Report to Tulsa Development Authority:

Geophysical Survey Conducted by the Mapping Historical Trauma in Tulsa, 1921-2021 project in October 2020

Introduction

On October 22nd, 2020, the Mapping Historical Trauma in Tulsa (MHTT) project, led by Dr. Alicia Odewale (Assistant Professor of Anthropology, University of Tulsa) and Dr. Parker VanValkenburgh (Assistant Professor of Anthropology, Brown University), conducted geophysical survey on property owned and managed by the Tulsa Development Authority (TDA). The MHTT survey team consisted of Dr. Alicia Odewale and Drs. Amanda Regnier and Scott Hammerstedt of the Oklahoma Archaeological Survey (OAS). MHTT hired OAS to conduct the survey because of that organization's demonstrated excellence in archaeological and geophysical survey, along with their possession of the necessary equipment for conducting it.

Figure 1. TDA east Greenwood survey area (in orange).

Survey Area

The team surveyed 3,600 square meters (4,306 square yards) of property located to the east of North Greenwood Avenue and property owned by Vernon AME Church, parallel to the historic location of North Hartford Avenue (Figure 1). This area was chosen based on our research employing Sanborn fire insurance maps from the early 20th century, which indicate the presence of various historic structures in this area prior to the 1921 Tulsa Race Massacre, including private homes, shops and the Dunbar School, pictured in Figure 9 below. In addition to geophysical survey in this area, we also visited the block of land bounded on the west by North Boston, on the north by East Fairview, and on the East by MLK Jr. Boulevard, and on the south by the crosstown Expressway onramp / abandoned section of Easton Street. In this latter area, the existence of significant standing architectural remains obviated the need for geophysical survey; we include photos of this area below.

Background

The land included in this survey area is owned and managed by the Tulsa Development Authority. The selected area under investigation, which is now an open field, was once the site of multiple structures that ran parallel to a street identified as North Hartford Avenue (Figure 2). While today both the historic structures and roadway are no longer visible on the surface, the resulting geophysical survey has led to new discoveries of what may have survived underground.

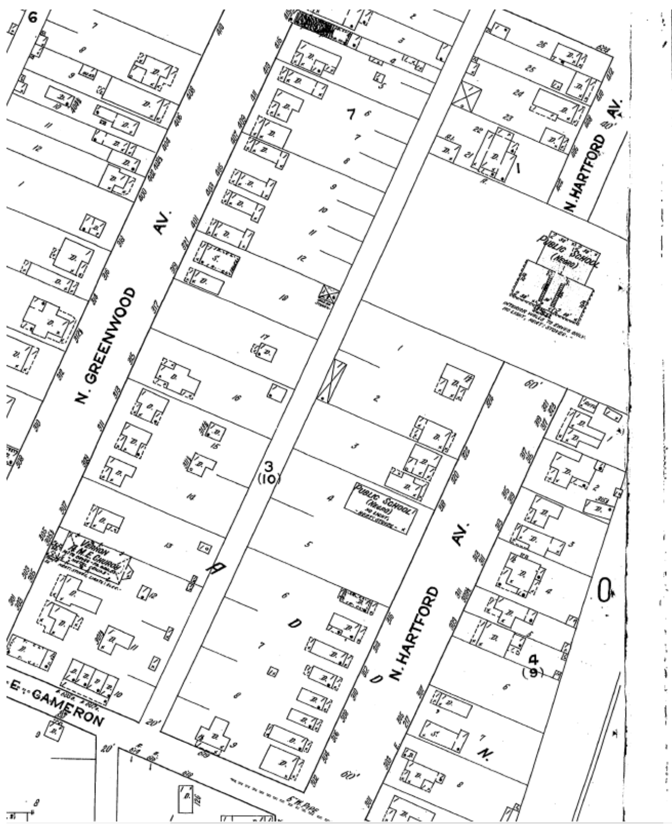

Figure 2. 1915 Sanborn Fire Insurance Map. Sheet 9. Map of North Hartford Avenue and adjacent structures

The North Hartford Avenue survey area connects to Historic Greenwood's architectural, cultural, religious, and educational legacy in many ways. This one survey area offers an important glimpse into multiple phases of Greenwood's history, including the initial rise of neighborhoods, schools, and churches, the destruction left in the wake of the 1921 Tulsa Race Massacre, and the rebuilding phase that immediately followed. Within the 3,600 square meters that were included in this survey (Figure 1), Sanborn Fire Insurance Maps from 1915 indicate that this area was originally home to more than 30 structures running along both sides of North Hartford (Figure 2). The list of structures that were erected in this space include single family dwellings, boarding houses, store fronts and businesses, such as the Harris Grocery Store at 305 N. Hartford, and at least two school houses that were designated as "Negro schools" on historic maps (Figure 2; Tulsa City Directory 1921b). In addition to these free-standing structures, it should be noted that before the two-story Mount Zion Baptist Church building was built on North Elgin in 1913, this congregation carried a different name "Second Baptist Church" and met in a smaller church house on North Hartford (Johnson 1998).

Figure 3. Image of Men's surgical ward inside the Maurice Willows Hospital. Photo courtesy of the Tulsa Historical Society and Museum.

It should also be noted that in the months immediately following the massacre in 1921, the Maurice Willows hospital, located at 324 North Hartford, was erected next door to the Dunbar school to serve as a Red Cross disaster relief headquarters and center for healing and recovery of massacre victims. (Figure 3; Johnson 1998; Tulsa City Directory 1922b). Many who came to this hospital were either wounded in the attack or required hospitalization due to a lack of adequate shelter once upwards of 10,000 Greenwood residents became homeless overnight (Figure 3). This nine-room building valued at $68,000 was furnished by the Red Cross but was actually built by the "Colored Citizens Relief Committee and East End Welfare Board" (Johnson 1998). Both the labor and financing for this structure is significant since this served as the first interracial collaborative building effort after the 1921 attack. And what makes this structure even more important to the story of Greenwood is the fact that this hospital served as the first African American hospital in Tulsa history. While Greenwood residents continued to have a number of doctors and doctors' offices both before and after the massacre, it wasn't until the construction of the Maurice Willows building that Greenwood residents had their own hospital (Figure 3).

Another feature of the post-1921 landscape of Hartford Avenue was a new hotel located at 124 North Hartford Avenue (Tulsa City Directory 1922a). The Hartford Hotel, which was non-existent before the Massacre, was built in 1922 (Tulsa City Directory 1922a). Because nearly all of the former boarding houses and rooms on Hartford street were destroyed during the attack on Greenwood in 1921, this new hotel would have provided sorely needed accommodations for survivors in the years following the disaster. While little documentation seems to exist for the Hartford Hotel's early years, it is clear that a hotel located at this address (124 North Hartford) was to become an important landmark for African American travelers in subsequent decades. Between 1950 and 1962, the *Negro Motorist Green Book*, a guide for African American travelers seeking safe business to visit across the United States before the Civil Rights Era, listed an establishment called the Miller Hotel at the exact same address (The Negro Motorist Green Book 1962: 79.). It is unclear what may have led the business's name to be changed, but the mere inclusion of a hotel located at 124 North Hartford in the Green Book indicates that it served as a site of safe harbor not only for the Greenwood community, but also Black people across the country. Indeed, while previous editions of the Green Book had listed dozens of sites in Oklahoma, by 1962, the hotel at 124 North Hartford was one of only eight sites listed in the state (The Negro Motorist Green Book 1962).

Figure 4. Remains of Dunbar Grade School following the 1921 attack on the Greenwood District. Photo courtesy of Oklahoma State University Library. https://dc.library.okstate.edu/digital/collection/TulsaRR/id/391/

The largest and most well-known structure that once stood within this survey area on Hartford Avenue between Easton and Cameron Street was the Dunbar Grade School (Tulsa City Directory 1921a, p170. Before the 1921 attack on Greenwood occurred, when the Dunbar school was destroyed (Figure 4), most of Greenwood's youth received their education from two schools, the Dunbar Grade School (for elementary students) and Booker T Washington High School (for upper grades). While the educational legacy of Greenwood dates back to 1905, with the erection of the Tulsa Ward School (Tulsa Preservation Commission), both of the Dunbar and Booker T school buildings were completed in 1910 when the population of Black families moving into Greenwood began to surge (Johnson 1998; Jones Parrish 1923). The Dunbar building valued at $20,000 was an eight-room structure, while the high school was built to be a fifteen-room brick building (Jones Parrish 1923). Both schools began as small spaces housed within one building until the number of students grew beyond the capacity of each small church-school structure. In 1910 Dunbar became "a freestanding, two-story, eight-room brick school" that served first through eighth grade (Johnson 1998).

Methods and Technologies

Surveying and Mapping. Within the geophysical survey area, corner stakes for each survey grid were positioned using a laser total station. Standardized ropes 20 meters in length, marked at 50 cm intervals, were then attached to these stakes an used to guide geophysical instruments, which were carefully pushed (in the case of the GPR) and carried (in the case of the gradiometer) across the landscape, by surveyed walking back and forth along transects spaced 50cm apart from one another. In this fashion, we surveyed approximately 3,600 m^2 (4,306 yd^2) using a Bartington Grad 601 gradiometer, and 4,000 m^2 (4,784 yd^2) with a Geophysical Survey Systems, Inc. (GSSI) UtilityScan ground-penetrating radar (GPR) system (Figure 7).

Geophysics. Geophysics has become a common tool in archaeology and consists of a number of non-invasive methods to find and analyze subsurface features (Clark 1996; Conyers 2012; Kvamme 2001; Weymouth 1986). Cultural features are usually recognized by contrasts or other differences between the feature and undisturbed surrounding soils. Human activities alter soil texture in many ways, including compaction, stratigraphy, moisture retention, and burning, among others. Geophysical technologies allow us to measure and locate variations of the physical characteristics of the soil. These instruments operate near or at ground surface. The use of the ropes described above allow for spatial control and the subsequent accurate location of soil anomalies detected with geophysical technologies. In many cases, the use of multiple geophysical techniques on the same project has proven useful (e.g., Clay 2001; Hammerstedt et al. 2017).

Ground-penetrating radar (GPR). GPR is commonly used in cemeteries and in other archaeological applications (Conyers 2006, 2012). It is an active technology, meaning it introduces an artificial field to measure response. GPR works by sending pulses of radar into the ground, which are reflected, absorbed, or otherwise deflected by these buried features. The return time of these pulses indicates the depth to the anomaly. Data are collected in sequential profiles, which can then be combined in proprietary software (in this case, RADAN 7) to create three-dimensional views. Data can then be viewed vertically and horizontally to search for anomalies.

Soil properties and the frequency of the GPR antenna determine both the depth that the radar pulse will penetrate and its resolution. Higher frequencies will not go particularly deep, but can detect smaller objects. Lower frequencies will go deeper and can detect larger objects (Conyers 2004). The speed of the pulse depends on the composition and moisture levels of the soil through which the signal travels (Conyers 2004, 2012).

Figures 5 and 6. Drs. Amanda Reignier and Scott Hammerstedt establishing reference points for geophysical survey on TDA property

Figure 7. Dr. Alicia Odewale operating Ground Penetrating Radar at another location.

Archaeological features appear in the data as multiple types of anomalies. These are generally caused by the deflection/reflection of the radar pulse created by the contrast between a feature or grave and the surrounding soil (Bevan 1991; Conyers 2004, 2012). Hyperbola-shaped anomalies often appear directly over archaeological features. These can mark pits, hearths, burial vaults, air pockets created by coffins, coffin furniture, or buried foundations such as headstones and stone outlines (Bevan 1991; Conyers 2004, 2006, 2012; Gaffney and Gater

2003). However, tree roots, rocks, and rodent burrows can cause similar hyperbolas, thus requiring careful mapping of the survey area and care in interpretation of the data. Generally, if an anomaly appears in the same place in multiple sequential profiles, it is more likely to be archaeological than a naturally occurring feature.

A GSSI Utility Scan with a 350 MHz antenna was used for this project (Figure 4). It was moved in a sequential zigzag pattern across the survey area and the antenna constantly remained on the ground surface during data collection. Data was collected at 100 readings per meter with 0.5 meter spacing between transects. Signal strength was good to a depth of roughly 2 meters, well within the depth of historic buildings. Data were downloaded into RADAN 7 for processing.

Gradiometry. A gradiometer is a passive sensor that measures changes in magnetic fields in a unit known as nanoteslas (nT) (Aspinall, et al. 2008; Clark 1996). Burning and disturbance both alter the magnetic reading of soil, meaning features such as fire pits, mounds, old excavation units, burials, and house floors are typically detectable using this technology. Soils with high organic contact also have slightly higher magnetic readings (Lockhart 2010). Metal objects have very high readings and are visible as dipoles (a strong alternate high and low nT reading). The presence of large quantities of metal on a site can sometimes make data collection with a gradiometer problematic but can also be helpful, particularly at historic sites. A Bartington Grad 601 gradiometer was used for this project (Figure 5). Data were collected in a zigzag pattern every 12.5 cm along the same transects used for GPR. The data were downloaded into TerraSurveyor 3 and standard processing methods were applied in order to identify any possible subsurface anomalies.

Figure 8. Scott Hammerstedt using Bartington gradiometer at another site.

Results and Interpretations

As noted above, we surveyed a total of 3,600 m^2 (Figure 1). Two 20x20 m grids were skipped with the gradiometer because of a fence and a metal electrical box that would have interfered with data collection. However, these grids were both collected with GPR. Several other grids were collected with only one instrument due to other field considerations (Table 1).

Grid	Gradiometer	GPR
N942E1063		x
N962E1063	x	x
N982E1063	x	x
N1002E1063	x	x
N1022E1063		x
N1042E1063	x	x
N1062E1063	x	x
N1062E1083		x
N1082E1063	x	x
N1082E1083	x	x
N1102E1063	x	
N1102E1083	x	

Table 1. Survey tract grid squares surveyed by each instrument. Grids are named by the UTM coordinate of their southwest corner.

Gradiometer data point to the presence of numerous metal objects in the survey area (Figure 6). No discernable patterns were evident in the southernmost three grids due to the sheer number of magnetic anomalies. The 1915 Sanborn map of this area indicates that many buildings were present, which may explain the relatively high quantities of metal, but some of these anomalies may correspond to metal artifacts deposited in later times. The northern portion of the surveyed area is more magnetically quiet, with notable exceptions of clusters of increased magnetism in N1042E1063 and N1062/N1082E1083. These correspond well with anomalies evident in the GPR data and the locations of buildings on the Sanborn map, which we suggest correspond to the foundations of historic structures. We will discuss these data more thoroughly below.

GPR data (visualized in Figures 10-12, 14-16, and 18-20) indicate that a number of subsurface anomalies are present. Some indicate clear patterns and allow us to make some interpretations of what may be lying below the surface; others are more ambiguous. We limit ourselves to the most obvious targets in this report and will discuss selected anomalies in individual grid squares from south to north. See Figure 1 for grid references.

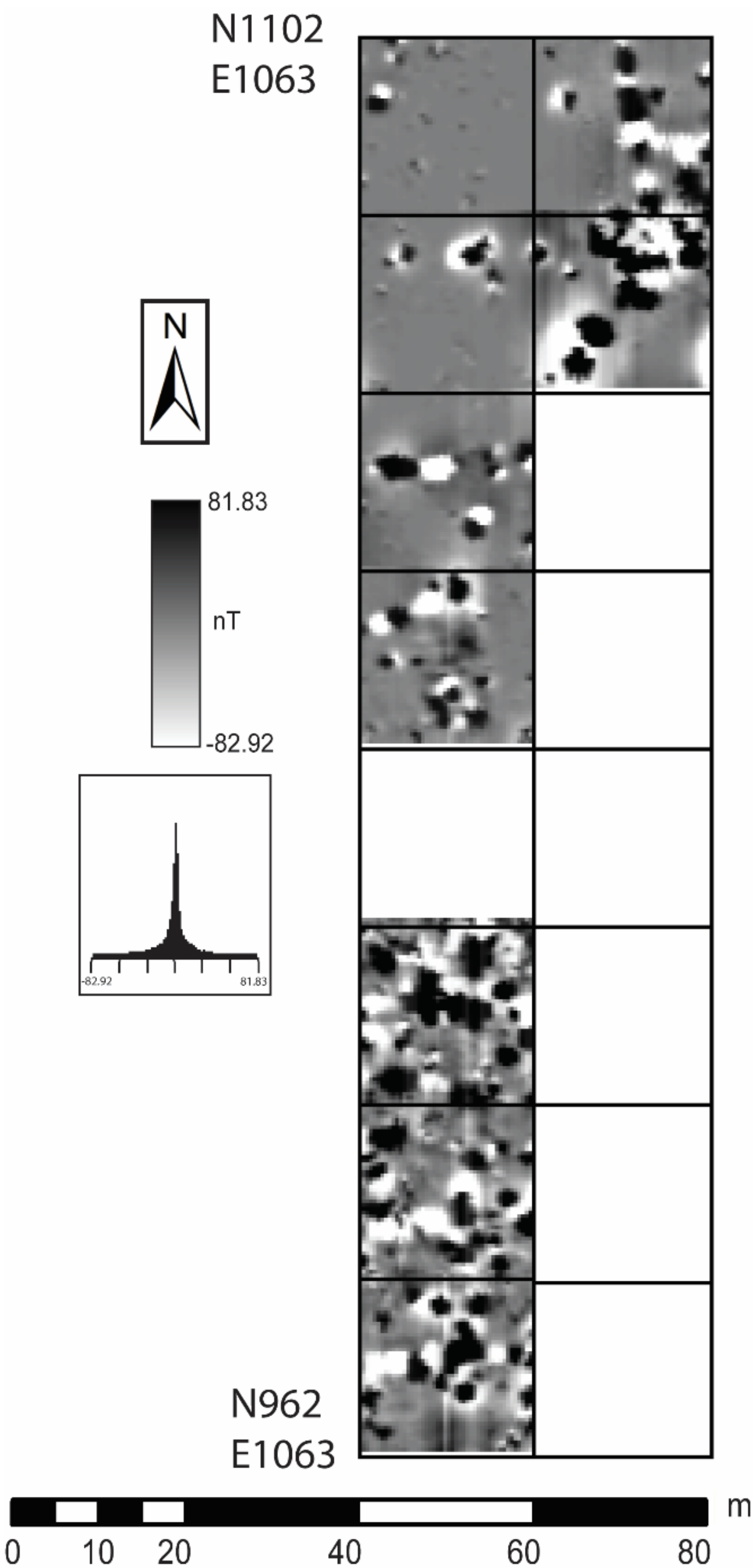

Figure 9. Representation unbar School tract gradiometer results. 20x20 m squares. Dark indicates higher magnetism. Lighter areas indicate zones of lower magnetism.

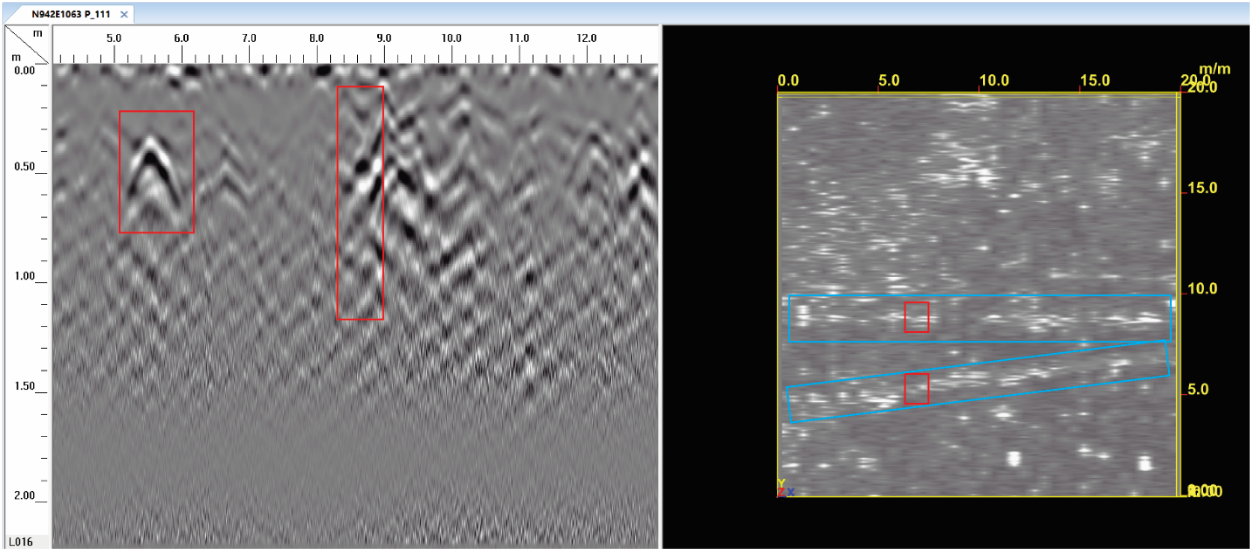

Figure 10. Linear anomalies in N942E1063 in profile (left) and in a horizontal time slice 50 cm below surface (right). The locations of the parabolas in the profile are marked on the time slice in red and the linear anomalies are outlined in blue.

<u>Grid Square N962E1063</u>: There is only one anomaly of note in N962E1063 (Figure 11). It is L-shaped and each long axis is roughly two meters in length. It is possible that it corresponds to a feature marked on the 1915 Sanborn maps, but it is likely too far to the west (Figure 12). This grid likely encompassed the location of several buildings on the map, as well as subsequent constructions occupied in later years, but the GPR data do not directly attest to their presence. In contrast, the high concentration of magnetism visible in the gradiometer data points to the likely presence of nails and other iron objects that may have been part of historic constructions on this site.

<u>Grid Square N942E1063</u>: The most notable anomalies in N942E1063 are two linear features that stretch from east to west across the entire square (Figure 10). It is possible that these represent buried pipes. We do not have corresponding gradiometer data for this square because it was too close to a metal fence. Regardless, there are no anomalies that suggest the presence of subsurface structural remains. Based on the available data, it is not possible for us to speculate how old these pipes might be or whether they might be connected to historic structures.

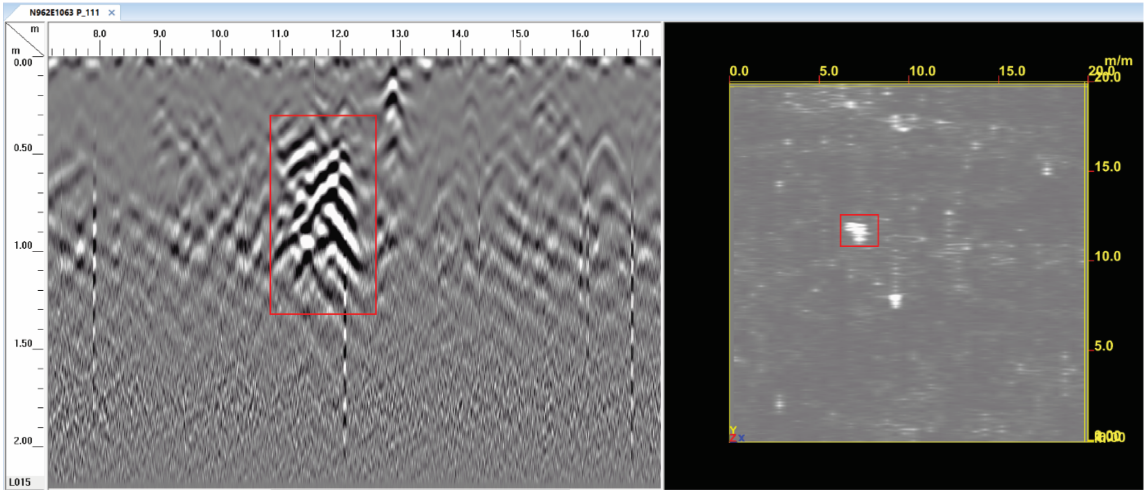

Figure 11. L-shaped anomaly outlined in red in profile (left) and in a horizontal time slice 60 cm below surface.

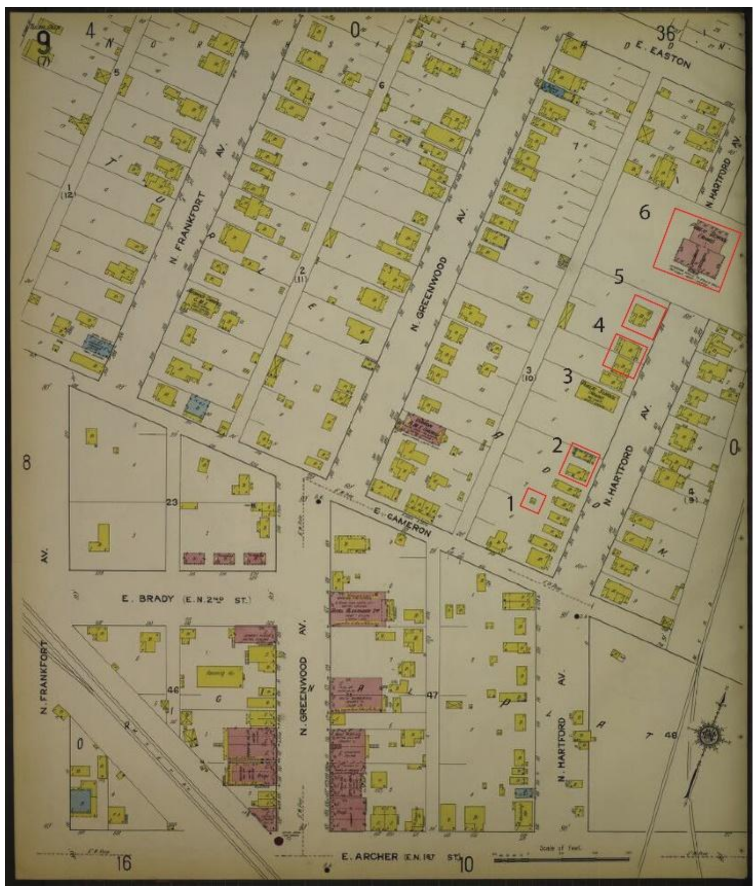

Figure 12. 1915 Sanborn map indicating location of some potential structures whose remains may be indexed in the GPR and Gradiometer Data. 1. N962E1063; 2. N982E1063; 3. N1022E1063; 4. N1042E1063; 5. N1062E1063; 6. N1062/1082E1083. Downloaded on November 5, 2020 from https://www.loc.gov/collections/sanborn-maps

Grid Square N982E1063: Both gradiometer and GPR data from N982E1063 show evidence of possible buildings marked on the Sanborn map (Figure 12). Gradiometer data consist of two large concentrations of higher magnetism near the location of these buildings (Figure 13). There are multiple consecutive GPR profiles showing an anomaly measuring approximately 6 m north-south and eight m east-west (Figure 14). The time slice is less regular, but this is not uncommon. Only the northern anomaly was detected using GPR.

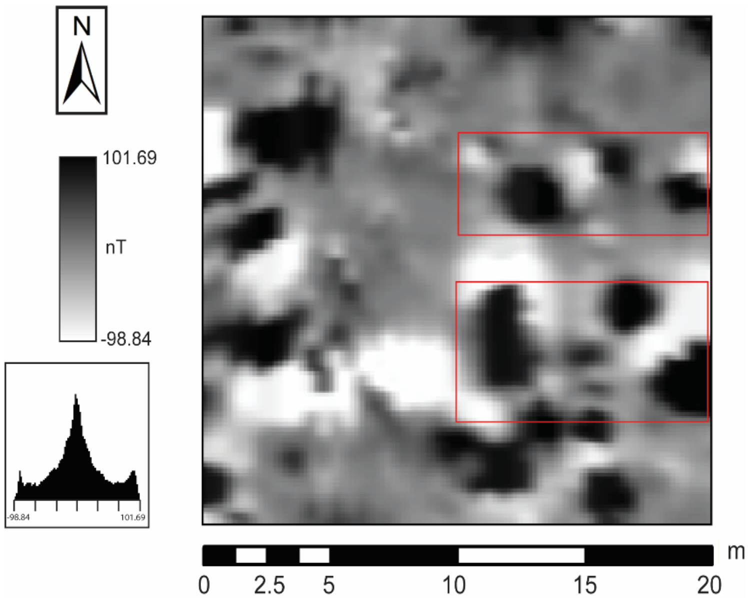

Figure 13. Gradiometer data from N982E1063. Note two areas of increased magnetism outlined in red.

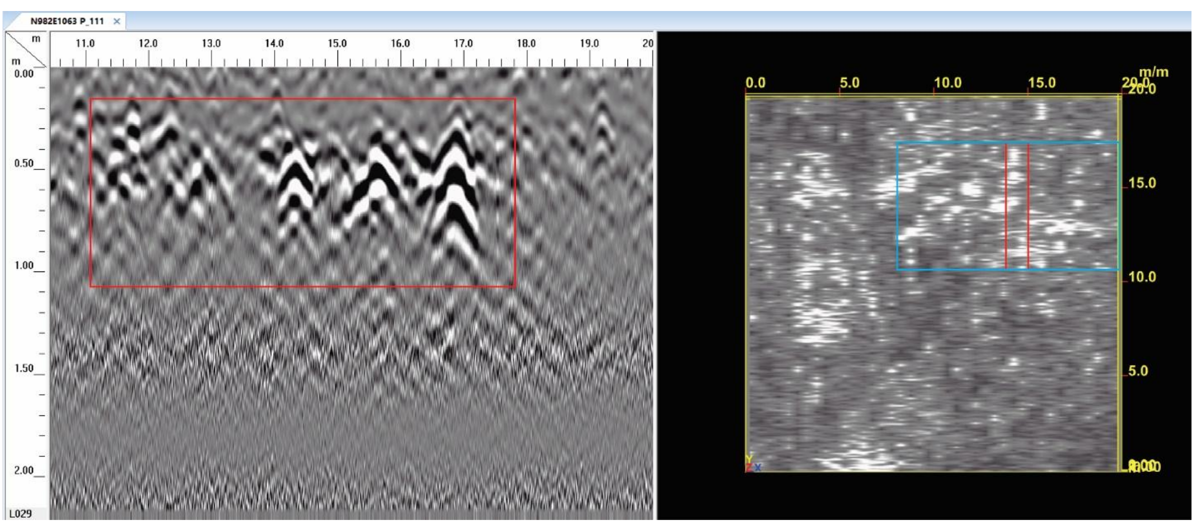

Figure 14. Possible structure in N982E1063 in profile (left) and in a horizontal time slice 50 cm below surface (right). The location of the profile is marked on the time slice in red and the overall anomaly is outlined in blue.

Grid Square N1002E1063: No anomalies of interest were noted in N1002E1063. This area corresponds to a vacant section of the Sanborn map.

Grid Square N1022E1063: No gradiometer data were collected in N1022E1063 due to the presence of a metal electric box. The Sanborn maps show several structures in this area, including a public school (Figure 9). GPR data show disturbance in the top 50 cm of nearly every profile in this grid (Figure 12), but the horizontal slices show only one 5x5 m regularly shaped anomaly (Figure 13). This suggests that large portions of this area have been disturbed. While artifacts and foundational remnants may still exist, no strong evidence of them was found during this survey.

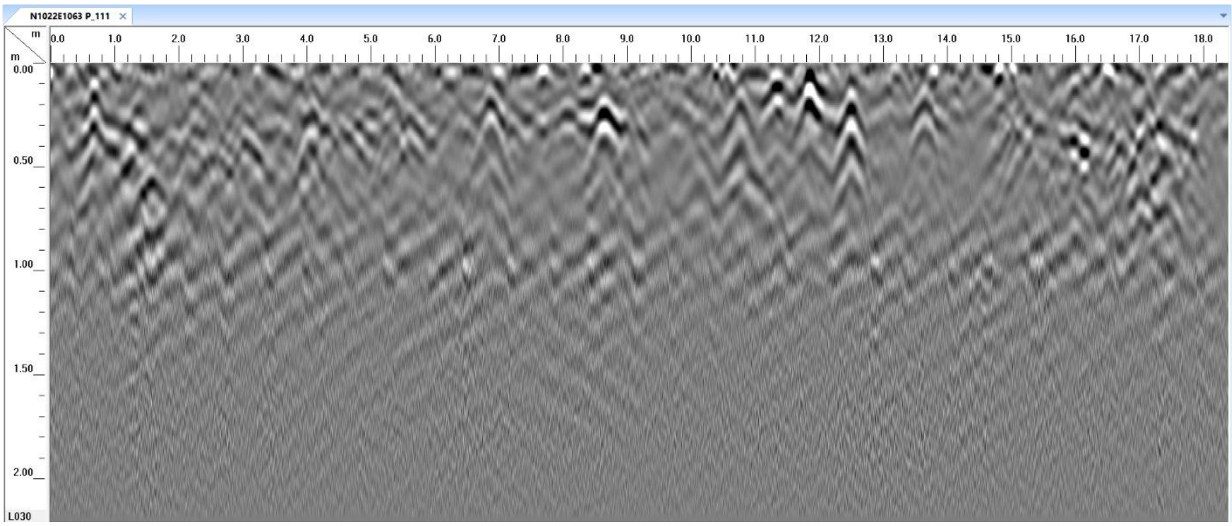

Figure 15. Typical profile from N1022E1063. Note series of anomalies in the top 50 cm.

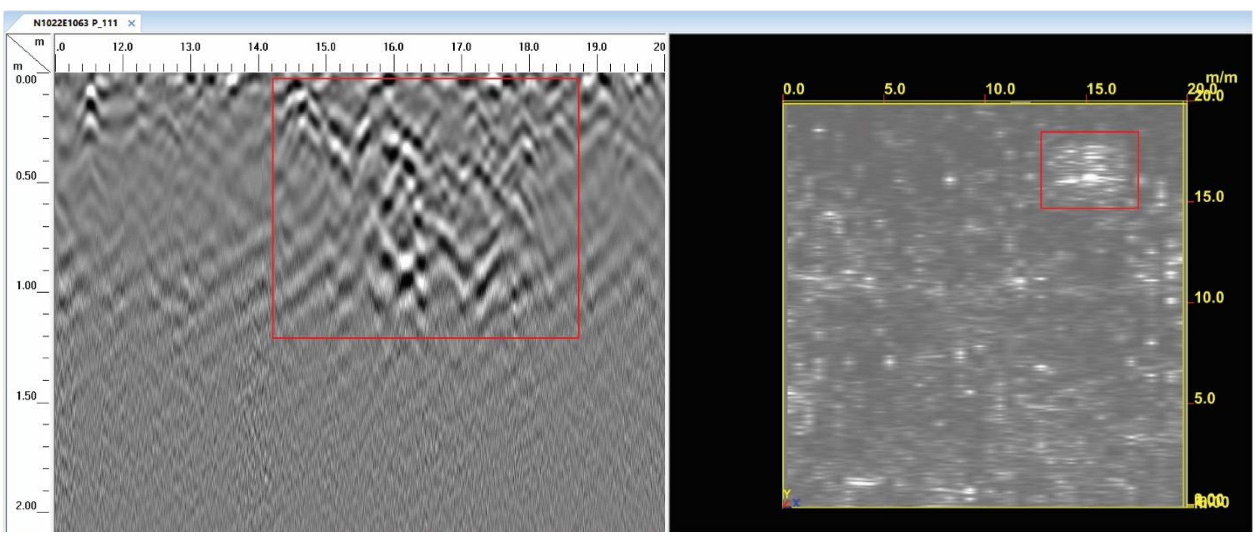

Figure 16. Profile (left) and horizontal time slice at 50 cm below surface of square anomaly in N1022E1063.

Grid Square N1042E1063: Both gradiometer and GPR data show a large anomaly encompassing most of N1042E1063 (Figures 14 and 15). The Sanborn maps indicate that several buildings stood in this location (Figure 9). The strength of the anomalies in the geophysical data suggest that intact deposits from these structures may exist.

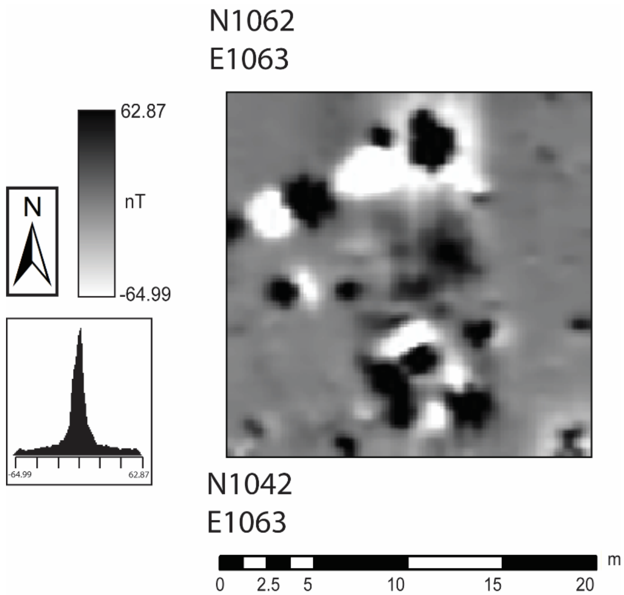

Figure 17. Large cluster of magnetic anomalies across the entire center of N1042E1063. Dark indicates higher magnetism.

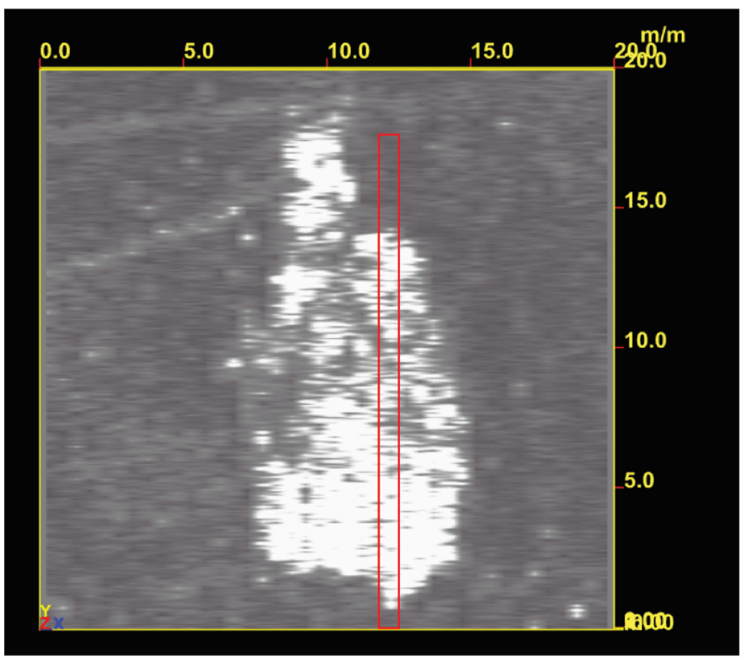

Figure 18. PR profile (bottom) and horizontal time slice at 60 cm below surface in grid N1042E1063.

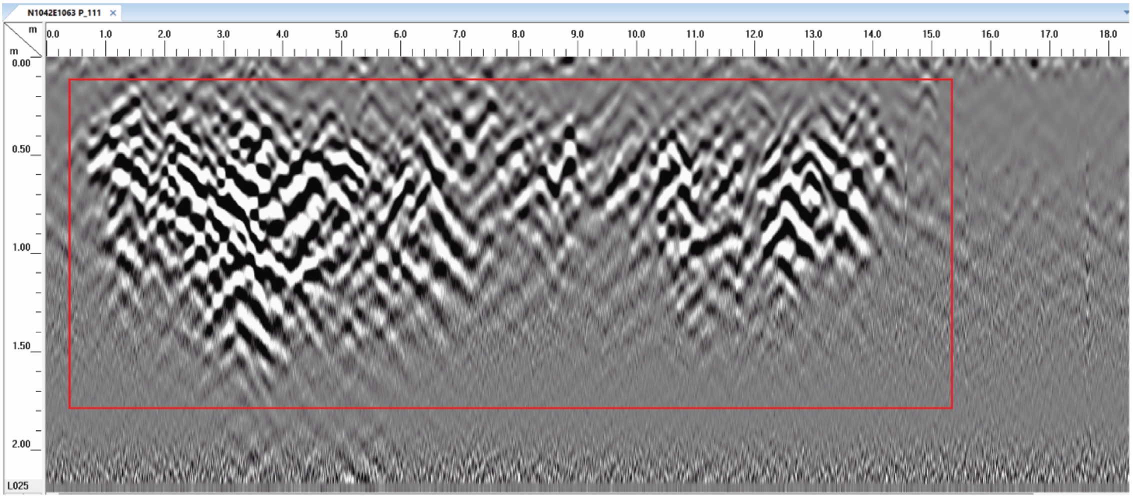

Figure 19. GPR profile from Grid N1042E1063. The location of the profile is marked in red on the time slice.

<u>Grid Square N1062E1063</u>: The 1915 Sanborn Map also shows that one structure may have been present in the southeast portion of N1062E1063 (Figure 9). Neither the gradiometer nor the time slices show any regularly shaped features, but there are strong reflections in many of the GPR profiles from this section of the grid (Figures 16 and 17). This suggests that some deposits may remain intact. There is also a large linear anomaly detected by both the GPR and the gradiometer that is likely a buried metal object (Figures 16 and 18).

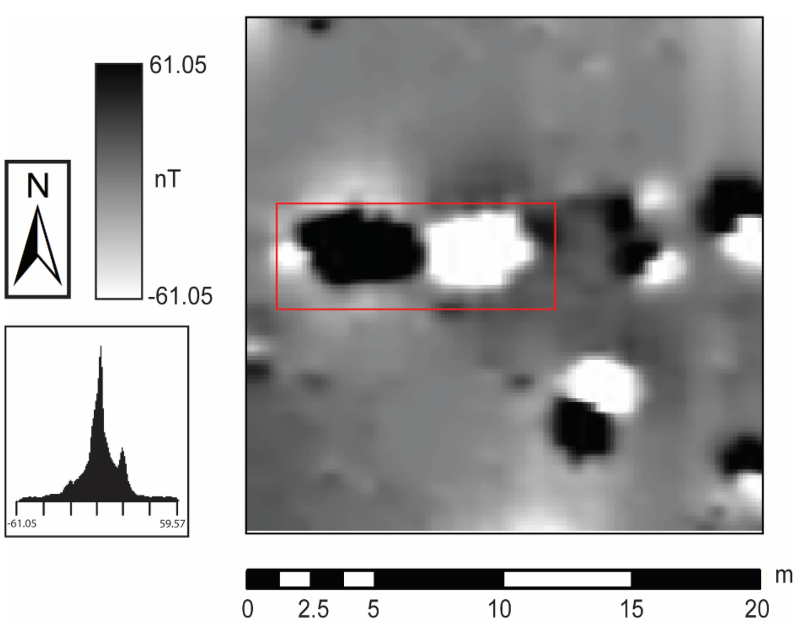

Figure 20. Gradiometer data from N1062E1063. Note the lack of large features in the southeast corner. The dipole outlined in red corresponds with the GPR anomaly seen in Figure 18 and is likely a large metal object.

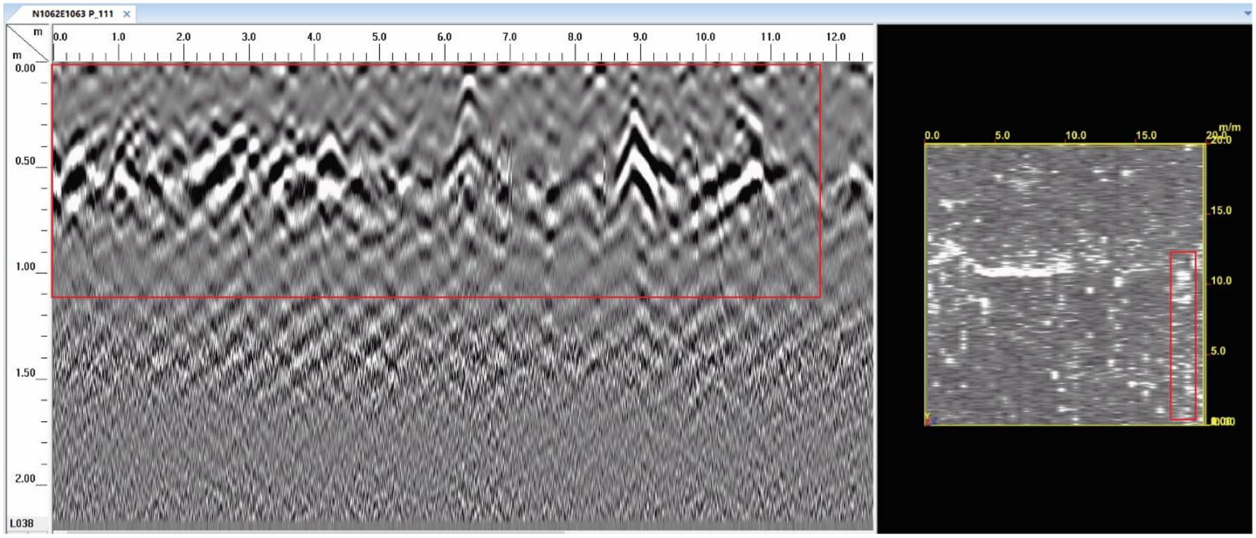

Figure 21. GPR profile (left) and horizontal time slice of N1062E1063 at 60 cm below surface (right). The location of the profile is marked in red on the time slice.

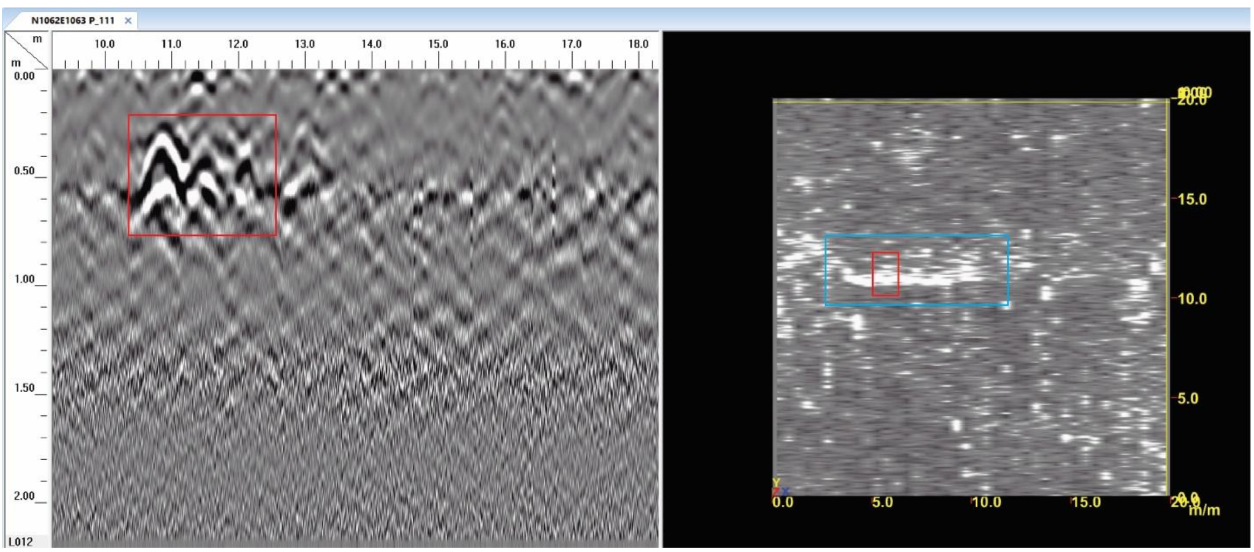

Figure 22. GPR profile (left) and horizontal time slice of a linear anomaly in N1062E1063 at 60 cm below surface (right). The location of the profile is marked in red and the anomaly is outlined in blue on the time slice.

Grid Square N1082E1063: A roughly 7x1 m north-south anomaly was identified in N1082E1063 with GPR (Figure 19) but it does not appear in the gradiometer data (Figure 6). This suggests that it is not metallic. The Sanborn map does not show a structure in this area.

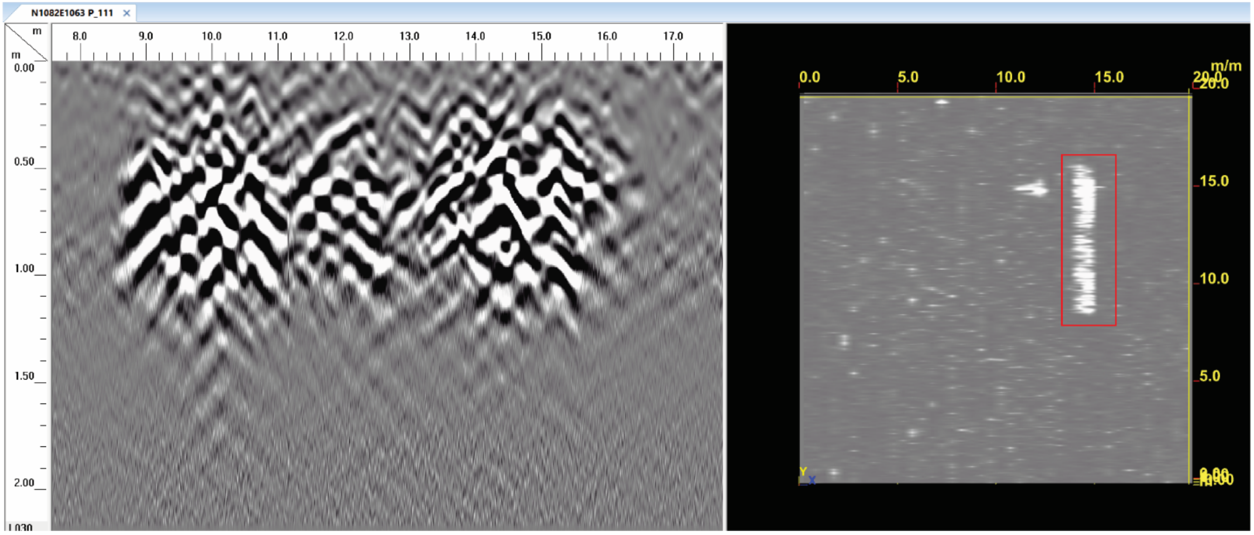

Figure 23. Linear anomaly in N1082E1063 in profile (left) and horizontal time slice at 45 cm below surface. The location of the profile is marked in red on the time slice.

Grid Square N1082E1083: A large magnetic anomaly is apparent in the northeast corner of N1082E1083 and southeast corner of N1102E1083 (Figure 20). This corresponds with a large T-shaped anomaly in the GPR data (Figure 21). The Sanborn map suggests that this may have formerly been the location of the Dunbar School (Figure 4). The robust geophysical signature of this area suggests that intact deposits may exist here and may be related to this school, which was one of the earliest public schools in the Greenwood area run by the Creek Nation (Tulsa Preservation Commission).

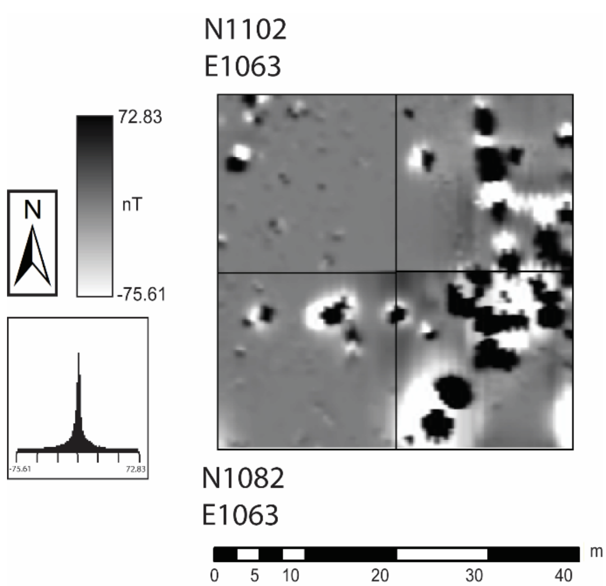

Figure 24. Large cluster of magnetic anomalies in the northeast corner of N1082E1083 and southeast corner of N1102E1083. Dark indicates higher magnetism. The linear band of alternating high and low magnetism extending to the north is likely a metal pipe.

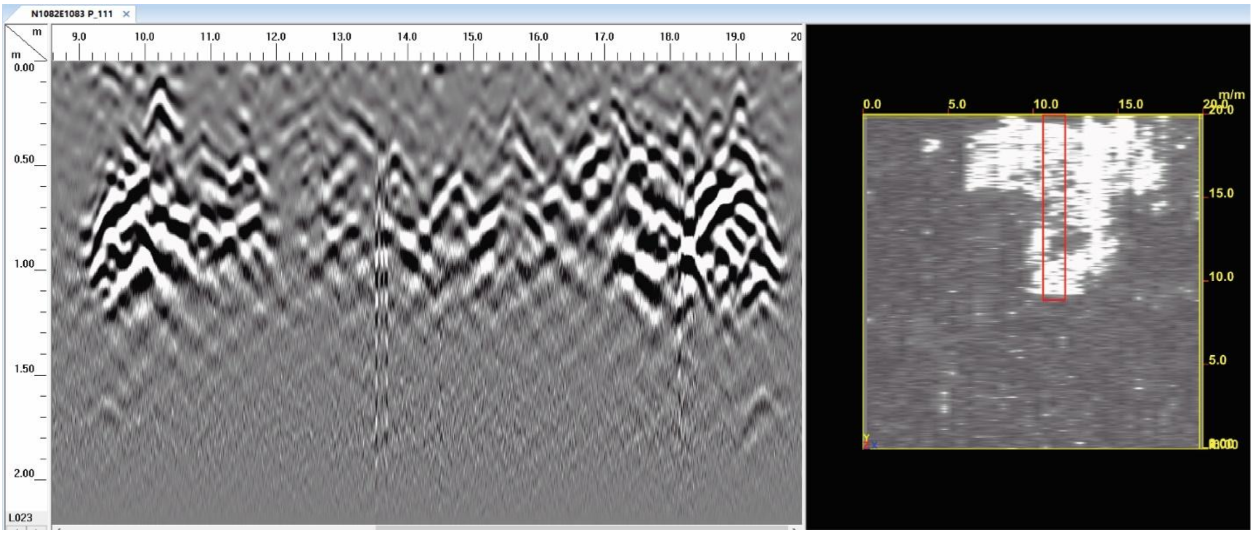

Figure 25. GPR profile (left) and horizontal time slice at 70 cm below surface of N1082E1083. The location of the profile is marked in red on the time slice.

Ward School Area.

In addition to the geophyiscal survey area, we also documented the remains of standing structures on the block bounded on the west by North Boston, on the north by East Fairview, on the East by MLK Jr. Boulevard, and on the south by an abandoned section of Easton Street, now parallel to the crosstown Expressway onramp. Sanborn maps indicate that this block was the site of the historic Tulsa Ward school, and the remains of a number of historic structures remain visible on its surface. We include several relevant photographs of these remains here.

Figure 26. Remains of staircase within Tulsa Ward School area

Figure 27. Wall foundations within Tulsa Ward School area

Figure 28. Bricks within tulsa ward school area

Summary. At least six areas of the East Greenwood tract could potentially contain the remains of buildings that existed on the 1915 Sanborn map and were subsequently destroyed in 1921. Of these, two have the highest potential for further archaeological investigation: N1042E1063 and N1082/1102E1083. These have relatively robust geophysical signatures and match the locations of a building that may be related to a public school and the Dunbar School itself. In addition to the geophysical results, examination of aerial imagery from September 10, 2016 shows crop marks that match the GPR time slices (Figure 22). This provides further evidence that intact deposits likely exist on these sites.

Given the significance of this area to the history of Greenwood and evidence for the continued preservation of at least two historic structures within this landscape, we would suggest that further documentation of structures and remains be carried out within the two areas highlighted in Figure 29. If the Tulsa Development Authority is open to this possibility, we truly look forward to discussing opportunities for future collaboration.

Figure 29. Aerial image from September 10, 2016 showing crop marks, corresponding to two major anomalies revealed in GPR data.

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