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Topographic Mapping of the Burns Site (8BR85), Cape Canaveral Air Force Station, Brevard County, Florida

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TOPOGRAPHIC MAPPING OF THE BURNS MOUND ARCHAEOLOGICAL SITE (8BR85), CAPE CANAVERAL AIR FORCE STATION, FLORIDA

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A Report Submitted to Thomas E. Penders, 45th Space Wing Cultural Resources Manager,

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Project Objectives

The prime objective of the project was to acquire the data requisite in producing a topographic map of the Burns Mound (8BR85) site. In addition to the technical aspects of mapping, the project is engaged in mitigation and preservation. This is the overarching goal of the Cape Canaveral Archaeological Mitigation Project (CCAMP) under the direction of Thomas Penders, 45th Space Wing Cultural Resources Manager (Penders 2015). Moreover, this project builds upon data collected and maps generated during the previous field season.

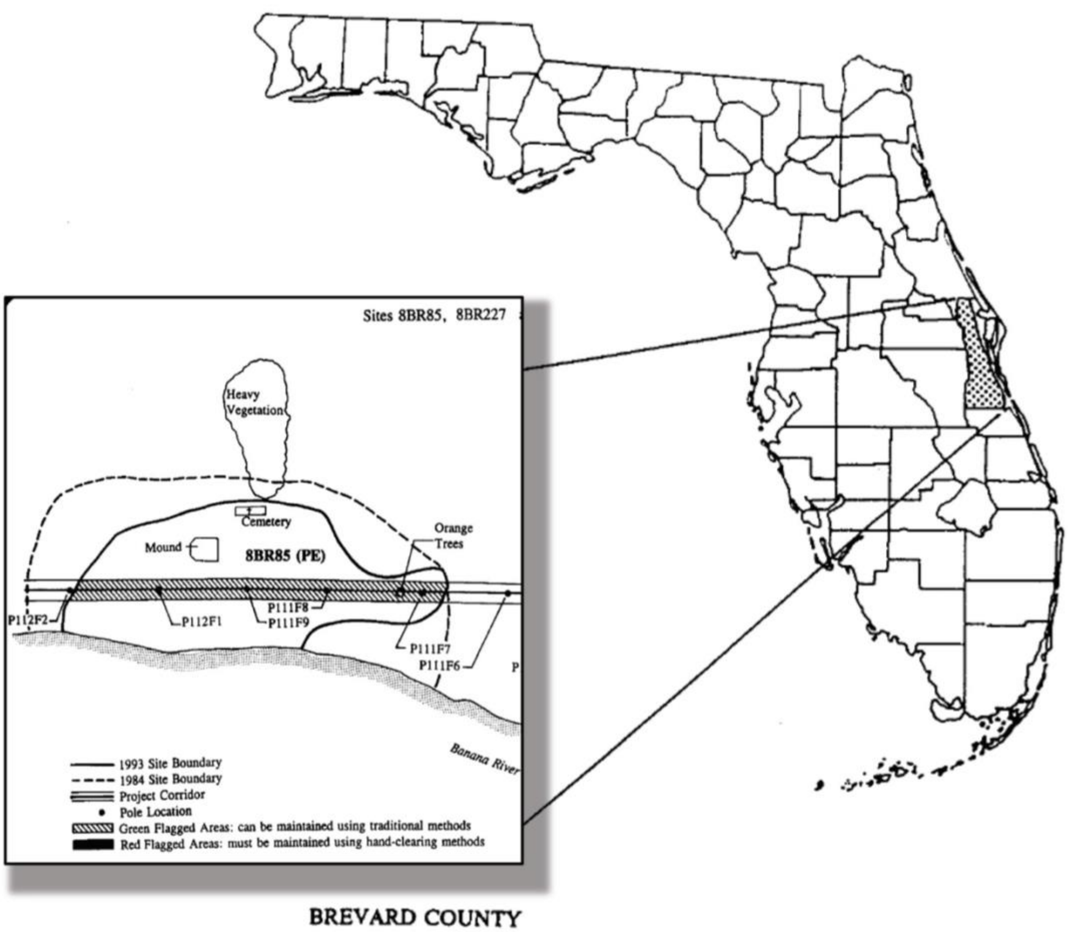
In addition to academic research, this project aims to submit for recognition of the historic component of Burns Mound by the National Registration of Historic Places (NRHP). This not only provides further protection for the site, it assists in creating a permanent and accessible record. Gathering, recording and analyzing the greatest amount of relevant data from Burns Mound is the principal objective. The research presented here is focused on one element of a grander proposal. In order to present the most pertinent and detailed report, our concentration will focus on topographic mapping and a brief nearest neighbor spatial analysis of the Burns Mound site.

Public outreach and awareness is the final aim of the project. Along with official registration with the NRHP, presentations of initial results have already taken place, and further publications are forthcoming. The Global Positioning System (GPS) and other spatial data collected at Burns Mound will be made available for use in Geographic Information Systems (GIS) and topographic maps made available for further research.

Site Background

The Burns Mound archaeological site is located on the Cape Canaveral Air Force Station (CCAFS). Positioned in the SE 1/4 of Section 26, T23S, R37E, of the Cape Canaveral Quadrangle Map (Penders 2015), the datum placed for survey this field season is located at UTM WGS 17R 539638.14m E 3147176.03m N. The Burns Mound topography is the focus of this report, although the Burnham Family Cemetery (BR2352) and the Wilson Brothers Cemetery (BR2353) fall within the survey area. Conferring with Florida Master Site File (FMSF) records the Burns Site dimensions are N/S 910m; E/W 370m with an assessed total area of ca. 33.67 hectares (ha) (83.20 acres [ac]) (Levy 1984: 97).

Figure 1: Location of Burns Mound Site, Cape Canaveral, Brevard County, Florida



Source: Bellomo Janis Research 1996

Expanding across a sand ridge along the Banana River, the midden, prehistoric and historic cemeteries demonstrate that the Burns Mound site has had an extensive chronicle of habitation. Natives, European settlers, slaves, and space travelers inhabited this over the centuries, continually altering the landscape. Sacred spaces are interspersed with 19th century homesteads and 20th century launch pads, spatially as well as temporally (Penders 2015).

Figure 2: Burns Mound 8BR85 2018

Source: Richard Ott (8BR85) 2018 field season

A lengthy chronicle of archaeology has taken place at the Burns Mound, both amateur and academic. In 1869 J. S. Adams, a Civil War correspondent for the New York World, was the first to publish an account

of the mound (Rouse 1951). The mound was reported to be 6.1 meters (m) (20 feet [ft]) high and 27.43m (90 ft) wide. Adams also recounted that artifacts, including a myriad of ceramics, human remains, and other unidentified cultural materials had been gathered by antiquarian Sir Francis Sykes (Rouse 1951: 192-94).

J. Francis Le Baron investigated the site in 1884 and confirmed locating the mound, but stated it was only 2.44m (8 ft) high and 15.25m (50 ft) in diameter. There are no records of artifact collection or excavations during this surface assessment (Levy 1984; Rouse 1951).

In 1931 Harvard Peabody Museum archaeologist G.M. Stirling conducted what could be described as the first academic survey. Stirling focused exclusively on the mound and did not implement any excavations. Although Stirling conducted surface collection no report on the dimensions of Burns Mound could be discovered (Rouse 1951:192).

As a result of the Civil Works Program of 1933-34, archaeologist George Woodbury conducts what he describes as a complete excavation of the mound. Building on Stirling's preliminary report, Woodbury states the mound to be 13 ft (3.96m) high and 79 ft (24.07m) in diameter (Levy 1984; Stirling 1935). The stratigraphy of the mound was documented by Woodbury at this time. During this excavation many shell artifacts, faunal and human remains collected and were sent to the U.S. National Museum (Rouse 1951: 194).

The next archaeological report providing any dimensional data on the mound was Gordon R. Willey's excavation of the mound in 1954. Willey's Burns Mound and Fuller Mound Group reports revealed discrepancies with the Woodbury excavation analysis.

Pertinent to this report are the conflicting mound dimensions between the 1935 and 1954 surveys. Willey details that prior to his excavation the mound measured 3.95m (12ft) high and 23.9111 (78.5ft) in diameter. Also, Willey's stratigraphic analysis demonstrates that only half of the volume of the mound was excavated by Woodbury (Willey 1954). The mound's dimensions as reported by Woodbury are 3.96m (13 ft) high and 24.07m (79 ft) in diameter (Levy 1984; Stirling 1935) while Willey shows greater dimensions.

An 8.333 % increase in height and 0.636% increase in width occurred between the two excavations. What taphonomic processes created this incongruence are not discussed by the researcher. Our spatial analysis will show that a height increase in the Burns Mound occurs again, even after destructive processes.

In 1966 George A. Long conducted a surface investigation of native and historic sites around Kennedy Space Center (Long 1967). Two parts of Long's report to Kennedy Space Center (KSC) are pertinent to our analysis of the mound topography. First, Long is the first to have recorded X/Y site coordinates on the KSC Master Plans. He places the Burns Site at Congressional Location: NE ¼ SE ¼ S26 R37E T23S (Long 1967). Second, Long states that a "bulldozer reportedly plowed through the mound in recent years and shell was removed from the middle in the [sic] Tex Williams reshaped the mound and erected posts and cables around it" (Long 1967:102). Although this is informant based evidence, our research will show that Long was correct in his reporting.

In 1982 Richard Levy with Resource Analysts, Inc (RAI) conducted an archaeological survey of Cape Canaveral Air Force Station (CCAFS) over 15,800 acres (6,394 ha). Using a methodology that included archival documents, local informants, pedestrian shovel tests, remote sensing, windshield survey, and surface exposures the project surveyed 26 known sites including 8BR85 and six new sites (Levy 1984).

Using the Florida Power and Light Company (FPL) transmission line as an access route, the RIA team reconnoitered a 402.34m (1320.01ft) wide band trailing the Banana River coastline (Levy 1984:60). The surveyors' employed linear features including road shoulders, canal drainage routes and skid strips as transect lines (Levy 1984:60-62). Levy reports that the "midden extended 360m (1181.1 ft) northward and 270m (885.82ft) to the south of the datum point on 1st power pole south of burial mound and varied between 50m and 150m in width" (Levy 1984:98). Levy, who apportioned the site into three "Areas", details that Area 1 comprises an open grassy area by the powerline. The interest of this report to our study are the bulldozer piles by the tree line and the elevated surface down the middle of the corridor (Levy 1984:110).

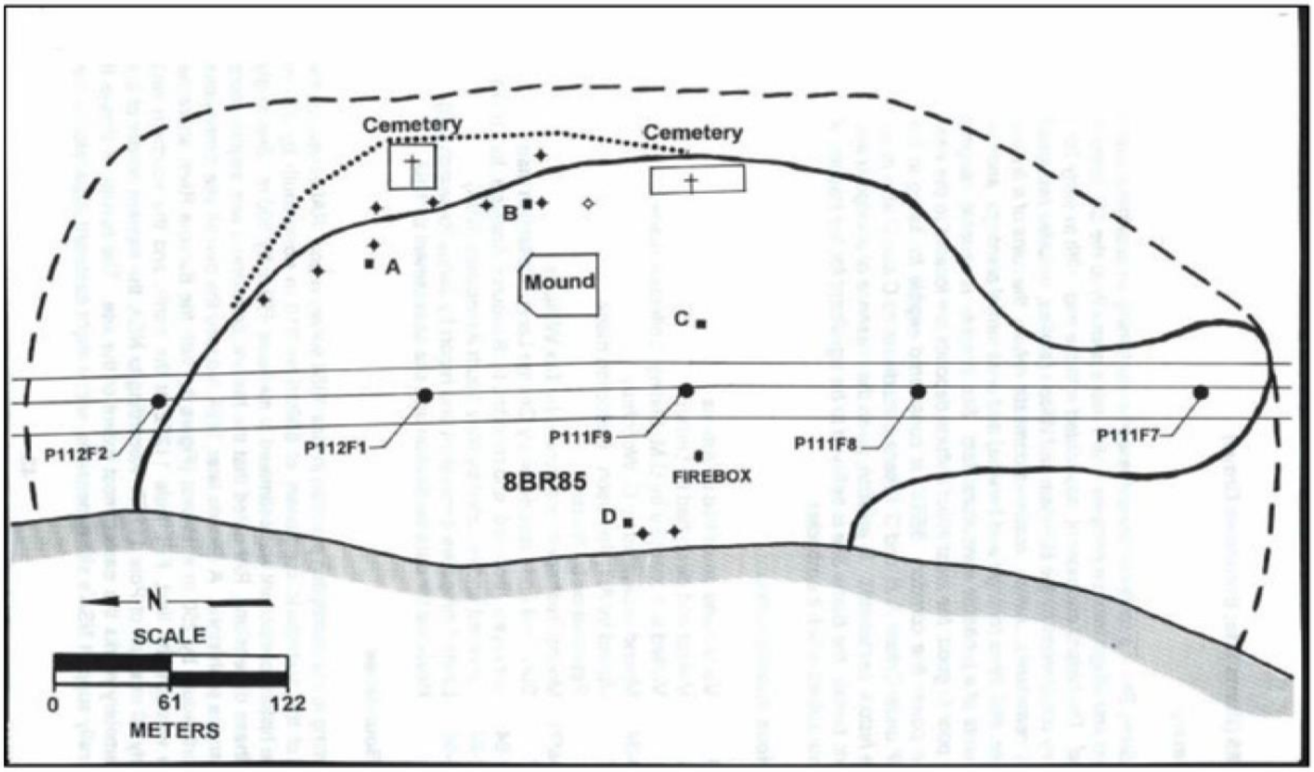
New South Associates (NSA) directed an historic properties survey encompassing 578 ha (1,430 ac) which included 8BR85 (Cantley et al 1993). The survey crew cut transects 25m (82ft) apart vertical to the FPL, on which they conducted shovel tests. NSA's survey area encompassed both the mound and the historic cemeteries at 8BR85. Through their GPS analysis, NSA found incongruities in the size of the site in relation to Levy's data. The site is 720m (2362.2ft) N/S by 250m (820.21 ft) E/W (Cantley et al.).

Cultural Resource Management (CRM) company Janus Research under contract of FPL reconnoitered the Burns Site from 1994-1995. The survey was conducted to mitigate culturally and historically meaningful resources being impacted by replacing older FPL line poles (Bellomo 1996: 102- 107). Although the test pit analysis is beyond the scope of this report, Bellomo has produced several survey maps for comparison.

In 1999 J. Deming in affiliation with Archaeological Consultants, Inc (ACI) conducted Phase II excavation at Burns Mound. ACI's investigation included evaluation of 16 previously identified sites for their NRHP eligibility and to obtain more exact site boundaries using GPS equipment (Deming 1999). ACI analyses agree that the prehistoric assemblages date to the Malabar II period but they diverge with previous site size estimates (Deming 1999:49). ACI extended the Eastern site boundary, aggregating the total site to 600m (1968.5ft) N/S by 250m (82021ft) E/W (Figure 4) (Deming 1999:4-5).

The Burns Mound encompasses 4272.4 square meters (l.06ac) and is surrounded by a chain link fence (Penders 2015:23). This sacred native site currently meets the criteria for NRHP eligibility. 8BR85 has is now a sanctioned indigenous repatriation area for prehistoric remains discovered at CCAFS (Penders 2015:23). Repatriation Area 1 neighbors to the southeast corner Burns Mound and the circular mounded Repatriation Area 2 is to the west.

Figure 3: ACI Survey Map 8BR85



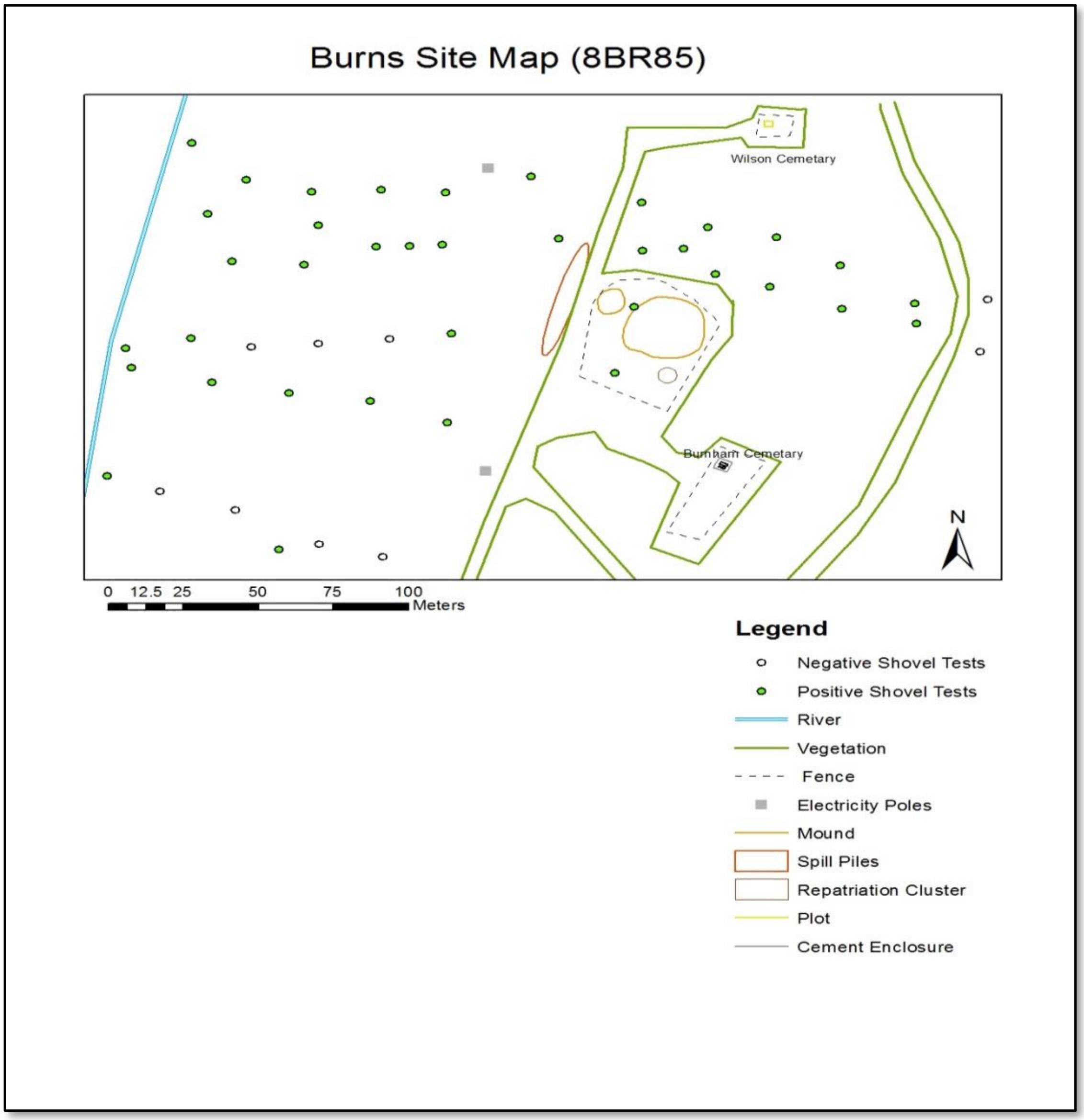
Source: Deming ACI 1999:44

In 2017 the Cape Canaveral Archaeological Mitigation Project completed a Phase I and remote survey of the Burns Site. CCAMP is a cooperative archaeological mitigation project between the University of Central Florida (UCF) and the Cultural Resource Management Program of the 45th Space Wing. Graduate and undergraduate students work under the direction of Thomas E. Penders, Cultural Resource Manager CCAFS along with Drs. Sarah B. Barber and Neil Duncan of UCF. This report continues and builds upon the GPS and spatial data presented by this 2017 CCAMP investigation concentrating on producing precise topographic maps and spatial analysis data.

Trimble GPS point collection, Total Station survey, and spatial analysis in ArcGIS. The points of reference used were the fenced enclosures of the Burns Mound, Burnham Cemetery, and Wilson Cemetery. The survey data was imported into ArcGIS and rendered to Triangular Irregular Network (TIN) files. These

files were then used to generate various maps for the site, provide reference data for further spatial analysis and establish a consensus on the boundary (Figure 4) (Peabody 2017).

Figure 4: CCAMP 2017 Burns Site Map



Source: Jesann Gonzalez CCAMP, 2017

Methodology

The methodology of this survey and map generation followed closely with that established by the 2017 CCAMP team. Utilization of the Topcon 230 Total Station for elevation and GPS point collection was crucial to producing a precise topographic map. Data collected with this dedicated survey equipment allowed position and height data to be continuously captured across the Burns Site. The survey crew included Michael Felice and Richard Ott, undergraduate interns under the direction of Dr. Sarah B. Barber, UCF.

One significant change in data collection that should be noted is the use of backsite point settings instead of reorienting to 0 degrees N at each new survey datum location. This allows for shooting to a known point and maintaining continuity across the site survey. Declination was also taken into account for setting the occupy position. The Nation Oceanic and Atmospheric Administration (NOAA) was utilized to verify and set the magnetic declination when setting the Total Station. A reading of -6.87 @ +/- .33 degrees was used during this survey. Each time to Total Station was set measurements of height for the unit and the stadia were taken to ensure proper elevation readings. Similar to previous surveys the first datum was set near the FRL corridor, transmission pole 111F8. In addition to this point, survey was conducted from an optimal position on top of the mound, with a backsite to the already established datum 1. This helped establish a relative plane for separate point data. Figure 5 shows the survey datum points around the site along with the two excavation units of the field season.

After capturing the spatial data through the site survey, the information was processed using Pathfinder for error correction. This data was then input into Esri ArcGIS in order to render X/Y and elevation reading into a topographic map. The resultant .shapefile, raster and TIN files will be made available for further spatial research and future mitigation efforts.

Table 1: Burns Site Datum Points

	Datum 1	Mound Datum
A	204° 04’ 07”	235° 45’ 58”
Z	89° 51’ 20”	90° 09’ 45”
S	118.461 m	95.282 m
E	27.370 m	27.859 m

Figure 5: Burns Mound Datum Points

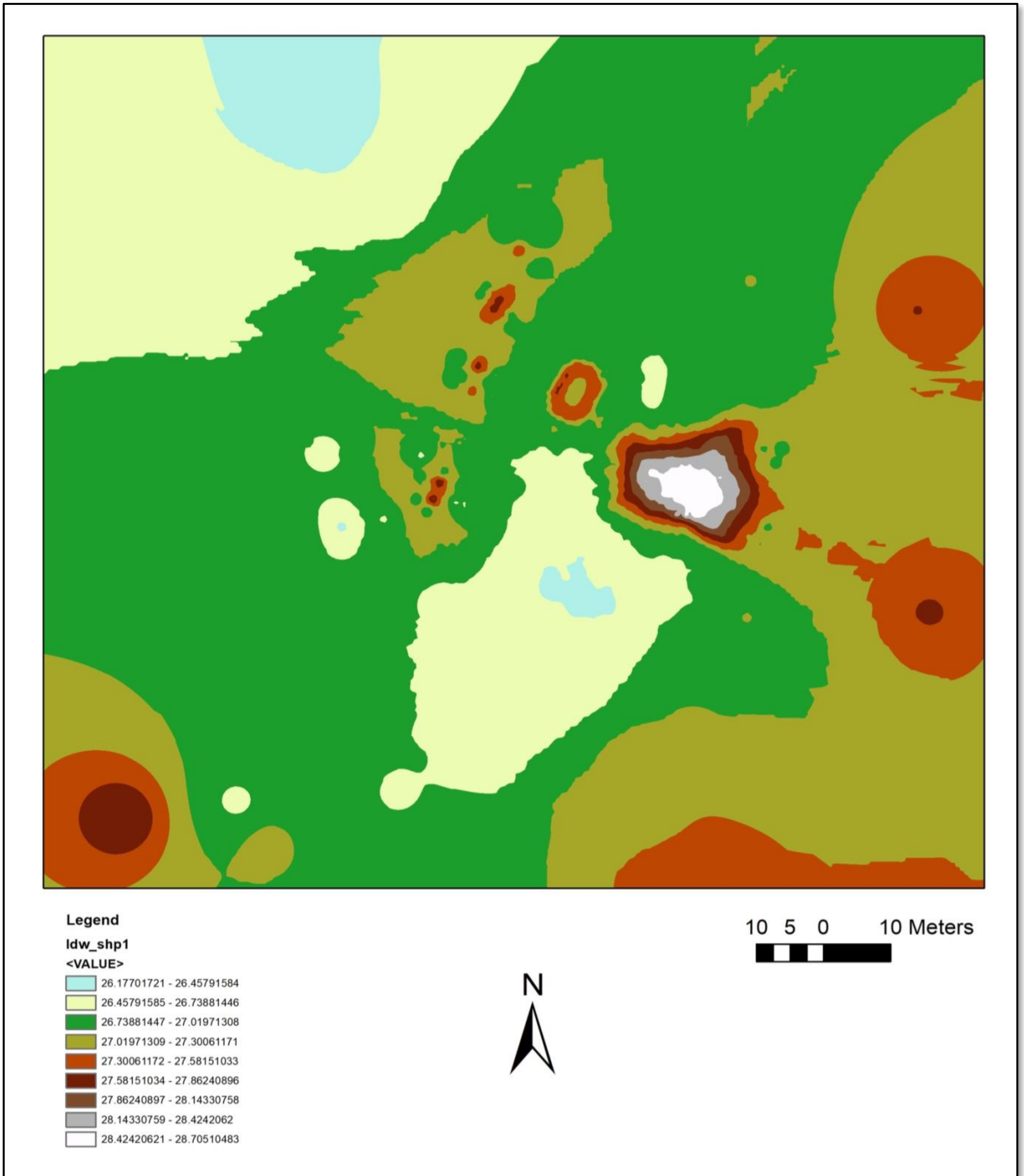
Source: Google Earth

Once all of the point data was imported into ArcGIS a shapefile was generated from the Comma Separated Value (CSV) file output from Pathfinder. Erroneous and redundant point data was then edited for the most accurate rendering of topographic data possible.

First, a topographic to raster file (Topo to Raster) was created with the edited spatial data from the site survey. This file was used as a comparison basis while processing with other interpolation algorithms. Since each type of spatial data processing produces different results it is a best practice to audition differing algorithms when producing the raster file from X/Y and elevation points (Wheatley & Gillings 2002). The second file produced was an Inverse Distance Weighted (IDW) raster. This formula produces a raster surface from points using a weighted distance average of points while the Topo to Raster algorithm imposes constraints on elevation data to ensure hydrologically accurate digital elevation models (DEMs) (Watson & Philip 1985). Spatial data was processed with Natural Neighbor (NN) interpolation was processed last. This formula locates the closest subdivision of points to a query point and applies proportional area weights to them to interpose a value (Sibson 1981). An advantage of this method is that interpolated heights are ensured to be within the range of elevation input data. This interpolation does not produce topographic details that are not already denoted by the input points (Sibson 1981). All interpolation models generated pertinent elevation data and should be used in conjunction for an holistic analysis of the Burns Mound topography.

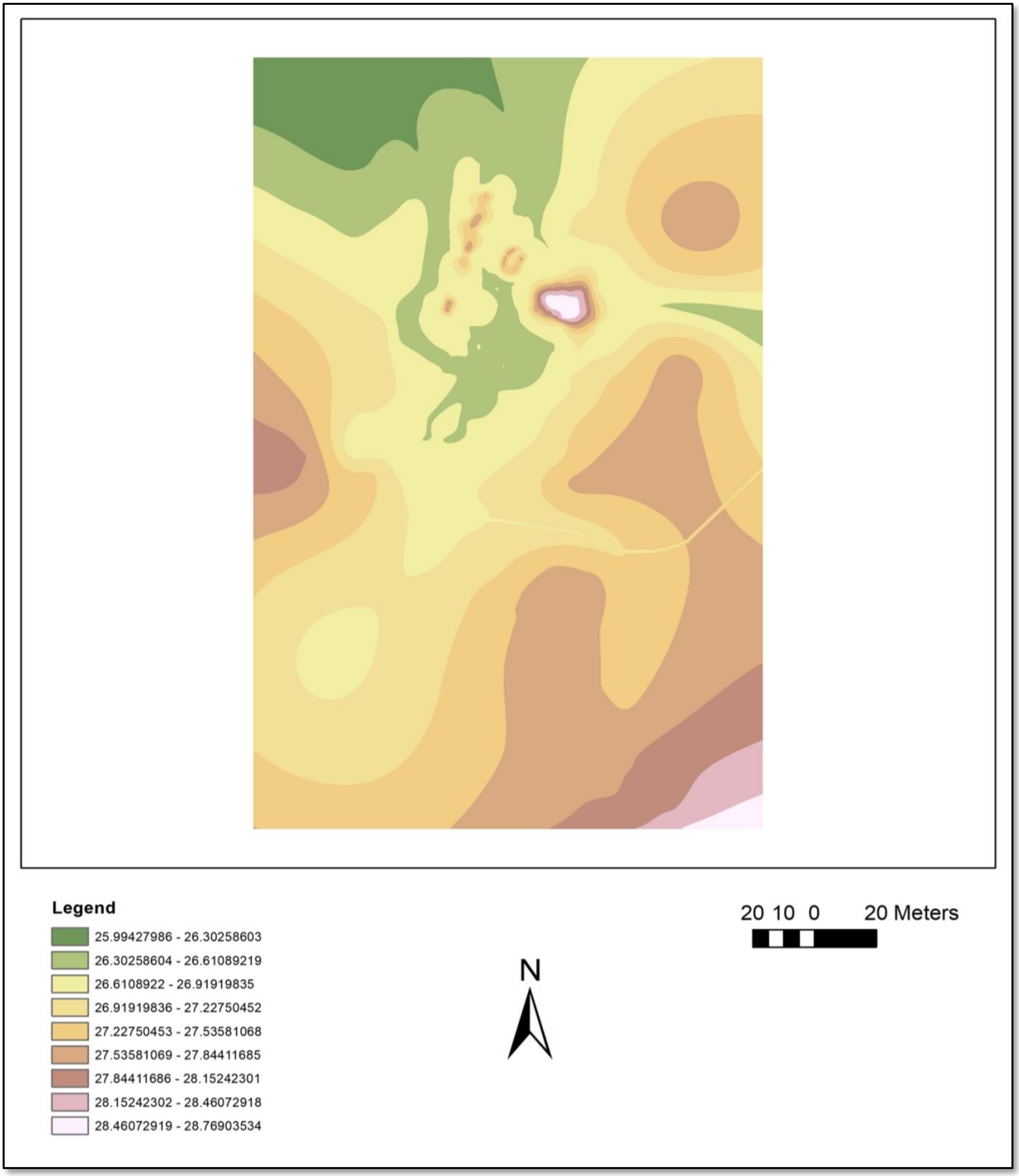
Our methodology resolved on generating multiple topographic maps of 8BR85, with a concentration on the burial and repatriation mounds. IDW (Figure 6), Topo to Raster (Figure 7), and NN (Figure 8) interpolated maps were generated, along with Contour files (Figures 9-13). In addition to the topographic data already discussed, Hillshade Effect images were generated to view the surface of the site in more unobstructed detail (Figures 14-15).

Figure 6: IDW interpolated topography



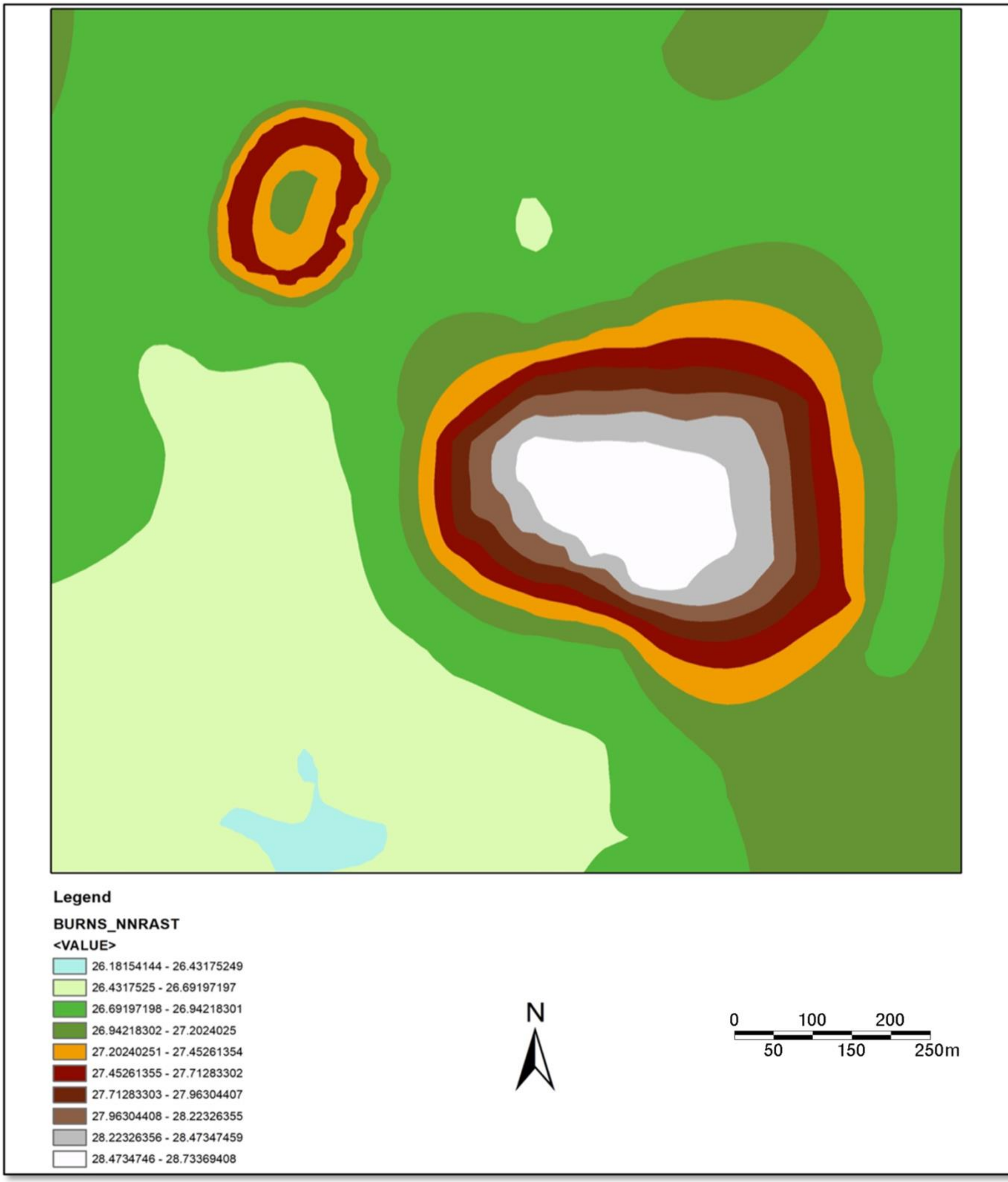
Source: Richard Ott CCAMP 2018

Figure 7: Topo to Raster interpolated topography



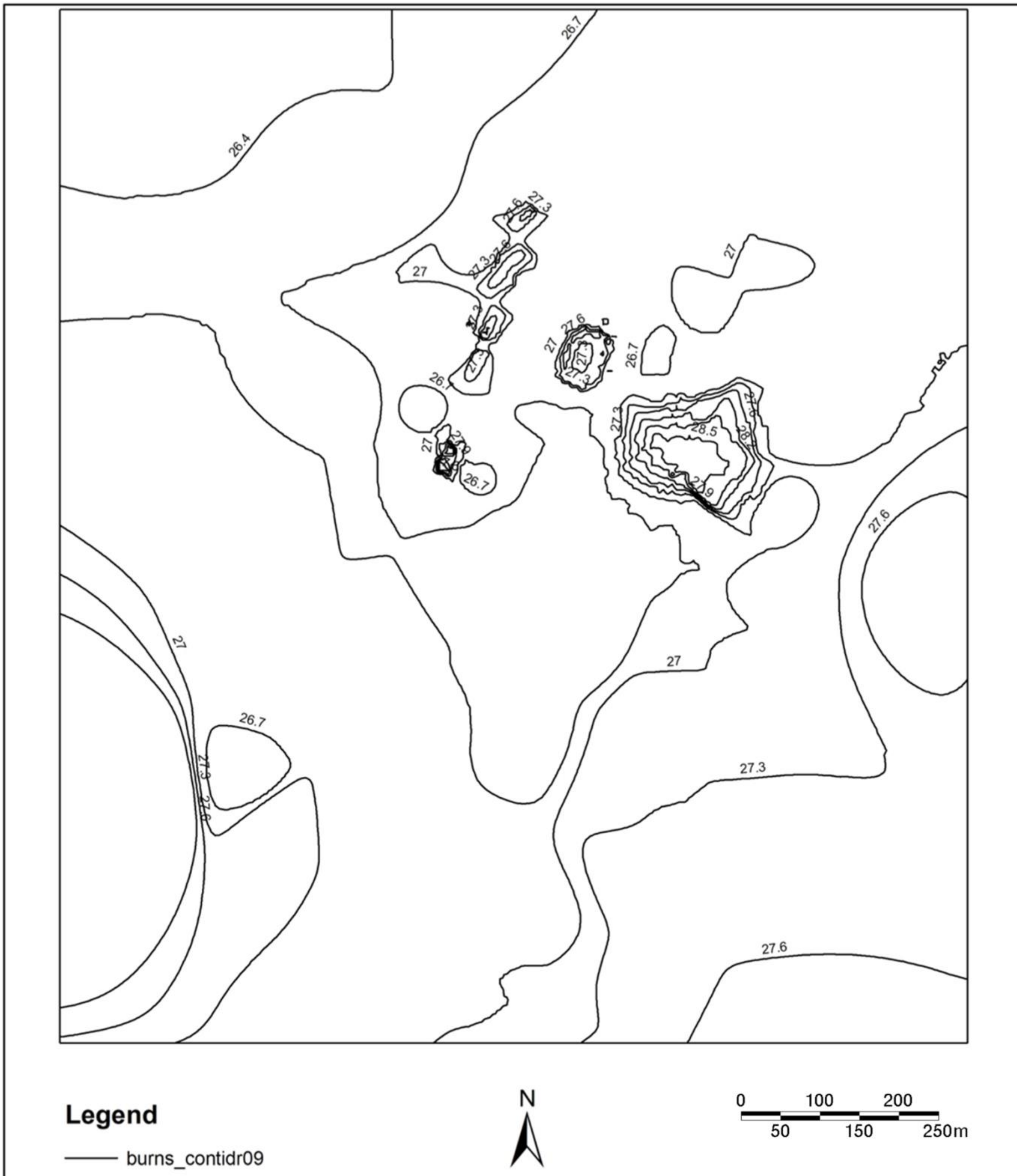
Source: Richard Ott CCAMP 2018

Figure 8: NN interpolated topography



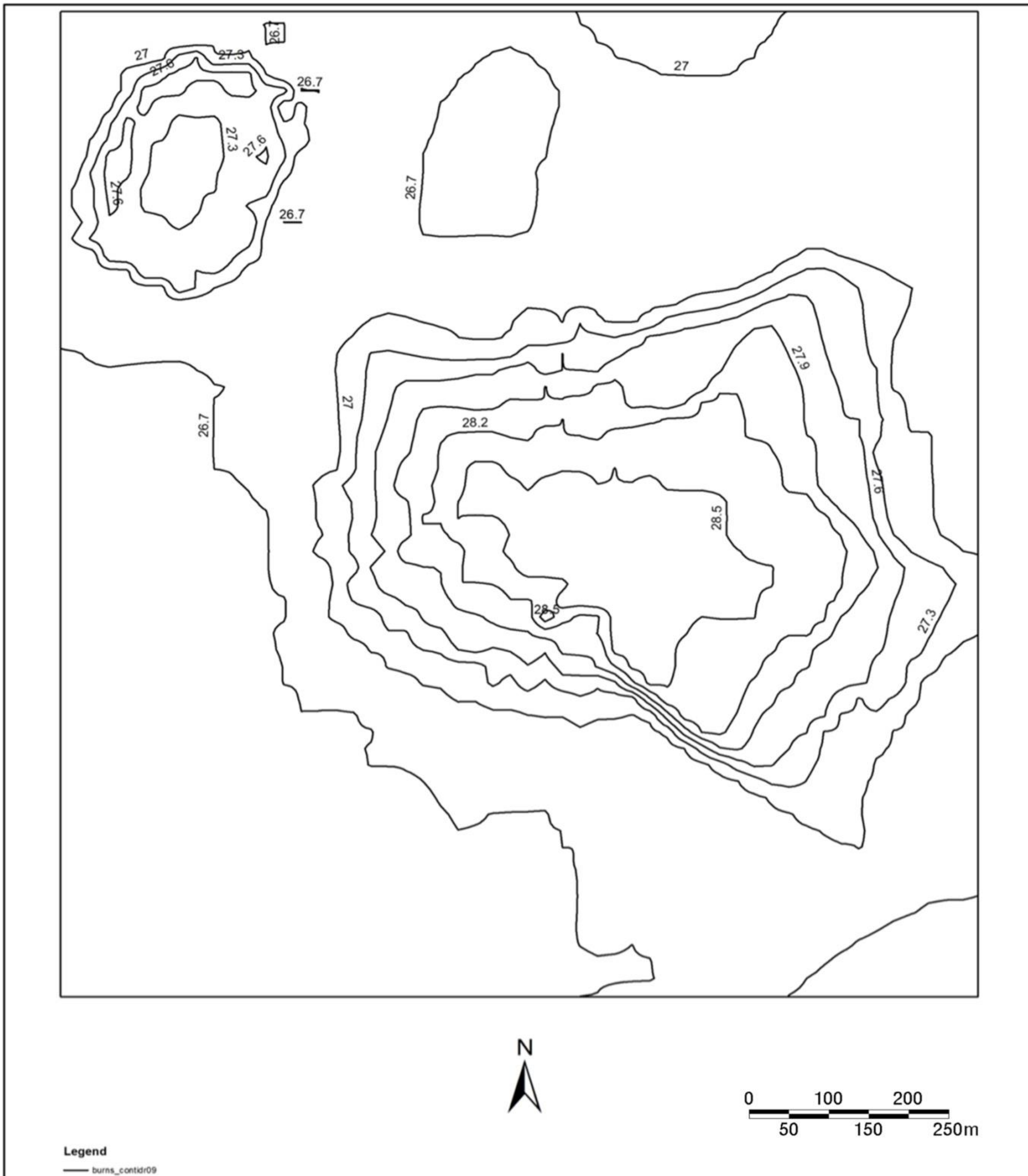
Source: Richard Ott CCAMP 2018

Figure 9: Contour IDW interpolated topography



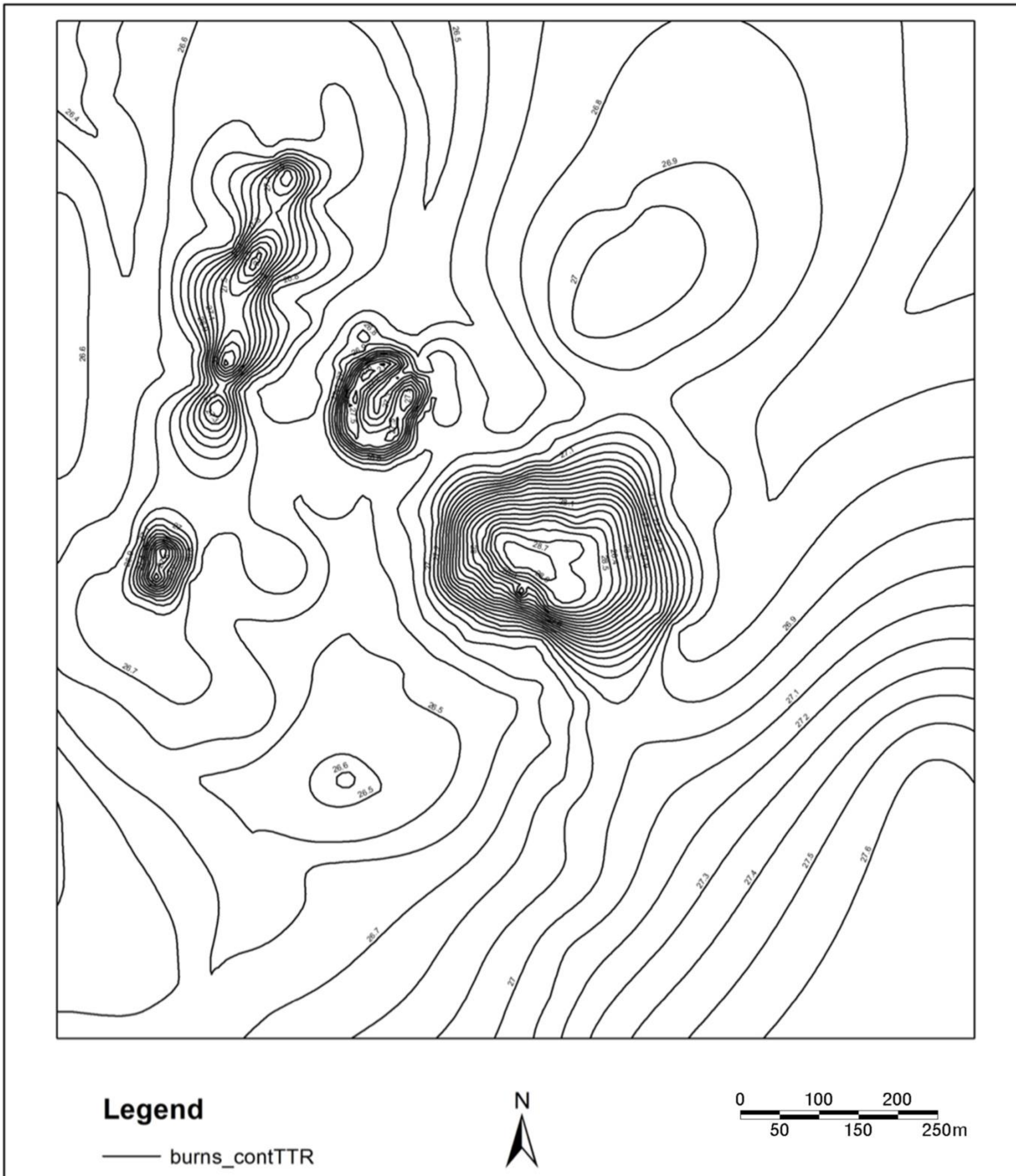
Source: Richard Ott CCAMP 2018

Figure 10: Contour mound IDW interpolated topography



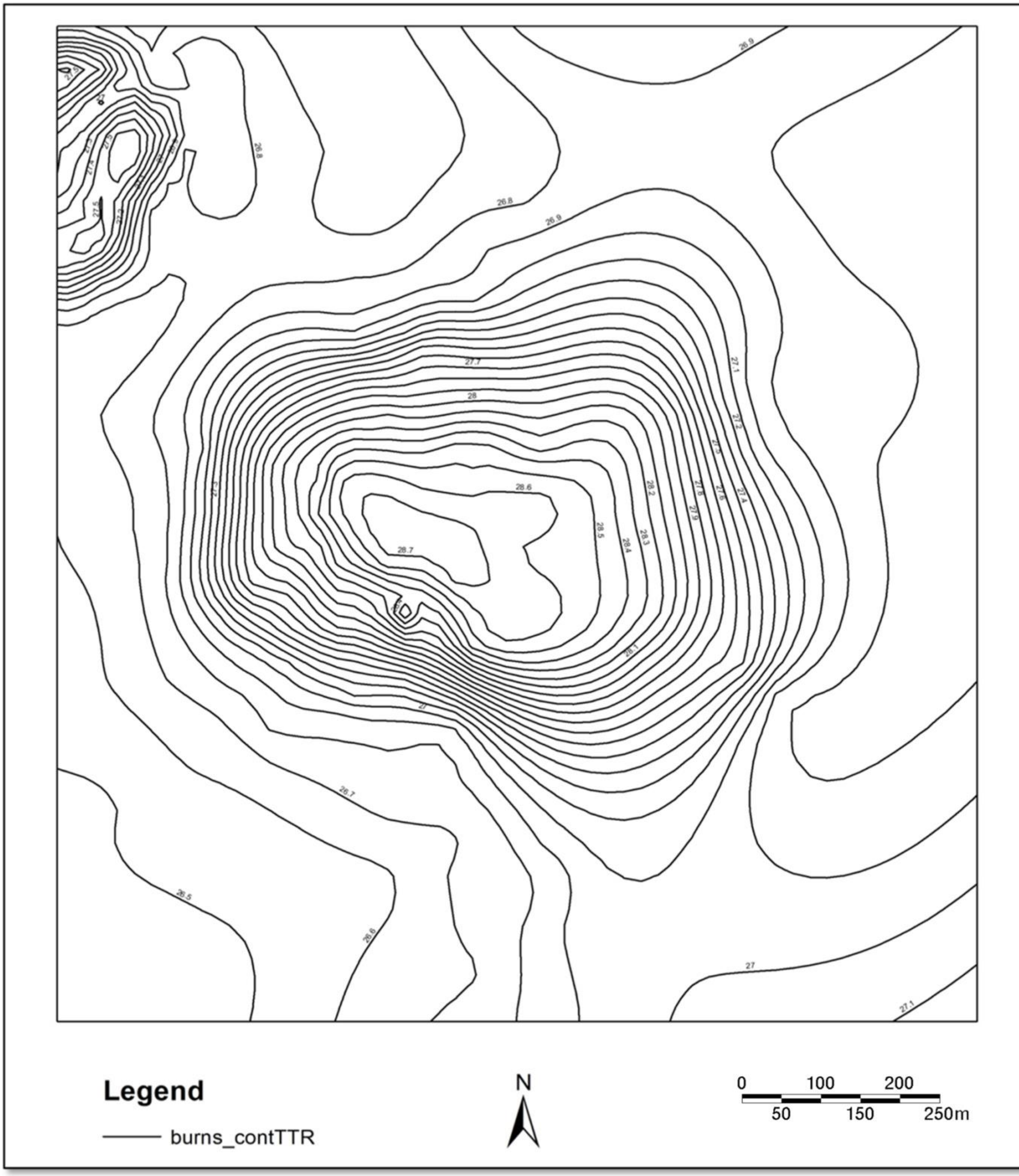
Source: Richard Ott CCAMP 2018

Figure 11: Contour Topo to Raster interpolated topography



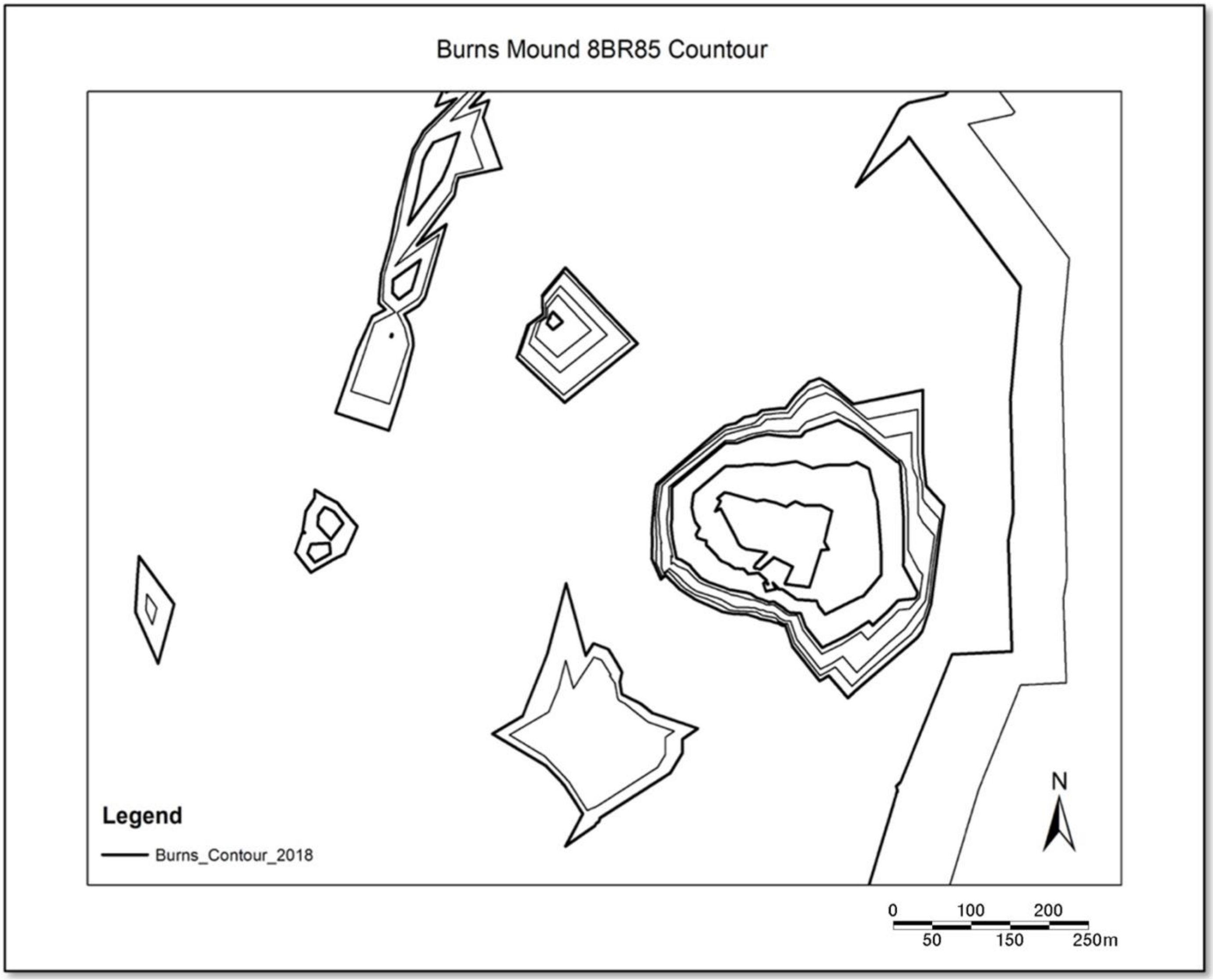
Source: Richard Ott CCAMP 2018

Figure 12: Contour mound Topo to Raster interpolated topography



Source: Richard Ott CCAMP 2018

Figure 13: Contour mound NN interpolated topography



Source: Richard Ott CCAMP 2018

Conclusions

It is our hope that the maps generated from this CCAMP 2018 field season prove to be a valuable resource to the program and Thomas Pender's mitigation and NRHP registration report. This document should be viewed as a preliminary report and further spatial analysis and topographic maps will be forthcoming. At this time the researchers are still conducting field work at 8BR85 and more data is projected to be collected.

To summarize the analysis at this point in the investigation, a brief review of the interpolation methods would be beneficial. Natural Neighbor, IDW, and Topo to Raster methods were employed in spatial analysis of the site data. A holistic view was adopted in this report based on the advantages and disadvantages of each formula. The final report will provide further spatial analysis of these tools and generate statistic data to support a final output map.

It is the opinion of this report that further Total Station and GPS survey is required at the site. Based on additional research a point grid method should be employed cross the entire fence boundary of the Burns Mound with an increased density of points focused on the earthworks (University of York 2018). This methodology combined with the already processed data will result in the best possible spatial data for topographic representation and terrain 3-D modeling.

Additionally new transects have been cut and excavation unit E has revealed what appears to be undisturbed midden and possible features. Further excavation is occurring this field season and these factors could affect the delimitations of the site boundary. We will also provide conclusive elevation data for the Burns and repatriation mound along total existing circumference measurements.

To conclude this report will focus on the preliminary spatial analysis of a Hillshade image generated from the IDW raster. By interpolating X/Y and elevation of the Total Station point data a map is produced that creates a shaded relief view by calculating the light source angle and shadows (Watson & Philip 1985). Figures 14 and 15 are a preliminary rendering with the Hillshade algorithm.

As we have alluded to earlier in this report this map demonstrates that Long's witness was correct and the mound was bulldozed then attempted to be reconstructed by Tex Williams (Long 1967:102). By analyzing Figures 14 and 15 bulldozer blade and tracks can be seen in the topography. There are also geometric patterns that are not natural or prehistoric. Interestingly the N and NE sides of the mound appear to be most intact demonstrating the minimum blade marks. Further research with stratigraphic analysis

could verify whether this part of the mound is original midden, backfill from previous excavation, or modern reconstruction. The maps are provided here for further interpretation and analysis.

Figure 14: Hillshade mound IDW interpolated topography

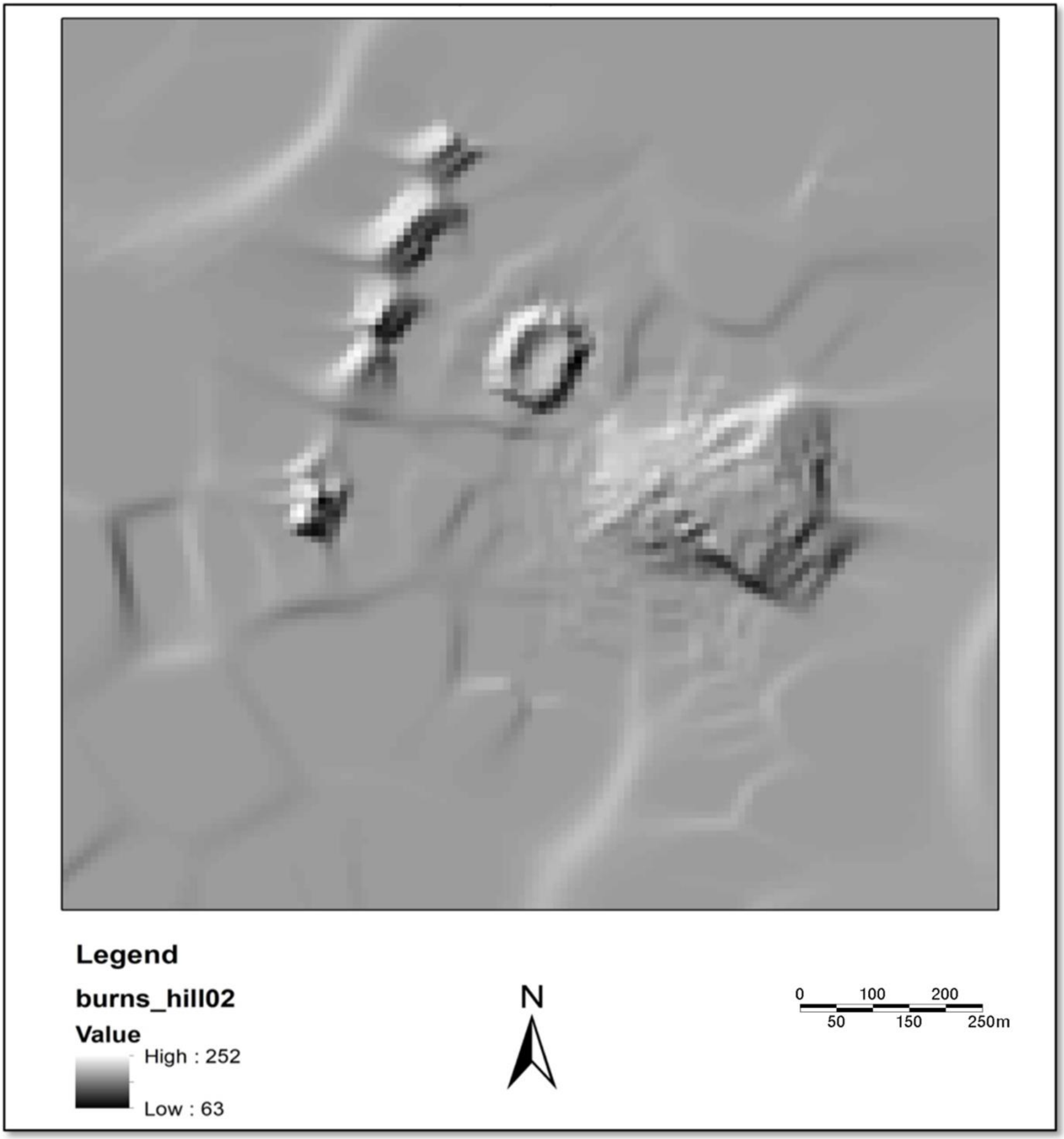
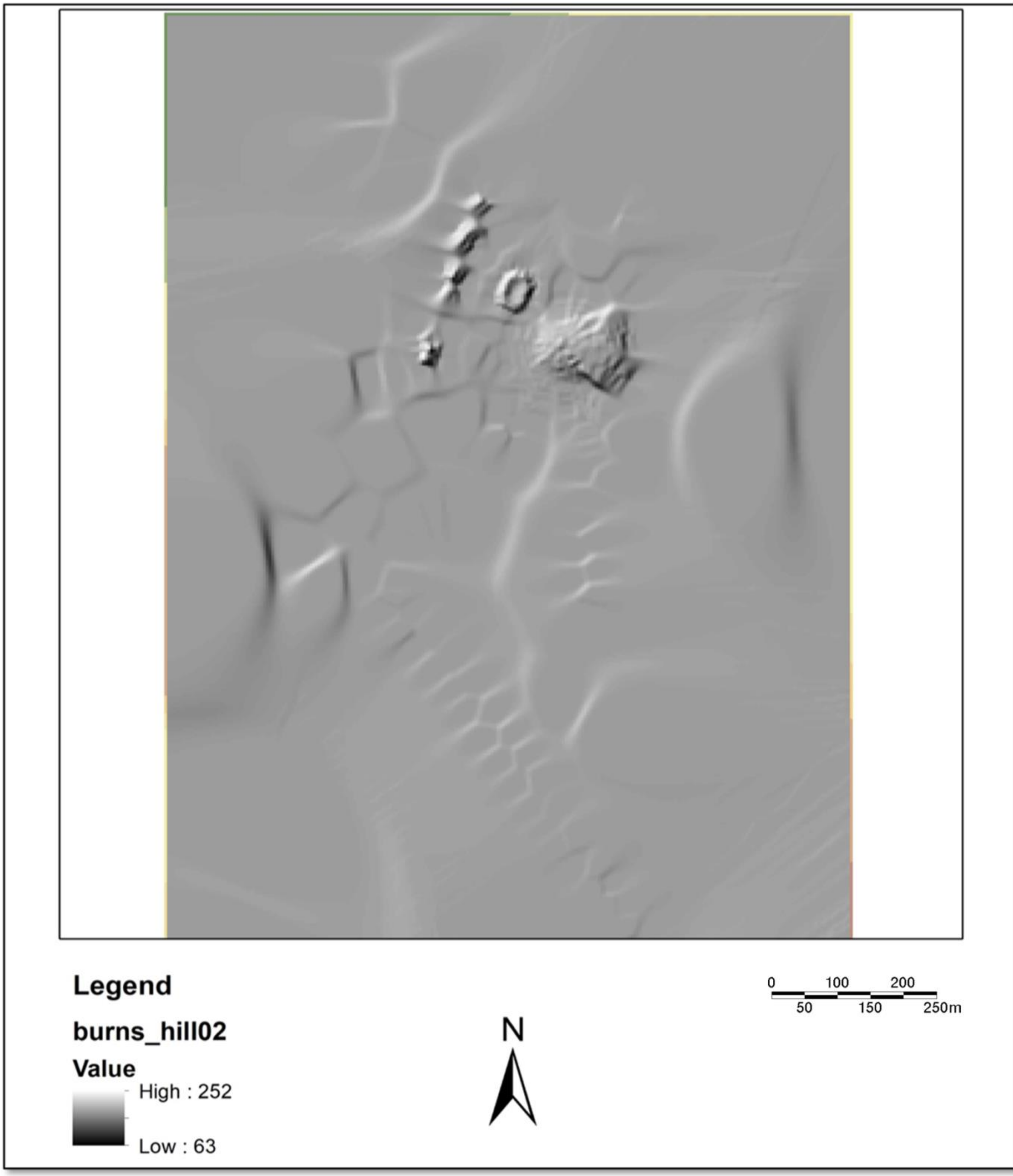


Figure 14: Hillshade IDW interpolated topography



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