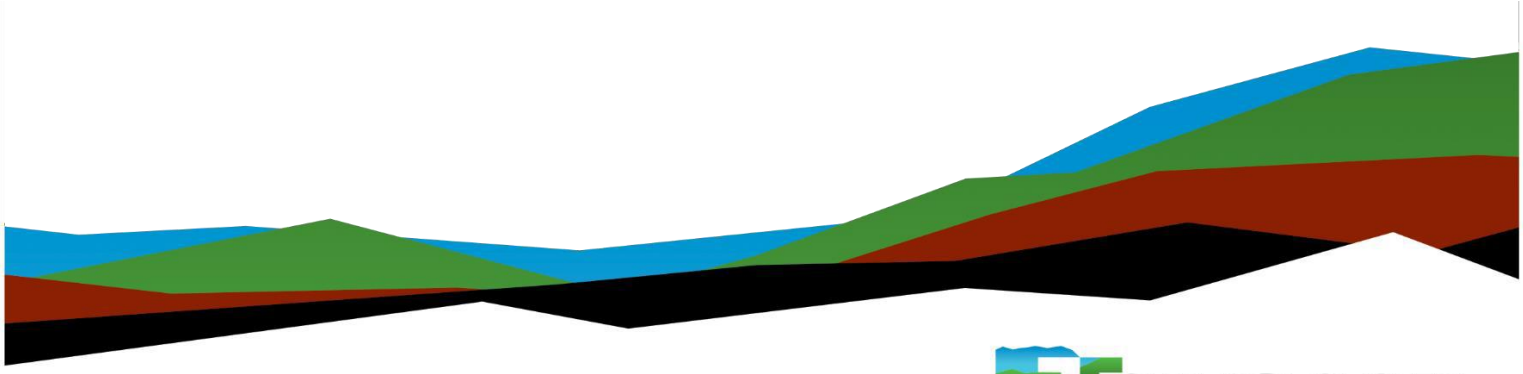
Weirs Creek Solar

Preliminary Mine Desktop Review Report

April 22, 2024 | Terracon Project No. N4245028

Prepared for:

NextEra Energy Resources LLC
700 Universe Boulevard
Juno Beach, Florida 33408



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April 22, 2024

NextEra Energy Resources LLC
700 Universe Boulevard
Juno Beach, Florida 33408

Attn: Ms. Esther Atkinson – Project Manager
E: esther.atkinson@nexteraenergy.com

Re: Preliminary Mine Desktop Review Report
Weirs Creek Solar
Hopkins and Webster Counties, Kentucky
Terracon Project No. N4245028

Dear Ms. Atkinson:

We have completed the scope of Preliminary Mine Desktop Review services for the above referenced project. This report presents the findings of the preliminary desktop study at the proposed Weirs Creek Solar site in Hopkins and Webster Counties, Kentucky.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

Joshua Valentino, PhD, PG
Project Geologist

Paul Burkart, PE
Senior Principal

Introduction

The proposed Weirs Creek Solar site located in Hopkins and Webster Counties, Kentucky was assessed for potential historical mine geohazards underlying the property. The proposed site encompasses approximately 2,270 acres (Exhibit 1). The objective of the desktop review was to identify suspect surface features related to an abandoned underground mine (AUM) which could impact the proposed solar arrays, roadways, and supporting infrastructure. The entirety of the site is mapped as underlain by mineable geologic formations and the historical maps indicate that subsurface mining was prevalent at the site.

Geology and Terrain

Physiography

The proposed Weirs Creek Solar Site is situated within the Highland Rim section of the Interior Low Plateaus Physiographic Province of Kentucky[1,2]. In general, the Interior Low Plateaus range from approximately 380 to 1,200 feet in elevation and comprise primarily rolling plains and eroded/dissected plateaus. This region is almost entirely composed of nearly horizontal beds of sandstone, shale, and limestone dating from the Paleozoic Era (541 to 252 million years ago). The Interior Low Plateaus exist at the southeastern edge of the Central Lowlands, the boundary occurring where the maximum extent of the Pleistocene glaciers reached. They are bordered to the west by the Coastal Plain Province, and to the east and south by the Appalachian Plateaus Province.

Kentucky is divided into state-level physiographic regions, and the Weirs Creek site is located entirely within the Western Coal Field region of Kentucky. The outcrop of Pennsylvanian strata defines the limits of the Western Kentucky Coal Fields, and its counterpart, the Eastern Kentucky Coal Field. The Western Kentucky Coal Field comprises the southern edge of a larger geologic feature called the Illinois or Eastern Interior Basin, which includes the coal fields in Indiana and Illinois. The border of the Western Kentucky Coal Field and the Mississippian Plateau is commonly marked by an

[1]Fenneman, Nevin M. (January 1917). "Physiographic Subdivision of the United States". Proceedings of the National Academy of Sciences of the United States of America. 3 (1): 17 –22.

[2]Fenneman, Nevin M. (1938). Physiography of eastern United States. McGraw-Hill.

escarpment because the thick Pennsylvanian-age sandstones of the region are resistant to erosion. However, because this coal field is not adjacent to the Appalachian Mountains, and the sandstones are less continuous, the escarpment is not as dramatic as along the Cumberland Escarpment of the Eastern Kentucky Coal Field.

Topography

Referencing the USGS catalog of 7.5-minute topographic quadrangles, the entire site is located in the Nebo KY Quadrangle (37087-D6). Based on topographic mapping, the site is relatively level, with an average elevation of 379 feet. The highest elevations are located in areas of low hills on the northeast and southern sections of the site. The absolute highest elevation is at 470 feet at the northeastern corner of the site just south of the Webster and Hopkins County line.

Several streams originate in the uplands in the northern part of the site. Two of these streams leave the site boundaries and appear to end in an area of marsh near the center of the parcel assemblage. Two other streams originate on the northwestern part of the assemblage, and flow south where they flow into man-made drainage channels. Weirs Creek has two branches, both on the south side of the assemblage. The southern branch originates in the uplands on the southeastern part of the site. Both branches are diverted into man-made channels, leaving the southern part of the site where it is bordered by Route 41.

The site land use is primarily agricultural, with areas of row cropping dominating. There are limited areas of forested land, mainly in the central and southwestern sections of the assemblage and also along some of the stream channels.

Based on data obtained from the Kentucky Mine Management Information System (MMIS), there are no reclaimed surface (strip) mines within the parcel boundaries. However, there are several reclaimed mines located to the south and west of the site assemblage.

Maps of the site location and topography are included as Exhibits 1 and 2 at the end of this report.

Geology

The Weirs Creek site is underlain by bedrock formations all dated to the Pennsylvanian Geologic Period. All of the bedrock units mapped[3] at the site are part of the McLeansboro Group, a series of coal-measure cyclothems[4] which are dated to the Upper Pennsylvanian Geologic Period. Lithology of the McLeansboro Group consists of detrital and marine rocks occurring in repetitive sequences. These formations are described from youngest to oldest as follows, and are shown on Exhibit 3.

Shelburn Formation (Psh)

This unit has undergone a number of revisions over the years[5], being formerly called the Lisman Formation, and then the Sturgis Formation. The most recent revision has renamed it the Shelburn Formation, dated to the Upper Pennsylvanian Geologic Period. Regardless of nomenclature, the Shelburn Formation consists of 60 percent siltstone, 20 percent sandstone, 20 percent shale, with incidental occurrences of limestone and coal. The Shelburne is only present in a small area of the southwestern part of the site and is almost entirely mantled by alluvium. It is 240 feet in thickness.

Patoka Formation (Pp)

This unit is the dominant bedrock formation present across the majority of the site, overlying the Shelburn Formation. This unit has also undergone a number of revisions over the years, being formerly called the Lisman Formation, and then the Sturgis Formation. The most recent revision has renamed it the Patoka Formation, dated to the Upper Pennsylvanian Geologic Period. Regardless of nomenclature, the Patoka Formation consists of 60 percent siltstone, 20 percent sandstone, 20 percent shale, with incidental occurrences of limestone and coal. The Patoka ranges from 240 to 280 feet in thickness.

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[3]Franklin, G. J., 1969, Geologic map of the Nebo quadrangle, Webster and Hopkins Counties, Kentucky, gq777.

[4]Cyclothems are alternating stratigraphic sequences of marine and non-marine sediments, sometimes interbedded with coal seams. The cyclothems consist of repeated sequences, each typically several meters thick, of sandstone resting upon an erosion surface, passing upwards to pelites (finer-grained than sandstone) and topped by coal.

[5]Noger, M. C., and J. A. Drahovzal, 2005, Lithostratigraphy of Precambrian and Paleozoic Rocks along Structural Cross Section KY-1, Crittenden County to Lincoln County, Kentucky, Kentucky Geological Survey, Report of Investigations 13, Series XII.

Bond Formation (Pb)

This unit is present only in the northeastern part of assemblage and overlies the Patoka Formation. Like the Shelburn and Patoka Formations, it has undergone numerous revisions, and was formerly part of the Lisman and Sturgis Formations. It also consists of 60 percent siltstone, 20 percent sandstone, 20 percent shale, with incidental occurrences of limestone and coal. It is approximately 600 feet in thickness.

There are extensive areas along the various stream valleys that are mapped as **Quaternary Alluvium (Qala)**. This unit is composed of unconsolidated coarse detrital sand and fine detrital silt. The alluvial sediments overlie the bedrock of the McLeansboro Group and occur mostly in the central part of the site and along various stream channels.

Coal Mining

The Western Coalfield region of Kentucky has been extensively mined for bituminous ("soft") coal since its discovery in the early 19th century. Coal production continued to increase throughout the 19th century, and by 1879 the region had produced 1 million tons of coal. Hopkins County, where the majority of the project site is located, continues to this day to have the largest number of surface and underground coal mines, along with Muhlenberg and Ohio counties. As of 2012, 781 million tons of coal were extracted from Hopkins County and 317 million tons from Webster County, with reserves of 7251 and 5688 tons of coal in each county, respectively.

Referencing the data available from the Kentucky Mine Mapping Information System (MMIS), there are no known mine portals, either surface or shaft, located within the project boundaries or closer than 1.9 miles from any of the parcels. The majority of mapped portals are located to the west in Webster County, primarily within and around the City of Providence, KY.

Nearly the entire site assemblage is mapped as underlain by mined out areas (Exhibit 4), and all of the regional underground mines are inactive and have been abandoned. The three major companies working the coal seams below the site were the Island Creek Coal Company, Webster County Coal Company, and the Shamrock Mining Company Inc. The MMIS did not have any information regarding which seam or at what depth the Island Creek Company was working. However, the Shamrock mining company was working the No. 11 coal seam, at an elevation of 250 feet, and the Webster County Coal Company was working the Western KY No. 13 seam, at an elevation of EL300 feet. Based on the cross-section of the Nebo Quadrangle geologic map, the No. 13 seam is located at the base of the Patoka Formation, and the No. 9 seam is at the base of the Shelburn Formation. Therefore, at the location of the project assemblage, the two seams which were mined out are located greater than 250 feet below the surface.

No surface collapses have been documented in the area of the project site; however, high-resolution LiDAR may be able to determine if any suspect surface collapses have occurred, usually manifesting as sinkholes or surface water swallets. Review of the USGS 3DEP LiDAR data for the project site did reveal several anomalous drainages that appear to disappear into the subsurface, and these will be discussed in greater detail in the results section of the report.

Finally, a suspect collapse did occur in 2022 during the construction of a new retail store in the City of Providence, and a mine roof collapse killed two workers in one of the Webster County Coal Company mines in 2010. There were 14 mines within the city limits of Providence originally, and numerous surface collapses have plagued the town for decades due to the relatively shallow depths of the mines under the town.

Preliminary Desktop Data Review

A review of the LiDAR derived shaded relief map and 2 -foot contour layer across the site resulted in the identification of nine suspect mine features, where thirty-four (34) are point features and five (5) are area features (Exhibits 1, 2, and 3). The "point" and "area" designation are related to the dimensions, where point features are typically less than 10-feet and area features are anything larger. This system works well for display on maps and planning and data management.

The shaded relief map derived from LiDAR data shows slope related details of the suspect mine collapse related features on-site, and concentrations of suspect features. The majority of the features identified are small, shallow depressions that often follow the streams and the natural drainages and contours of the site. It is likely that many of these features may be related to compromised drain tiles, but it is still important to mark and call out suspect features. The most significant area is the southernmost parcel of the site, where numerous depressions are clustered together. It is important to note that there are lineaments of closed depressions that do not appear natural and may be old adits (horizontal mine entrances) along the base of a shallow slope (Image 1A). The most striking features on-site are two parallel features that are not apparent in the LiDAR information but are clear in the latest Google Earth imagery (dated 2024) as shown by the yellow dashed polygon (Image 1B). The LiDAR data was collected in 2019; therefore, this means that the features have formed between 2019 and 2024 and are quite recent. These features appear to have steep walls, fresh erosion, and receive drainage from the surrounding area and may be connected to mine structures in the subsurface. It is important to note that there is a strong correlation of the suspect mine features with the historical outlines of the subsurface mine passages as shown in Exhibit 4.

Image 1. (A) Three closed depressions in a sharp lineament along the base of a shallow slope which may be mine adits. (B) Two parallel closed depressions that formed between 2019 and 2024 and show evidence of erosion and growth.

General Comments

Our services and any correspondence or collaboration are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical and geological engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

This memo outlines the findings and opinions of our initial step in the proposed preliminary mine desktop survey. Information presented herein is based on the review of publicly available information. No site or project-specific information has been reviewed for the preparation of this memo. This report is representative only of surficial indications from remote sensing data observable at the time the data was collected. Absence of a mapped resource does not mean that it is not present.

Our opinions of the site surface and subsurface geologic conditions are very preliminary in nature. Confirmation of opinions stated in this document is essential. These opinions may be validated with site-specific field reconnaissance, exploration, and testing. Geotechnical explorations will provide the necessary sampling and testing to provide design parameter recommendations. In conjunction with borings, a geophysical survey can also correlate depth of rock and offer some reduction to the potential number of necessary explorations, thus reducing our impact on any given site. Additionally, the

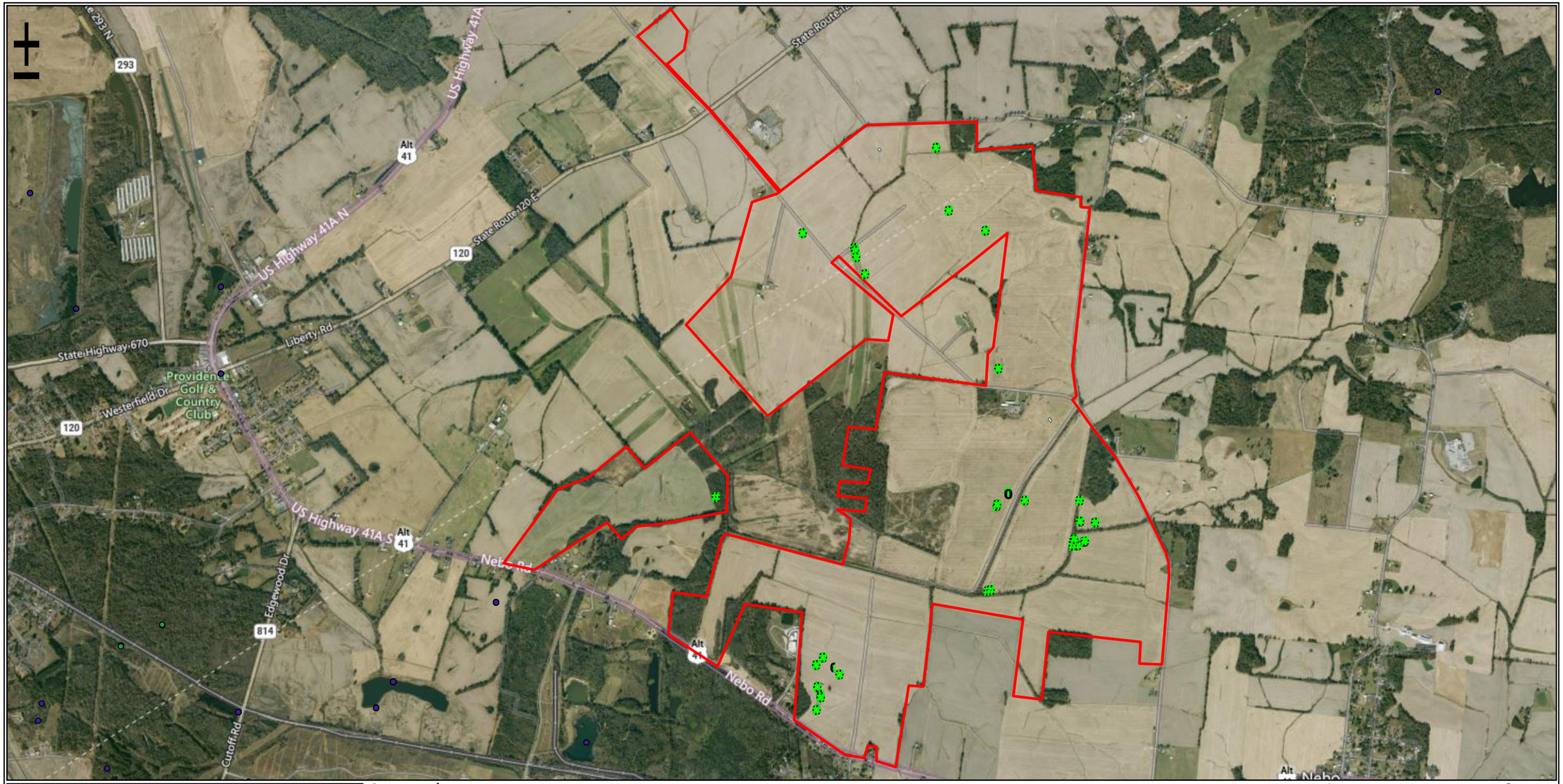
results of the geophysical survey can be used to characterize the subsurface conditions and potential mine features more accurately.

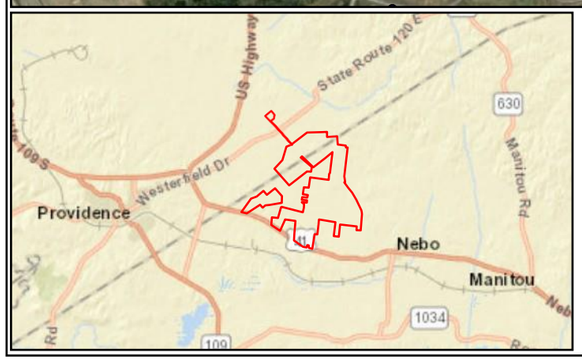
All parties are advised that any decisions or actions taken by any party based on the information contained herein, including decisions with financial implications are done solely at the risk of that party. By providing this information in this preliminary form, Terracon expressly disclaims any duties or obligations associated with the usage of this information for decision-making or design purposes.

In the event that changes to the nature, design, or location of the project, as outlined in this report, are planned, the preliminary conclusions and recommendations contained in this report shall not be used unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing. As the project moves into the design phase, Terracon should be retained to develop and complete a scope of work that includes site-specific explorations.

Figures

Contents:





Legend

- (MMIS) Coal Mine Portal
- Suspect Mine Points
- Suspect Mine Areas
- Property

DATA SOURCES:
ESRI WMS - World Aerial Imagery, OpenStreetMap

0 0.5 1 2 Miles

Project No.:	N4245089
Date:	Apr 2024
Drawn By:	JDV
Reviewed By:	RKD

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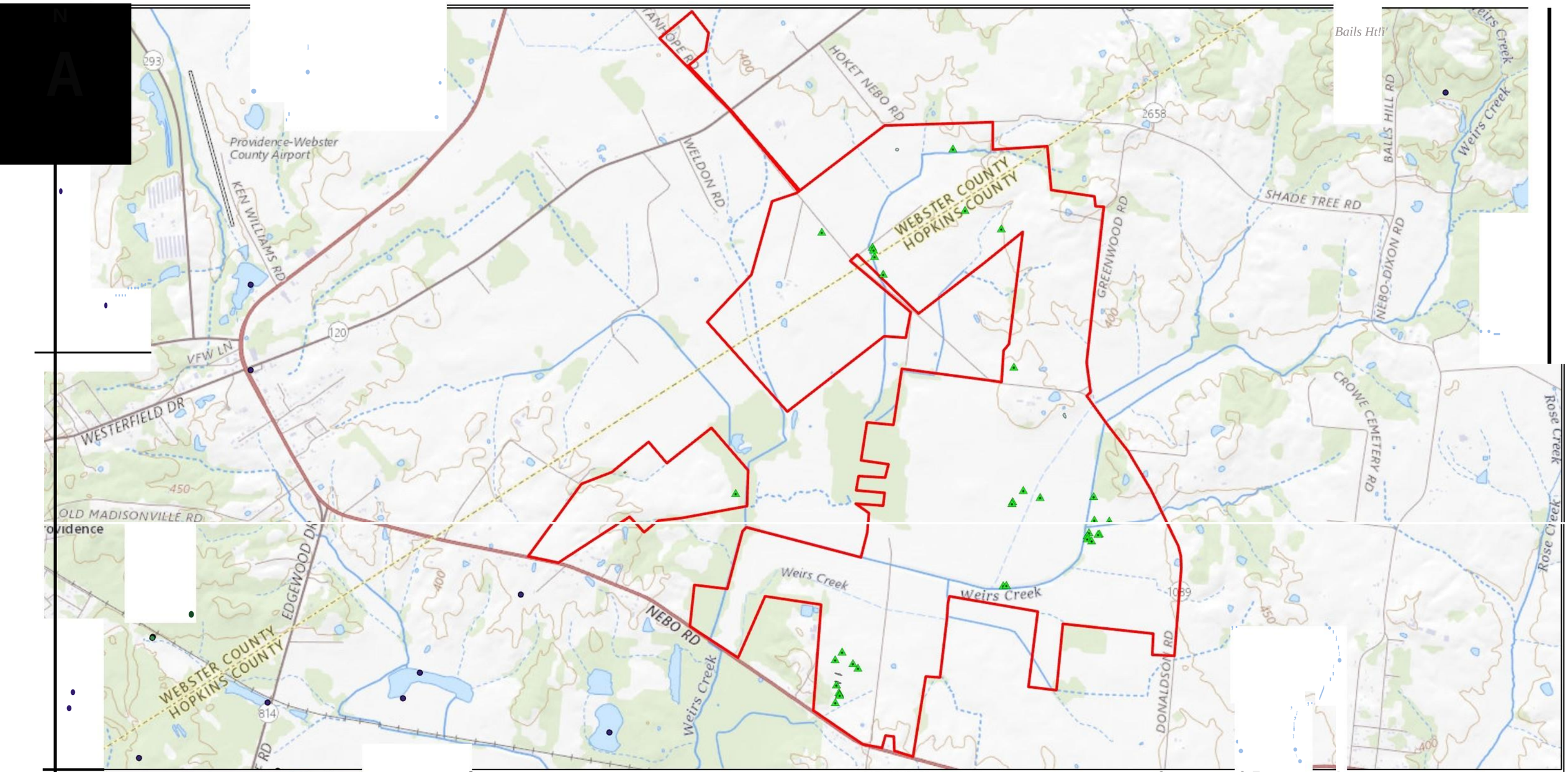
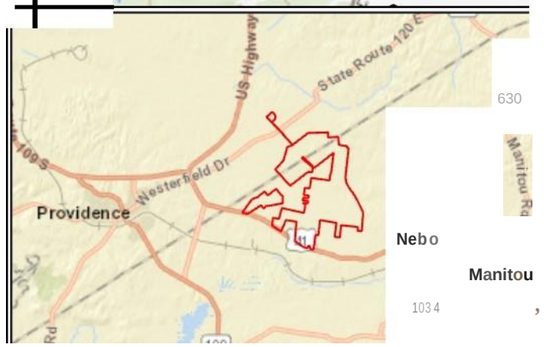
Site Map

Weirs Creek Solar
Historical Mine Survey

Exhibit

1





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Topography Map

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Historical Mine Surrvey

Exhibit
2

N

A

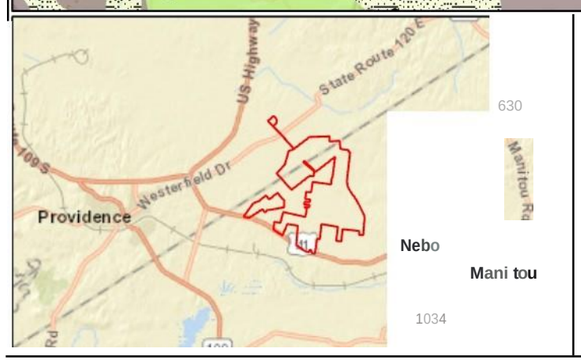
Qala

Pp

Psh

Pb

Pc



Legend

- (MMIS) Coal Mine Portal
- Suspect Mine Points
- Suspect Mine Areas
- Property
- (Qala) Quaternary Alluvium
- (Psh) Shelburn Formation
- (Pp) Patoka Formation
- (Pb) Bond Formation

DATA SOURCES:
ESRI WMS - World Aerial Imagery,OpenSrteetMap

0 0.5 1 2 Miles

Project No.:	N4245089
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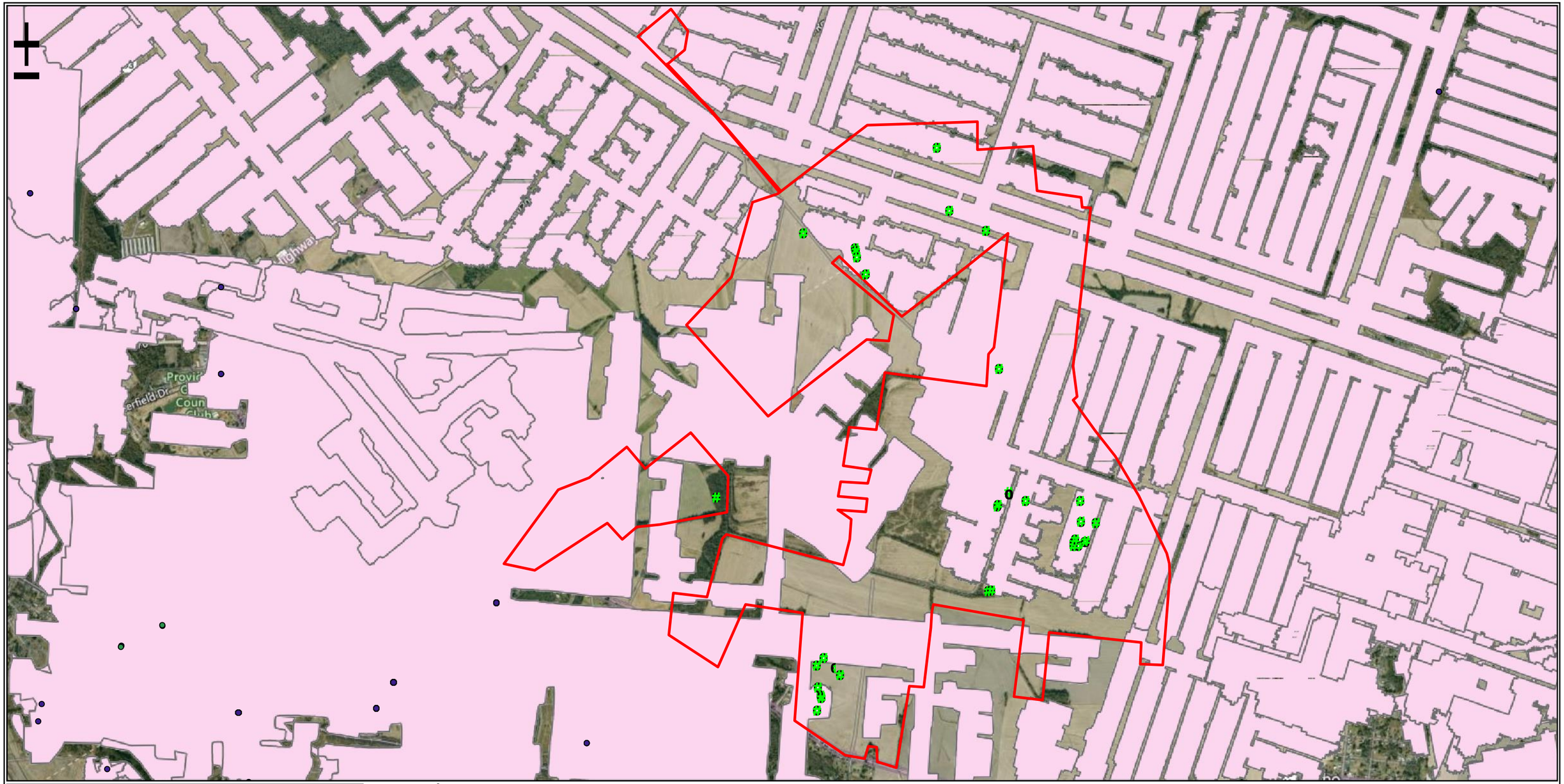
Geology Map

Weirs Creek Solar
Historical Mine Survey

Exhibit

3



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Mine Areas Map

Weirs Creek Solar
Historical Mine Survey

Exhibit

4