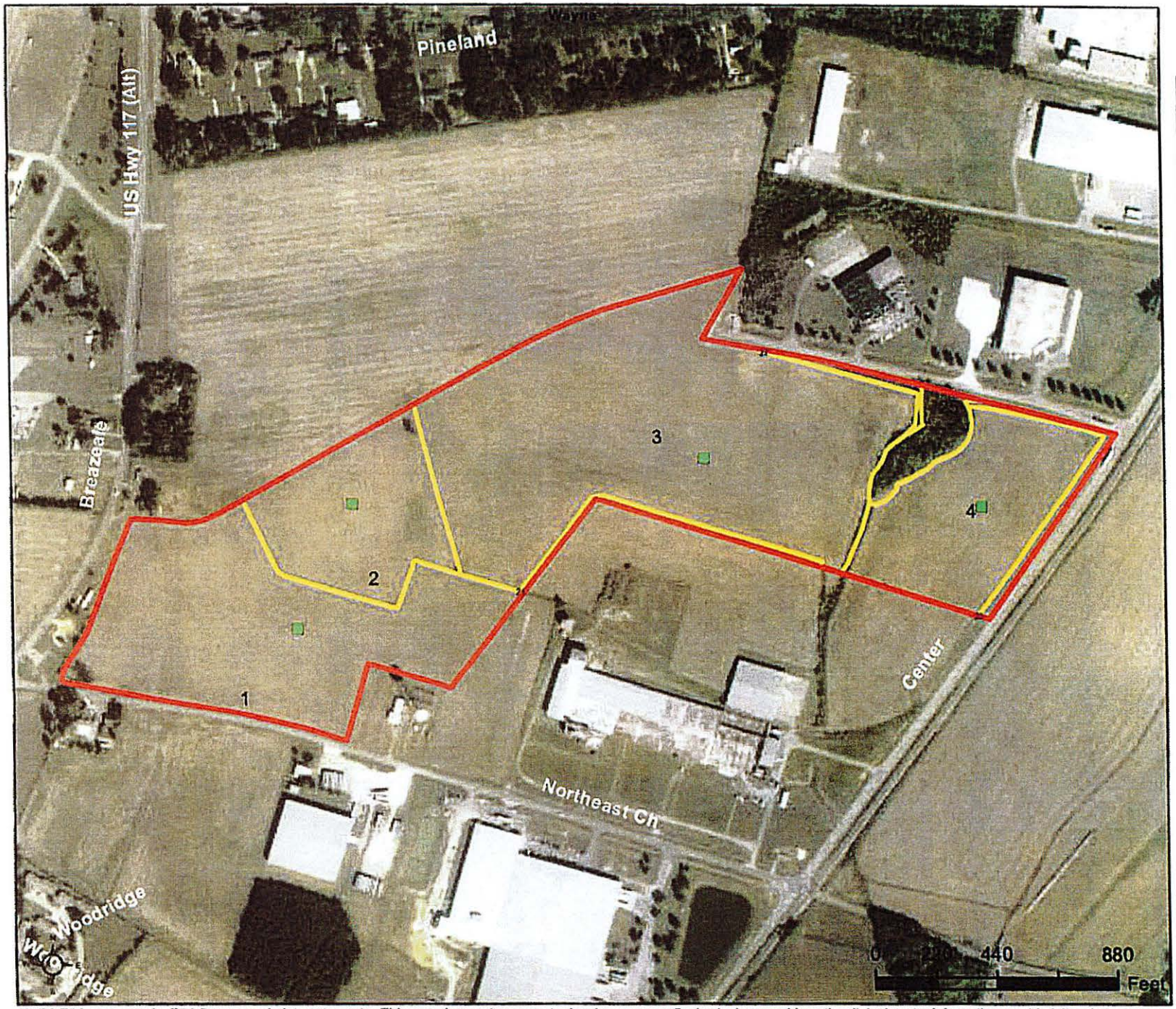
Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

Department of Agriculture

Wayne County, North Carolina



Farm 11607
Tract 1876
2020 Program Year

CLU	Acres	HEL	Crop
1	17.2	NHEL	
2	7.58	NHEL	
3	27.86	NHEL	
4	8.7	NHEL	
21	0.55	NHEL	Noncropland
23	0.81	NHEL	Noncropland
25	1.66	UHEL	Noncropland
27	0.39	NHEL	Noncropland

Page Cropland Total: 61.34 acres

Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

USDA United States Department of Agriculture

Wayne County, North Carolina

Farm 389
Tract 3262
2020 Program Year

CLU	Acres	HEL	Crop
2	20.25	NHEL	
4	1.08	NHEL	Noncropland
5	1.05	NHEL	Noncropland
11	43.82	NHEL	
12	132.39	UHEL	Noncropland

Page Cropland Total: 64.07 acres



Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

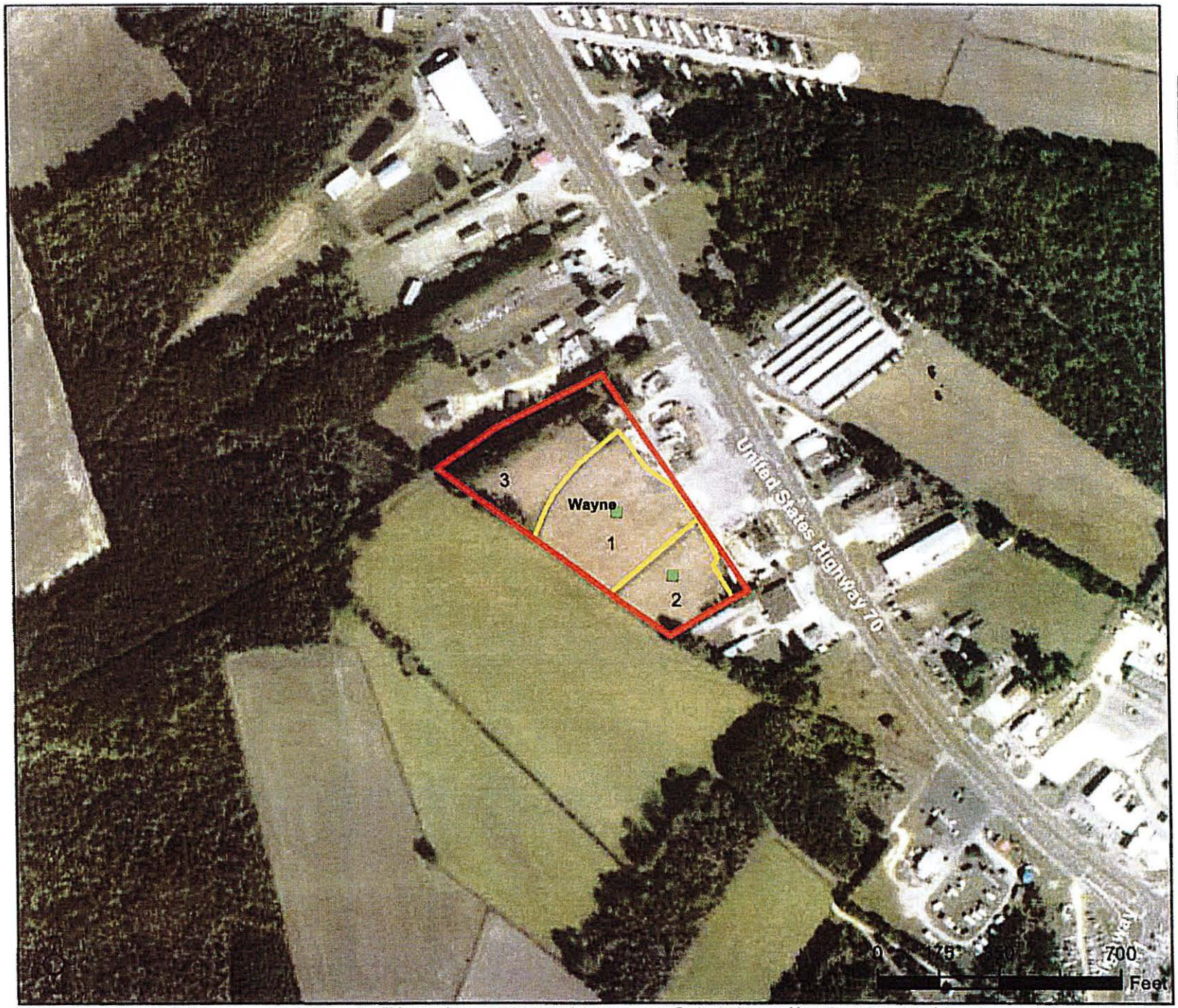
United States Department of Agriculture

Wayne County, North Carolina

Farm 13562
Tract 8554
2020 Program Year

CLU	Acres	HEL	Crop
1	2.72	NHEL	
2	1.36	NHEL	
3	2.98	UHEL	Noncropland

Page Cropland Total: 4.08 acres



Map Created April 28, 2020

Base Image Layer flown in 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

USDA FSA maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or the NAIP imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. The USDA Farm Service Agency assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact NRCS.

Carol Bowden

From: Overman, Christopher B <cboverman@ncdot.gov>
Sent: Wednesday, November 22, 2023 6:45 AM
To: Carol Bowden
Subject: [External] - Shepherds Field
Attachments: request SR2.pdf

Request SR2 for road addition.

Chris Overman
Division 4 – District 3- Johnston and Wayne Counties
District Engineers Office
919-739-5300

67 JR Road , Suite 700
Selma, NC 27576

PLEASE NOTE OUR NEW ADDRESS

Email correspondence to and from this sender is subject to the N.C. Public Records Law and may be disclosed to third parties.

CAUTION
This email originated outside the County of Wayne's network.
Do not open any attachments or click on links unless you trust the sender or expecting this email.

North Carolina Department of Transportation
Division of Highways
Request for Addition to State Maintained Secondary Road System

North Carolina

County: Wayne

Road Description: Shepherd's Field Drive, Shepherd Court, Lamb Court, and Mutton Drive

---

WHEREAS, the attached petition has been filed with the Board of County Commissioners of the County of Wayne requesting that the above described road, the location of which has been indicated in red on the attached map, be added to the Secondary Road System, and

WHEREAS, the Board of County Commissioners is of the opinion that the above described road should be added to the Secondary Road System, if the road meets minimum standards and criteria established by the Division of Highways of the Department of Transportation for the addition of roads to the System.

NOW, THEREFORE, be it resolved by the Board of County Commissioners of the County of Wayne that the Division of Highways is hereby requested to review the above described road, and to take over the road for maintenance if it meets established standards and criteria.

CERTIFICATE

The foregoing resolution was duly adopted by the Board of Commissioners of the County of Wayne at a meeting on the 5th day of December, 2023.

WITNESS my hand and official seal this the 5th day of December, 2023.

Official Seal

Carol Bowden
Clerk, Board of Commissioners
County: Wayne

PLEASE NOTE:

Forward direct with request to the Division Engineer, Division of Highways

Form SR-2 (3/2006)

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

November 21, 2023

J.R. "JOEY" HOPKINS
SECRETARY

Board of Commissioners
Wayne County
PO Box 227
Goldsboro, NC 27533

SUBJECT: Shepherd's Field
Wayne County
Pikevlle Township

Dear Commissioners:

We have been petitioned to add the following roads in the subject subdivision to the State Maintenance System:

Shepherds Field Drive, Shepherd Court, Lamb Court, and Mutton Drive

The petition is attached along with a copy of our Investigation Report and a vicinity map showing the location of the roads. If you concur with the petitioners recommendation, please return the petition along with Form SR-2 for our further handling. This is ***not*** to be mistaken as final acceptance onto the State Maintenance System.

If you have any questions or need additional assistance, please contact Chris Overman or myself at 919-739-5300.

Sincerely,

DocuSigned by:
Jennifer Collins
F47E03DD04B84F2...

Jennifer K. Collins
District Engineer

JKC/cbo
Attachments
cc: Subdivision File
ec: Berry Gray – Wayne County Planning Director

NC DEPARTMENT OF TRANSPORTATION
DISTRICT ENGINEER
67 JR Rd., Suite 700
Selma, NC 27576

Telephone:(919) 739-5300
Fax: (919) 731-2017
Customer Servce: 1-877-368-4968

Website: www.ncdot.gov

RECEIVED JANUARY 5, 2023

North Carolina Department of Transportation
Division of Highways
Petition for Road Addition

ROADWAY INFORMATION: (Please Print/Type)

County: Wayne Road Name: SHEPHERDS FIELD DRIVE
(Please list additional street names and lengths on the back of this form.)

Subdivision Name: SHEPHERDS FIELD Length (miles): 0.28 mile

Number of occupied homes having street frontage: 18 Located (miles): 0.1

miles N ☐ S ☐ E ☒ W ☐ of the intersection of Route SR1535 and Route SR1534
(Check one) (SR, NC, US) (SR, NC, US)

We, the undersigned, being property owners and/or developers of SHEPHERDS FIELD in Wayne County, do hereby request the Division of Highways to add the above described road.

CONTACT PERSON: Name and Address of First Petitioner. (Please Print/Type)

SAS Land Development, LLC

Name: Adam Stuckey Phone Number: 919-201-3172

Street Address: 1388 Rains Crossroad Rd Princeton, NC 27569

Mailing Address: Same Email: stuckeysbackhoe@gmail.com

PROPERTY OWNERS

Name	Mailing Address	Telephone

Form SR-1 (3/2006; Rev 1/2010)

INSTRUCTIONS FOR COMPLETING PETITION:

1. Complete Information Section
2. Identify Contact Person (This person serves as spokesperson for petitioner(s)).
3. Attach four (4) copies of recorded subdivision plat or property deeds, which refer to candidate road.
4. Adjoining property owners and/or the developer may submit a petition. Subdivision roads with prior NCDOT review and approval only require the developer's signature.
5. If submitted by the developer, encroachment agreements from all utilities located within the right of way shall be submitted with the petition for Road addition. However, construction plans may not be required at this time.
6. Submit to District Engineer's Office.

FOR NCDOT USE ONLY: Please check the appropriate block

☐ Rural Road ☐ Subdivision platted prior to October 1, 1975 ☒ Subdivision platted after October 1, 1975

REQUIREMENTS FOR ADDITION

If this road meets the requirements necessary for addition, we agree to grant the Department of Transportation a right-of-way of the necessary width to construct the road to the minimum construction standards of the NCDOT. The right-of-way will extend the entire length of the road that is requested to be added to the state maintained system and will include the necessary areas outside of the right-or-way for cut and fill slopes and drainage. Also, we agree to dedicate additional right-of-way at intersections for sight distance and design purposes and execute said right-of-way agreement forms that will be submitted to us by representatives of the NCDOT. The right-of-way shall be cleared at no expense to the NCDOT, which includes the removal of utilities, fences, other obstructions, etc.

General Statute 136-102.6 (see page 29 for Statute) states that any subdivision recorded on or after October 1, 1975, must be built in accordance with NCDOT standards in order to be eligible for addition to the State Road System.

ROAD NAME	HOMES	LENGTH	ROAD NAME	HOMES	LENGTH
SHEPHERD COURT	6	0.06 mi			
LAMB COURT	5	0.05 mi			
MUTTON DRIVE	8	0.21 mi			

NORTH CAROLINA STATE DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SECONDARY ROAD ADDITION INVESTIGATION REPORT

County *Wayne* Co. File No. _____ Date *November 16, 2023*

Township *Pikeville* Div. File No. _____

Local Name *See Attachment 1* Subdivision Name *Shepherd's Field*

Length *See Attachment 1* Width *See Attachment 1* Surface Type *I-2* Pavement Condition *new*

Surface Thickness *2 inches* Base Type *STBC* Base Thickness *9 inches*

* Bridges Yes ___ No *X* * Pipe > 48" Yes ___ No *X* * Retaining Walls Within Right of Way Yes ___ No *X*

*** If Yes - Include Bridge Maintenance Investigation Report**

Is this a subdivision street subject to the construction requirements for such streets? *Yes*
Recording Date *See Attachment 1* Book *See Attachment 1* Page *See Attachment 1*
Number of homes having entrances into road *See Attachment 1*
Other uses having entrances into road *0*
Right-of-Way Width *See Attachment 1* If right-of-way is below the desired width, give reasons under "Remarks and Recommendations."
Is petition (SR-1) attached? *Yes*
Is the County Commissioners Approval (SR-2) attached? *Yes*
If not, why? _____
Is a map attached indicating information for reference in locating road by the Planning Department? *Yes*
Cost to place in acceptable maintenance condition: Total Cost $ *0.00*
Grade, drain, stabilize $ *0.00*, Drainage $ *0.00*, Other $ *0.00*

Remarks and Recommendations *Add to State System*

Submitted By DocuSigned by: Jennifer Collins DISTRICT ENGINEER Reviewed and Approved _____ DIVISION ENGINEER

Reviewed and Approved
BOARD OF TRANSPORTATION MEMBER _____

(Do not write in this space -
For use by Secondary Roads Unit)

Petition No. _____

(Do not write in this space -
For use of Planning Dept.)

Form SR-4 (11/07)

Attachment 1

SECONDARY ROAD INVESTIGATION REPORT
Shepherd's Field
Subdivision Identification Number S-4309607004
Shepherds Field Drive, Shepherd Court, Lamb Court, and Mutton Drive
Wayne County
Pikeville Township

NAME	NO. HOMES	LENGTH (miles)	WIDTH (feet)	R/W (feet)	Recording Date	Book	Page
Shepherds Field Drive	*18*	*0.28*	*20*	*60*	*2/17/2021*	*P*	*33-I* *33-J*
Shepherds Court	*6*	*0.06*	*20*	*60*	*2/17/2021*	*P*	*33-J*
Lamb Court	*5*	*0.05*	*20*	*60*	*2/17/2021*	*P*	*33-I*
Mutton Drive	*8*	*0.21*	*20*	*60*	*2/17/2021*	*P*	*33-I*
TOTALS	**37**	**0.60**					



Wayne County – Vicinity Map
Petition for Road Addition

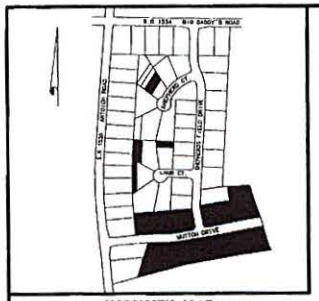
The main entrance at the intersection of Shepherds Field Drive and SR 1534 is 0.10 mile East of intersection of SR 1534 and SR 1535.

1.	Shepherds Field Drive	0.28 mi	4.	Mutton Drive	0.21 mi
2.	Sheperd Court	0.06 mi			
3.	Lamb Court	0.05 mi			

_ _ _ _ _ - **Unpaved SR**
_____ - **Paved SR**
_____ - **Proposed SR Addition**



P. 33-I



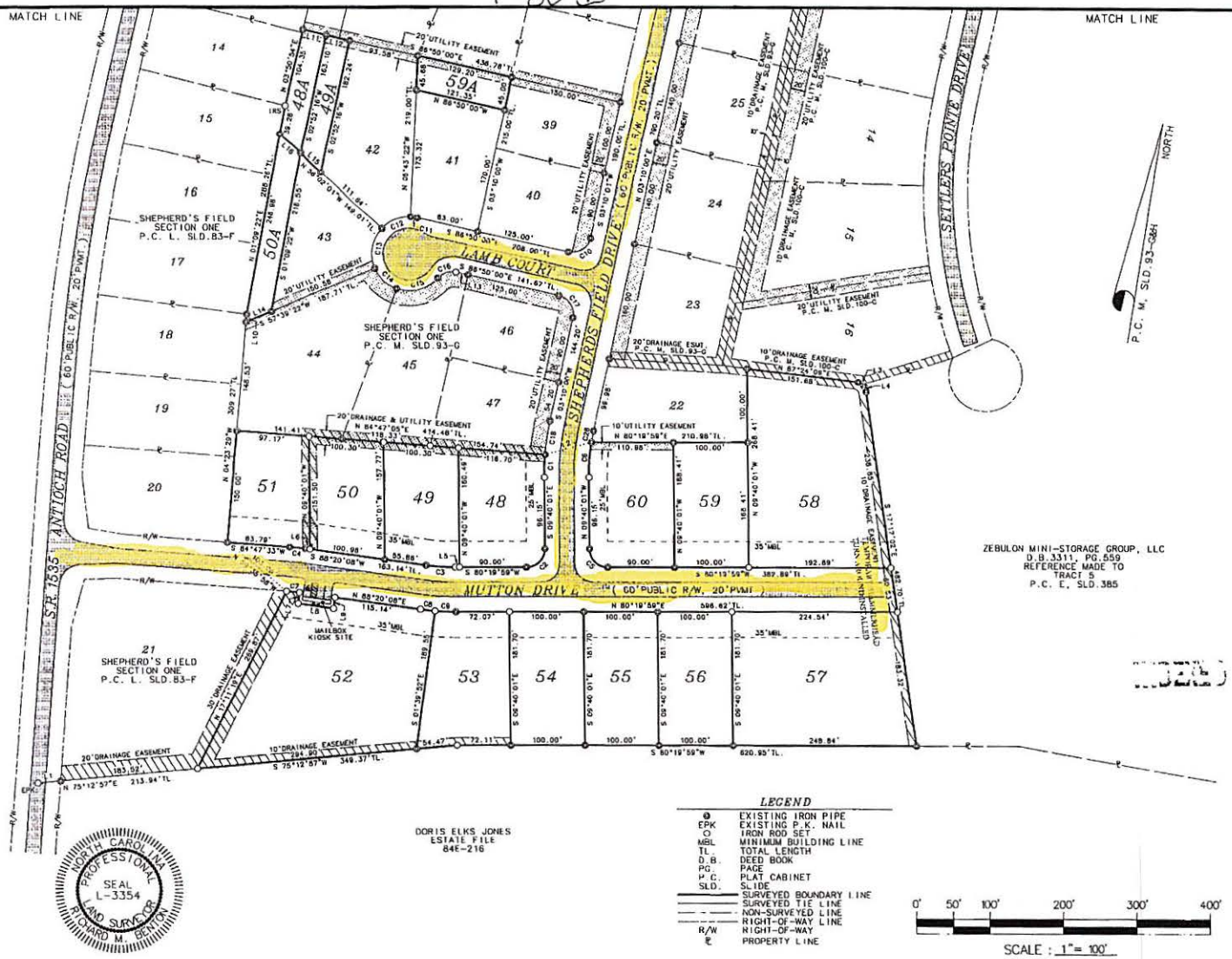
VICINITY MAP
NOT TO SCALE

PRESENTED
FOR REGISTRATION
DATE: 02.17.2021
TIME: 10:24:31 AM

CONSTANCE CORAM
REGISTER OF DEEDS
WAYNE COUNTY, NC
BY: [signature] DEPUTY, ASSISTANT

NOTES:

1. SUBJECT PROPERTY IS NOT LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA AS PER WAYNE COUNTY FIRM 3720363300K DATED 06/20/2018
2. SUBJECT PROPERTY IS SUBJECT TO ANY RESTRICTIONS, EASEMENTS AND RIGHT-OF-WAYS OF RECORD, IF ANY.
3. SEE SHEET 2 OF 2 FOR CURVE AND LINE TABLES
4. SEE SHEET 2 OF 2 FOR LOT AREA TABLE
5. HOMES MUST BE WITHIN 500' OF AN EXISTING FIRE HYDRANT.
6. SEE SHEET 2 OF 2 FOR ADDITIONAL NOTES AND CERTIFICATIONS



LEGEND

⊕	EXISTING IRON PIPE
EPK	EXISTING P.K. NAIL
○	IRON ROD SET
MBL	MINIMUM BUILDING LINE
TL	TOTAL LENGTH
D.B.	DEED BOOK
PG.	PAGE
P.C.	PLAT CABINET
SLD.	SLIDE
———	SURVEYED BOUNDARY LINE
———	SURVEYED TIE LINE
- - -	NON-SURVEYED LINE
———	RIGHT-OF-WAY LINE
R/W	RIGHT-OF-WAY
℄	PROPERTY LINE

0' 50' 100' 200' 300' 400'

SCALE : 1"= 100'

CERTIFICATION

I, RICHARD M. BENTON, CERTIFY THAT THIS PLAT IS OF A SURVEY; THAT CREATES A SUBDIVISION OF LAND WITHIN AN AREA OF A COUNTY OR MUNICIPALITY THAT HAS AN ORDINANCE THAT REGULATES PARCELS OF LAND.

NORTH CAROLINA

I, RICHARD M. BENTON, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL FIELD SURVEY OF DESCRIPTION(S) AS RECORDED IN DEED BOOK 3490, PAGE 853 PLAT CABINET M, SLIDE 93-GBH THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS SUCH AND WERE PLOTTED FROM INFORMATION AS REFERENCED HEREON; THAT THE RATIO OF PRECISION OR POSITIONAL ACCURACY BEFORE ADJUSTMENTS WAS 1:10,000+ ; THAT THIS PLAT MEETS THE REQUIREMENTS OF THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA (21 NCAC 56 .1600) AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY HAND AND SEAL THIS 14 DAY OF DECEMBER, A.D. 2020

[signature]
PROFESSIONAL LAND SURVEYOR L-3354

I, BERRY GRAY, REVIEW OFFICER OF WAYNE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATE IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

[signature] 12/21
REVIEW OFFICER DATE

OWNERSHIP AND DEDICATION

I (WE) HEREBY CERTIFY THAT I AM (WE ARE) THE OWNER(S) OF THE PROPERTY SHOWN AND DESCRIBED HEREON WHICH WAS CONVEYED TO ME (US) BY DEED(S) RECORDED IN DEED BOOK 3490, PAGE 853 AND THAT I (WE) HEREBY ADOPT THIS PLAN OF SUBDIVISION WITH MY (OUR) FREE CONSENT. FURTHER, I (WE) CERTIFY THAT THE LAND AS SHOWN HEREON IS WITHIN THE SUBDIVISION REGULATIONS JURISDICTION OF WAYNE COUNTY.

[signature] [signature]
OWNER DATE

OWNER DATE

WAYNE COUNTY HEALTH DEPT.

THE WAYNE COUNTY HEALTH DEPARTMENT HAS PREFORMED A SOIL ANALYSIS ON EACH LOT WITHIN THIS SUBDIVISION. COPIES OF THE SOIL ANALYSIS FOR EACH LOT ARE AVAILABLE FOR REVIEW IN THE OFFICE OF THE ENVIRONMENTAL HEALTH SECTION. THE SOIL ANALYSIS IS NOT A PERMIT OR A GUARANTEE THAT A PERMIT WILL BE ISSUED. EACH LOT WILL HAVE TO BE RE-EVALUATED FOR AN IMPROVEMENT PERMIT USING STANDARDS CURRENT AT THE TIME PERMITS ARE REQUESTED AND A PLOT PLAN SHOWING THE PROPOSED STRUCTURE HAS BEEN MADE AVAILABLE TO THE HEALTH DEPARTMENT.

[signature]
WAYNE COUNTY HEALTH DEPARTMENT
DATE 1-21-2021

DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

PROPOSED SUBDIVISION ROAD CONSTRUCTION STANDARDS CERTIFICATION

APPROVED [signature]
DISTRICT ENGINEER
DATE JAN 19, 2021

APPROVAL FOR RECORDING

I HEREBY CERTIFY THAT THE SUBDIVISION PLAT SHOWN HEREON HAS BEEN FOUND TO COMPLY WITH THE SUBDIVISION REGULATIONS OF WAYNE COUNTY, NORTH CAROLINA AND THAT THIS PLAT HAS BEEN APPROVED BY THE WAYNE COUNTY BOARD OF COMMISSIONERS FOR RECORDING IN THE OFFICE OF THE REGISTER OF DEEDS OF WAYNE COUNTY.

[signature]
CHAIRMAN, WAYNE COUNTY BOARD OF COMMISSIONERS
DATE 2-16-21

SHEET 1 OF 2
SURVEY FOR
SHEPHERD'S FIELD SECTION THREE
PIKEVILLE TOWNSHIP WAYNE COUNTY NORTH CAROLINA

OWNER : SAS LAND DEVELOPMENT, LLC
ADDRESS : 1388 RAINS CROSSROADS ROAD PRINCETON, NC 27569
PHONE : 919-201-3172

BENTON & ASSOCIATES
LAND SURVEYING AND MAPPING
119 E. WALNUT STREET GOLDSBORO, N.C.
PHONE (919) 735-0440 FAX 735-0840
FIRM LICENSE NO. C-1705

APPROVED RMB	DATE 12/14/20
SURVEYOR JHL	DRAFTER RMB
FILE NUMBER	20-018

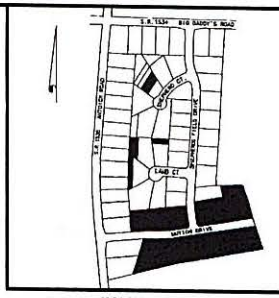
P.33-J

CURVE	DELTA ANGLE	RADIUS	ARC	TANGENT	CHORD	CHORD BEARING
C1	05°06'35"	340.00'	30.32'	15.17'	30.31'	S 07°08'44"E
C2	60°00'01"	25.00'	39.27'	25.00'	35.36'	S 35°18'59"W
C3	08°00'08"	280.00'	39.11'	19.59'	39.08'	S 84°20'03"W
C4	03°32'35"	340.00'	21.03'	10.52'	21.02'	S 88°33'50"W
C5	90°00'00"	25.00'	39.27'	25.00'	35.36'	N 54°40'01"W
C6	09°43'04"	280.00'	47.49'	23.80'	47.43'	N 04°48'29"W
C7	03°32'35"	280.00'	17.31'	8.66'	17.31'	N 86°33'50"E
C8	03°17'43"	340.00'	19.55'	9.78'	19.55'	N 86°41'16"E
C9	04°42'26"	340.00'	27.93'	13.97'	27.93'	N 82°41'12"E
C10	60°00'00"	25.00'	39.27'	25.00'	35.36'	S 48°10'00"W
C11	09°53'22"	50.00'	8.63'	4.33'	8.62'	S 88°13'18"W
C12	49°19'38"	50.00'	43.05'	22.95'	41.72'	S 58°37'18"W
C13	69°18'57"	50.00'	57.87'	32.66'	54.69'	S 00°48'41"W
C14	47°09'23"	50.00'	41.15'	21.82'	40.00'	S 55°55'20"E
C15	69°30'54"	50.00'	60.66'	34.70'	57.01'	N 65°44'32"E
C16	62°10'54"	25.00'	27.13'	15.08'	25.82'	N 62°04'33"E
C17	69°39'58"	25.00'	30.27'	25.00'	35.36'	S 41°50'60"E
C18	07°43'56"	340.00'	45.83'	22.95'	45.80'	S 00°41'43"E
C19	16°32'26"	340.00'	98.15'	49.42'	97.81'	S 07°12'25"E
C20	81°20'00"	25.00'	35.49'	21.48'	32.58'	S 25°11'22"W
C21	10°24'35"	340.00'	61.77'	30.97'	61.69'	S 60°39'04"W
C22	18°54'47"	340.00'	100.36'	50.55'	100.00'	S 48°58'23"W
C23	09°46'26"	340.00'	58.00'	29.07'	57.93'	S 33°38'47"W
C24	38°39'50"	25.00'	16.87'	8.77'	16.55'	S 48°05'30"W
C25	30°51'50"	50.00'	26.93'	13.80'	26.61'	S 61°55'30"W
C26	03°08'57"	280.00'	15.23'	7.62'	15.23'	N 01°36'31"E
C27	05°01'29"	340.00'	29.82'	14.92'	29.81'	N 00°39'16"E
C28	22°17'09"	340.00'	132.25'	66.97'	131.41'	N 13°00'03"W
C29	25°12'26"	280.00'	123.19'	62.61'	122.19'	N 11°32'25"W

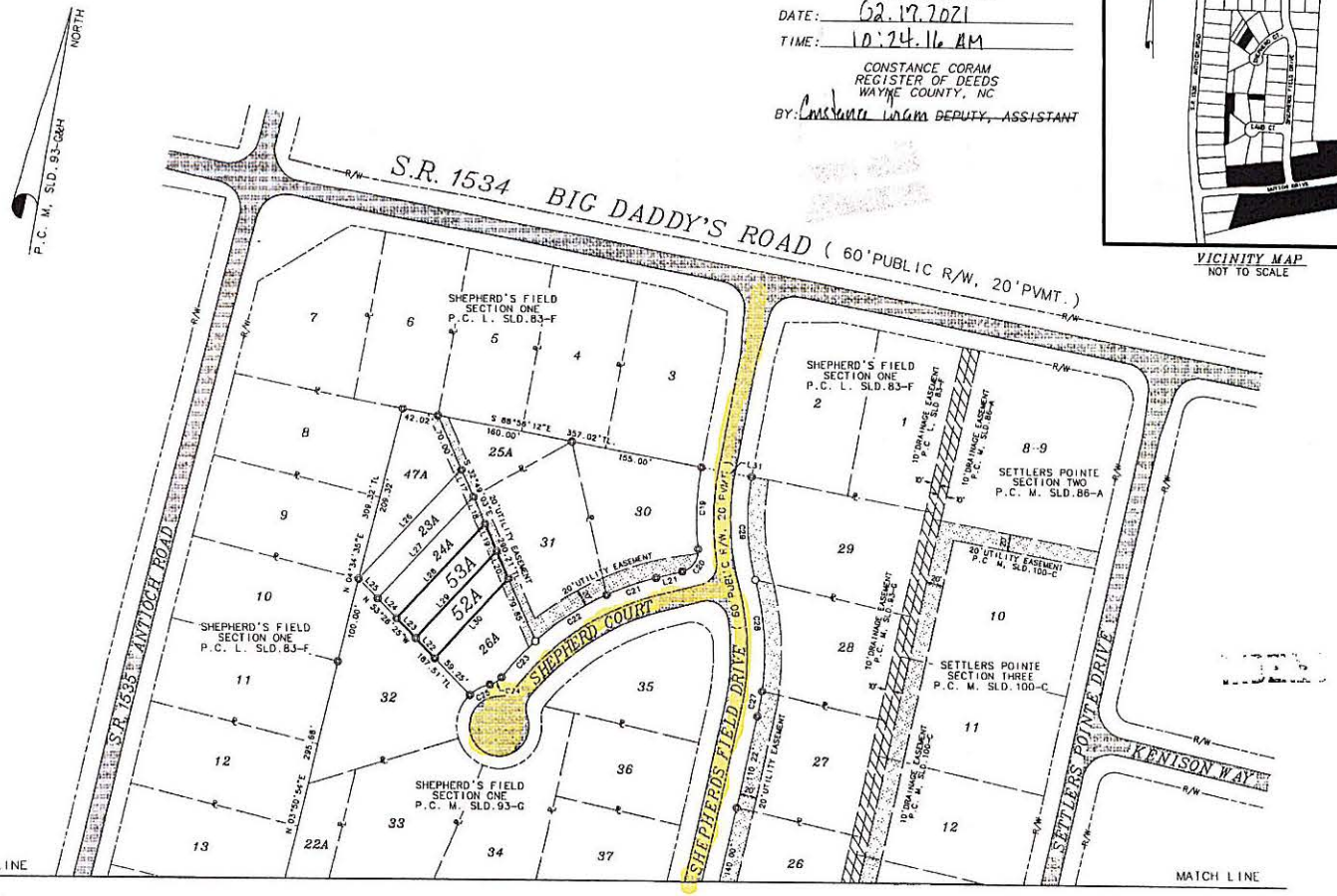
LINE	BEARING	DISTANCE
L1	N 75°12'57"E	30.42'
L2	N 65°10'16"E	64.93'
L3	S 65°00'39"E	9.52'
L4	S 30°27'39"E	8.12'
L5	S 80°19'59"W	5.70'
L6	S 88°20'08"W	8.30'
L7	S 01°39'52"E	15.00'
L8	N 88°20'08"E	48.00'
L9	N 01°39'52"W	15.00'
L10	N 04°23'29"W	10.74'
L11	S 88°50'00"E	32.00'
L12	S 88°50'00"E	32.00'
L13	S 88°50'00"E	16.67'
L14	S 57°38'22"W	37.13'
L15	N 38°02'01"W	37.37'
L16	N 38°02'01"W	38.07'
L17	S 32°48'03"E	35.09'
L18	S 32°49'03"E	35.09'
L19	S 32°49'03"E	35.09'
L20	S 32°49'03"E	35.09'
L21	S 65°51'22"W	31.97'
L22	N 53°26'25"W	32.06'
L23	N 53°26'25"W	32.06'
L24	N 53°26'25"W	32.06'
L25	N 53°26'25"W	32.06'
L26	S 32°57'44"W	177.63'
L27	S 32°57'45"W	165.25'
L28	S 32°57'45"W	152.87'
L29	S 32°57'45"W	140.48'
L30	S 32°57'45"W	128.10'
L31	N 88°56'12"W	60.00'

LOT NUMBER	LOT AREA
48	+17,821 SQ.FT. +0.4091 ACRE
48A	+5,053 SQ.FT. +0.1160 ACRE
49	+16,037 SQ.FT. +0.3682 ACRE
49A	+5,525 SQ.FT. +0.1268 ACRE
50	+15,463 SQ.FT. +0.3550 ACRE
50A	+7,657 SQ.FT. +0.1758 ACRE
51	+15,822 SQ.FT. +0.3586 ACRE
52	+51,888 SQ.FT. +1.1935 ACRE
52A	+4,297 SQ.FT. +0.0987 ACRE
53	+20,657 SQ.FT. +0.4742 ACRE
53A	+4,694 SQ.FT. +0.1078 ACRE
54	+18,170 SQ.FT. +0.4171 ACRE
55	+18,170 SQ.FT. +0.4171 ACRE
56	+18,170 SQ.FT. +0.4171 ACRE
57	+43,007 SQ.FT. +0.9873 ACRE
58	+45,372 SQ.FT. +1.0418 ACRES
59	+16,841 SQ.FT. +0.3866 ACRE
59A	+5,637 SQ.FT. +0.1294 ACRE
60	+19,170 SQ.FT. +0.4401 ACRE

PRESENTED FOR REGISTRATION
DATE: 12.17.2021
TIME: 10:24:16 AM
CONSTANCE CORAM
REGISTER OF DEEDS
WAYNE COUNTY, NC
BY: Constance Coram DEPUTY, ASSISTANT



VICINITY MAP
NOT TO SCALE



NOTES:

1. SUBJECT PROPERTY IS NOT LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA AS PER WAYNE COUNTY FIRM 3720363300K DATED 06/20/2018
2. SUBJECT PROPERTY IS SUBJECT TO ANY RESTRICTIONS, EASEMENTS AND RIGHT-OF-WAYS OF RECORD, IF ANY.
3. HOMES MUST BE WITHIN 500' OF AN EXISTING FIRE HYDRANT.
4. SEE SHEET 1 OF 2 FOR ADDITIONAL NOTES AND CERTIFICATIONS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION NOTES:

ONLY NORTH CAROLINA DEPARTMENT OF TRANSPORTATION APPROVED STRUCTURES ARE TO BE CONSTRUCTED ON PUBLIC RIGHT-OF-WAYS.

THE 10'X 70' SIGHT TRIANGLE TAKES PRECEDENCE OVER ANY SIGN EASEMENTS.

ALL DRAINAGE EASEMENTS SHALL BE DEDICATED AS PUBLIC AND IT SHALL BE THE RESPONSIBILITY OF THE PROPERTY OWNERS TO MAINTAIN THE DRAINAGE EASEMENTS AND ANY DRAINAGE STRUCTURES THEREIN, SO AS TO MAINTAIN THE INTEGRITY OF THE DRAINAGE SYSTEM AND INSURE POSITIVE DRAINAGE.

SITE DATA

TOTAL AREA OF DEVELOPMENT = 8.69 ACRES
TOTAL NUMBER OF LOTS = 13 STANDARD, 6 OFFSITE SEPTIC LOTS
AVERAGE STANDAND LOT SIZE = 24,345 SQ.FT. OR 0.56 ACRE
SUBJECT PROPERTY IS NOT ZONED
FRONT MINIMUM BUILDING LINE = 35'
SIDE MINIMUM BUILDING LINE = 10'
CORNER LOT SIDE MINIMUM BUILDING LINE = 25'
REAR MINIMUM BUILDING LINE = 25'
ELECTRICAL SERVICES PROVIDED BY DUKE ENERGY-PROGRESS
WATER SERVICE PROVIDED BY BELFAST-PATETOWN SANITARY DISTRICT
SANITARY SEWER SERVICE PROVIDED BY PRIVATE SEPTIC SYSTEMS

0' 50' 100' 200' 300' 400'
SCALE : 1" = 100'

LEGEND

⊙	EXISTING IRON PIPE
EPK	EXISTING P.K. NAIL
○	IRON ROD SET
MBL	MINIMUM BUILDING LINE
TL.	TOTAL LENGTH
D.B.	DEED BOOK
PG.	PAGE
P.C.	PLAT CABINET
SLD.	SLIDE
	SURVEYED BOUNDARY LINE
	SURVEYED TIE LINE
	NON-SURVEYED LINE
	RIGHT-OF-WAY LINE
R/W	RIGHT-OF-WAY
℄	PROPERTY LINE

CERTIFICATION

I, RICHARD M. BENTON, CERTIFY THAT THIS PLAT IS OF A SURVEY; THAT CREATES A SUBDIVISION OF LAND WITHIN AN AREA OF A COUNTY OR MUNICIPALITY THAT HAS AN ORDINANCE THAT REGULATES PARCELS OF LAND.

NORTH CAROLINA

I, RICHARD M. BENTON, CERTIFY THAT THIS PLAT WAS PREPARED UNDER MY SUPERVISION FROM AN ACTUAL FIELD SURVEY OF DESCRIPTION(S) AS RECORDED IN DEED BOOK 3490, PAGE 853 PLAT CABINET M, SLIDE 93-G&H THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED AS SUCH AND WERE PLOTTED FROM INFORMATION AS REFERENCED HEREON; THAT THE RATIO OF PRECISION OR POSITIONAL ACCURACY BEFORE ADJUSTMENTS WAS 1:10,000+, THAT THIS PLAT MEETS THE REQUIREMENTS OF THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA (21 NCAC 56 .1600) AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY HAND AND SEAL THIS 14 DAY OF DECEMBER, A.D. 2020

PROFESSIONAL LAND SURVEYOR L-3354

I, BERRY GRAY, REVIEW OFFICER OF WAYNE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATE IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

REVIEW OFFICER 2/16/21 DATE

NORTH CAROLINA PROFESSIONAL SEAL L-3354 LAND SURVEYOR RICHARD M. BENTON

I, ADAM STUCKEY AM RESPONSIBLE FOR THE CONSTRUCTION, MAINTENANCE AND REQUIRED ROAD IMPROVEMENTS OF SUBDIVISION STREETS UNTIL:
A) APPROVED/TAKEN OVER BY NORTH CAROLINA DEPARTMENT OF TANSPORTATION FOR PUBLIC ROADS, OR
B) APPROVED/TAKEN OVER BY HOMEOWNERS ASSOCIATION FOR PRIVATE ROAD MAINTENANCE, OR
C) PRIVATE ROAD MAINTENANCE AGREEMENT IS SIGNED AND RECORDED BY OWNERS OF EACH LOT.

DEVELOPER/OWNER DATE

SHEET 2 OF 2
SURVEY FOR
SHEPHERD'S FIELD SECTION THREE
PIKEVILLE TOWNSHIP WAYNE COUNTY NORTH CAROLINA

OWNER : SAS LAND DEVELOPMENT, LLC
ADDRESS : 1388 RAINS CROSSROADS ROAD PRINCETON, NC 27569
PHONE : 919-201-3172

BENTON & ASSOCIATES
LAND SURVEYING AND MAPPING
119 E. WALNUT STREET GOLDSBORO, N.C.
PHONE (919) 735-0440 FAX 735-0840
FIRM LICENSE NO. C-1705

APPROVED RMB	DATE 12/14/20
SURVEYOR JHL	DRAFTER RMB
FILE NUMBER	20-018

NORTH CAROLINA

WAYNE COUNTY

RESOLUTION #2023-27 GRANTING WETZEL PYROTECHNICS PERMISSION TO USE PYROTECHNICS FOR THE MOUNT OLIVE NEW YEARS EVEN PICKLE DROP

WHEREAS, the Board of Commissioners of Wayne County has received a request from Wetzel Pyrotechnics for permission for pyrotechnics to be exhibited, used, and discharged in a safe and proper manner under the supervision of experts for a fireworks celebration on December 31, 2023, in the Town of Mount Olive, North Carolina, as provided by North Carolina General Statute 14-410; and

WHEREAS, it is the intention of Wetzel Pyrotechnics to use said display in a public celebration; and

WHEREAS, it appears to the Wayne County Board of Commissioners that a permit to use pyrotechnics should be given for such celebration as provided by North Carolina General Statutes 14-410 and 14-413; and

WHEREAS, contingent upon the Wayne County Inspections Department approval of the fireworks display and show plan for Wetzel Pyrotechnics located at the Town of Mount Olive, North Carolina on December 31, 2023.

NOW, THEREFORE, BE IT RESOLVED by the Wayne County Board of Commissioners that Wetzel Pyrotechnics is hereby given permission to use pyrotechnics under the supervision of an expert at their public celebration to be held on December 31, 2023, contingent upon the individual or entity who will use, handle or discharge the pyrotechnics providing to the Clerk to the Wayne County Board of Commissioners a Certificate of Registration, which will be effective on December 31, 2023, proof of insurance as required by statute and the proper permits through the County of Wayne, and contingent on the approval of the Wayne County Inspections Department.

This the 5th day of December, 2023.

Chris Gurley, Chairman
Wayne County Board of Commissioners

Attest:

Carol Bowden
Clerk to the Board



Carol Bowden

From: Ashley Wetzel <wetzelpyroadmin@icloud.com>
Sent: Monday, November 27, 2023 12:36 PM
To: Carol Bowden; Jason Baker
Subject: Mt. Olive Pickle Drop FIreworks
Attachments: MT Olive Pickle Drop Permit Package.pdf

Hi Carol and Jason,

We hope you both have had a wonderful Thanksgiving holiday. I am hoping we aren't too late in trying to get this fireworks permit package to you for the Mt. Olive NYE Pickle Drop. We didn't have all of the necessary information until recent. I have attached the permit package here. Is there anything else we need to do for you? Our insurance renews at the end of the year so we can provide you with another COI if needed. The COI's can be tricky with NYE shows. Please do not hesitate to reach out with any questions you may have.
Ashley Wetzel Wetzel Pyro wetzelpyroadmin@icloud.com

31 December 2023
Mt. Olive Pickle Drop Fireworks Shoot Sheet



3" Single Shells Assorted – 120
4" Single Shells Assorted – 60

120 Shot Finale
4" Finale -12

No shell will be greater than 4" for this display. Reserve the right to substitute or replace product based on inventory available with no product being greater than the maximum size of 4" radius.

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 11/27/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Ryder Rosacker McCue & Huston (MGD by Hull & Company)
509 W Koenig St
Grand Island NE 68801

CONTACT NAME: Kristy Wolfe
PHONE (A/C, No, Ext): 308-382-2330 **FAX (A/C, No):** 308-382-7109
E-MAIL ADDRESS: Kwolfe@ryderinsurance.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : SCOTTSDALE INS CO	41297
INSURER B :	
INSURER C :	
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Kevin Wetzel
Wetzel Pyrotechnics
125 Eagleton Circle
Moyock NC 27958

COVERAGES **CERTIFICATE NUMBER:** 2103958798 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY			CPS4020777	12/31/2022	12/31/2023	EACH OCCURRENCE	$ 1,000,000
	X COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
	CLAIMS-MADE X OCCUR						MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$ 2,000,000
	X POLICY PRO-JECT LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS / NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY						WC STATU-TORY LIMITS / OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N N / A (Mandatory in NH)						E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)
Regarding the General Liability coverage, Waiver of Subrogation applies to the entities listed below per attached form CG 24 04 when required by written agreement.
Regarding the General Liability coverage, Blanket Additional Insured applies to the entities listed below per attached form GLS-150s when required by written agreement.
Mt. Olive Pickle
County of Wayne
Display Site 567 James B Hunt Ave Mt. Olive, NC 28365

CERTIFICATE HOLDER

Mt. Olive College
634 Henderson St.
Mt. Olive NC 28365
United States

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

© 1988-2010 ACORD CORPORATION. All rights reserved.

The ACORD name and logo are registered marks of ACORD

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 24 04 05 09

WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

SCHEDULE

Name Of Person Or Organization:
Any person or organization with whom the insured has agreed to waive rights of recovery, provided such agreement is made in writing and prior to the loss.
Additional Premium is Included
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

The following is added to Paragraph **8. Transfer Of Rights Of Recovery Against Others To Us** of **Section IV - Conditions:**

We waive any right of recovery we may have against the person or organization shown in the Schedule above because of payments we make for injury or damage arising out of your ongoing operations or "your work" done under a contract with that person or organization and included in the "products-completed operations hazard". This waiver applies only to the person or organization shown in the Schedule above.

Copyright, Insurance Services Office, Inc., 2008

INSURED
cg2404a.fap

SCOTTSDALE INSURANCE COMPANY®

ENDORSEMENT NO. _____

ATTACHED TO AND FORMING A PART OF POLICY NUMBER	ENDORSEMENT EFFECTIVE DATE (12:01 A.M. STANDARD TIME)	NAMED INSURED	AGENT NO.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

BLANKET ADDITIONAL INSURED ENDORSEMENT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

With respect to this endorsement, **SECTION II—WHO IS AN INSURED** is amended to include as an additional insured any person or organization whom you are required to add as an additional insured on this policy under a written contract, written agreement or written permit which must be:

a. Currently in effect or becoming effective during the term of the policy; and

b. Executed prior to the "bodily injury," "property damage," or "personal and advertising injury."

The insurance provided to these additional insureds is limited as follows:

1. That person or organization is an additional insured only with respect to liability for "bodily injury," "property damage" or "personal and advertising injury" caused, in whole or in part, by:

   a. Your acts or omissions; or

   b. The acts or omissions of those acting on your behalf.

   A person's or organization's status as an additional insured under this endorsement ends when your operations for that additional insured are completed.

2. With respect to the insurance afforded to these additional insureds, the following exclusions are added to item **2. Exclusions** of **SECTION I—COVERAGES:**

   This insurance does not apply to "bodily injury," "property damage" or "personal and advertising injury" occurring after:

   a. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or

   b. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

3. The limits of insurance applicable to the additional insured are those specified in the written contract, written agreement or written permit or in the Declarations for this policy, whichever is less. These limits of insurance are inclusive of, and not in addition to, the Limits of Insurance shown in the Declarations for this policy.

4. Coverage is not provided for "bodily injury," "property damage," or "personal and advertising injury" arising out of the sole negligence of the additional insured.

5. The insurance provided to the additional insured does not apply to "bodily injury," "property damage," or "personal and advertising injury" arising out of an architect's, engineer's or surveyor's rendering of or failure to render any professional services including:

Includes copyrighted material of ISO Properties, Inc., with its permission.
Copyright, ISO Properties, Inc., 2004

a. The preparing, approving or failing to prepare or approve maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; and

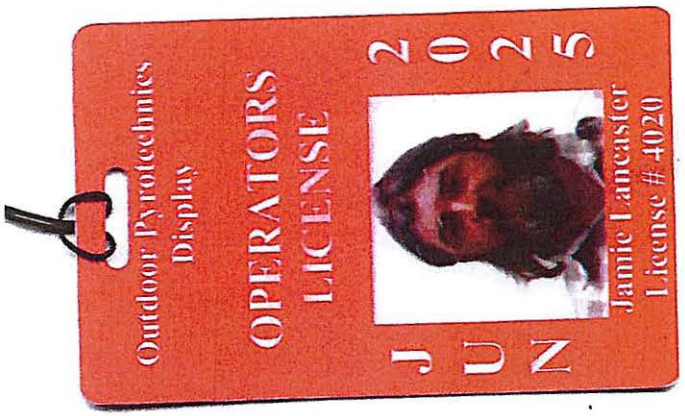
b. Supervisory, inspection, architectural or engineering activities.

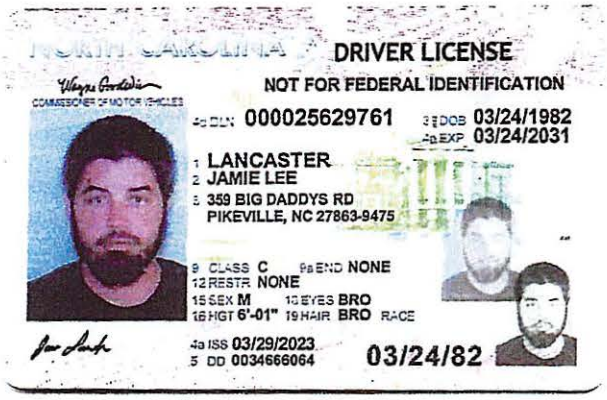
6. Any coverage provided hereunder will be excess over any other valid and collectible insurance available to the additional insured whether primary, excess, contingent or on any other basis unless a written contract specifically requires that this insurance be primary.

When this insurance is excess, we will have no duty under **SECTION I—COVERAGES** to defend the additional insured against any "suit" if any other insurer has a duty to defend the additional insured against that "suit." If no other insurer defends, we will undertake to do so, but we will be entitled to the additional insured's rights against all those other insurers.

AUTHORIZED REPRESENTATIVE DATE

Includes copyrighted material of ISO Properties, Inc., with its permission.
Copyright, ISO Properties, Inc., 2004


Outdoor Pyrotechnics Display
OPERATORS LICENSE
2025
JUN
Jamie Lancaster License #4020


DRIVER LICENSE
NOT FOR FEDERAL IDENTIFICATION
COMMISSIONER OF MOTOR VEHICLES
4d DLN: 000025629761
3 DOB 03/24/1982
4b EXP 03/24/2031
1 LANCASTER
2 JAMIE LEE
8 359 BIG DADDYS RD
PIKEVILLE, NC 27863-9475
9 CLASS C
9a END NONE
12 RESTR NONE
15 SEX M
16 HGT 6'-01"
18 EYES BRO
19 HAIR BRO
RACE
4a ISS 03/29/2023
5 DD 0034666064
03/24/82

Bureau of Alcohol, Tobacco, Firearms and Explosives

(18 U.S.C. Chapter 40)

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555), you may engage in the activity specified in this license or permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. **THIS LICENSE IS NOT TRANSFERABLE UNDER 27 CFR 555.53.** See "WARNINGS" and "NOTICES" on reverse.

Direct ATF Correspondence To	ATF - Chief, FELC 244 Needy Road Martinsburg, WV 25405-9431	License/Permit Number	**1-NC-053-50-5E-01022**
Chief, Federal Explosives Licensing Center (FELC)	Mama Howard	Expiration Date	**May 1, 2025**

Name

KEVIN EUGENE WETZEL

Premises Address (Changes? Notify the FELC at least 10 days before the move.)

125 EAGLETON CIR
MOYOCK, NC 27958-

Type of License or Permit

50-MANUFACTURER OF EXPLOSIVES

Purchasing Certification Statement

The licensee or permittee named above shall use a copy of this license or permit to assist a transferor of explosives to verify the identity and the licensed status of the licensee or permittee as provided by 27 CFR Part 555. The signature on each copy must be an original signature. A faxed, scanned or e-mailed copy of the license or permit with a signature intended to be an original signature is acceptable. The signature must be that of the Federal Explosives Licensee (FEL) or a responsible person of the FEL. I certify that this is a true copy of a license or permit issued to the licensee or permittee named above to engage in the business or operations specified above under "Type of License or Permit."

Mailing Address (Changes? Notify the FELC of any changes.)

KEVIN EUGENE WETZEL
125 EAGLETON CIR
MOYOCK, NC 27958-

Licensee/Permittee Responsible Person Signature _____ Position/Title _____

Printed Name _____ Date _____

Previous Edition is Obsolete KEVIN EUGENE WETZEL:125 EAGLETON CIR:27958:1-NC-053-50-5E-01022:May 1, 2025:50-MANUFACTURER OF EXPLOSIVES

ATF Form 5400.14/5400.15 Part I
Revised September 2011

Federal Explosives License (FEL) Customer Service Information

Federal Explosives Licensing Center (FELC)
244 Needy Road
Martinsburg, WV 25405-9431

Toll-free Telephone Number: (877) 283-3352
Fax Number: (304) 616-4401
E-mail: FELC@atf.gov

ATF Homepage: www.atf.gov

Change of Address *(27 CFR 555.54(a)(1))*. Licensees or permittees may during the term of their current license or permit remove their business or operations to a new location at which they intend regularly to carry on such business or operations. The licensee or permittee is required to give notification of the new location of the business or operations not less than 10 days prior to such removal with the Chief, Federal Explosives Licensing Center. The license or permit will be valid for the remainder of the term of the original license or permit. **(The Chief, FELC, shall, if the licensee or permittee is not qualified, refer the request for amended license or permit to the Director of Industry Operations for denial in accordance with § 555.54.)**

Right of Succession *(27 CFR 555.59)*. (a) Certain persons other than the licensee or permittee may secure the right to carry on the same explosive materials business or operations at the same address shown on, and for the remainder of the term of, a current license or permit. Such persons are: (1) The surviving spouse or child, or executor, administrator, or other legal representative of a deceased licensee or permittee; and (2) A receiver or trustee in bankruptcy, or an assignee for benefit of creditors. (b) In order to secure the right provided by this section, the person or persons continuing the business or operations shall furnish the license or permit for for that business or operations for endorsement of such succession to the Chief, FELC, within 30 days from the date on which the successor begins to carry on the business or operations.

(Continued on reverse side)

Cut Here ✂

Federal Explosives License/Permit (FEL) Information Card

License/Permit Name: **KEVIN EUGENE WETZEL**

Business Name:

License/Permit Number: **1-NC-053-50-5E-01022**

License/Permit Type: **50-MANUFACTURER OF EXPLOSIVES**

Expiration: **May 1, 2025**

Please Note: Not Valid for the Sale or Other Disposition of Explosives.

Kevin Wetzel
Wetzel Pyrotechnics

Safety Procedures for Fireworks Displays

NFPA 1123 Codes are to be followed at all times.

1. Firing Procedure:

A. Operators are to use the Pre-display checklist provided in the display paperwork. AT NO TIME are the materials to be left unattended.
B. Upon arrival at the site, check site conditions for any hazards that may impede the safety of the display operation.
C. Verify the site meets all distance requirements of NFPA1123 at a minimum. Add additional buffer to account for conditions.
D. Confirm that there is adequate ingress and egress for emergency vehicles.
E. Inspect all racks and equipment as it is coming off the truck. Any equipment that is damaged or broken is not to be used in the display.
F. All mortar racks are to be setup and installed prior to any loading of live materials.
G. Inspect all shells and fireworks devices such as cakes, candles, and ground effects prior to loading, or placing in the firing area. Any materials found to be damaged, or not in proper condition are not to be used in the display.
H. All materials fuses are to be situated and secured for easy access and removal of safety caps just prior to firing.
I. (Electric Firing) Any e-matching of materials will take place at least 50 feet from the truck holding the fireworks, and at least 100 feet from any public access. Limit the amount of materials in this area to just ONE box at a time.
J. (Electric Firing) Once all materials are setup, no personnel are allowed within the firing area during the continuity testing. If there is a need to check contact points, or adjust materials, the firing control panel must be disabled completely before an operator enters the firing area.
K. (Manual Firing) Operators will use fusees (flares) for ignition of shell leaders.
L. Previously installed multiple ignition points are to be placed along Finale racks, or any chain fused sections of the display.

2. Termination and Emergency Procedures

A. If, at any time before, or during the discharge of a display, there arises a condition that adversely affects the firing or completion of the display, the operator will IMMEDIATELY halt the display, until such a time that the condition can be either corrected, or deleted from the program.
    1. The AHJ will also have the authority to halt the display, should any such condition arise.
    2. Communications between the operator and the AHJ will be necessary to provide for the continuation of the display (if halted).

B. If there is a weather-related concern, the display is to be halted, or postponed, until better conditions prevail. If there is no alternative, or if conditions remain at an unsafe level, then the operator is to cancel the display, and the Rain Date option will be considered.

1. All mortar racks are to be covered with tarps, plastic or other suitable materials to prevent materials from getting wet. Cakes, and other ground effects can be placed in plastic bags.
2. Any materials that do become wet shall not be used and are to be placed into regulation cartons and returned to ATF approved storage.

C. If, during the display, an errant shell or malfunction of equipment causes materials to be sent unintentionally towards the spectator area, or out of the intended fallout area, the operator will IMMEDIATELY halt the display.

1. The safety of the spectators is the primary concern, and the operator is to ensure that any errant shell trajectories or malfunctions are dealt with as soon as it is safe to do so. Repositioning of the racks or dropping that part of the display will be done before resuming any firing.
2. A situation of this nature could cause the rest of the display to be postponed or cancelled with the communication and cooperation of the AHJ.
3. Identification of the errant materials and/or equipment is to be documented in the operators after display report.
4. If there is ANY injury of any nature, to a spectator, or any other person, the display is to be halted, and the assistance of the local EMS, Fire Department, and/or other fire and life safety personnel on duty at the time is to be utilized.

D. Ingress and Egress routes are always to be maintained and are to remain clear for emergency vehicles and personnel.

1. Should there be any reason to need such access, the operator shall halt all firing, and suspend the display.
2. The operator and other display personnel may assist such emergency personnel to control and contain any condition to insure the safety and security of the site.

3. Post Display

A. Once the display has been completed, the operator will make the determination to break down the display equipment when s/he finds all conditions safe to do so.

1. The operator and assistances will allow a minimum of 30 minutes for a "cool-down" period, once the display is completed.

a. Beginning with the mortars that were fired first, make sure that all shells and materials were discharged.
b. Once all racks and equipment have been cleared, the operator will approve the break down of the display.

2. Misfired Materials
   a. Identify any and all misfired materials.
   b. Ensure that there are no ignition hazards present before handling. All sparks are to be extinguished, E-matches should be disconnected and shunted, and then may be carefully removed and stored.
   c. Carefully remove materials from the discharge area.
   d. Place materials into regulation carton, and transport back to approved ATF storage.
   e. Record misfires in the operator's display report

B. The operator will assist the AHJ in conducting the post display inspection and sign off on any documentation the AHJ may require.
C. Once the inspection is completed, the operator may clear the on-duty Fire Department personnel.
D. The entire discharge area and fallout zones are to be inspected to ensure there are no duds, misfires, or any other materials left on the display site. A full site check will also be performed early the following morning.
E. Clean up includes removal of all equipment, paper debris, and any other items that remain as a result of the display.

A copy of the operators after display report will be provided to the local fire code official if requested.

Safety Data Sheet

SECTION 1: IDENTIFICATION

Product Name **Firewire Initiators**
Identifier Uses No specific first aid measures noted.

Supplier

MJG Technologies Inc.
836 Camden Avenue
Blackwood, NJ 08012
Tel: 856-228-6118

Contact Person info@electricmatch.com
Emergency Telephone 1-352-323-3500 Contract # 100588

SECTION 2: HAZARDS IDENTIFICATION

Appearance Solid. Medium brown colored bead of pyrotechnic composition on a copper-clad chip with two PVC insulated connecting wires of various lengths. Red or blue lacquer coating on igniter head.

Color Medium brown colored.

Odor No odour information available.

Pictogram(s)



Signal Word Danger

Hazard Statements

H204 Fire or projection hazard.
H302 Harmful if swallowed.
H332 Harmful if inhaled.
H351 Suspected of causing cancer .
H361 Suspected of damaging fertility or the unborn child .
H372 Causes damage to organs [*] through prolonged or repeated exposure [*].

Precautionary Statements

P201 Obtain special instructions before use.
P210 Keep away from heat/ sparks/open flames/hot surfaces. — No smoking.
P250 Do not subject to grinding/ shock/[*]/friction.
P260 Do not breathe dust/fume/ gas/mist/vapours/spray.
P264 Wash hands thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P281 Use personal protective equipment as required.
P301 + P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P334 Immerse in cool water/wrap in wet bandages.
P370 + P380 In case of fire: Evacuate area.

P373 DO NOT fight fire when fire reaches explosives.
P374 Fight fire with normal precautions from a reasonable distance.
P405 Store locked up.

Contains orange lead

GHS Classification

Physical and Chemical Hazards	Expl. 1.4 - H204
Human Health	Acute Tox 4 - H302, Acute Tox 4 - H332, Carc. 2 - H351, Repr. 2 - H361, STOT RE 1 - H372,
Environment	Not classified

OSHA Regulatory Status This product is Hazardous under the OSHA Hazard communication Standard.

Inhalation Inhalation of large amounts of igniter heads may cause respiratory discomfort.
Ingestion Harmful if swallowed.
Skin contact Thermal burns to the skin caused by accidental ignition of igniters. Not absorbed through the skin.
Eye contact Thermal burns to the eyes caused by accidental ignition of igniters .
Routes of Exposure No Information available.
Other Hazards Not applicable.

SECTION 3: Composition/Information on Ingredients

Name	Product Identifier	GHS Classification	%
boron	CAS-No.: 7440-42-8 EC No.: 231-151-2		10-30%

Composition Comments Chemical names/ identifiers have been removed without affecting the overall safety information on the Safety Data Sheet.

SECTION 4: FIRST AID MEASURES

Description of first aid measures

General Information CAUTION! First aid personnel must be aware of own risk during rescue! Remove victim immediately from source of exposure. Provide rest, warmth and fresh air. Burns must be treated by doctors. Place unconscious person on the side in the recovery position and ensure breathing can take place. If heart stops, heart-compression must be carried out. In case of accidents: Call an ambulance immediately! Show the MSDS.
Inhalation If this product is inhaled and symptoms occur, move the exposed person to fresh air promptly. Seek medical attention if symptoms persist.
Ingestion Get medical attention immediately. Do NOT induce vomiting. If victim is conscious and alert, wash out mouth with water then give water. Never give anything by mouth to an unconscious person. If vomiting occurs spontaneously, keep airway clear.
Skin contact Remove all contaminated clothes and footwear immediately unless stuck to skin. Drench the affected skin with running water for 10 minutes or longer if substance is still on skin. Transfer to hospital if there are burns or symptoms of poisoning. Consult a doctor.
Eye contact Do not rub eye.Make sure to remove any contact lenses from the eyes before rinsing. Promptly wash eyes with plenty of water while lifting the eye lids. Get medical attention immediately. Continue to rinse. Continue to rinse for at least 15 minutes.

Most important symptoms and effects, both acute and delayed

General Information The severity of the symptoms described will vary dependant of the concentration and the length of exposure.
Inhalation Inhalation of large amounts of igniter heads may cause respiratory discomfort.
Ingestion Harmful if swallowed.
Skin contact Thermal burns to the skin caused by accidental ignition of igniters. Not absorbed through the skin.
Eye contact Thermal burns to the eyes caused by accidental ignition of igniters .
Routes of Exposure No Information available.

Most important symptoms and effects, both acute and delayed

Notes To The Physician Treat Symptomatically.

SECTION 5: Firefighting Measures

Auto Ignition Temperature (°C)	No Information available.
Flammability Limit - Lower(%)	No Information available.
Flammability Limit - Upper(%)	No Information available.
Flash point	No Information available.
Extinguishing Media	Use fire-extinguishing media appropriate for surrounding materials.
Hazardous combustion products	Smoke contains Boron and Titanium.
Unusual Fire & Explosion Hazards	Burning igniters will project sparks several feet and can cause secondary fires. Igniters may rupture a container if ignited under confinement. Igniters may be ignited by extreme impact, friction or electrostatic discharge.
Special Fire Fighting Procedures	If possible, fight fire from protected position. Avoid breathing fire vapours. Keep up-wind to avoid fumes. Ventilate closed spaces before entering them. Containers close to fire should be removed immediately or cooled with water. Use water spray to cool container and prevent rupture.
Protective equipment for fire-fighters	Fire fighters should wear full protective equipment, including a self-contained breathing apparatus. Water should be used to cool surrounding containers.

SECTION 6: Accidental Release Measures

Personal Precautions	Use proper personal protection (refer to Section 8).
Environmental Precautions	Run off from fire control or dilution water may cause pollution. Keep out of drains, municipal sewers, open bodies of water and water course.
Spill Clean Up Methods	Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal.

SECTION 7: Handling and Storage

Handling	Read and follow manufacturer's recommendations. Do not handle broken packages without protective equipment. Avoid spilling, skin and eye contact. Do not use contact lenses. Keep away from heat, sparks and open flame. Take precautionary measures against static discharges when there is a risk of dust explosion.
Usage Description	Use only according to directions.
Storage Precautions	Store igniters in accordance with local,state and federal regulations.Keep dry and avoid temperatures above 120 degree F. Store in closed container away from incompatible materials, sunlight and heat to prolong shelf life. Minimize exposure in accordance with good hygiene practices. Keep out of reach of children.Keep away from food and drink. Containers opened must be resealed and kept upright. Do not store in unlabelled containers.
Specific End Use(s)	Igniter.

SECTION 8: Exposure Controls/Personal Protection

Protective Equipment



Ingredient Comments	No occupational exposure limits noted for the ingredients(s).
Process Conditions	Ensure that eye flushing systems and safety showers are located close to the working place.
Engineering Measures	Provide adequate ventilation.
Respiratory Equipment	If ventilation is inadequate use a suitable respirator.
Hand Protection	The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product.Due to risk of fire, leather footwear and cotton clothing should never be used.Long sleeved shirt, trousers, rubber boots, rubber gloves, and rubber apron.
Eye Protection	Use equipment for eye protection tested and approved under appropriate government

Hygiene Measures	standards such as NIOSH (US) or EN 166(EU). Wash hands before breaks and immediately after handling the product. When using, do not eat, drink or smoke. Take off immediately all contaminated clothing. Avoid contact with skin, eyes and clothing.

SECTION 9: Physical and Chemical Properties

Information on Basic Physical and Chemical Properties

Appearance	Solid. Medium brown colored bead of pyrotechnic composition on a copper-clad chip with two PVC insulated connecting wires of various lengths. Red or blue lacquer coating on igniter head.
Color	Medium brown colored.
Odor	No odour information available.
Odor Threshold - Lower	No Information available.
Odor Threshold - Upper	
pH-Value, Conc. Solution	No Information available.
pH-Value, Diluted Solution	No Information available.
Melting point	No Information available.
Initial boiling point and boiling range	No Information available.
Flash point	No Information available.
Evaporation rate	No Information available.
Flammability State	No Information available.
Flammability Limit - Lower(%)	No Information available.
Flammability Limit - Upper(%)	No Information available.
Vapor pressure	No Information available.
Vapor Density (air=1)	No Information available.
Relative density	No Information available.
Bulk Density	No Information available.
Solubility	No information available.
Decomposition temperature	No Information available.
Partition coefficient; n-octanol/water	No Information available.
Auto Ignition Temperature (°C)	No Information available.
Viscosity	No Information available.
Explosive Properties	Bead of pyrotechnic composition on a copper-clad chip with two PVC insulated connecting wires of various lengths.
Oxidizing Properties	No Information available.
Molecular Weight	No Information available.
Volatile Organic Compound	No Information available.

SECTION 10: Stability and Reactivity

Reactivity	Reaction with heat,acids and reducing agents.
Stability	Stable under normal temperature conditions and recommended use.
Hazardous Polymerisation	Will not polymerise.
Hazardous Decomposition Products	Smoke contains oxides of Boron and Titanium.
Conditions to Avoid	Avoid contact with strong oxidisers. Avoid heat, flames and other sources of ignition.
Materials to Avoid	Keep away from strong acids.Keep away from strong reducing agents and strong oxidising agents.

SECTION 11: Toxicological Information

Toxicological Information	No toxicological information for the overall finished product.
Acute Toxicity (Oral LD50)	No Information available.
Acute Toxicity (Dermal LD50)	No Information available.
Acute Toxicity (Inhalation LC50)	No Information available.
Skin Corrosion/Irritation	No Information available.
Respiratory Sensitisation	No Information available.
Skin Sensitisation	No Information available.
Reproductive Toxicity:	No Information available.
Germ Cell Mutagenicity:	
Genotoxicity - In Vitro	
Genotoxicity - In Vivo	
Carcinogenicity:	
Carcinogenicity	No Information available.
NTP - Carcinogenicity	The product and its components are not listed.
OSHA - Carcinogenicity	The product and its components are not listed.
IARC Carcinogenicity	The product and its components are not listed.

Specific Target Organ Toxicity - Single Exposure:

STOT - Single Exposure	No Information available.

Specific Target Organ Toxicity - Repeated Exposure:

STOT - Repeated Exposure	No Information available.

SECTION 12: Ecological Information

Ecotoxicity	The product does pose an environmental hazard.
Acute Toxicity - Fish	No Information available.
Acute Toxicity - Aquatic Invertebrates	No Information available.
Acute Toxicity - Aquatic Plants	No Information available.
Degradability	There are no data on the degradability of this product.
Bioaccumulative Potential	No data available on bioaccumulation.
Mobility	No information available.
Results of PBT and vPvB Assessment	No information available.
Other Adverse Effects	No information available.

SECTION 13: Disposal Considerations

Waste Management	When handling waste, consideration should be made to the safety precautions applying to handling of the product.

Disposal Methods	Waste disposal must be in accordance with appropriate federal, state, and local regulations.

SECTION 14: Transport Information

UN Number

UN No. (DOT/TDG)	UN454
UN No. (IMDG)	UN454
UN No. (IATA)	UN0454

Proper Shipping Name

DOT/TDG Proper Shipping Name	IGNITERS
IMDG Proper Shipping Name	IGNITERS
IATA Proper Shipping Name	Igniters

Transport Hazard Class(es)

DOT/TDG Class	1.4
IMDG Class	1.4 S
IATA Class	1.4S

Transport Labels



Packing Group(s)

DOT Packing Group	<none>
IMDG Packing Group	-
IATA Packing Group	<none>

Special Precautions for User

EMS	F-B, S-X

Environmentally Hazardous Substance/Marine Pollutant

ADR	No
IMDG	No
IATA	No

SECTION 15: Regulatory Information

US Federal Regulations

SARA Section 302 Extremely Hazardous Substances Tier II Threshold Planning Quantities
The Following ingredients are listed None Listed.

CERCLA/Superfund, Hazardous Substances/Reportable Quantities (EPA)
The Following ingredients are listed None Listed.

SARA Extremely Hazardous Substances EPCRA Reportable Quantities
The Following ingredients are listed None Listed.

SARA 313 Emission Reporting
The Following ingredients are listed None Listed.

CAA Accidental Release Prevention
The Following ingredients are listed None Listed.

OSHA Highly Hazardous Chemicals

The Following ingredients are listed None Listed.

US State Regulations

California Proposition 65 Carcinogens and Reproductive Toxins
The Following ingredients are listed None Listed.

California Air Toxics "Hot Spots" (A-I)
The Following ingredients are listed None Listed.

California Air Toxics "Hot Spots" (A-Ii)
The Following ingredients are listed None Listed.

Massachusetts "Right To Know" List
The Following ingredients are listed None Listed.

Rhode Island "Right To Know" List
The Following ingredients are listed None Listed.

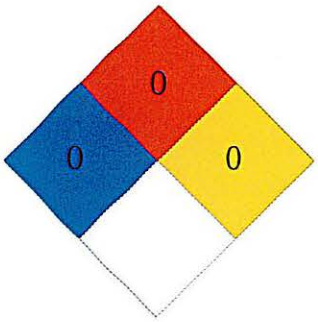
Minnesota "Right To Know" List
The Following ingredients are listed None Listed.

New Jersey "Right To Know" List
The Following ingredients are listed None Listed.

Pennsylvania "Right To Know" List
The Following ingredients are listed None Listed.

SECTION 16: Other Information

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)



HAZARDOUS MATERIAL INFORMATION SYSTEM (HMIS)

Health	0
Flammability	0
Physical Hazard	0
Personal Protection	

Revision Comments	This is first issue
Revision Date	02/11/2016
Revision	1

Disclaimer

ALL INFORMATION APPEARING HEREIN IS BASED UPON DATA OBTAINED FROM THE MANUFACTURER AND/OR RECOGNIZED TECHNICAL SOURCES. THIS INFORMATION IS BELIEVED TO BE CORRECT, BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. MJG TECHNOLOGIES INC. MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY OR COMPLETENESS OF THIS INFORMATION. IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE SUITABILITY OF THIS INFORMATION FOR THE ADOPTION OF NECESSARY SAFETY PRECAUTIONS AND/OR COMPLIANCE WITH LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS.

Safety Data Sheet

1. IDENTIFICATION

Last revision – May 10, 2018

Product Identifier – Fireworks, 1.4 Explosive UN0336
Trade Name – Consumer Fireworks

Suppler:
ZHUFU FIREWORKS CO.LTD
#1 HENGXIA, SHANGLI
PINGXIANG CITY, JIANGXI PROVINCE, CHINA
Telephone: (86) 731 83648292
Fax: (86) 731 83657292

2. HAZARDS IDENTIFICATION

Classification – Explosive
Pictogram:



3. COMPOSITION/INFORMATION ON INGREDIANTS

Percentages of each chemical used and what chemicals are included in the device are trade secrets.

The following chemicals may be used:
Potassium Perchlorate - $KClO_4$
Potassium Nitrate - KNO_3
Sulfur – S
Carbon – C
Aluminum – Al
Titanium – Ti
Barium Nitrate – $Ba(NO_3)_2$
Strontium Carbonate – $SrCO_3$

4. FIRST AID MEASURES

Swallowed: Wash out mouth with water provided person is conscious. Call a physician.

Inhaled: Take person to area with fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
Skin contact: Immediately wash skin with soap and water.

5. FIREFIGHTING MEASURES

Extinguishing media - DO NOT attempt to fight fire near other fireworks.

Unusual fire and explosion hazards - If exposed to fire, articles will explode and propel burning projectiles. There is a risk of explosion if large quantities of fireworks are involved in a fire.

Firefighting equipment - In the case of a small amount on fire apply as much water as possible from as much distance as practical. Larger fires involving more than one carton require large volumes of water and extra care from fumes and debris. Evacuate fire area IMMEDIATELY and seek shelter. Follow emergency evacuation plan.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions - Wear protective equipment. Keep unprotected persons away. Remove persons from danger area. Ensure adequate ventilation. Isolate area and prevent access.

Environmental Precautions - Do not allow undiluted product or large quantities of it to reach ground water or sewage system.

Cleanup methods - Pick up while wearing proper protective equipment. Dispose of in suitable waste containers.

7. HANDLING AND STORAGE

Handling – Handle with care. Do not drop or throw. Place upright. Keep away from open flames, sparks

Storage – Avoid storage near extreme heat, ignition sources or open flames. Store in a dry and well-ventilated location. Items are best stored in original packaging. Store in accordance to all local and national regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Limits of Exposure – No limits when items are in their original packaging.
Eye protection - None required when handling finished fireworks
Skin protection – Wear cotton clothing
Respiratory protection - None required when handling finished fireworks

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance – All the chemical composition is contained in paper casing
Odor - All the chemical composition is contained in paper casing
Solubility in water – Partly soluble in water

10. STABILITY AND REACTIVITY

Stability – Stable
Conditions to avoid – Avoid high temperatures, heating, open flames or ignition sources. Do not allow items to become soaking wet
Materials to avoid – Oxidizers and flammable agents

11. TOXICOLOGICAL INFORMATION

Eyes – N/A when handling finished product. When in use, particles possibly could irritate eyes.
Skin - N/A when handling finished product. When in use, particles possibly could irritate skin.
Breathing - N/A when handling finished product. When in use, particles possibly could irritate breathing.

Safety Data Sheet

1. IDENTIFICATION

Last revision – May 10, 2018

Product Identifier – Fireworks, 1.4 Explosive UN0336
Trade Name – Consumer Fireworks

Suppler:
ZHUFU FIREWORKS CO.LTD
#1 HENGXIA, SHANGLI
PINGXIANG CITY, JIANGXI PROVINCE, CHINA
Telephone: (86) 731 83648292
Fax: (86) 731 83657292

2. HAZARDS IDENTIFICATION

Classification – Explosive
Pictogram:



3. COMPOSITION/INFORMATION ON INGREDIANTS

Percentages of each chemical used and what chemicals are included in the device are trade secrets.

The following chemicals may be used:
Potassium Perchlorate - $KClO_4$
Potassium Nitrate - KNO_3
Sulfur – S
Carbon – C
Aluminum – Al
Titanium – Ti
Barium Nitrate – $Ba(NO_3)_2$
Strontium Carbonate – $SrCO_3$

4. FIRST AID MEASURES

Swallowed: Wash out mouth with water provided person is conscious. Call a physician.

Inhaled: Take person to area with fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.
Skin contact: Immediately wash skin with soap and water.

5. FIREFIGHTING MEASURES

Extinguishing media - DO NOT attempt to fight fire near other fireworks.

Unusual fire and explosion hazards - If exposed to fire, articles will explode and propel burning projectiles. There is a risk of explosion if large quantities of fireworks are involved in a fire.

Firefighting equipment - In the case of a small amount on fire apply as much water as possible from as much distance as practical. Larger fires involving more than one carton require large volumes of water and extra care from fumes and debris. Evacuate fire area IMMEDIATELY and seek shelter. Follow emergency evacuation plan.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions - Wear protective equipment. Keep unprotected persons away. Remove persons from danger area. Ensure adequate ventilation. Isolate area and prevent access.

Environmental Precautions - Do not allow undiluted product or large quantities of it to reach ground water or sewage system.

Cleanup methods - Pick up while wearing proper protective equipment. Dispose of in suitable waste containers.

7. HANDLING AND STORAGE

Handling – Handle with care. Do not drop or throw. Place upright. Keep away from open flames, sparks

Storage – Avoid storage near extreme heat, ignition sources or open flames. Store in a dry and well-ventilated location. Items are best stored in original packaging. Store in accordance to all local and national regulations.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Limits of Exposure – No limits when items are in their original packaging.
Eye protection - None required when handling finished fireworks
Skin protection – Wear cotton clothing
Respiratory protection - None required when handling finished fireworks

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance – All the chemical composition is contained in paper casing
Odor - All the chemical composition is contained in paper casing
Solubility in water – Partly soluble in water

10. STABILITY AND REACTIVITY

Stability – Stable
Conditions to avoid – Avoid high temperatures, heating, open flames or ignition sources. Do not allow items to become soaking wet
Materials to avoid – Oxidizers and flammable agents

11. TOXICOLOGICAL INFORMATION

Eyes – N/A when handling finished product. When in use, particles possibly could irritate eyes.
Skin - N/A when handling finished product. When in use, particles possibly could irritate skin.
Breathing - N/A when handling finished product. When in use, particles possibly could irritate breathing.

Lidu Fireworks Hazard Communication Safety Data Sheets

Lidu Town, JinXian Country, NanChang City, JiangXi Province, China 331725
Phone: 86-791-8563 8888 Fax: 86-791-8563 8138
UN0335 1.3G Display Fireworks

Date Prepared: Feb.24th, 2017

Section 1, Identification

Each device labels:

(1): Commodity description in both Chinese and English for CAKES
(2): Warning labels for CAKES
(3): Distributor name and address, Manufacturer name and address, Produce date, Country of origin

Cartons information:

Cakes shoot, Cakes item No., Packing, Cakes item name, The same information as above section 1 part (3), Warning information, Order No., UN0335 1.3G, Bill of Lading remark emergency phone number.

· Recommended use and restriction on use
· Recommended use: Explosive product for professional use for entertainment and technical purposes
· Restrictions on use: Contact manufacturer/supplier

Section 2, Hazard(s) identification

Warning label show correctly and safely display fireworks is put on each cartons and devices.

· Classification of the substance or mixture
Expl. 1.3 H203 Explosive; fire, blast or projection hazard.
· Label elements
· GHS label elements
The product is classified and labeled according to the Globally Harmonized System (GHS).
· Hazard pictograms:
GHS01



· Signal word: Danger
· Hazard statements:
H203 Explosive; fire, blast or projection hazard.

· Precautionary statements:
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P250 Do not subject to grinding/shock/friction.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P373 DO NOT fight fire when fire reaches explosives.
P370+P380 In case of fire: Evacuate area.
P372 Explosion risk in case of fire.

Section 3, Composition/information on ingredients

Cakes Main ingredients:
Potassium Perchlorate—KClO4
Potassium Nitrate—KNO3
Sodium fluoroaluminate-NA3ALF6
Barium Nitrate—Ba(NO3)2
Strontium carbonate—SrCO3
Sulfur— S
Carbon— C
Copper Oxide— CuO
Aluminum— Al
Al+Mg Alloy
Titanium—Ti
LAC—C16H24O5
Resin—C48H42O7
PVC—(C2HCl)n
Powder of polished glutinous rice

Section 4, First-aid measures

No chemical components are released during normal handling of this device. In normal use with adequate ventilation the smoke produced should not be a problem. However, ground level smoke generated during the shooting of public display shows may contain gases which may cause irritation of eyes and mucous membranes, prolonged inhalation of smoke should be avoided.

Persons with pre-existing respiratory conditions (i.e. asthma, emphysema, etc) should avoid inhalation of smoke. Move to fresh air and avoid further exposure to smoke and seek medical assistance.

Information is only applicable to product contents, and not to product as normally supplied. This information is applicable to damaged, leaking, or spilled product as contact with contents is possible under these conditions.

-After inhalation: Supply fresh air; consult doctor in case of complaints.

-After skin contact:
Wash with soap and water.
In case of minor burns, flush with cool water.
If skin irritation is experienced, consult a doctor.
-After eye contact:
Remove contact lenses if worn.
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
-After swallowing:
Unlikely route of exposure.
Do not induce vomiting; immediately call for medical help.

Section 5, Fire-fighting measures

Cool pyrotechnic devices and/or package with water and remove them if possible. Do not use suffocation methods - devices contain their own oxygen. Fireworks will burn rapidly in the event of fire. If a large amount of fireworks are involved, allow them to burn and prevent spread of fire.
Do Not Smoke at any time when dealing with pyrotechnic devices.

· Extinguishing media
· Suitable extinguishing agents:
DO NOT fight fire when fire reaches explosives.
Flood area with water. If no water is available, carbon dioxide, dry chemical or earth may be used. If the fire reaches the cargo, withdraw and let fire burn.
· For safety reasons unsuitable extinguishing agents: None.
· Special hazards arising from the substance or mixture Explosive; fire, blast or projection hazard.
During heating or in case of fire poisonous gases are produced.
· Advice for firefighters
· Protective equipment:
Wear self-contained respiratory protective device.
Wear fully protective suit.
· Additional information:
Eliminate all ignition sources if safe to do so.
In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.
Cool endangered receptacles with water spray.
Flammability Classification: (defined by 29 CFR 1910.1200) Explosive. Can explode under fire conditions.
Individual devices will randomly explode. Mass explosion of multiple devices is possible under certain conditions. Burning material may produce toxic and irritating vapors. In unusual cases, shrapnel may be thrown from exploding

devices under containment. See 2012 Emergency response Guidebook for further information.

Section 6, Accidental release measures

Prolonged exposure to smoke generated during the shooting of this device may cause respiratory irritation, difficulty in breathing, headaches, nausea and irritation of eyes and may result in vomiting.

Carefully pick up spills with non-sparking and non-static producing tools. Supervision only by a person knowledgeable in explosives. Avoid skin contact. In case of contact with skin, wash hands immediately.

· Personal precautions, protective equipment and emergency procedures
Wear protective equipment. Keep unprotected persons away.
Remove persons from danger area.
Ensure adequate ventilation.
Isolate area and prevent access.
· Environmental precautions
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· Methods and material

Section 7, Handling and storage

· Handling

· Precautions for safe handling:
Handle with care. Avoid jolting, friction and impact.
Restrict the quantity stored at the work place.
Keep out of reach of children.
· Information about protection against explosions and fires:
In case of fire: Evacuate area.
Explosion risk in case of fire.
Keep away from sparks and open flames. - No smoking.
Emergency cooling must be available in case of nearby fire.
· Conditions for safe storage, including any incompatibilities
· Conditions to Avoid: No open items, smoking and moisture in the vicinity of stored fireworks, avoid friction and impact.
· Incompatibility: Do not allow fireworks to get wet

· Storage

Store in a cool dry place, humidity should preferably be less than 70%. Avoid

extreme temperatures. In particular sub-zero temperatures where freezing and re-thaw can alter the performance of the article.
· Requirements to be met by storerooms and receptacles:
Avoid storage near extreme heat, ignition sources or open flame.
· Information about storage in one common storage facility:
Store in accordance with local/regional/national/international regulations.
Store away from foodstuffs.
Store away from flammable substances.
· Further information about storage conditions:
Store in cool, dry conditions in well sealed receptacles.
Store locked up.

Section 8, Exposure controls/personal protection
Eye Protection: None.
Respiratory Protection: None.
Skin Protection: Metal free and non-static producing clothes.
Other Protection: None.
Ventilation Recommended: Not required in open, unconfined areas.
· Control parameters
· Components with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· Exposure controls
· Personal protective equipment:
· General protective and hygienic measures:
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Wash hands before breaks and at the end of work.
· Engineering controls: Provide adequate ventilation.
Breathing equipment: Not required under normal conditions of use.
· Protection of hands: When needed, wear gloves for protection against mechanical hazards.
· Eye protection:
Safety glasses
Follow relevant national guidelines concerning the use of protective eyewear.
· Body protection: When needed, wear protective clothing for protection against mechanical hazards.
· Limitation and supervision of exposure into the environment
No relevant information available.
· Risk management measures

Organizational measures should be in place for all activities involving this product.

Section 9, Physical and chemical properties

Solubility in Water: Slight
Appearance and Odor: All pyrotechnic composition is contained in a cardboard casing. Usually they are cardboard balls or cardboard tubes individually or in a group combination.

Hazardous Decomposition Products: Smoke generated during the use of these devices may contain small amount of Carbon Monoxide, Hydrogen Sulfite and Nitrogen Oxides. Avoid prolonged inhalation of smoke.

Section 10, Stability and reactivity

Stability: Stable
Thermal Stability Test Results: The test was performed on the Lidu Display Fireworks finished items. The device did not ignite, explode, or undergo any significant decomposition during heating at 75°C (167°F) for 48 hours.

Hazardous Polymerization: Will Not Occur

Chemical stability:

· Thermal decomposition / conditions to be avoided: Risk of explosion if heated under confinement.
· Possibility of hazardous reactions Explosive; fire, blast or projection hazard. Toxic fumes may be released if heated above the decomposition point. Reacts with strong acids and alkali.
· Conditions to avoid Excessive heat.
· Sources of ignition: sparks, open flame, incompatible materials
· Incompatible materials Oxidizers, strong bases, strong acids
· Hazardous decomposition products
Carbon monoxide and carbon dioxide
Nitrogen oxides
Sulfur oxides (SOx)

Section 11, Toxicological information

-Information on toxicological effects
--Acute toxicity:
-LD/LC50 values that are relevant for classification: None.

-Primary irritant effect:
-On the skin:
Not a skin irritant in unused form. Vapors/particles from used product are possibly irritating to skin.
-On the eye:
Not an eye irritant in unused form. Vapors/particles from used product are possibly
Inhalation: Yes, when shooting. (Refer to above Section 6)
Skin: No.
Ingestion: No.
· Probable route(s) of exposure:
Skin contact.
Eye contact.
Inhalation.
· Acute effects (acute toxicity, irritation and corrosivity):
Danger of blast or crush-type injuries.
Risk of thermal burns.
· Repeated dose toxicity: From product as supplied: None.
· CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)
· Germ cell mutagenicity: Based on available data, the classification criteria are not met.
· Carcinogenicity: Based on available data, the classification criteria are not met.
· Reproductive toxicity: Based on available data, the classification criteria are not met.
· STOT-single exposure: Based on available data, the classification criteria are not met.
· STOT-repeated exposure: Based on available data, the classification criteria are not met.
· Aspiration hazard: Based on available data, the classification criteria are not met.

Section 12, Transport information

The local inspection bureau spot check every batch of cargos before any shipments. Then issue commodity inspection certificate and dangerous goods transport package identification for us to declare to the customs.

The containers usually ship to loading port by truck or by barge. Next they will be loaded to the vessel shipping to port of discharge by sea, then ship to place of delivery by rail. At last the consignee will pick it up by truck after finish customs clearance.
UN-Number
· DOT, ADR, IMDG UN0335

· IATA FORBIDDEN
· UN proper shipping name
· DOT, ADR, IMDG Fireworks
· IATA FORBIDDEN
· Transport hazard class(es)
· **DOT**



· Class 1.3
· Label 1.3G
· **ADR**



· Class 1.3
· Label 1.3G
EMS Number: F-S,B-X
· Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Not applicable.

Section 13 Ecological information
· **Toxicity**
· **Aquatic toxicity** No relevant information available.
· **Persistence and degradability** No relevant information available.
· **Bioaccumulative potential:** May be accumulated in organism
· **Mobility in soil:** No relevant information available.
· **Other adverse effects** No relevant information available.

Section 14 Disposal considerations
· Waste treatment methods
· Recommendation:
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
Incinerate in accordance with local, state and federal regulations.
The user of this material has the responsibility to dispose of unused material, residues and containers in
compliance with all relevant local, state and federal laws and regulations regarding treatment, storage

and disposal for hazardous and nonhazardous wastes. Residual materials should be treated as
hazardous.

Section 15 Regulatory information

· Safety, health and environmental regulations/legislation specific for the substance or mixture
· United States (USA)
· SARA
· Section 313 (Specific toxic chemical listings): Contact manufacturer.
· TSCA (Toxic Substances Control Act)
All ingredients are listed.
· Proposition 65 (California)
· Chemicals known to cause cancer: Contact manufacturer.
· Chemicals known to cause reproductive toxicity for females: Contact manufacturer.
· Chemicals known to cause reproductive toxicity for males: Contact manufacturer.
· Chemicals known to cause developmental toxicity: Contact manufacturer.
· Carcinogenic categories
· EPA (Environmental Protection Agency): None of the ingredients are listed.
· IARC (International Agency for Research on Cancer): Contact manufacturer.
· NIOSH-Ca (National Institute for Occupational Safety and Health): Contact manufacturer.

Section 16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.
· Abbreviations and acronyms:
ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
CAS: Chemical Abstracts Service (division of the American Chemical Society)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 04/25/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Kristy Wolfe	
Ryder, Rosacker, McCue & Huston 509 W. Koenig St. Grand Island NE 68801	PHONE (A/C, No, Ext): (308) 382-2330	FAX (A/C, No): (308) 382-7109
	E-MAIL ADDRESS: info@ryderinsurance.com	
	INSURER(S) AFFORDING COVERAGE	NAIC #
	INSURER A : Auto-Owners	10190
INSURED	INSURER B :	
Wetzel Pyrotechnics, Kevin Wetzel dba 125 Eagleton Cir Moyock NC 27958	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	COMMERCIAL GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ CLAIMS-MADE ☐ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
							MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$
	☐ POLICY ☐ PRO-JECT ☐ LOC						PRODUCTS - COMP/OP AGG	$
	OTHER:							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO						BODILY INJURY (Per person)	$
	☐ OWNED AUTOS ONLY ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ONLY ☐ NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	☐ UMBRELLA LIAB ☐ OCCUR						EACH OCCURRENCE	$
	☐ EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
X	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N						X PER STATUTE ☐ OTH-ER	
X	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? ☐ (Mandatory in NH)	N / A		69IOU4N31960423	04/24/2023	04/24/2024	E.L. EACH ACCIDENT	$ 100,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 100,000
							E.L. DISEASE - POLICY LIMIT	$ 500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER

Office of State Fire Marshal
1202 Mail service Center

Raleigh, NC 27699-1202

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE <MM>

© 1988-2015 ACORD CORPORATION. All rights reserved.

The ACORD name and logo are registered marks of ACORD

Journal Proof Report

Journal Number: 901 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165602-562000	Grant Expenditures				$25000.00
BUA	1165602-562000 E-X2412 -SOA -TRANS -Medical	Grant Expenditures			$25000.00	
			Journal 2024/5/901	Total	$25000.00	$25000.00

Journal Proof Report

Journal Number: 902 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165600-562000	Grant Expenditures				$29500.00
BUA	1165600-562000 E-X2411 -SOA -PrgmSuppl -H & HI	Grant Expenditures			$29500.00	
			Journal 2024/5/902	Total	$29500.00	$29500.00

Journal Proof Report

Journal Number: 903 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165600-562000	Grant Expenditures				$45000.00
BUA	1165600-562000	Grant Expenditures			$28300.00	
	E-X2410 -SOA -Salaries -SalReg					
BUA	1165600-562000	Grant Expenditures			$9078.00	
	E-X2410 -SOA -Salaries -Sal-PTorEH					
BUA	1165600-562000	Grant Expenditures			$2245.00	
	E-X2410 -SOA -Fringe Ben-FICA					
BUA	1165600-562000	Grant Expenditures			$525.00	
	E-X2410 -SOA -Fringe Ben-Medicare					
BUA	1165600-562000	Grant Expenditures			$3654.00	
	E-X2410 -SOA -Fringe Ben-Retirement					
BUA	1165600-562000	Grant Expenditures			$566.00	
	E-X2410 -SOA -Fringe Ben-401-K Reti					
BUA	1165600-562000	Grant Expenditures			$632.00	
	E-X2410 -SOA -Fringe Ben-WorkComp					
			Journal 2024/5/903	Total	$45000.00	$45000.00

Journal Proof Report

Journal Number: 910 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165603-562000	Grant Expenditures				$2100.00
BUA	1165603-562000 E-X2414 -SOA -OfficeSupp-NonCapFF&E	Grant Expenditures			$2100.00	
			Journal 2024/5/910	Total	$2100.00	$2100.00

Journal Proof Report

Journal Number: 911 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165604-562000	Grant Expenditures				$5000.00
BUA	1165604-562000 E-X2413 -SOA -TRANS -General	Grant Expenditures			$5000.00	
			Journal 2024/5/911	Total	$5000.00	$5000.00

Journal Proof Report

Journal Number: 912 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165606-562000	Grant Expenditures				$133620.00
BUA	1165606-562000	Grant Expenditures			$100000.00	
	E-X2415 -SOA -Generator -Generator					
BUA	1165606-562000	Grant Expenditures			$33620.00	
	E-X2415 -SOA -OfficeSupp-NonCapFF&E					
			Journal 2024/5/912	Total	$133620.00	$133620.00

Journal Proof Report

Journal Number: 913 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	1165610-562000	Grant Expenditures				$2500.00
BUA	1165610-562000 E-X2416 -SOA -FCSP -Vouchers	Grant Expenditures			$2500.00	
			Journal 2024/5/913	Total	$2500.00	$2500.00

Journal Proof Report

Journal Number: 80 Year: 2024 Period: 6 Description: Sheriff Reference 1: 224 Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	4908100-599110	Contingency-Capital Outlay				$16174.26
BUA	4908100-598000	Transfers to Other Funds			$16174.26	
BUA	1104310-551000	Capital Outlay-Equipment			$16174.26	
BUA	1104310-398400	Transfers from Other Funds-CPF				$16174.26
			Journal 2024/6/80	Total	$32348.52	$32348.52

Journal Proof Report

Journal Number: 81 Year: 2024 Period: 6 Description: Reference 1: Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	1104131-512100	Salaries and Wages				$3057.00
BUA	1104131-512800	Bonus Pay			$3057.00	
			Journal 2024/6/81	Total	$3057.00	$3057.00

Journal Proof Report

Journal Number: 915 Year: 2024 Period: 5 Description: finance Reference 1: 38 Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	2154328-557000 E-ARPA -RevReplace-Fac Serv -Hwy117Fenc	Capital Outlay-Land			$35483.00	
BUA	2154328-335000-ARPA	Grant Revenues				$35483.00
			Journal 2024/5/915	Total	$35483.00	$35483.00

Journal Proof Report

Journal Number: 82 Year: 2024 Period: 6 Description: EMS Reference 1: Reference 2: Reference 3:

Source	Account Formatted Project String	Account Description	Line Description	OB	Debit	Credit
BUA	2154328-551000 E-ARPA -EMS -Defib/Mon -	Capital Outlay-Equipment			$110481.00	
BUA	2154328-551000 E-ARPA -EMS -PPE -	Capital Outlay-Equipment			$29782.00	
BUA	2154328-551000 E-ARPA -EMS -UTV -	Capital Outlay-Equipment			$19186.68	
BUA	2154328-551000 E-ARPA -EMS -SKED -	Capital Outlay-Equipment			$4285.00	
BUA	2154328-551000 E-ARPA -EMS -Trailer -	Capital Outlay-Equipment			$3360.00	
BUA	2154328-335000-ARPA	Grant Revenues				$167094.68
			Journal 2024/6/82	Total	$167094.68	$167094.68

Journal Proof Report

Journal Number: 916 Year: 2024 Period: 5 Description: Reference 1: Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	1265300-512200	Overtime-FT			$1247.19	
BUA	1265300-512100	Salaries and Wages				$1247.19
			Journal 2024/5/916	Total	$1247.19	$1247.19

Journal Proof Report

Journal Number: 83 Year: 2024 Period: 6 Description: Reference 1: Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	1315124-512800	Bonus Pay				$1000.00
BUA	1315124-525100	Vehicle Supplies-Fuel/Diesel			$1000.00	
			Journal 2024/6/83	Total	$1000.00	$1000.00

Journal Proof Report

Journal Number: 84 Year: 2024 Period: 6 Description: finance Reference 1: 220 Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	4908100-599110	Contingency-Capital Outlay				$198000.00
BUA	4908100-598000	Transfers to Other Funds			$198000.00	
BUA	1104260-558000	Capital Out-Bldg Struct & Impr			$285236.00	
BUA	1104260-398400	Transfers from Other Funds-CPF				$198000.00
BUA	1100000-399100	Fund Balance Appropriated				$87236.00
			Journal 2024/6/84	Total	$483236.00	$483236.00

Journal Proof Report

Journal Number: 917 Year: 2024 Period: 5 Description: HD Reference 1: 219 Reference 2: Reference 3:

Source	Account	Account Description	Line Description	OB	Debit	Credit
BUA	1315153-526100	Office Supplies-NonCaptl FF&E			$1125.00	
BUA	1315110-399100	Fund Balance Appropriated				$1125.00
			Journal 2024/5/917	Total	$1125.00	$1125.00