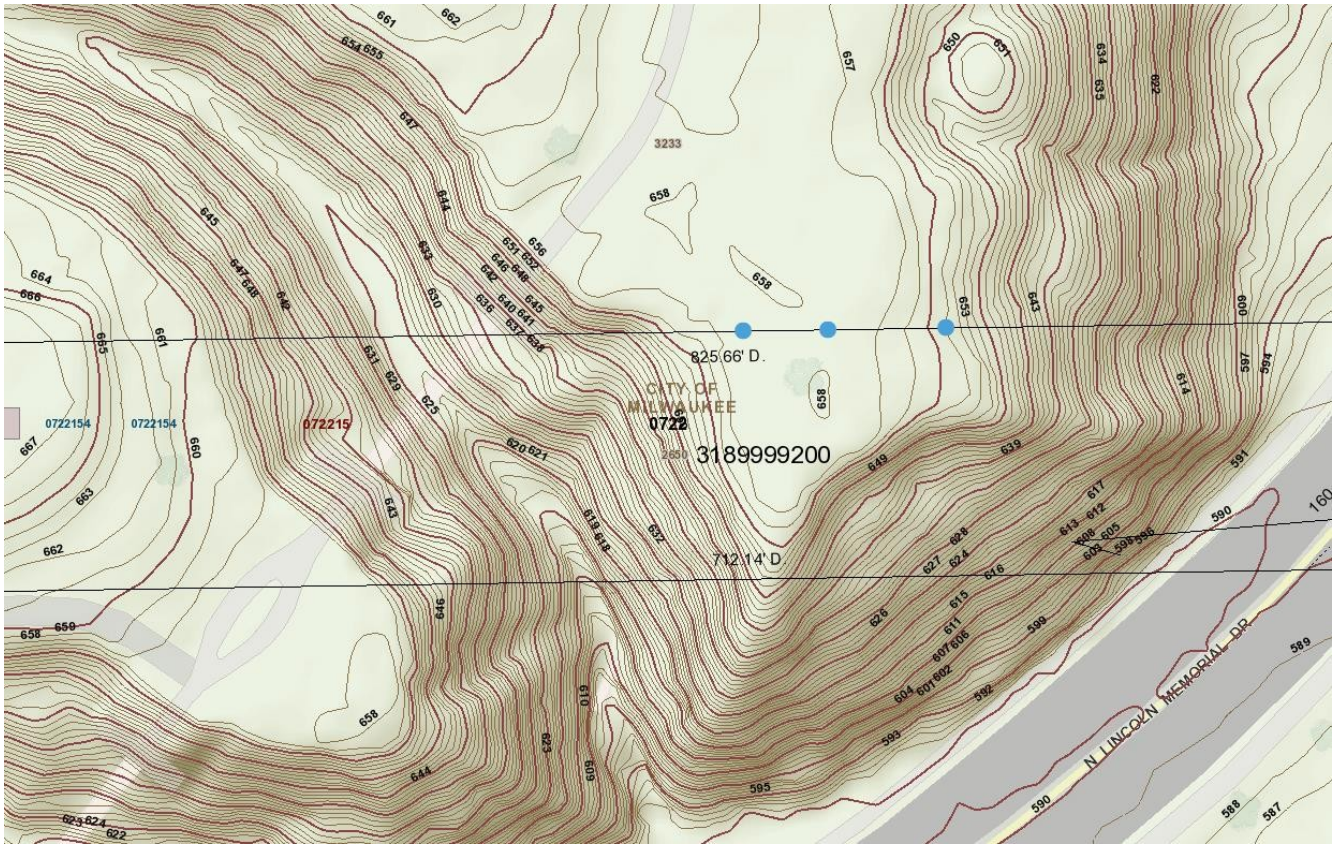
The Milwaukee Main Light at North Point of Milwaukee Bay

Ground Penetrating Radar Investigations Lake Park, Milwaukee County, Wisconsin



Daniel J. Joyce
Executive Director and Archaeologist
Kenosha Public Museums
5500 1st Avenue
Kenosha, Wisconsin 53140

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ABSTRACT

Bob Jeske and Brian Nicholls of the University of Wisconsin – Milwaukee invited the author to be part of a team attempting to locate remnants of the 1855 North Point Lighthouse in Lake Park, Milwaukee. The effort involved historical research and remote sensing in the form of aerial photograph analysis and ground penetrating radar. The result of this ground penetrating radar survey at the suspected location of the 1855 lighthouse follows.

ACKNOWLEDGMENTS

I would like to thank Bob Jeske and Brian Nicholls for the invitation to be part of this and future investigations at the lighthouse site. This investigation involved many others who were of considerable help including John Scripp, Timothy Ward, Mark Kuehn, Sue Grzeca, Guy Smith, Susanne Florenza, and Kevin Cullen.

I would like to thank Mayor John Antaramian for his interest in archaeology and his support in many, varied endeavors by myself and the museums. The Kenosha Public Museums and its Board of Trustees have always supported research by staff and continue to do so. Thanks to my colleague, Robert Sasso of the University of Wisconsin - Parkside for allowing me to use the ground penetrating radar in a number of local venues in conjunction with his University of Wisconsin - Parkside field school which for many years has been a cooperative effort between UW-P and the Kenosha Public Museum.

Thanks are always due due to John Broihahn, State Archaeologist State Historic Preservation Office and his wonderful staff. Support from their office has always been superb, carrying on the tradition of Bob Birmingham, the former state archaeologist to whom I also owe a debt for several previous projects.

Finally, thanks to my wife and fellow archaeologist Ruth Blazina-Joyce and our children Sara and Tessa for their patience with my time consuming preoccupations.

INTRODUCTION

On August 20. 2019 the author conducted a ground penetrating radar survey at Lake Park in north Milwaukee. He was invited to survey an area where the long demolished 1855 lighthouse was located. Previous work by Kevin Cullen suggested that a flat grassy area to the east and across a ravine from the present North Point lighthouse was a probable location to investigate. After reviewing the historical record, Mr. Cullen's report (Cullen 2010) and the site itself it was decided to err on the side of caution and start the north boundary of the survey well north of the lighthouse property, since the exact location of that line was unknown on the ground. Mr. Cullen's well written report was extensively consulted especially with regard to the history of the lighthouse.

One single grid was surveyed in a unidirectional manner, the south end line varied as each line ended when the vegetation stopped further progress of the machine. The data collection for the project was less than a half a day.

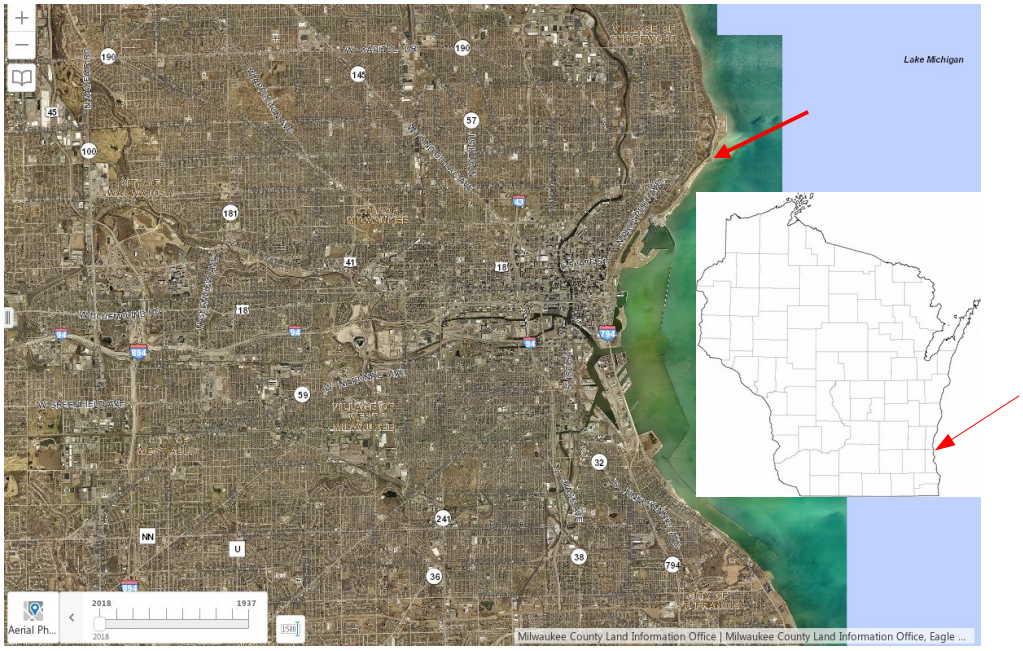

Figure 1. Location of the 1855 North Point Lighthouse in Lake Park, Milwaukee, Milwaukee County, Wisconsin.

Figure 2. GPR survey location in Lake Park, Milwaukee. The two acre lighthouse property (3189999200) is located between the two horizontal lines. The present day lighthouse is on the left or west. On the eastern part of the property is a relatively flat area that is the probable location of the lighthouse (red arrow). The road in the lower right is built on landfill and represents the old shoreline. Lake Michigan is to the right of this image.

BRIEF HISTORICAL BACKGROUND

Figure 3. This mid to late 1800's photograph is the only one of the lighthouse in use with it's lantern room still in place. The fence going into the distance probably marks the south boundary of the lighthouse property. (Milwaukee Public Library)

In 1851, the U.S. Lighthouse Service purchased an east-west trending two acres from J. Bonesteel for $1000. A new lighthouse was to be established at a cost of $10,000. This "Milwaukee Main Light at North Point of Milwaukee Bay" was number 679 of the Light-house Service. On November 22, 1855 the new lighthouse and keepers cottage opened at what is now known as Lake Park in Milwaukee. Both the lighthouse and keepers cottage were constructed of cream city brick. The twenty-eight foot tall North Point Lighthouse stood atop a 102 foot bluff at the edge of the lake making it the highest on the Great Lakes. The fixed white light flashed, two minutes between each illumination. The light could be seen 17 ½ statute miles away (Flower 1881:479-480).

Within a decade, sixteen feet of erosion at the bluff between the lighthouse and the lake made building a new lighthouse a necessity. It was decided that the new lighthouse would be one hundred feet west. In 1886 Congress approved $15,000 to build a new lighthouse and keepers quarters. Opened on January 10, 1888, the new lighthouse was of bolted cast iron and was thirty-nine feet tall. The new lighthouse used the old Fresnal lens. By 1907 the lighthouse was turned off due to increasing tree growth around it. Prior to that, in the mid-1890's, the area had become Lake Park designed by the famous landscape architect Frederick Law Olmsted.

In 1909, the Merchant's and Manufacturers Association of Milwaukee received a $10,000 grant to raise the lighthouse and the U. S. Lighthouse Board took control again. In 1912 a

new thirty-five foot tall structure was built and the 1888 lighthouse placed atop it. The new lighthouse was 74 feet tall and is the one you see today, incorporating parts of the 1855, 1888 lighthouses into the 1912 version. By April 1913 the lighthouse was operational, finally being decommissioned in 1994. Sometime between 1892 and 1895 the old decayed lighthouse was torn down (Cullen 2011:11). North Point Lighthouse Friends, Inc. was formed in 2003 when the land was transferred to Milwaukee County. After extensive restorations, the lighthouse was opened to the public as a museum (North Point Lighthouse web site; Wardius 2011).

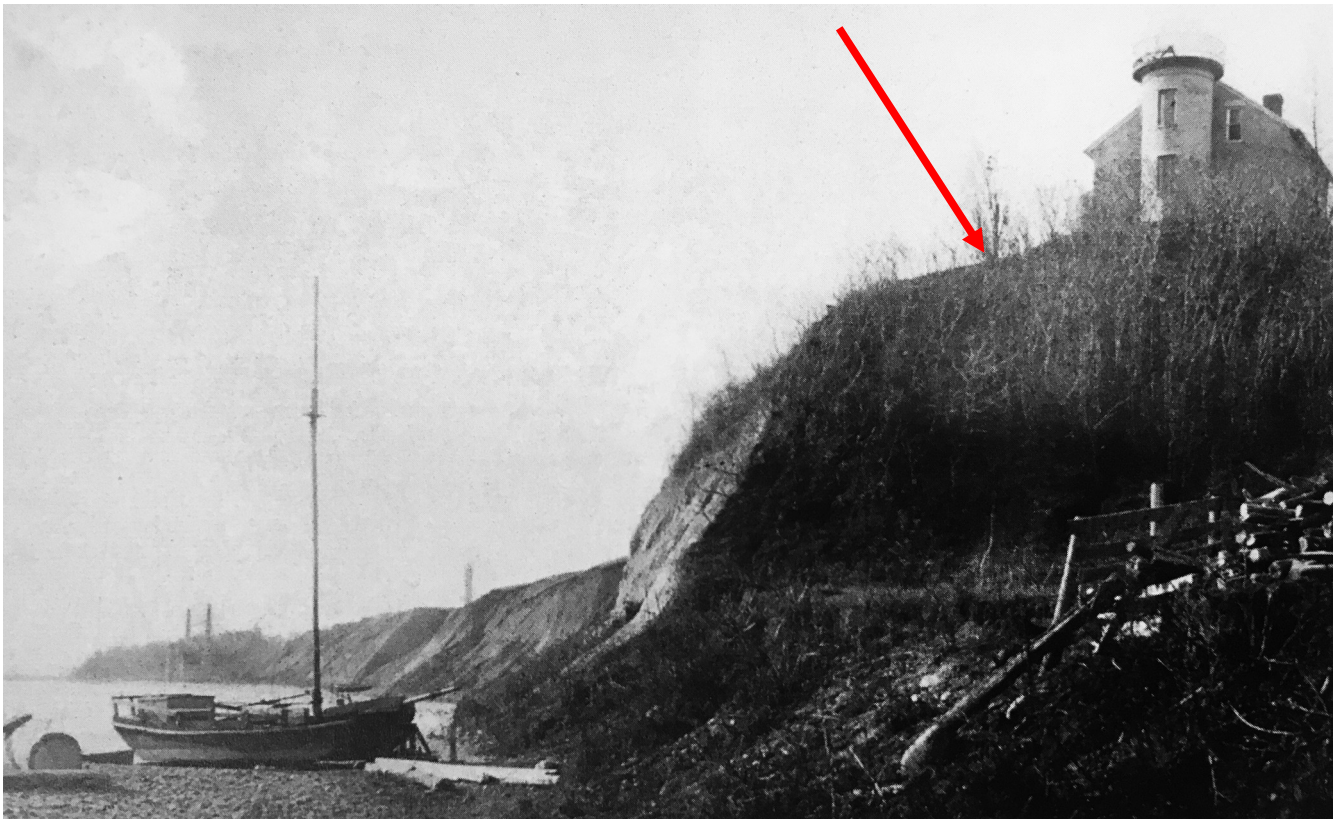

Figure 4. This view is said to date to 1887 which is unlikely since the 1855 lighthouse is not being used and the new one was not operational until January 1888. It clearly shows a concavity in the bluff line where the top of the bluff has eroded (red arrow). The shore here runs southwest – northeast. The lighthouse and keepers cottages long axis is roughly slightly north of east-west. (Milwaukee County Historical Society)

Figure 5. This undated (circa 1888 – 1895) photograph shows the lighthouse as it stood abandoned before being torn down circa 1892-1895. The ravines that can still be seen today are obvious. View looking northeast. (Milwaukee County Historical Society.

Figure 6. An 1897 sketch by Phil Hammersmith a Milwaukee artist. Although the lighthouse was gone at this point, Hammersmith recorded what it looked like. The tower walls were vertical unlike this rendering but shoreline and ravine are close to reality (see figure 8). (Northpoint Lighthouse Friends)

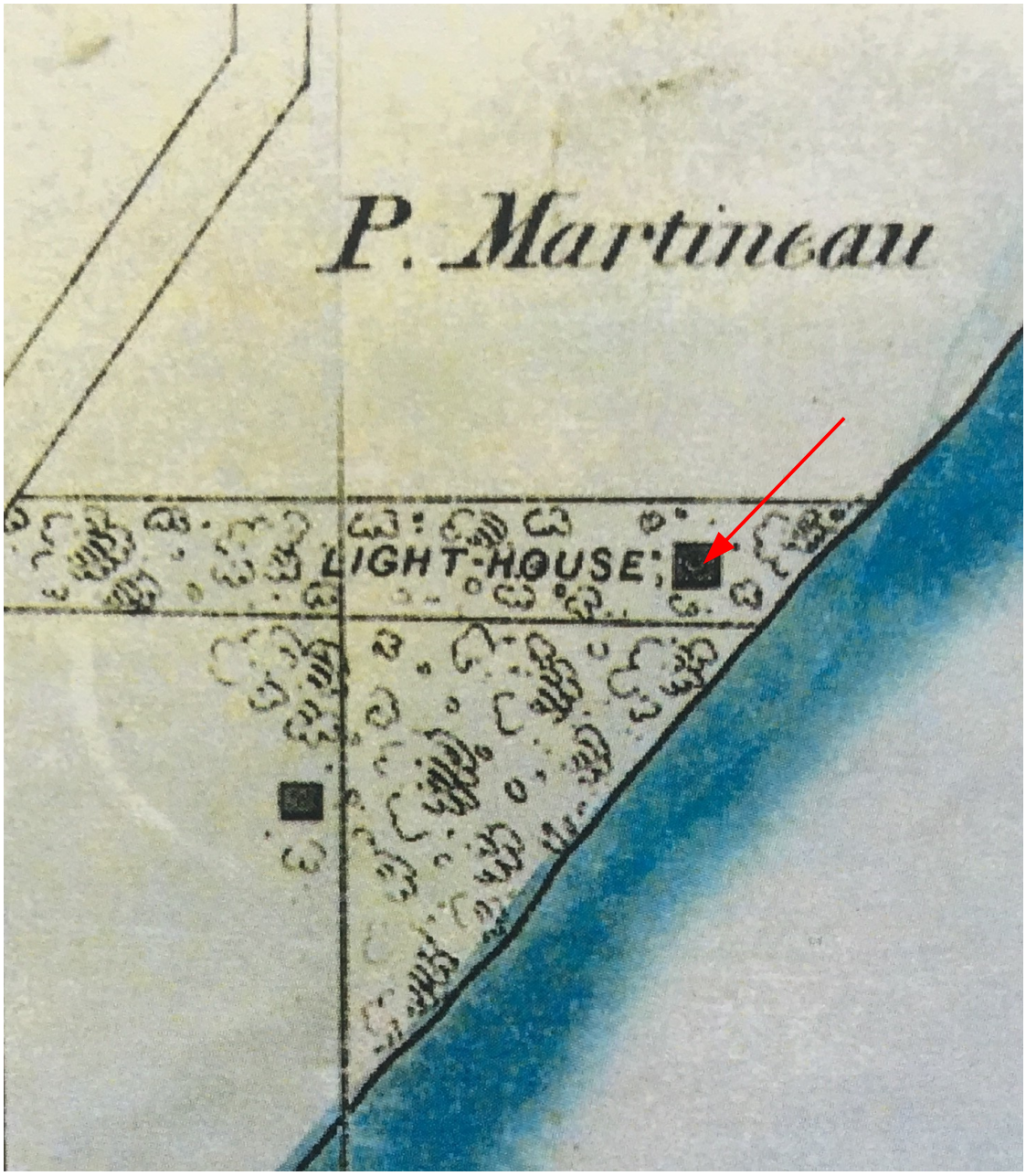

Figure 7. Milwaukee Fire Insurance Map, 1880 (Milwaukee Public Library).

Figure 8. Wrights 1888 Map of Milwaukee. This was the year that the new lighthouse was opened but only the old lighthouse is depicted. The concavity in the shoreline to the south of the lighthouse can be seen in figure 6. (American Geographical Society Library UWM).

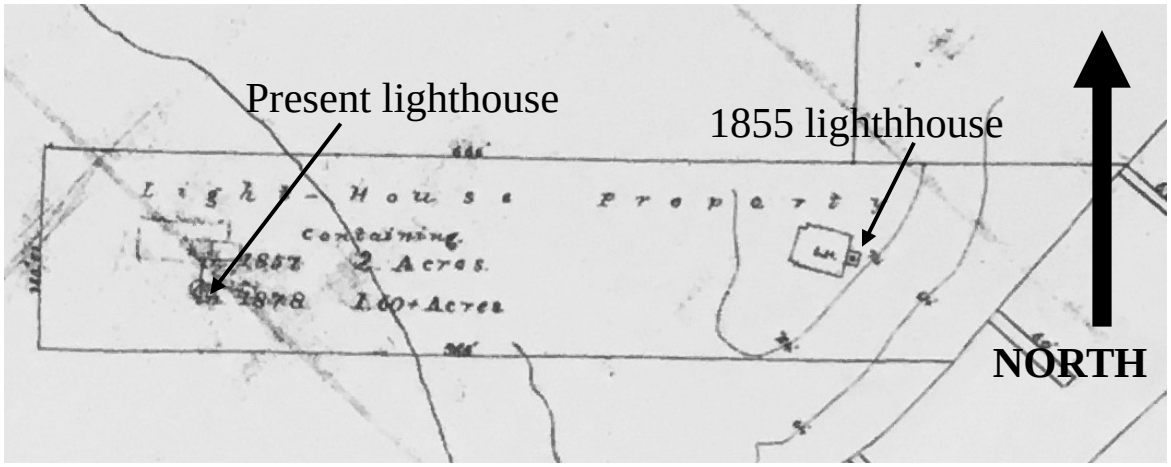

Figure 9. Undated plat of the lighthouse property. This plat is circa 1888-1895 due to the old lighthouse is still being there and the new one already in place.

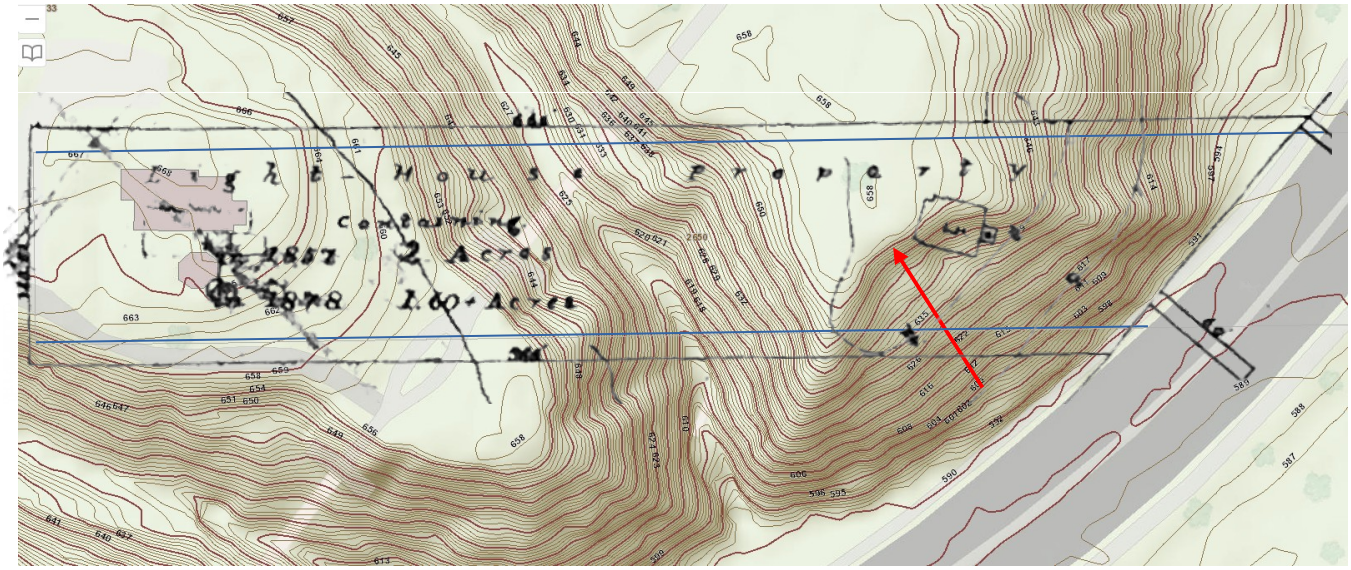

Figure 10. Topographic map with the above undated plat map superimposed. The present keepers cottage and lighthouse roug hly line up correctly. This combined image indicate that the lighthouse and keepers cottage have eroded down the bluff. The piers are in what was the lake at that time. While the east-west axis of the parcel is correct on the old plat, the north-south axis is too large to fit the modern boundary (blue line). The overall scale of the older map may be off. The red arrow shows an eroded concavity at the upper portion of the bluff, indicating that the erosion was not caused by the lake.

GROUND PENETRATING RADAR OVERVIEW

Ground-penetrating radar (GPR) is a nondestructive geophysical method that uses radar pulses to image the subsurface. It uses electromagnetic radiation in the microwave band, and detects the reflected signals from subsurface anomalies. GPR can be used in rock, soil, ice, fresh water, pavements and structures. It is capable of detecting objects, changes in material, and voids (Conyers, 1997).

Ground penetrating radar is a useful remote sensing technique to initially identify or refine targets in the course of archaeological work. It has the highest resolution of any remote sensing technique. The main advantage is that while a ground penetrating radar survey is being completed on site, the 2-D results are seen in real time. Post-processing software coupled with a survey cart and distance meter, lessens survey time considerably. Another advantage is that prospecting survey capabilities have improved in recent years. The addition and refinement of 2-D survey transects into 3-D blocks has improved interpretation immensely. The ability to rapidly process these data in the field has led to more efficient excavation strategies. Improvements in computer speed as well as software capabilities have coupled to lessen the time used in post-processing and analysis (Kvamme, K.L. 2003). High-frequency radio waves are transmitted into the ground. When the wave encounters an object or a boundary with different dielectric constants, the receiving antenna records variations in the reflected return signal.

The major disadvantage of ground penetrating radar is that the dielectric constant of the soil(s) has varying effects on signal attenuation. While dry sand is the ideal for use with radar, wet, saturated clay is the least favorable – absorbing or attenuating much of the signal and lessening penetration/depth. Advances in radar and antennae design have improved this situation somewhat recently (Kvamme, K.L. 2003).

Another disadvantage of ground penetrating radar is that the depth of the survey is not often known. This is especially true where two differing strata have two very different dielectric constants. While the machine can be set for one dielectric constant to give a somewhat accurate depth reading in a homogeneous strata, it cannot give a reading that reflects real depths where the strata is varied. One method of ground truthing the data is to bury a metal object at a known depth in an excavation wall and then calculating real depth onto the resulting radargram from the appearance of the metal on the transect radargram profile.

Despite limitations, geophysical survey techniques are a cost and time effective non-invasive method to gain information about the shipwreck and can serve as a base for future work in identifying suspected shipwrecks. This is due to the fact that ground penetrating radar, electrical resistivity, gradiometry, and other remote sensing techniques have been shown to be effective non-invasive survey techniques that have the potential to locate sub-surface archaeological features that otherwise would have required excavation.

Kaufmann and Kean (2002) demonstrated that geophysical survey techniques (D.C. resistivity, E.M. conductivity, and ground penetrating radar) could be used to locate subsurface disturbances (wooden palisade walls) at Aztalan State Park in Jefferson County, Wisconsin. The findings from this preliminary survey were supported by historical maps

and previous excavations at the park.

Hargrave el al. (2002) illustrated the potential of an electrical resistivity survey, and other geophysical survey techniques, when trying to manage and investigate a large historic site that is several hundreds of meters in size, such as the Army City site at Fort Riley, Kansas. Army City was a civilian owned, World War I era, planned community designed to meet the recreational needs of soldiers, the site was later abandoned and became a hay field.

In the 1990's, the site was considered for eligibility for the National Register of Historical Places (NRHP). Electrical resistivity surveys were used to locate buried building foundations for excavation in order to determine if the site met NRHP criteria. Ground-truthing excavations were used to verify results from the geophysical surveys. Due to the use of geophysical survey techniques, coupled with verification by actual excavation of the areas highlighted by the geophysical survey, Army City met the eligibility for NRHP.

Finally, Parrington (1979) demonstrated the use of geophysical survey techniques in a large, historical area that had suffered from modern disturbances in his survey of Valley Forge National Historical Park in Pennsylvania. With the geophysical surveys, he was still able to locate Revolutionary War era refuse pits and troop lodgings.

METHODOLOGY

The survey grids were laid out using fiber tapes and plastic pin flags to minimize radar signal disturbance. The survey wheel was calibrated for accurate distance measurement and the gain was adjusted before data collection. Transects were .5 meters apart.

The GPR used in the survey was a Geophysical Survey Systems, Inc (GSSI) TerraSearch SIR (Subsurface Interface Radar) 3000. It is a single channel data acquisition unit manufactured by GSSI, Model 5103. A 400 MHz GSSI antenna was used and attached to the Digital Control Unit (DC-3000). This antenna is both the transmitter and receiver of the radar signal and is ideal for most archaeological applications, penetrating 3 – 4 meters below the surface. The antennae is well shielded and generates a tight electromagnetic cone beneath the unit. Objects of 25 cm or more can be detected by a 400 MHz antenna. The antenna and DC-3000 are mounted on a GSSI Model 623 survey cart which incorporates a survey wheel for high-precision automatic distance measurements.

The GSSI DC-3000 was adjusted for data acquisition as follows:

- 512 samples per scan
- 16 bit samples
- Scans/Sec 100
- Scans/unit 50
- Units 2
- Diel =8
- Soil type 1 (sand)
- Approximate depth of up to 4 meters

The data were processed using GSSI's RADAN version 7.0 software and GIMP. The radargrams were processed to remove background noise, set time zero, deconvolution and migration. The gain was set higher to improve anomaly amplification examined using differing color palettes. These processing steps improve the resulting accuracy in determining size, shape, depth of anomalies, subsurface features and reduce noise in the data. Individual transects were assembled into one radargram and examined using multiple color palettes. The assembled transect/radargram data was then entered into 3-D mode and again examined in several color palettes and gain amplification for anomalies.

Survey 1

Survey one was located east of the present day lighthouse in the suspected location of the 1855 lighthouse and keepers cottage. This area is flat, grassy and falls off to a drop to the lake on the south and a ravine on the southwest. The grid was set using an east – west baseline on the north end of the grid. This was well north of the lighthouse property line, making sure that no feature related to the lighthouse was missed. Immediately north of the grid is the site of a former Cold War Nike missile tracking base. The point of beginning (POB) was at the northwest corner. From east to west the grid was 17.5 meters wide. Transects

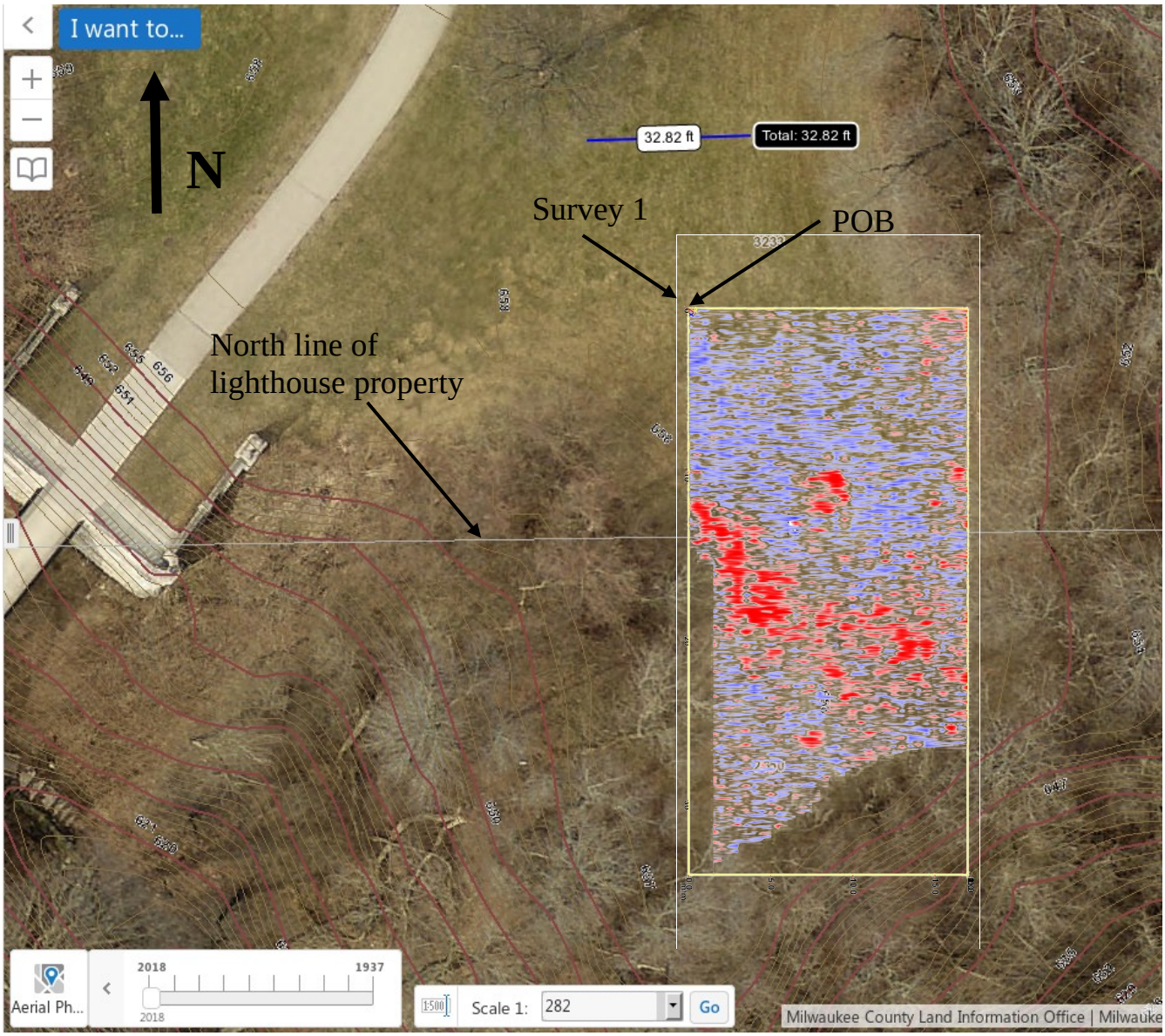

Figure 11. 2018 aerial photo of the area of investigation east of the present North Point Lighthouse with the GPR survey superimposed.

were run unidirectionally from north to south. The south ends were run until stopped by vegetation creating a jagged southern boundary. This maximized the area covered by a single survey. The longest transect was number 4 at 34.54 meters.

Figure 12. View of the survey area looking south. Transects were run south past the flags in the distance until stopped by vegetation.

The location of the survey can be seen in figure 11. The southern end of each transect stopped as dense vegetation was encountered. There is a ledge upon which this vegetation grows beyond the grid to the south, southeast and east. These areas that could not be reached with the GPR hold potential for in situ materials too. The red seen in the radargram shows a significant amount of anomalies in this plan view.

The site survey area can be seen in figure 12 looking south. The nearest flags are the starting point of each grid, the point of beginning of the survey is at the right (west) end of the line where the ground penetrating radar cart is located. Transects went beyond the line of flags in the distance ending in the vegetation.

The anomalies seen in figure 13 inside the black oval are more recent (?) near surface deposits. Within the red oval are deeper deposits and more likely to have materials related to the lighthouse.

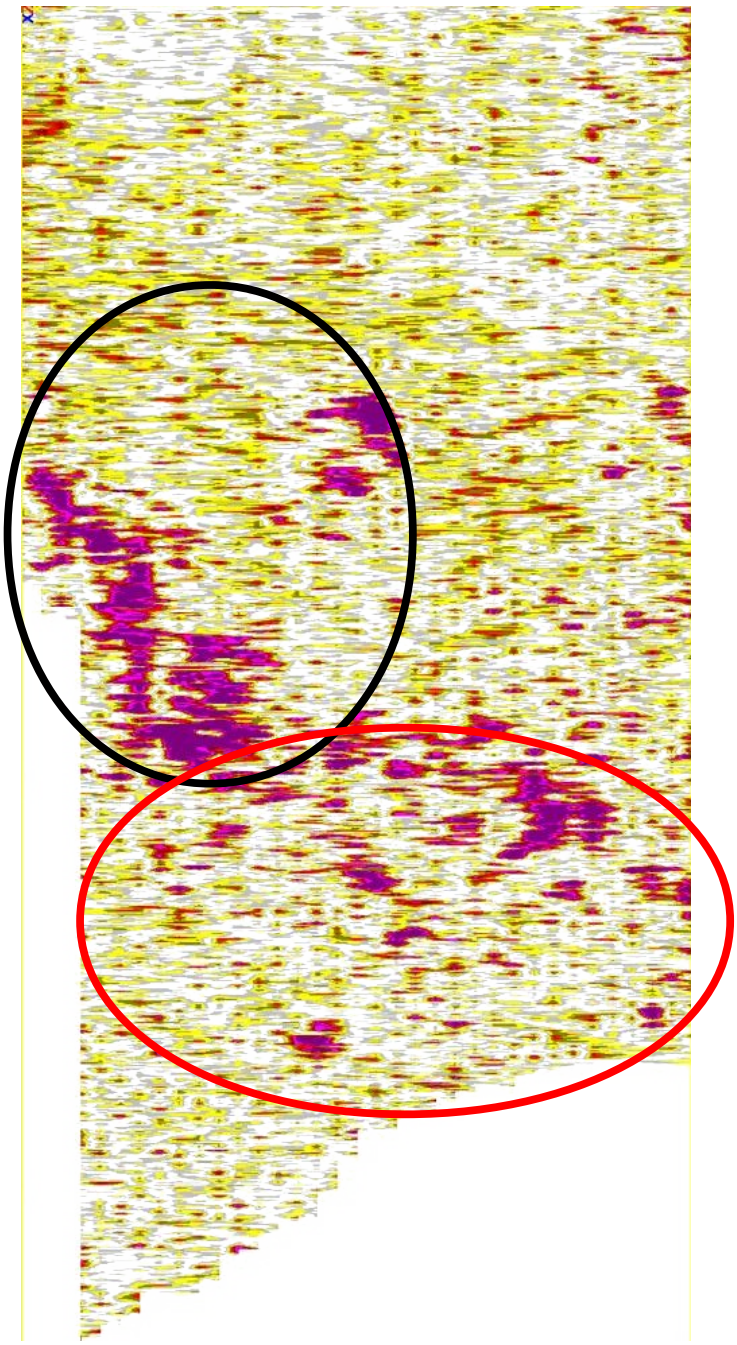

Figure 13. The area inside the black oval are more recent (?) near surface deposits. The area within the red oval are deeper deposits.

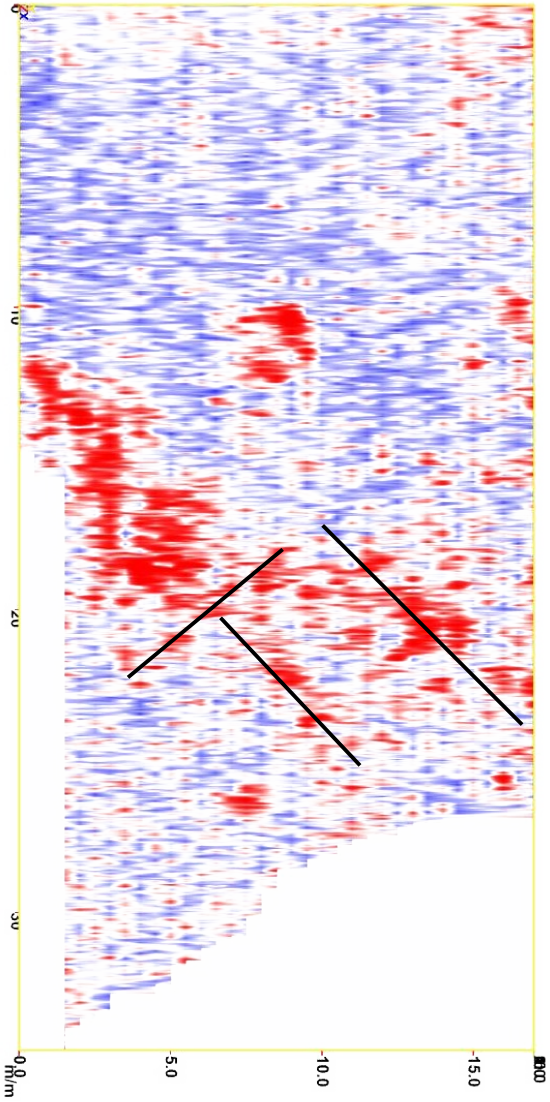

Figure 14. The area marked by black lines show possible foundations but they are vague at best. The survey map in figure 9 show the building being oriented slightly differently. These same lines can be seen in figure 13, an image created with a different color palette.

In figure 14 the black lines indicate possible foundation lines but they are vague and discontinuous at best. If they are a part of the foundation, then the building is oriented slightly different from the plat survey in figure 9. To the south and east are unsurveyed flat ledges covered in dense vegetation before the bluff drops off. These ares are also a likely prospect for more in situ materials.

If these southernmost anomalies relate to the lighthouse it is likely that some of the lighthouse has gone over the edge of the bluff, but probably not as much as seen in figure 10. In figure 10, a current topographic map has an undated plat map superimposed. The present keepers cottage and lighthouse line up correctly but the superimposed plat suggests that a large portion of the lighthouse and keepers cottage have both eroded down the bluff.

While the east-west axis of the parcel is correct on the old plat, the north-south axis is too large to fit the modern boundary (blue line). It is unlikely that the north-south dimension of the property has changed since its establishment. The overall scale of the older map may be off showing the old lighthouse and keepers cottage being too far to the east and not as eroded as it indicates. The survey results also suggest this conclusion.

CONCLUSIONS

While we cannot be certain that we have found the 1855 Lake Point Lighthouse, we can say that there are a number of anomalies in the area where the lighthouse likely stood and they are at an appropriate depth for their age. Of course, with any ground penetrating radar study nothing is certain until the probabilities are ground truthed through excavation.

If this is the lighthouse, it appears likely that some of the structure did succumb to erosion of the lake bluff. That does not mean that there is not any archaeology left. On the contrary, there is a large group of anomalies waiting to be tested.

A testing program that concentrated on the red oval area in figure 13 would be appropriate. Test excavation in this area, concentrating on the possible foundation lines and the easternmost portion of the oval may reveal that lighthouse. Concentrating on the east will tell if the lighthouse was partially eroded off of the edge of the height. A pedestriant survey of the upper portion of the east face of this bluff within the oval area may reveal eroding deposits. This effort was made under Cullen for the southern facing bluff face but not the east where erosion threatening the lighthouse occurred.

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