

TRANSPORTATION EFFECT AND ROUTE EVALUATION STUDY

FOR

Hillcrest Solar Project

Green Township, Brown County, Ohio

Developer:



Published: June 2017

Prepared By:



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Appendix A

Exhibit 1: Site Location/Road Study Map

Exhibit 2: Road Width and Conditions

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Appendix D – Areas of Concern Photos and Descriptions

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I. Project Overview

Fisher Associates, P.E., L.S., L.A., D.P.C (FA) has been contracted by Open Road Renewables to complete a Transportation Study for the proposed Hillcrest Solar Project. This study has been prepared to satisfy the relevant portions of the Ohio Power Siting Board (OPSB) requirements specified in the Ohio Administrative Code, Sections 4906-4-06(F)(3) and 4906-4-06(F)(4).

Section 4906-4-06(F)(3) states: *“The applicant shall evaluate and describe the anticipated impact to roads and bridges associated with construction vehicles and equipment delivery. Describe measures that will be taken to improve inadequate roads and repair roads and bridges to at least the condition present prior to the project.”*

Section 4906-4-06(F)(4) states: *“The applicant shall list all transportation permits required for construction and operation of the project, and describe any necessary coordination with appropriate authorities for temporary or permanent road closures, lane closures, road access restrictions, and traffic control necessary for construction and operation of the proposed facility.”*

The Hillcrest Solar Project is located in Green Township, Brown County, Ohio as depicted on the location map in Appendix A, Exhibit 1. The project area is highlighted on the exhibits provided in Appendix A. The developable area is approximately 1,650 acres, which will be composed of four (4) to five (5) large groups of solar panels. The developable area estimation includes the open space area within a 20 foot setback of the project area boundary.

A. Transportation Access Points

All construction equipment, aggregate, supplies, and general construction traffic could approach the project area from any direction. Unless authorized by the developer, this traffic will use the existing state routes until it reaches the project’s designated public roads. These state routes are US Route 68, which runs in a north to south direction just west of the project site and State Route 286, which runs in an east to west direction and bisects the project area.

The jurisdictions of the project’s designated public roads proposed to be used as shown in Appendix B are:

- Brown County – Greenbush East Road
- Green Township – Clements Road, Driver Collins Road, Mount Road, Moon Road, Mobley Road

Based on the project parcels and field study, it is estimated that there will be 25 individual site access points to the solar panels as shown in the exhibits in Appendix A. The arrows depict the access direction (there are 7 instances where access will be on both sides of the road, hence only 18 points are shown on the exhibits). The project will utilize existing field entrances where possible, but in most cases new gravel access roads with culverts will be

constructed. It is assumed that the gravel access roads will be relatively short (about 200 feet) and vehicles will use the existing open space to maneuver around the solar project.

II. Pre-Construction Roadway Characteristics

A. Traffic Volumes and Accident Data

Existing data on vehicle traffic volumes and accidents within the study area was obtained from the ODOT Transportation Information Mapping System (TIMS) and can be found in Appendix C. The Annual Average Daily Traffic (AADT) is listed for the State and county roads, but the local town roads had limited traffic volume data. Detailed capacity analysis was not completed for this study, however, field observation of the transportation network did not reveal any locations where traffic flow and/or capacity appeared to create undue delay for the traveling public.

The table below summarizes the traffic conditions on the roads within the study area.

Roadway Name	Lanes	Total Road Widths	AADT
Greenbush East Road	2	19' – 22.5'	1491
Moon Road	2	15' – 20'	501
Clements Road	2	12' – 17'	-
Driver Collins Road	2	14' – 18.5'	-
Mount Road	2	11.5' – 14'	-
Mobley Road	2	15.5' – 17.67'	-

* AADT = Average Annual Daily Traffic

* Traffic volumes for Greenbush East Road and Moon Road obtained from ODOT Transportation Information Mapping System (TIMS) on 4/11/17. Traffic volumes for Clements Road, Driver Collins Road, Mount Road, and Mobley Road were unavailable.

According to TIMS, between 2013 and 2015, there were eleven (11) accidents along the stretches of Greenbush East Road, Moon Road, Clements Road, Driver Collins Road, Mount Road, and Mobley Road within the transportation study area. Of the eleven (11) accidents, five (5) were at intersections (two (2) at the intersection of US Route 68 and Greenbush East Road, two (2) at the intersection of Greenbush East Road and Moon Road, and one (1) at the intersection of US Route 68 and Clements Road). US Route 68 has a posted speed limit of 55 mph and, therefore, extra caution must be taken while turning onto and off of that highway. Of the eleven (11) total accidents, none were fatal. Therefore, the fatal accident rate (fatal accidents/million vehicle miles) is zero (0) compared to the Ohio rural statewide average fatal accident rate of 1.50 fatal accidents/million vehicle miles between 2013 and 2015 as found on the United State Department of Transportation's National Highway Traffic Safety Administration's website.

B. School Bus Route Information and Mass Transit Systems

The students in the project area attend the Western Brown Local Schools in Mt. Orab. The high school, middle school, and elementary school are all located on the same campus, which is located about 4.5 miles southwest of the project site via US Route 68 southbound and West Main Street. Due to the distance from the schools and lack of sidewalks, most of the students

are picked-up/dropped-off at their place of residence. The number of stops and buses within the project area is limited due to the low density of houses within and adjacent to the project area. Because the majority of the project activities and deliveries will likely occur during the middle of the day, the impacts to the local school bus routes should be minimal.

There are no rail or bus mass transit systems in the project area.

C. Emergency Service Responder Information

Brown County is served by Mercy Health – Mount Orab Medical Center and Mercy Health – Clermont Hospital. These emergency services are located within 15 miles of the project southwest of the project site. They can be reached by travelling south on US Route 68 and west on Route 32.

An Emergency Response Plan for the project will be implemented which will include procedures (preconstruction through project operation) for fire and emergency services. This plan will outline on-site equipment and the procedures for fire suppression, medical and weather emergency evacuation as well as other critical areas. In addition, regularly scheduled meetings will be held with local emergency providers. As with any large-scale development, project components will meet all state and federal safety and fire codes.

D. Traffic Routes Load Bearing and Structural Rating Information

A field review of existing conditions along the roads within the project area was conducted by Fisher Associates on April 28-29, 2017. Data collected during the site visit as depicted in Appendices A and D, includes:

- Bridge and road load postings
- Road widths, type, and condition
- Culvert cover and condition
- Posted signs of caution

Bridge and Road Load Posting Restrictions

There are no posted loading restrictions to the bridges located on the transport route. As shown in Appendix B, along the transportation study roads, there are two (2) bridges on Greenbush East Road (#0833010 and #0833029), one (1) bridge on Mount Road (#0831700), and one (1) bridge on Moon Road (#0834971). These bridges all appear to be in good condition.

On Greenbush East Road, there is a weight limit reduction of 50% effective between February 1st and June 1st.

Road Surface Type and Widths

As depicted on the Road Width and Conditions Exhibit (Appendix A, Exhibit 2), the road surface types along the transport route are all asphalt. The table below summarizes the road conditions along the transport route.

Roadway Name	Total Road Widths	Road Condition
Greenbush East Road	19' – 22.5'	Fair, small cracking and potholes
Moon Road	15' – 20'	Excellent, recently paved
Clements Road	12' – 17'	Excellent, recently paved
Driver Collins Road- between Rt 286 & Upper Five Mile East Road	14' – 18.5'	Fair, small cracking
Driver Collins Road- between Greenbush East Road & Rt 286	14' – 18.5'	Good
Mount Road	11.5' – 14'	Fair, small cracking
Mobley Road	15.5' – 17.67'	Fair, small cracking

There are some minor existing road cracking, potholes, or pavement repair locations, which are depicted on the Areas of Concern Exhibit (Appendix A, Exhibit 3) and corresponding photographs in Appendix D. The biggest area of concern is the cracking and potholes on Driver Collins Road, which may be caused by subgrade conditions. The remainder of the transport roads do not appear to exhibit any underlying issues, but rather normal aging that requires routine maintenance. Road use agreements will be prepared with the county prior to construction to address any potential issues with the existing roads; however, there does not seem to be any significant concerns to the existing roads from a transportation perspective.

Culvert Cover and Conditions

As provided on the Areas of Concern Exhibit (Appendix A, Exhibit 3) and corresponding photographs in Appendix D, there are a few existing culverts that have a cause for concern and further analysis might be needed for possible culvert replacement or upgrades.

- Clements Road: 10" x 16" plastic pipe with less than one (1) foot of cover where the road dead ends into field (Area of Concern 1)
- Greenbush East Road: 60" concrete pipe with less than one (1) foot of cover and touch up asphalt (Area of Concern 3)
- Driver Collins Road and Mount Road: Small cracking in the asphalt over a 36" concrete pipe (Area of Concern 4)
- Driver Collins Road: 2-15" metal rusted pipes with less than one (1) foot of cover and asphalt deformation above pipes (Area of Concern 6)
- Mount Road: Cracking in the asphalt over a 24" concrete pipe with less than one (1) foot of cover (Area of Concern 10)

Road use agreements will be prepared with the county prior to construction to address any potential issues with existing culverts.

Posted Signs of Caution

As depicted on the Areas of Concern Exhibit (Appendix A, Exhibit 3) and corresponding photographs in Appendix D, there are 3 “roadway prone to flooding” signs on Moon Road and 1 “roadway prone to flooding” sign on Mount Road. During and after heavy storm events, construction vehicles traveling along these roads should use caution if the roads are covered with stormwater.

Overhead Clearance

Because the construction vehicles for the project will be legal heights and no intersection improvements are proposed, there will not be any issues with vehicle clearance to overhead electric crossings and tree overhang locations.

III. Trip Generation Characteristics

A. Vehicle Trips Frequency

A truck load estimate calculation during the construction phase is included in Appendix E. Any assumptions in the calculations are based on anticipated solar project loads. Based on the site visit, potential locations for proposed access roads off of the transport roads are depicted on the exhibits in Appendix A. As the construction traffic volumes do not appear to exceed capacities, the roadways should not be significantly impacted by standard construction traffic.

During operation and maintenance, the facility will not generate a significant volume of traffic with the anticipation of only a few pickup trucks each day.

IV. Traffic and Transportation Impacts of the Facility

A. Projected Future Traffic Conditions

While construction vehicles are traveling along project area and delivery route roadways, the existing traffic may experience minor delays to allow for the safe passage of these vehicles.

During development of the road use agreements, the Applicant will coordinate with appropriate authorities to determine applicable thresholds and procedures for implementing temporary or permanent road closures, lane closures, road access restrictions, and traffic control.

During operation and maintenance, the facility will not generate a significant volume of traffic. Therefore, any projected additional future traffic will be negligible.

B. Adequacy of the Road System to Accommodate Projected Traffic

Truck load assumptions are based on typical solar projects that will need to be finalized in conjunction with the anticipated county road use agreements. Roads with low strength and/or poor surface conditions will need to be improved prior to receiving construction traffic. The biggest area of concern is the cracking and potholes on Driver Collins Road, which may be a subgrade issue. The rest of the transport roads do not appear to exhibit an underlying issue, but just normal aging that requires routine maintenance. During development of the road use agreements, the applicant will coordinate with the county if any pre-construction road maintenance will be needed. However, there does not seem to be any significant concerns to the existing roads from a transportation perspective.

As shown in Appendix E, the trucks assumed to be used for the project are WB-50's (8.5 ft wide x 42.5 ft long x 10 ft high) for solar panel delivery and standard dump trucks for gravel delivery. An estimation of 2,100-2,600 trucks will be needed for the project, but none of the vehicles will be oversized or overweight. Roads will need to be monitored during construction and reviewed afterwards to determine the required repairs, if any. Roads will be returned to pre-construction conditions or better. This will likely require some asphalt patching or possibly some asphalt removal, subgrade compaction, and asphalt patching.

During operation and maintenance, the facility will not generate a significant volume of traffic. Therefore, improvements to the road system are not necessary to accommodate projected operations traffic.

C. Traffic and Transportation Mitigation Measures

In conjunction with the anticipated county road use agreements, mitigation measures to address maintenance will be developed as the project's layout is finalized. Final engineering design will be required prior to construction activities to ensure all transportation related impacts have

been addressed to the satisfaction of the local highway departments. High traffic areas will be determined once the engineering layout is determined.

All roads should be monitored during construction for potholing and deterioration of the pavement to ensure they are safe for general construction and local roadway traffic. The volume and weight of both the general construction traffic may cause accelerated distress that could require temporary repair. These temporary repairs/improvements could include repaving with asphalt, temporary traffic signs, etc. and be as a condition of a road use agreement with the county or town. After completion of construction activities, there may be permanent improvements needed due to any damage caused by the high frequency of vehicle traffic (especially on any roads that had temporary repairs made during the construction activities). Repairing the roadways to pre-construction conditions may include using treatments such as oil and stone or hot or cold mix asphalt, which may be required as a condition for a road use agreement. Other repairs will likely require some asphalt patching or possibly some asphalt removal, subgrade compaction, and asphalt patching.

The drainage pipes/culverts along the construction routes that have 1 foot or less of cover may have a potential to be damaged by construction activities causing delays to construction and local traffic. Each pipe should be analyzed during final design of the roadway improvements to determine the amount of cover over the pipe or necessary improvements needed to accommodate the construction traffic. Any improvements needed may be a condition under the road use agreement with the county.

D. Road Use and Restoration Agreements

Because the construction vehicles for the project will be legal heights, widths, and weights, obtaining special hauling permits is not anticipated. Road use agreements may be needed with the county where the local roads are being used for delivery of equipment. Driveway and Utility Permits will be needed with the county and state for proposed access roads or underground collection line road crossings.

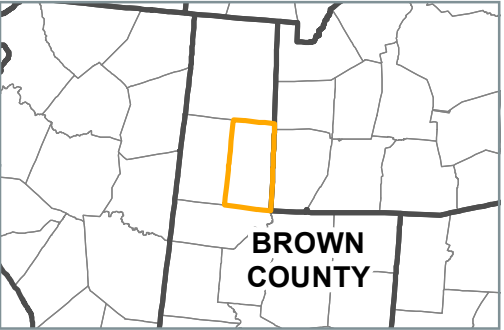
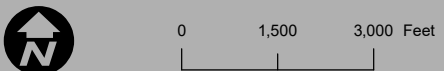
APPENDIX A

EXHIBIT 1 : SITE LOCATION / ROAD STUDY MAP
HILLCREST SOLAR PROJECT
BROWN COUNTY, OH

- ODOT Bridges
- Potential Access Points with Direction
- Transportation Study Roads
- US Highways
- State Highways
- County Highways
- Town Roads
- Other Roads
- Project Area
- Townships
- Counties

Project USGS Quad(s):
Mount Orab, Sardinia

Map Revision Date: 6/13/2017 Map Author: DN



Data Sources:
Roads - ESRI: USA Streetmaps Pro 2013

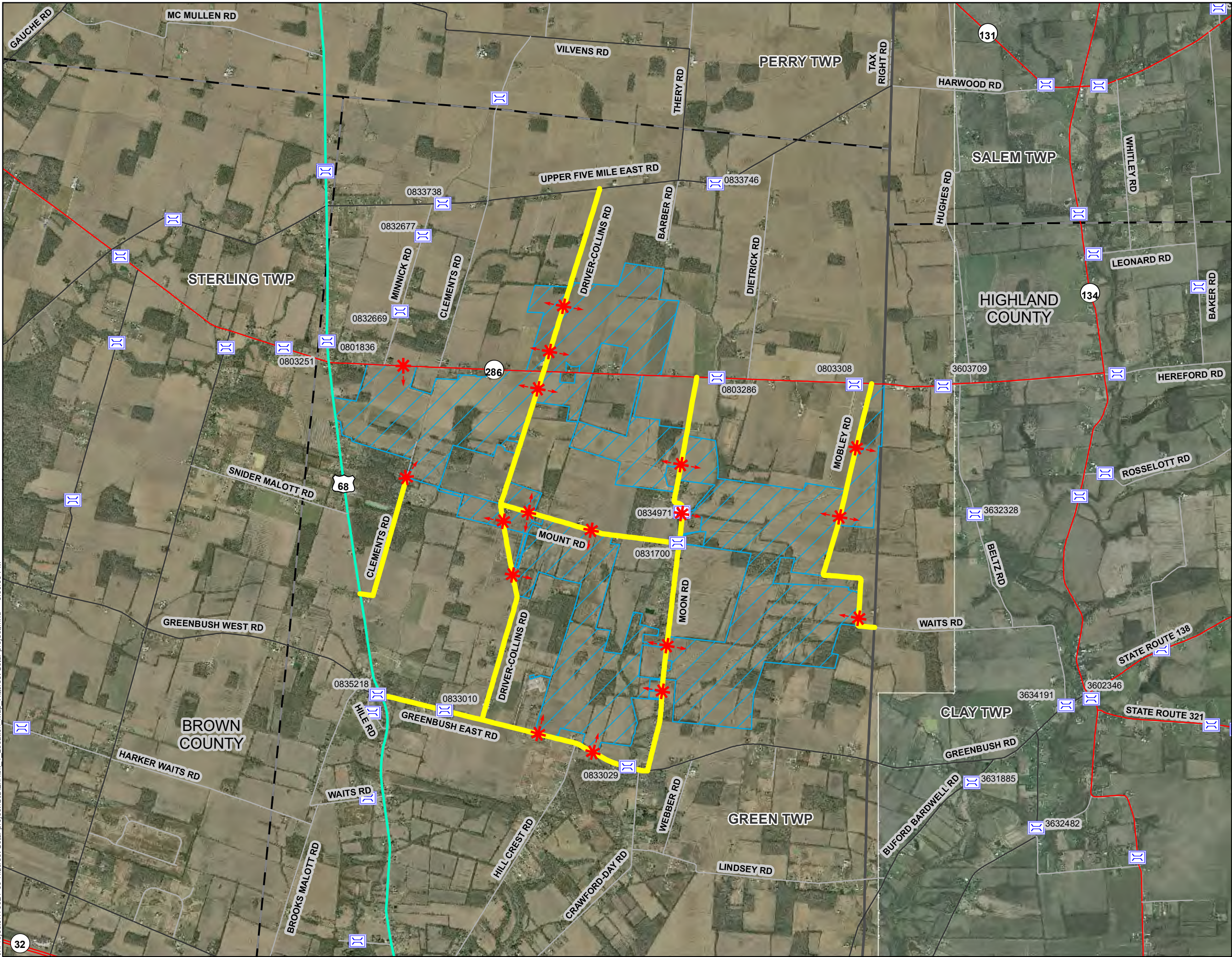
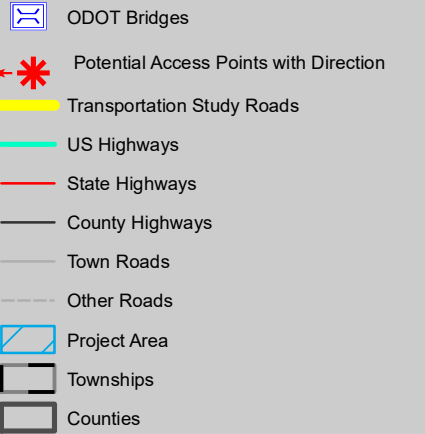



EXHIBIT 2 : ROAD WIDTH AND CONDITIONS
HILLCREST SOLAR PROJECT
BROWN COUNTY, OH



Project USGS Quad(s):
Mount Orab, Sardinia

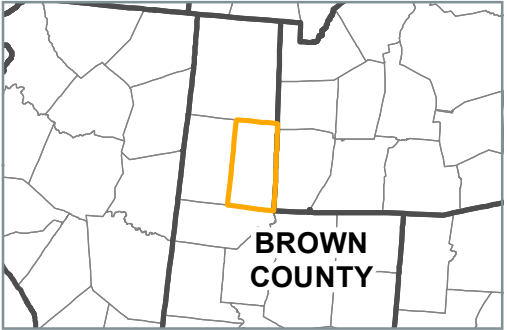
Map Revision Date: 6/13/2017 Map Author: DN



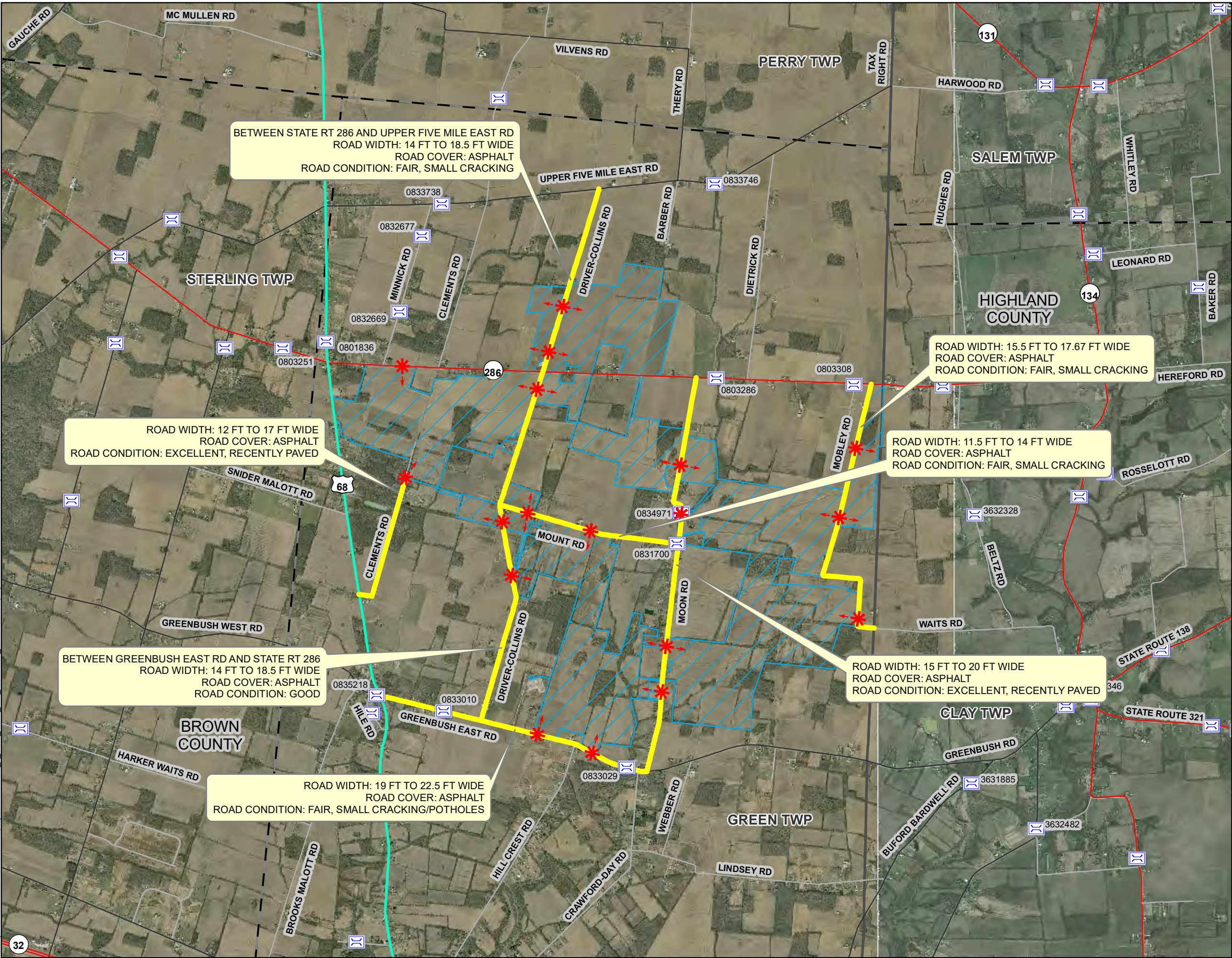
0

1,500

3,000 Feet



Data Sources:
Roads - ESRI: USA Streetmaps Pro 2013



- 1) Road dead ends into field. In field, there is a 10"x16" plastic pipe with very little cover.
2) Small asphalt cracking/potholes/touch-ups along road.
3) 5 ft concrete culvert has little cover and has a touch-up asphalt patch over the culvert.
4) Small cracking over 36 inch concrete pipe at intersection with Mt Rd. Asphalt transition clear at Mt Rd intersection.
5) Road cracking sporadically (in center of road in a few stretches) and potholes between Rt 286 and Upper 5 Mile East Road.
6) 2- 15" metal rusted culverts with little cover and road protruding
7) Small Asphalt repair transition stretch.
8a-8c) 3 "Roadway prone to flooding" signs.
9) Cement strip patchwork over plastic culvert at intersection at Rt 286- culvert cover seems to be ok.
10) Cracking in asphalt over 24 inch concrete pipe with little cover.
11) Minor cracking on sides of road.
12) "Roadway prone to flooding" sign.
13) Small asphalt cracking along road.



EXHIBIT 3 : AREAS OF CONCERN
HILLCREST SOLAR PROJECT
BROWN COUNTY, OH

ODOT Bridges

Potential Access Points with Direction

Hillcrest Solar Areas of Concern FA

Transportation Study Roads

US Highways

State Highways

County Highways

Town Roads

Other Roads

Project Area

Townships

Counties

Project USGS Quad(s):
Mount Orab, Sardinia

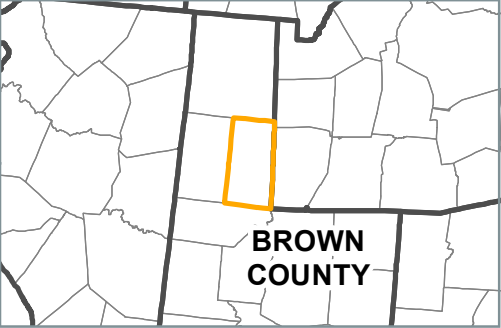
Map Revision Date: 6/13/2017

Map Author: DN

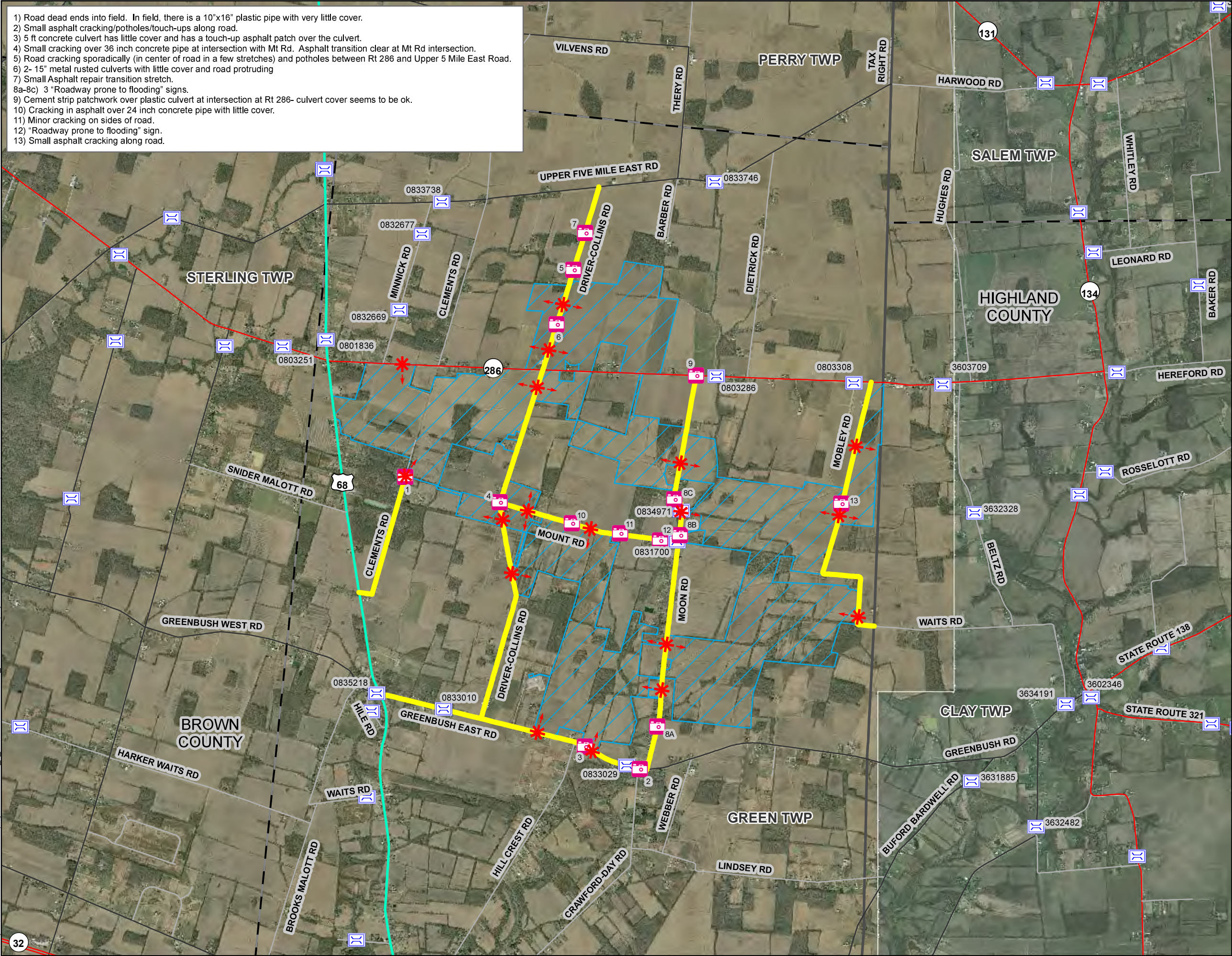
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1,500

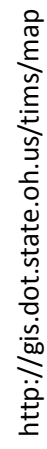
3,000 Feet



Data Sources:
Roads - ESRI: USA Streetmaps Pro 2013

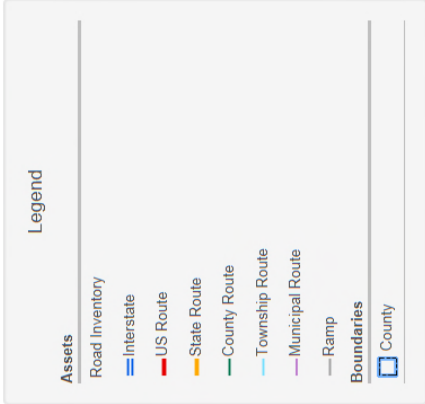
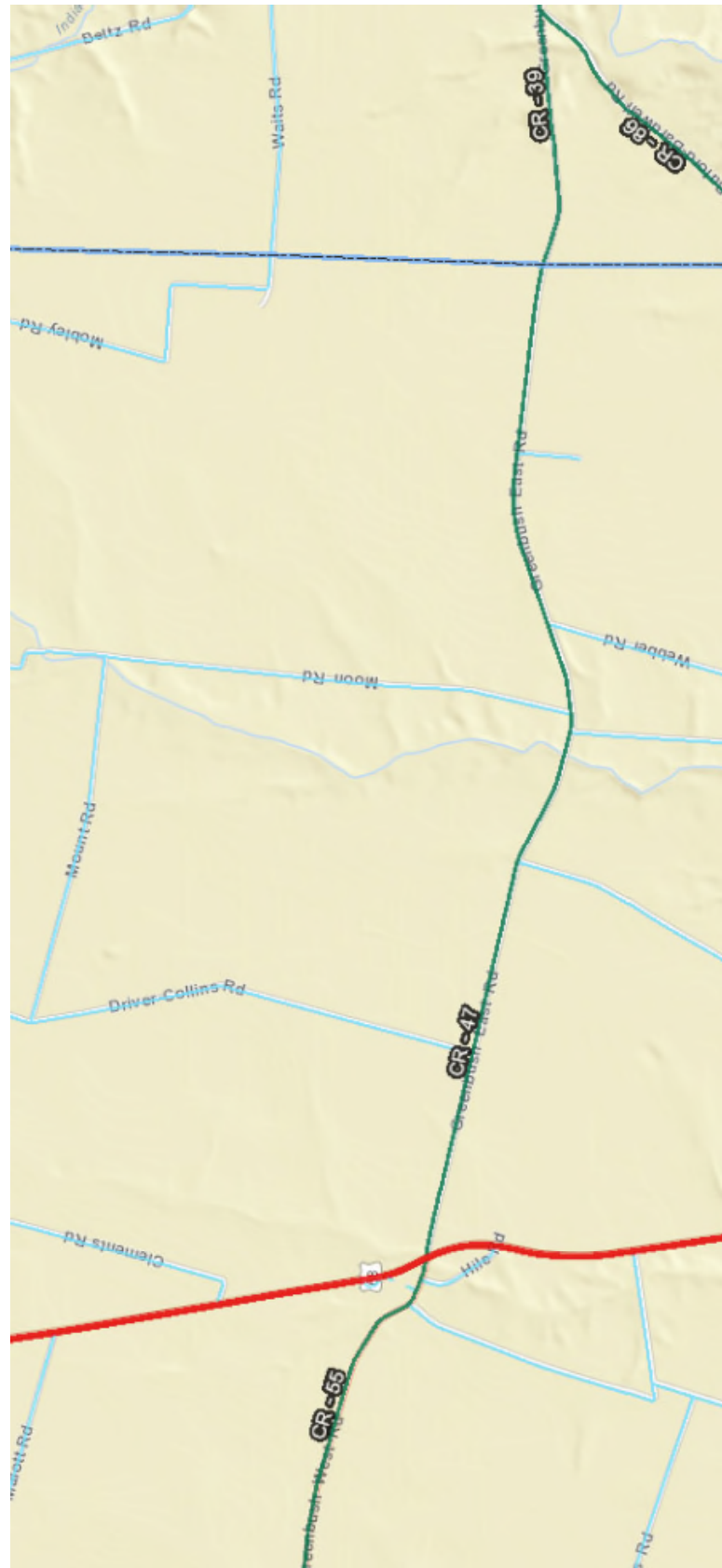


APPENDIX B



<http://gis.dot.state.oh.us/tims/map>

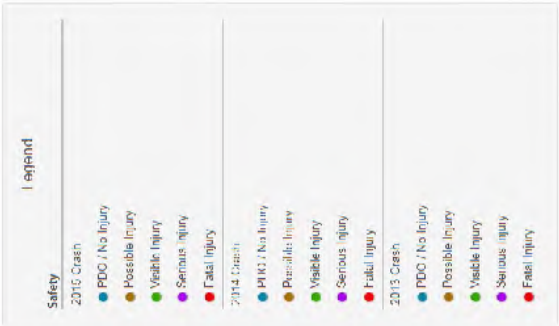
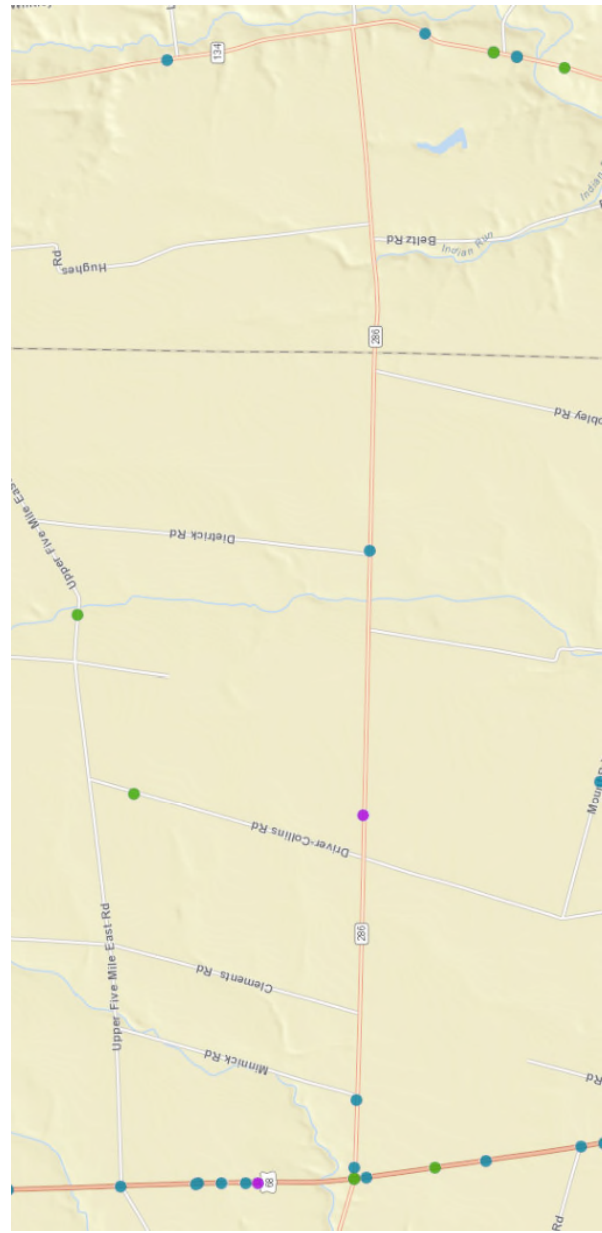
Hillcrest Solar- Road Jurisdiction



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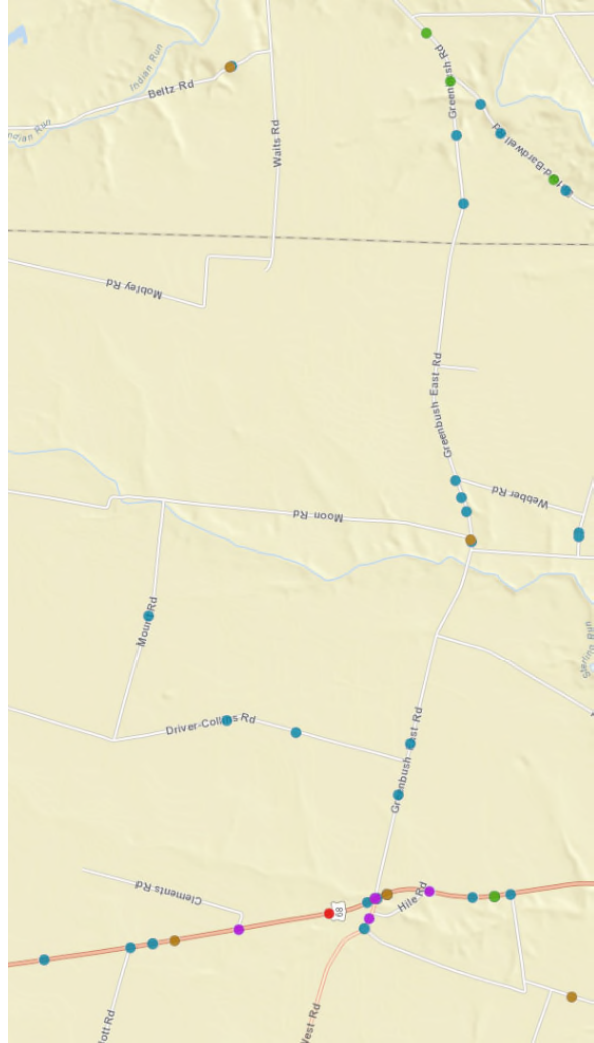
APPENDIX C

Hillcrest Solar- Accident Data



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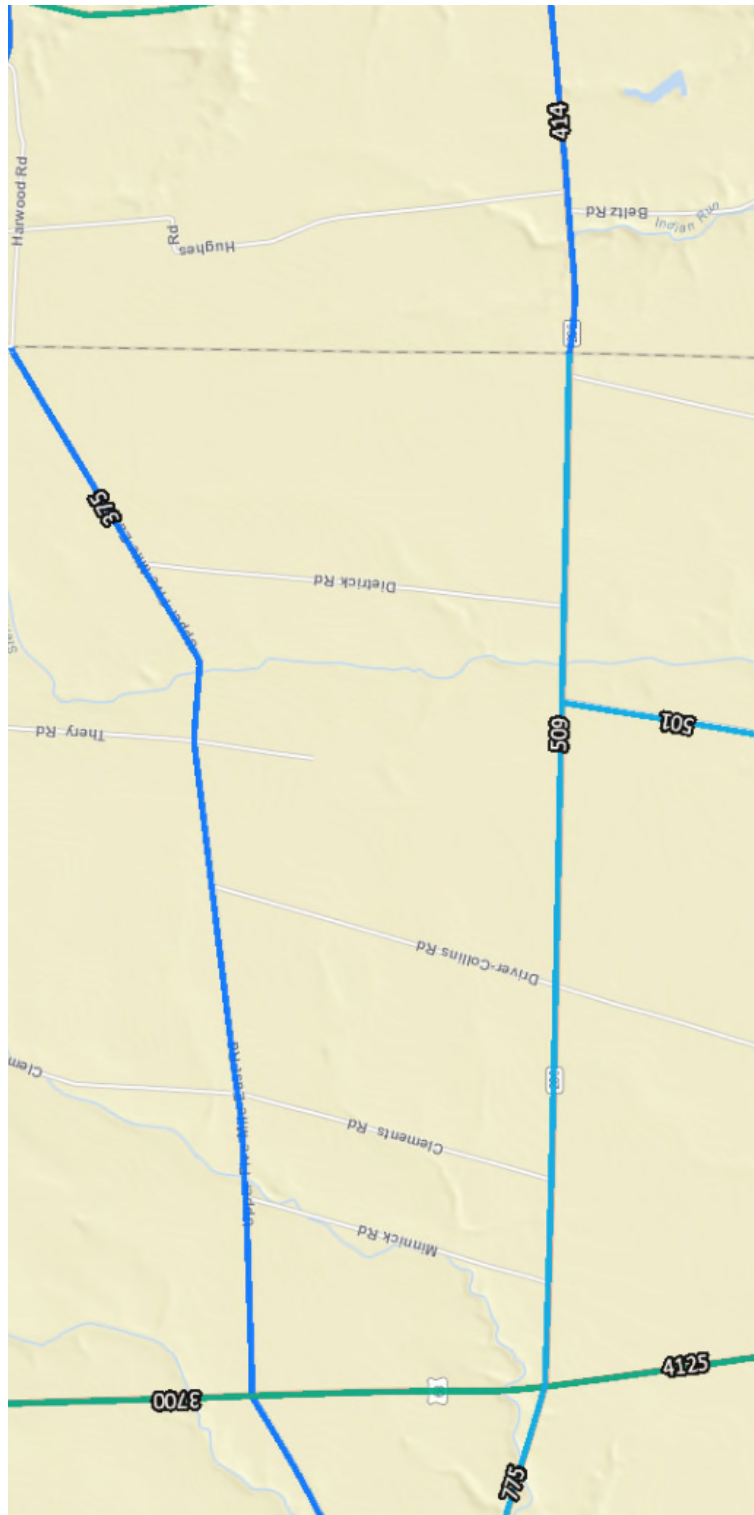
Hillcrest Solar- Accident Data



Legend	
Safety	
2010 Crash	
PDO / No Injury	Blue dot
Possible Injury	Yellow dot
Visible Injury	Green dot
Serious Injury	Purple dot
Fatal Injury	Red dot
2014 Crash	
PDO / No Injury	Blue dot
Possible Injury	Yellow dot
Visible Injury	Green dot
Serious Injury	Purple dot
Fatal Injury	Red dot
2013 Crash	
PDO / No Injury	Blue dot
Possible Injury	Yellow dot
Visible Injury	Green dot
Serious Injury	Purple dot
Fatal Injury	Red dot

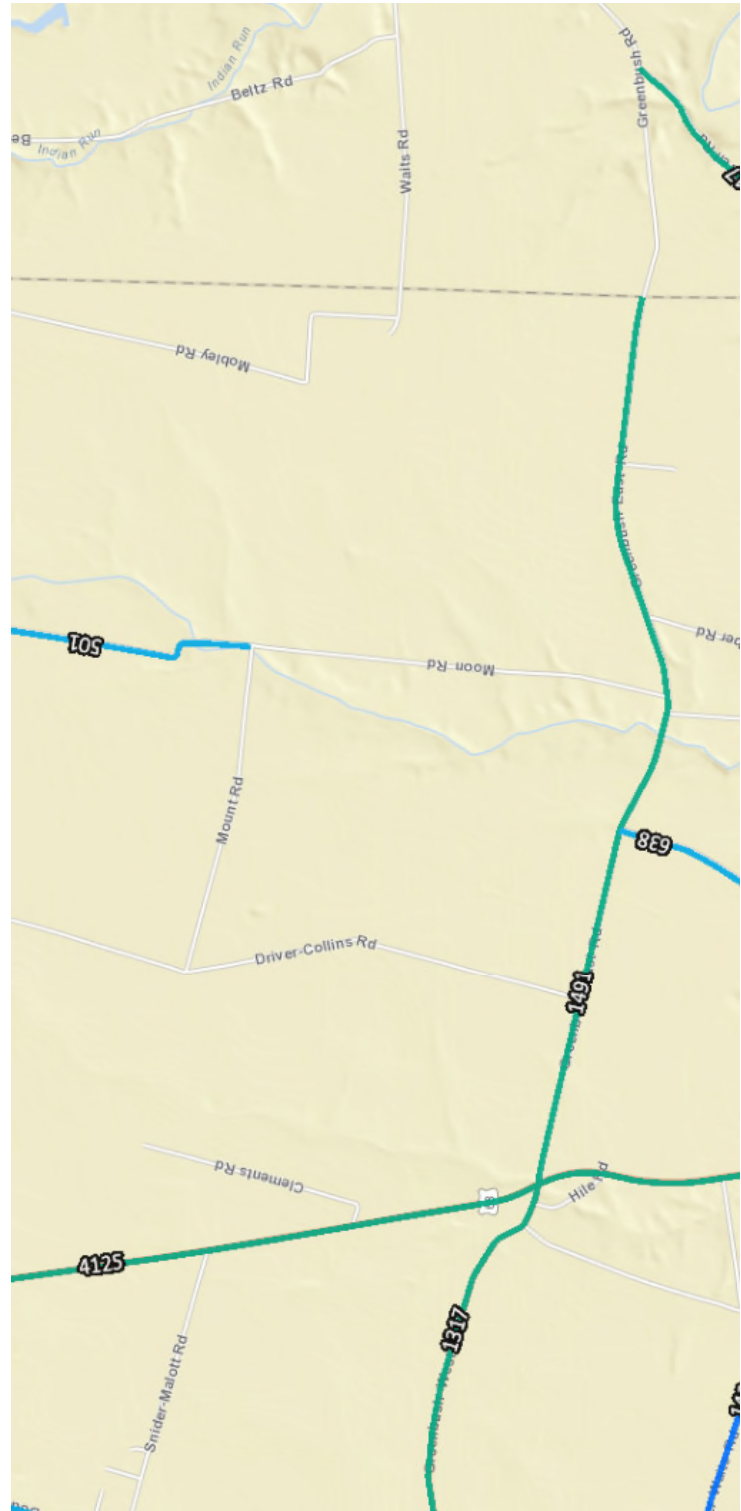
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Hillcrest Solar- AADT



<http://gis.dot.state.oh.us/tims/map>

Hillcrest Solar- AADT



<http://gis.dot.state.oh.us/tims/map>

Hillcrest Solar Existing Accident Data Table
4/14/2017

Route/Road Name	From	To	Town	Total Accidents 2013 - 2015	Average Accidents Per Year	Intersection Accidents	Non-Intersection Accidents	Fatal Accidents	Length of Road (miles)	AADT*	Accident Rate (Accidents/Million Vehicle Miles)	Fatal Accident Rate (Fatal Accidents/Million Vehicle Miles)	Ohio Rural Statewide Avg. Fatal Accident Rate 2013-2015 (Fatal Accidents/Million Vehicle Miles)
Clements Road	Rt 68	Dead End	Green	1	0.33	1	0	0	0.8	N/A	N/A	0.00	1.50
Greenbush East Road	Rt 68	Moon Road	Green	6	2.00	4	2	0	1.7	1491	2.15	0.00	1.50
Driver Collins Road	Greenbush East Road	Upper 5 Mile East Road	Green	3	1.00	0	3	0	2.0	N/A	N/A	0.00	1.50
Moon Road	Greenbush East Road	Rt 286	Green	0	0.00	0	0	0	1.1	501	0.00	0.00	1.50
Mount Road	Driver Collins Road	Moon Road	Green	1	0.33	0	1	0	1.1	N/A	N/A	0.00	1.50
Mobley Road	Rt 286	East Waits Road	Green	0	0.00	0	0	0	1.8	N/A	N/A	0.00	1.50

Note: No accident data was available at this time for local roads besides Moon Road.

APPENDIX D

Area of Concern 1- Clements Road



Road dead ends into field. In field, there is a 10"x16" plastic pipe with very little cover.

Area of Concern 2- Greenbush East Road



Small asphalt cracking/potholes/touch-ups along road.

Area of Concern 3- Greenbush East Road



5 ft concrete culvert has little cover and has a touch-up asphalt patch over the culvert.

Area of Concern 4- Driver Collins Road and Mount Road



Small cracking over 36 inch concrete pipe at intersection with Mt Rd. Asphalt transition clear at Mt Rd intersection.

Area of Concern 5- Driver Collins Road



Road cracking sporadically (in center of road in a few stretches) and potholes between Rt 286 and Upper 5 Mile East Road. Subgrade issues possible.

Area of Concern 6- Driver Collins Road



2- 15" metal rusted culverts with little cover and asphalt deformation above pipes.

Area of Concern 7- Driver Collins Road



Small Asphalt repair transition stretch.

Area of Concern 8- Moon Road



3 "Roadway prone to flooding" signs (see Exhibit 3 for locations 9a, 9b, and 9c).

Area of Concern 9- Moon Road and Rt 286



Cement strip patchwork over plastic culvert at intersection at Rt 286- culvert cover seems to be ok.

Area of Concern 10- Mount Road



Cracking in asphalt over 24 inch concrete pipe with little cover.

Area of Concern 11- Mount Road



Minor cracking on sides of road.

Area of Concern 12- Mount Road



"Roadway prone to flooding" sign.

Area of Concern 13- Mobley Road



Small asphalt (alligator) cracking along road. Subgrade and drainage issues possible.

APPENDIX E

Hillcrest Solar- Truck Load Estimation
6/16/2017

Solar Panel Truck Estimation

Developable Area	1650 acres
Solar Panels/Acre	850
Solar Panels Assumed for Project	1402500
Panel Size	3.6 cf
Truck Volume Capacity (WB-50)	3613 cf
Truck Volume Capacity at 90% full	3252 cf
# Solar Panels/Truck (assumed 90% capacity)	903
Trucks Needed for Solar Panel Delivery	1553 trucks

Notes/Assumptions:

1. Developable area estimation includes open space area within 20 ft setback of the project area boundary.
2. Panel size is assumed to be 40" x 77.5" x 2".
3. Solar panels/acre is based off of sample study area, which includes 16 ft wide access between panel rows.
4. Once engineering layout is finalized, solar panel count will be recalculated.
5. WB-50 is the assumed truck for solar panel deliveries. Dimensions assumed to be 8.5' wide x 42.5' long x 10' high with 90% truck capacity.

Gravel Truck Estimation

Number of Access Roads Assumed	25
Length of Access Road	200 ft
Width of Access Road	12 ft
Depth of Gravel for Access Road	0.5 ft
Volume of Each Access Road	1200 cf
Total Gravel Volume of All Access Roads	1111 cy
Trucks Needed for Gravel Delivery	74 trucks

Notes/Assumptions:

1. Once engineering layout is finalized, number, length, width, and depth of access roads will be recalculated.
2. Assumed 15 cy/truck for gravel delivery.

Other Facilities Truck Estimation

Other Facilities	960 trucks
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Notes/Assumptions:

1. Number of trucks assumed for other facilities is based off of the assumption from other solar projects that solar panels make up 60% of the total number of trucks needed for project.

Total Estimation of Trucks for Project	2587 trucks
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OTHER SOLAR FARMS IN THE UNITED STATES INDICATE THAT FOR SOLAR PROJECTS, THERE IS AN AVERAGE OF 17-18 TRUCKS PER MW OF POWER. THE HILLCREST SOLAR PROJECT IS A 125 MW PROJECT. THEREFORE, WE ESTIMATE THAT THERE WILL BE BETWEEN 2100 AND 2600 TRUCKS FOR THE PROJECT.



This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

6/29/2017 3:55:33 PM

in

Case No(s). 17-1152-EL-BGN

Summary: Application - Exhibit E Transportation Study electronically filed by Mr. Michael J. Settineri on behalf of Hillcrest Solar I, LLC