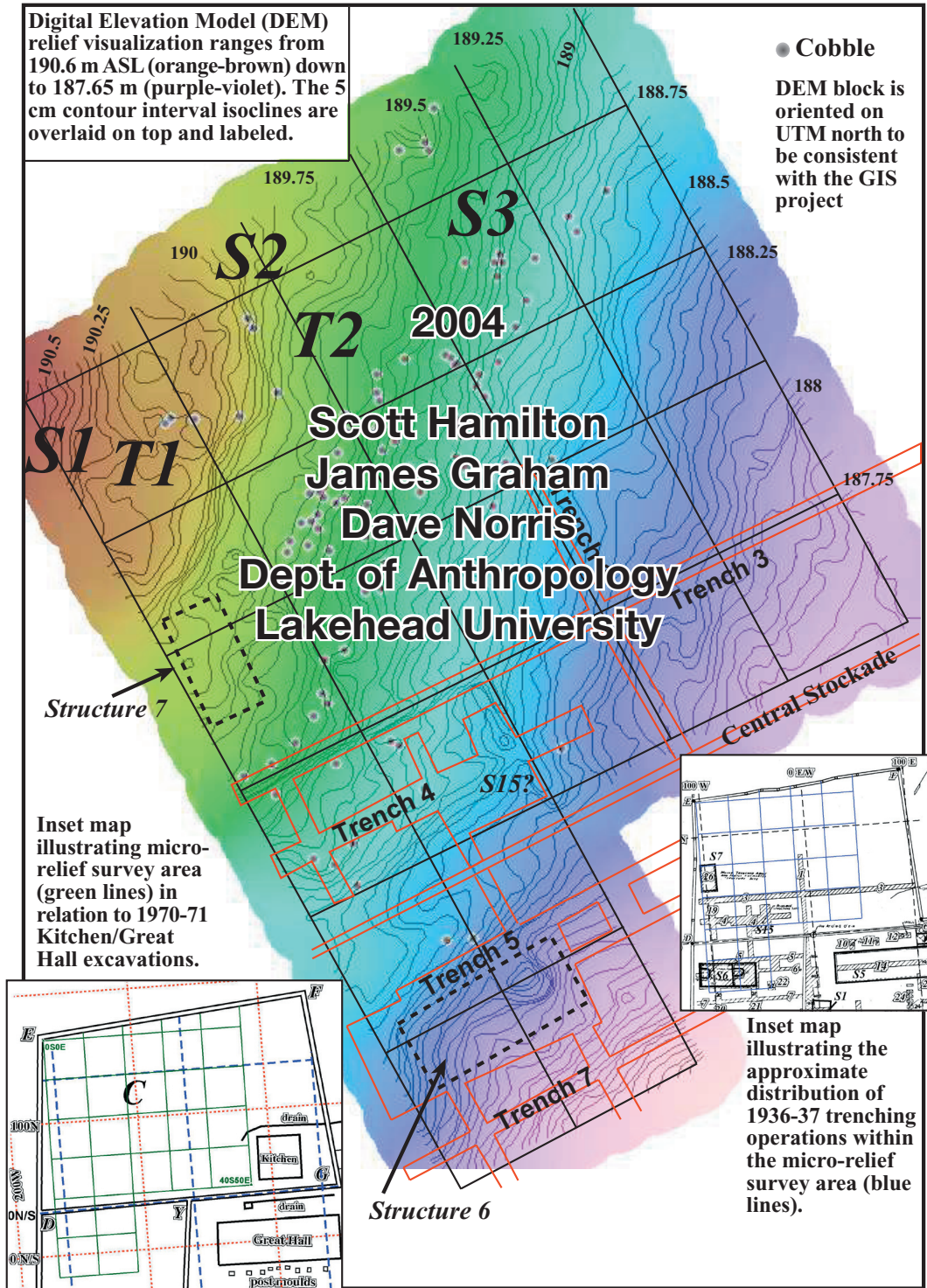


If These Walls Could Speak: Using GIS to Explore the Fort at Grand Portage National Monument (21CK6)



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**Using GIS to Explore the Fort at
Grand Portage National Monument (21CK6)**

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Executive Summary

This report summarizes aspects of the 68 year history of archaeological research at the Grand Portage National Monument (21CK6) with a particular emphasis on the integration of the spatial data deriving from the various excavations. It outlines the location and nature of the excavations from 1936 through to the mid 1980s, and includes a summary of the 2001 mapping activities by Lakehead University and the Midwestern Archaeological Center at the site. The primary objective is to integrate the extant cartographic information relevant to the main fort compound into a GIS environment as the first stage of rendering the enormous archaeological collection more accessible to research and public heritage interpretation. The secondary objective is to review the existing artifact database, interpret the surviving provenience information, and develop a means of integrating the archaeological database with the GIS-based map of the site.

This review reveals a complex history of excavation, with at least six different grid systems employed over the years to document the archaeological recoveries. While considerable summary documentation survives, the legacy data is at risk in light of the inconsistent provenience control systems, and the magnitude of early excavations conducted by largely untrained crews. We acknowledge the efforts of Alan and Nancy Woolworth, who have collected and synthesized much of the archaeological research in their various reports about the site. While these reports were absolutely crucial for future research at the site, we note some inconsistencies, gaps in the documentation, and possible errors and omissions that are an inevitable consequence of such ambitious excavations often conducted under *ad hoc* conditions.

This report offers an integration of elements of the past excavation reports in the hope that it will contribute to the development of: 1) a master grid system for the site; 2) a strategy for refining the existing archaeological database; and 3) a readily accessible system of querying the extant data in order to facilitate ongoing Cultural Resource Management at the Monument.

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Introduction

In the winter of 2000 David Cooper (Grand Portage National Monument) and Scott Hamilton (Dept of Anthropology, Lakehead University, Thunder Bay, Ontario) began exploring the possibility of collaborative heritage research at Grand Portage National Monument. This led to a proposal for a pilot study to integrate the long history of archaeological research at the site into a GIS environment using the newly established GIS research facility at Lakehead University. By the spring of 2001 funding had been secured, and a suitable contract negotiated between the US National Parks Service and Lakehead University. However, because of conflicting research commitments research was not initiated until the fall of 2001.

As the project was originally conceived, Lakehead University was to review the extant paper-based maps and GIS products already developed by the National Parks Service, and address discrepancies between the electronic and paper-based data by collecting new UTM coordinates of mapped localities using a differentially corrected Global Positioning System (dGPS) (using the NAD'83 datum). These coordinates would then be used to 'warp' and geo-reference the extant data to a common UTM-derived co-ordinate system. Additional fieldwork was to include mapping of micro-relief in the back corner of the fort compound where minimal archaeological research and other disturbances have occurred. This sought indications of cultural modification of the surface that might suggest presently undocumented structures. Finally, some preliminary efforts were to be made to develop a common artifact provenience system that could be used to integrate the various excavations conducted at the site since 1936. Ultimately, this may aid in modifying the existing electronic artifact database (produced by National Parks Service), and enable more

effective database queries and artifact spatial analyses within the GIS environment.

The Grand Portage National Monument staff provided paper-based maps of the past excavations. We also used documents held in the archives of the Ontario Ministry of Culture regional archaeology lab in Thunder Bay, Ontario. This was possible because of the efforts of the late Joyce Kleinfelder, the co-director of the Fort William excavations, who had collected many reports and maps regarding the Grand Portage National Monument for comparative purposes. Upon her death, her library and archive was donated to the Ontario Ministry of Culture. Of particular note are copies of large scale excavation plans and various overview reports produced by Alan and Nancy Woolworth. Mr. Bill Ross, then Regional Archaeologist with the Ministry of Culture, kindly loaned these materials to facilitate our research.

This project has been long in completion, in large measure because of conflicting research projects at Lakehead University, and a rapid turnover of student staff with suitable GIS expertise. As will be evident in the following report, there has also been a subtle shift in research goals to produce a research product that seeks to synthesize the archaeological data collected over the past 68 years, and to integrate the various provenience and grid systems employed at the site. We take the view that this data integration is a necessary pre-condition to effective GIS-based management of the site and its archaeological collection.

History of Archaeological Research

The 1936-37 Grand Portage Grid Systems

The first stage of research required a review of the long and rather tangled history of excavation at Grand Portage that dates back to 1936. This involved documentation of the grid systems used, and determination where the excavations were conducted. We decided that perhaps the most productive first step was production of a large-scale map that compiled the various phases of excavation at the site using standard micro-computer graphics programs (ie. Freehand and Illustrator).

It was initially thought that these vector-based drawings could be geo-referenced and integrated directly into the GIS database. This rather optimistic notion was confounded by serious difficulties in uploading ‘non-native’ data into the GIS software (ESRI Arcview 3.2). In part, this is a function of the complexities of Arcview 3.2 data manipulation and geo-referencing. It also reflects the limited practical ESRI software training of the Lakehead University senior participant in the project. The rather constrained ability of Arcview 3.2 to easily geo-reference non-native vector images eventually forced us to import our composite plan as a geo-referenced tiff file. It was then used as a template to redefine the excavations as a series of lines, points and polygons within Arcview 3.2 through a process of ‘heads up’ digitizing. As an aside, we have subsequently begun using Arcmap 8 (an upgraded version of ESRI’s Arcview 3.2) that is more user-friendly, particularly when used in conjunction with third party software such as ASI’s Geomatica. Unfortunately, there seems to be comparatively little ‘backwards compatibility’ between various ESRI products, and therefore, we have kept all of the Grand Portage data in its native Arcview 3.2 format to ensure that the Grand Portage National Monument staff can access

it in whatever version they have available.

As we reviewed the archival data regarding the site, it became apparent that other researchers before us have also encountered difficulties in harmonizing and integrating the various excavations at the site. Alan and Nancy Woolworth (1963, 1982) sought to address and resolve these problems with syntheses that outlined the various activities at the site. They note that the Minnesota Historical Society conducted the first excavations in 1936 and 1937 under the direction of R.D. Brown and G. Hubert Smith (Woolworth and Woolworth 1982:xi). These early excavations were funded by the “US Indian Service- Civilian Conservation Corps”, with the dual intention of documenting the location and nature of the historic site, and providing employment to local Chippewa (Ojibwa) residents of Grand Portage Reservation. The archaeological goals were to identify and document the expanse of the palisade system and the Great Hall, and also to undertake exploratory test trenching within the fortified compound to locate the remnants of structures. We note that the excavation objectives and rather rudimentary excavation methodology of the times led to generally poor documentation and provenience control. The ‘make work’ nature of the project also appears to have caused difficulties in maintaining sufficiently detailed records of the broad range of features and artifacts that were encountered. This has significantly compromised the information yield from these early excavations.

In a summary and review of the 1936-37 excavations, Woolworth (1963:27) notes that Brown did not initially establish a grid system across the site, and instead, focused upon tracing and excavating the stockade trenches. This was likely calculated to document the

spatial expanse of the fort compound, and to permit accurate reconstruction of the fortifications and Great Hall in 1938. Strategic corners of the stockade system were given letter labels, and the portions of stockade trench located between these corners were defined by reference to these letter codes (see Figure 1). This ‘geometric’ orientation was initially thought to be sufficient for simple documentation of the stockade. By drawing upon the expertise of Stanley S. Walker, an Indian Department engineer, a formal grid was established later in the 1936 field season when the inadequacies of the earlier system became apparent. This was done by identifying three datum points from which strategic corners of the stockade could be identified by triangulation (Figure 2). The precise location of these three datum points is not relevant here since Brown did not establish permanent monuments at these locations, but Datum 3 has some enduring importance as it was used as the basis of Brown’s first block excavation in the vicinity of Corner G (Figures 1 and 2). This will be addressed more fully below.

Walker also collected sufficient relief information to produce a surprisingly detailed topographic map of the site (Figure 1). This map was reproduced by Woolworth (1963), and presented at a one foot contour interval throughout much of the property, with the exception of the southern extreme of the compound adjacent to the Lake Superior shoreline. The Walker/Woolworth map also recorded recent disturbance of the site from road construction through the compound (Figure 1). As an aside, we note a significant discrepancy between a copy of the original Walker topographic map (in the Kleinfelder collection) and the version presented by Woolworth (1963:5b). In the original Walker map, the contours are labeled from a topographic high of 667 feet near corner E down to 644 feet near corner X. However, on the Woolworth version, elevation from

the same points vary from 627 (corner E) to 604 (corner X) – a difference of 20 feet. As the Woolworth version conforms more closely to the elevation of Corner E (ca. 190.6 meters ASL) derived by dGPS survey, we use the Woolworth version. We assume that some systematic error occurred with the original Walker calculations that were likely based upon barometric pressure-derived elevation calculations at his primary measuring point (presumably at Datum 3 that is noted as having an elevation of 658.0 feet on the original Walker map). There is no appreciable difference in the nature of the relief representation aside from the fact that the ‘missing’ contour lines on the Woolworth map (Figure 1) are reported on the original Walker map. Presumably Woolworth chose to remove some lines along the steep lakeshore bank to improve map clarity.

The three temporary datums were also used to define a Cartesian ‘point of origin’ (designated **0N-S/0E-W**), located within the middle of the stockade compound (Figure 1). The geometric triangulation undertaken by Walker to document this primary datum is presented in Figure 2. Woolworth (1963) indicates that this original ‘primary datum’ coincided with an internal stockade that divides the compound into north and south halves between corners D and G (Figure 1). He (1963:35) specifically states that this grid baseline ran along the center line of this internal stockade (Figure 1), and that the baseline ran approximately “20 feet north of and parallel to the northern wall of the Great Hall”, and had an “approximate course 45 degrees east of the true north/south” (Woolworth 1963:36). We caution the reader to note that sometimes considerable variability exists from map to map regarding the north orientation, and few explicitly differentiate between True and Magnetic north. No doubt, considerable difficulty was experienced in precisely and consistently identifying North because of the

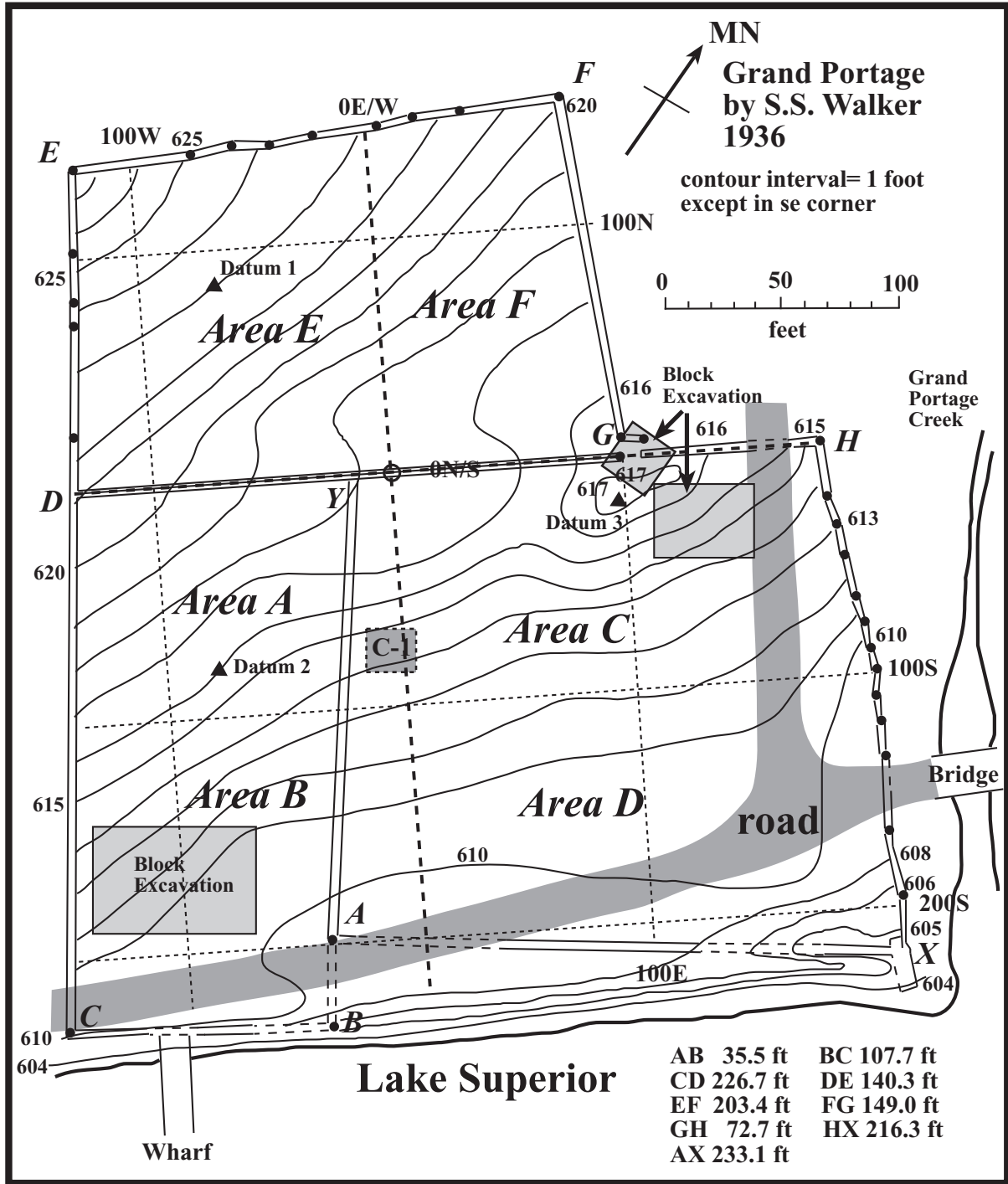


Figure 1 Walker's 1936 map of Grand Portage.

widespread bedrock exposures in the area, and the high density of ferric objects buried across the site. We also note that elsewhere Woolworth (1963:86) indicates that the back wall of the Great Hall is located 17 feet (and not 20 feet) south of the internal palisade

that coincides with the O N/S grid baseline. We suspect that this discrepancy relates to confusion whether one is referring to the 1937 grid base line (running down the centre of the palisade footer trench) as opposed to the north extent of the excavation trench dug by

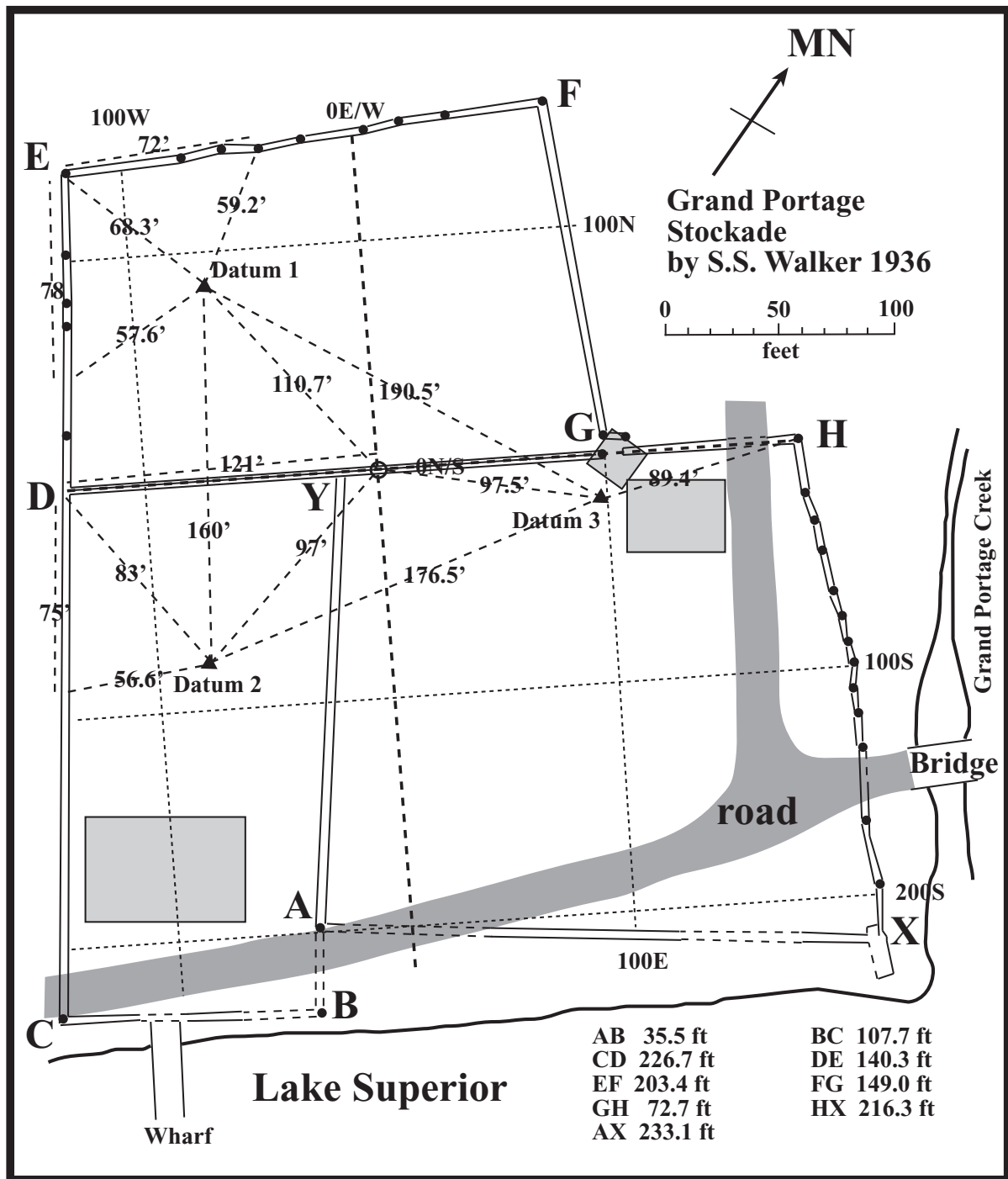


Figure 2 Walker's triangulation to establish the 1936-37 grid.

the archaeologists to locate this footer trench, or alternatively, from the center line of the stockade trench to the center line of the Great Hall foundation. For the sake of consistency with the Woolworth maps, we arbitrarily use the 20 foot measure in Figure 3 and within the

GIS projects, but note that even Woolworth places the back wall of the Great Hall about 15 to 17 feet south of the interior palisade line in his detailed maps of the Kitchen/Great Hall excavations (to be discussed below). This important issue can only be resolved

by exploratory excavation, but may be confounded by repeated excavations in the area of interest.

The 0 E/W baseline ran at a perpendicular angle to the 0 N/S baseline, and it is parallel to and about 23.7 feet west of the western wall of the Great Hall (Figure 3). The primary datum, located at the intersection of these two baselines, was defined by a steel pin set into the centre line of the 'central wall' (or internal stockade). This datum is located '121 feet east of the exterior face of the western palisade trench line, near Corner D' (Woolworth 1963: 36) (Figure 1). Given that the only enduring and most secure landmark available during the 1936-37 excavations was the foundation of the Great Hall, it will figure prominently in any effort to relocate this datum and establish a permanent marker. We caution that even this primary structure on the site (the Great Hall) has been subjected to excavation at least twice, has been twice reconstructed, and destroyed by fire once. We must assume that the stone foundation 'footprint' remains in 'approximately' the same position as it was when discovered by Brown in 1936. The dimensions in feet along the various sections of the stockade walls are also reported in Figures 1 and 2 based upon Woolworth's observations (1963).

We reiterate that the 1937 grid system is not the only one employed at this site. In 1963 Woolworth established a new grid to facilitate the excavation of the stockade and to undertake the exploration of the area immediately to the west of the fort compound. In 1971, he established yet another point of origin and a new grid system, specifically to conduct the salvage excavation of the Great Hall foundations after the first reconstruction was destroyed in a fire. This grid was also employed to explore the nearby front porch and back kitchen area. The details of these various grids are explained in more detail

below.

Apparently the original primary datum was used in both the 1936 and 1937 field seasons to establish a grid system across the site, and was used to define the various exploratory trenches and block excavations within the stockade compound (Woolworth 1963:29, 31). Unfortunately, no enduring monument was constructed to define it, and its precise location is not currently known with any more precision than cited above. While three smaller-scale block excavations were conducted independent of this grid, two were established in approximately the same orientation as the grid, thereby enabling their approximate integration into the primary grid system. These block excavations include the 'east gate area at corner G', 'Structure C-1' (or S-1), and 'Corner X' in the southeast corner of the palisade (Figure 1), with the latter two approximating the primary grid. The early excavations in the vicinity of Corner G (the east gate) were conducted following an approximate Magnetic North orientation. Fortunately, one of the Brown's sketch plans identifies the outline of these 1936 excavations, enabling its integration into the existing site plan. The specifics of this magnetic north grid system are addressed below in the context of Trench 13. Woolworth (1963:36-37) also notes that two extensive block excavations were conducted in 1937 that involved expansion of the exploratory trenches in a fashion consistent with the primary cartesian grid (both labeled 'Block Excavation' in Figure 1).

A review of the available documents indicates that the 1936-37 stockade excavation, as well as Woolworth's 1963 exploration, were conducted independent of the original grid system. Consequently, it may be difficult to integrate the artifact recoveries into a Cartesian grid system. During the 1936 excavations there was also an effort made

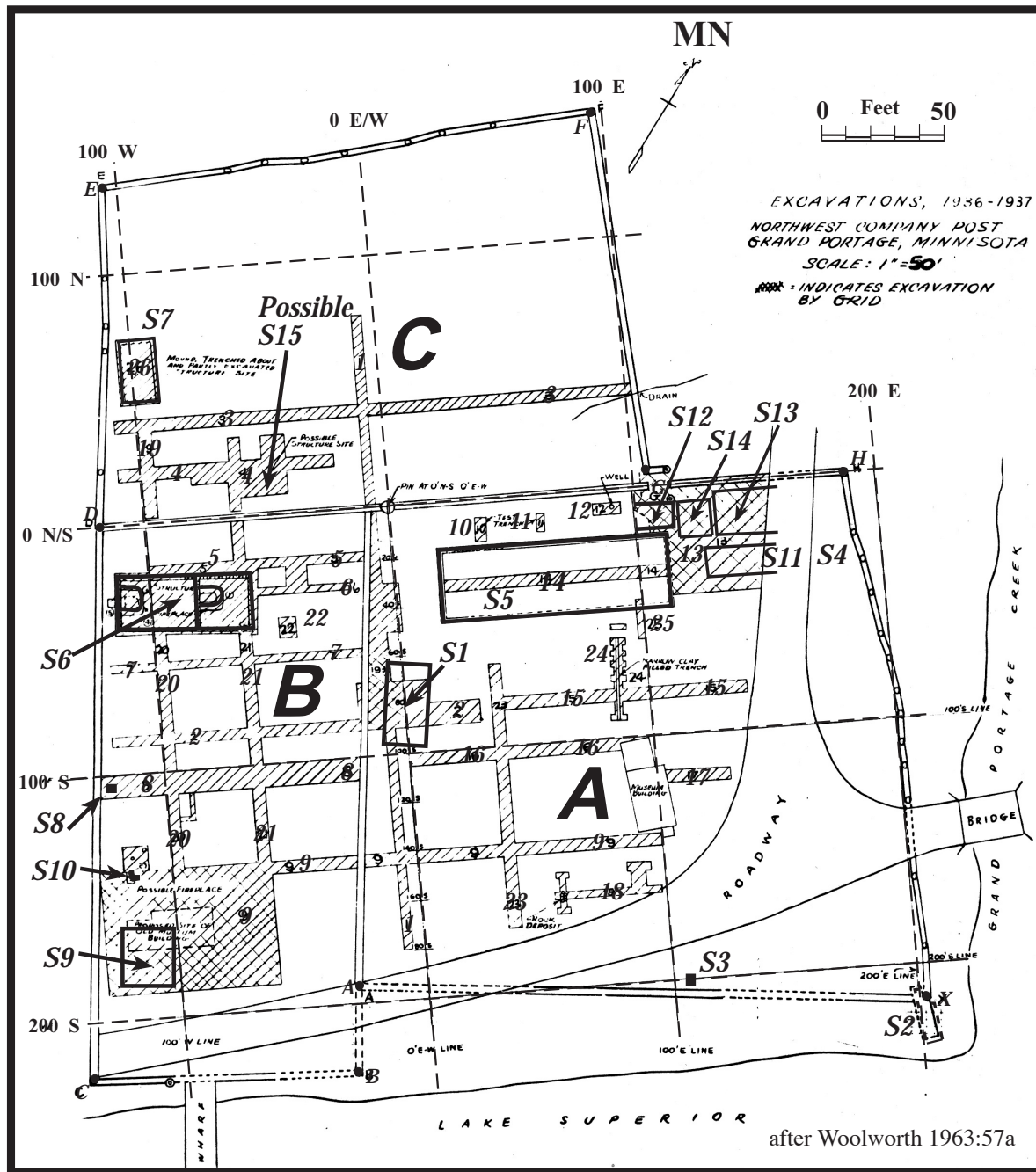


Figure 3 The 1937 excavations at Grand Portage

to divide the area within the stockade into labeled 'zones' or 'areas' to facilitate artifact provenience control. However, Woolworth (1963:35) indicates that this system was eventually dropped in 1936, when it proved unworkable. He notes that Brown divided the internal fort compound into quadrants labeled by letters A through to F (Figure 1), and that

they were further subdivided into 20 foot and 10 foot wide squares as needed. It was thought that these sub-divided blocks were then given discrete designations (ie. A-6, A-9, and A-10). However, examination of some of the detail maps included in Woolworth's 1963 report reveal discrete features that were given labels consisting of a letter prefix followed

by a sequential number. The letter prefix often corresponds to the quadrants illustrated in Figure 1, suggesting a quadrant-based sequential catalogue of features. Woolworth (1963:36-37) indicates that Brown's notes are not adequate to relocate these provenience unit/feature designations, but he notes that they periodically appeared on the original artifact bags. We briefly mention this quadrant provenience system in the event that reference to it appears in the electronic artifact catalogue.

The initial research at Grand Portage was conducted to facilitate partial reconstruction, and to promote economic development as the region became more accessible to tourism. However, the outbreak of WWII, and the eventual mobilization of the USA, led to an abrupt curtailment of all such activities until the early 1950s when there was renewed interest in site reconstruction. Grand Portage was eventually declared a National Monument in 1958 (Woolworth and Woolworth 1982:xi), and a series of excavation projects occurred throughout the 1960s and 1970s by the Minnesota Historical Society and the US National Parks Service. This involved site exploration, and basic Cultural Resource Management and site interpretation activities. Much of this work was conducted under the direction of Alan Woolworth. These latter excavations (with their different grid systems) are described below, particularly when they were conducted within the main fort compound.

Woolworth (1963:41-46) provides a summary of the excavation methodology used during the 1936-37 seasons, and relevant portions are paraphrased here. It appears that, while the Cartesian grid system was used to facilitate excavation and mapping, the style of excavation and provenience control was not adequate by modern standards. Woolworth contextualizes these failings by reference to

the state of archaeological methodological development in the mid 1930s, the level of training of the field workers involved, and also that Brown and Smith did not have any trained crew supervisors on site to assist them. As much of the exploration was conducted by exploratory trench and block excavations, and since many of these trenches are referred to by sequentially assigned numbers rather than grid coordinates, Woolworth (1963) had considerable difficulty in gleaned information from the notes and the plethora of artifact bags that he reviewed. While careful review of these notes and re-examination of the collection might restore some level of provenience control, we fear that much of the early collection might have to be treated as 'lost provenience'.

The 1936-37 Excavation Results

Much of Brown's work in 1936 focused upon documenting the palisade system by excavating 'cross trenches' at intervals along the linear depressions that became apparent as the overlying vegetation was removed. These depressions proved to be the palisade footer trenches that surround the main compound. While these trenches are not apparent in Figure 1 (contours at one foot intervals), the senior author can attest to the utility of using such subtle micro-relief in non-destructively defining fur trade post compounds. Similar indications of palisade configuration and building remnants were observed after brush clearing and micro-relief mapping as part of the proton magnetometer survey at Brandon House, located in southwestern Manitoba (Hamilton 1983) and also at Rocky Mountain Fort in northeastern British Columbia (Burley, Hamilton and Fladmark 1996). We specifically mention Brown's use of these surface indications because we believe that it might have implicitly contributed to decisions where to conduct exploratory trench excavations.

Brown used cross trenches to bisect the linear depressions to document the precise location of the palisade footer trenches with their remnant structural members. The fill within the footer trenches was then removed to receive new stockade pickets as part of the reconstruction plan. This suggests that the original 1938 reconstruction might have been quite accurately placed. These cross trenches were likely obliterated by Woolworth's subsequent investigations of the stockades in 1963. These excavations revealed a roughly quadrilateral palisade that had been expanded to address the requirements of the Montreal merchants who operated the site. Since Grand Portage was operated early in the period of British domination of the Montreal-based fur trade, several independent ventures maintained forward depots in the locality. Thus, it is possible that the three discrete compounds represent the independent operations of trade firms prior to the formation of the North West Company. Woolworth (1963) speculates that the southwesterly enclosure might have been used by the XY Company (Figure 3, Compound B). This possibility has some credence when we consider the shared stockade walls noted at such sites as Fort Edmonton and Carlton House (Hamilton 1991:87, 90).

While there is some possibility that the compound sub-divisions represent several discrete trade operations, we propose that the three enclosures may represent a process of growth, with the enclosure containing the Great Hall being the oldest and most important one. Subsequent growth likely involved expansion to the west (into Compound B in Figure 3), with the final phase of growth representing the back compound (Compound C in Figure 3) that abuts the lower slopes of Mount Rose (Figures 1 and 3). This is hinted at with the appearance of a stockade footer trench underlying Structure 9 (S9 in Figure

3) that suggests a complex history of building refurbishment and stockade expansion.

Woolworth (1963:68) notes that significant portions of the stockade trench defining the northwest side of the back enclosure (corner D to E in particular, as well as the stockade between corners X and H, Figure 1) were excavated through a slate bedrock exposure or dense till deposits. The 'jogs' or irregularities in the palisade lines reflect efforts to avoid subsurface bedrock or boulder obstructions. The front face of the palisade runs parallel to the shoreline of Lake Superior, with the primary building (Great Hall) being placed in the visually most prominent position at the back of the Compound A (Figure 3). No doubt, continued fort growth and refurbishment resulted in various building phases bisecting and truncating each other. This is also apparent in the context of Woolworth's (1969: 11) 1963 stockade re-excavation, whereby he notes that the front face of the stockade once extended in a line east from section CB (Figure 1), but that lakeshore erosion forced the reconstruction of the stockade line AX as an irregular 'jog' along the front face of the fort complex. After the North West Company abandoned the site in favor of Fort William (located within British territory), at least a century of subsequent occupation occurred on the locality, and contributed to a significant degree of confusion and ambiguity for the archaeologists. Historical reviews by Erwin Thompson (1969) and Nancy and Alan Woolworth (1982) are particularly useful in documenting the history of the site, and its reuse after abandonment by the North West Company.

Upon documenting the palisade extent, Brown's attention shifted to the excavation of a 25 by 30 foot block area near the 'east gate' using a 5 foot grid system, oriented on a magnetic 'N-S' axis, and which originated from Datum 3 (Figure 1). This excavation is

briefly mentioned below in the context of Alan Woolworth's excavations in the area in the 1970s. Sediment was removed in 6 inch thick levels, with some screening of the backdirt when the recovery rate of small objects was deemed to warrant more intensive recovery methods. Obviously such *ad hoc* screening methodology will significantly affect any analysis of the spatial distribution of artifacts across the site. A tracing of Brown's original site plan reveals the provenience system employed, and it will be briefly described in the context of Trench 13.

During the 1936 season two additional exploratory trenches were excavated in the center of the compound along the original cartesian grid system. These trenches were labeled Trench 1 and 2 (Figure 3). Trench 1 was four feet wide and 260 feet long, and was positioned 5 feet west of the 0 E/W line (and 23.5 feet west of and parallel to the west wall of the Great Hall). It extends from 80N to 180 S and its width ranges from 5W to 9W. Trench 2 was arranged perpendicular to Trench 1, was also originally 4 feet wide, but appears to have been widened later to more fully explore features that it intercepted. The south wall of the trench runs along the 90S grid line, and it extends for 150 feet east/west between grid location 30E to 120W (Figure 3). The intersection of these two trenches exposed a structure that was identified as C-1 or Structure 1 (Figure 3, S1) that is described in more detail below.

The balance of the 1937 field season was spent in further exploratory trenching within the compound using the Cartesian grid system. Apparently, when archaeological features were encountered in these trenches, the excavations were expanded to more fully explore their extent and possible function. We refer the reader to the sequentially assigned trench numbers that were reported by Woolworth (1963:57a, Map 9) (Figure 3).

The complex arrangement of exploratory trenches and block excavations conducted in 1936 and 1937 form much of the past excavations within the fort compound, and their documentation was essential for the GIS project. We note that Woolworth's (1963) exhaustive examination of the original maps, plans, drawings and notes indicate that some additional excavations were conducted, but they do not seem to have been recorded on Brown's master map of the site. Again, this suggests that a presently unknown portion of the archaeological collection may have to be assigned a 'lost provenience' designation. Using Woolworth's synthesis of the early excavations we offer relevant observations gleaned from these trenches, but refer the reader back to his 1963 text for the specifics. He (1963:57) summarizes the excavations by noting that 13 and possibly 15 structures were intercepted, and that a 'considerable number of isolated features possibly related to structures were found'. We offer a brief summary of those observations under the heading for relevant trenches and structure numbers, and replicate detail drawings when they are included in Woolworth's reports.

Trenches 1 and 2 revealed a house structure at their point of intersection. This structure was initially designated as **C-1**, and later as **Structure 1** (Figure 3, S1). This rectangular building is 18 feet e/w and 30 feet n/s. The back (west) wall of the building is 6 feet east of, and parallel to, the internal stockade that extends from corner A to Y (and is within compound A) (Figure 3). A detail illustration (Figure 4) indicates that the trench operations encountered only one compartment of a row house, with a second row house compartment immediately to the north. The building outline is defined by a narrow footer trench containing vertically oriented wall posts. No evidence of a fireplace is evident in Figure 3. Woolworth (1963:78) cites Brown to indicate that the artifact recoveries consisted of 'square nails,

window glass, pipe stems and the like'. Test excavations under the direction of Vergil Noble (1990) were conducted in the vicinity of this structure in 1989 in anticipation of the construction of a drainage trench. These excavations involved the development of yet another grid system that will be briefly addressed in the appropriate section below.

Structure 2 is located in the southeast corner of the compound (Corner X) adjacent

to the mouth of Grand Portage Creek (Figures 1 and 5). It was discovered and excavated in 1936, presumably as a consequence of palisade exploration and excavation. It consists of a short section of two north/south oriented palisade footer trenches running parallel to one another about 4 feet apart (Figure 5). They are interpreted as a narrow passageway at the corner of the palisade. The narrow and constricted access passageway

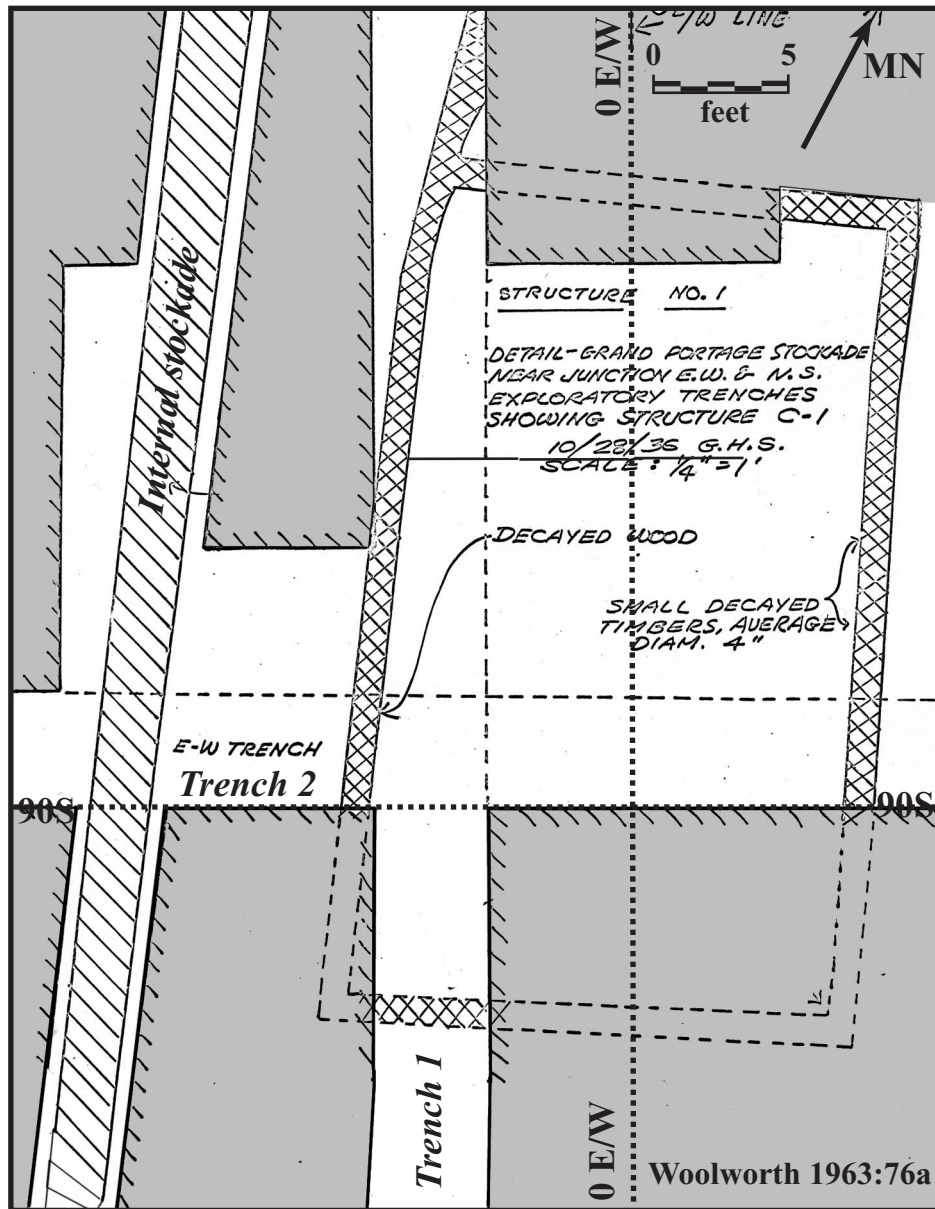


Figure 4 Structure 1 at Grand Portage (see Figure 3 to locate this building within the compound).

was likely intended to provide a convenient point of access into the fort compound that could be readily restricted and defended if necessary. Security was sometimes a necessary consideration in light of the turbulence of the trade, and the volume of goods stored within such major depots. Woolworth (1963:

82) shares the perspective that the feature represents a defensive structure, and further suggests that it might have been a small bastion that permitted observation of the south face of the stockade and the Lake Superior shoreline.

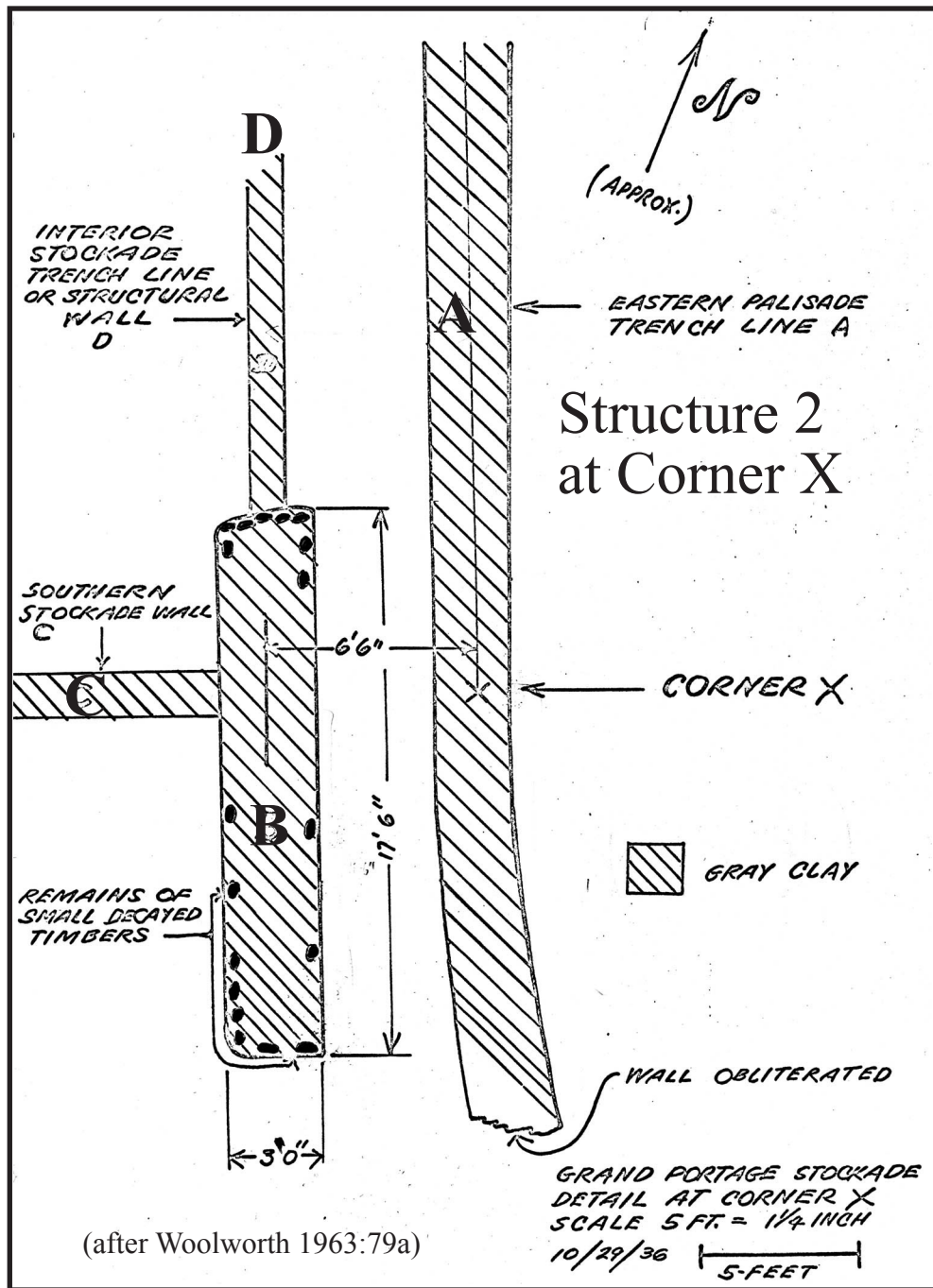


Figure 5 Structure 2, an entry way located in Corner X, Grand Portage.

Structure 3 consists of an accumulation of stones interpreted as the remnants of a fireplace (Figure 3, S3). It was encountered while excavating the south palisade. Woolworth (1963:84) relocated the feature during his 1963 excavations, and describes it as being about 6 feet in diameter, located at about 200S/100E, and about six feet inside (and north of) the south palisade. While no notes, plans or photographs are available, Woolworth interprets it as a portion of a structure located along the inner wall of the stockade compound A.

Trench 4 is thought to have intercepted a possible structure labeled as **S15** (Figure 3). It is located at 12N/50W, within compound C (Figure 3), and about 12 feet north of the internal palisade. Woolworth (1963:105) interprets this pile of rock slabs and rubble as a possible collapsed fireplace. Brown only recorded it in a photograph (Figure 6) that marked the final stage of exposure when work was discontinued. The balance of the feature and possibly the associated building was not disturbed further by the 1936-37 excavations since there were no trained crew members available to supervise the excavation and recording of the finds.

Trenches 5 and 6 intersected a two room structure designated as **Structure No. 6** that is 22 feet wide and 55 feet long, and which contained two fireplaces (Figure 3, S6). It was found in 1937 during exploratory trenching. It consists of two compartments (Figure 7), the east one being approximately 22 feet by 22 feet, while the west one is 22 feet by about 32 feet. The rectangular building lies perpendicular to the west palisade wall, and is therefore arranged at a slight angle to the grid system. We note that our superimposition of the grid onto Woolworth's illustration is approximate because no reference points were provided. (ie. within 4 to 8 inches of its actual position). The east compartment is

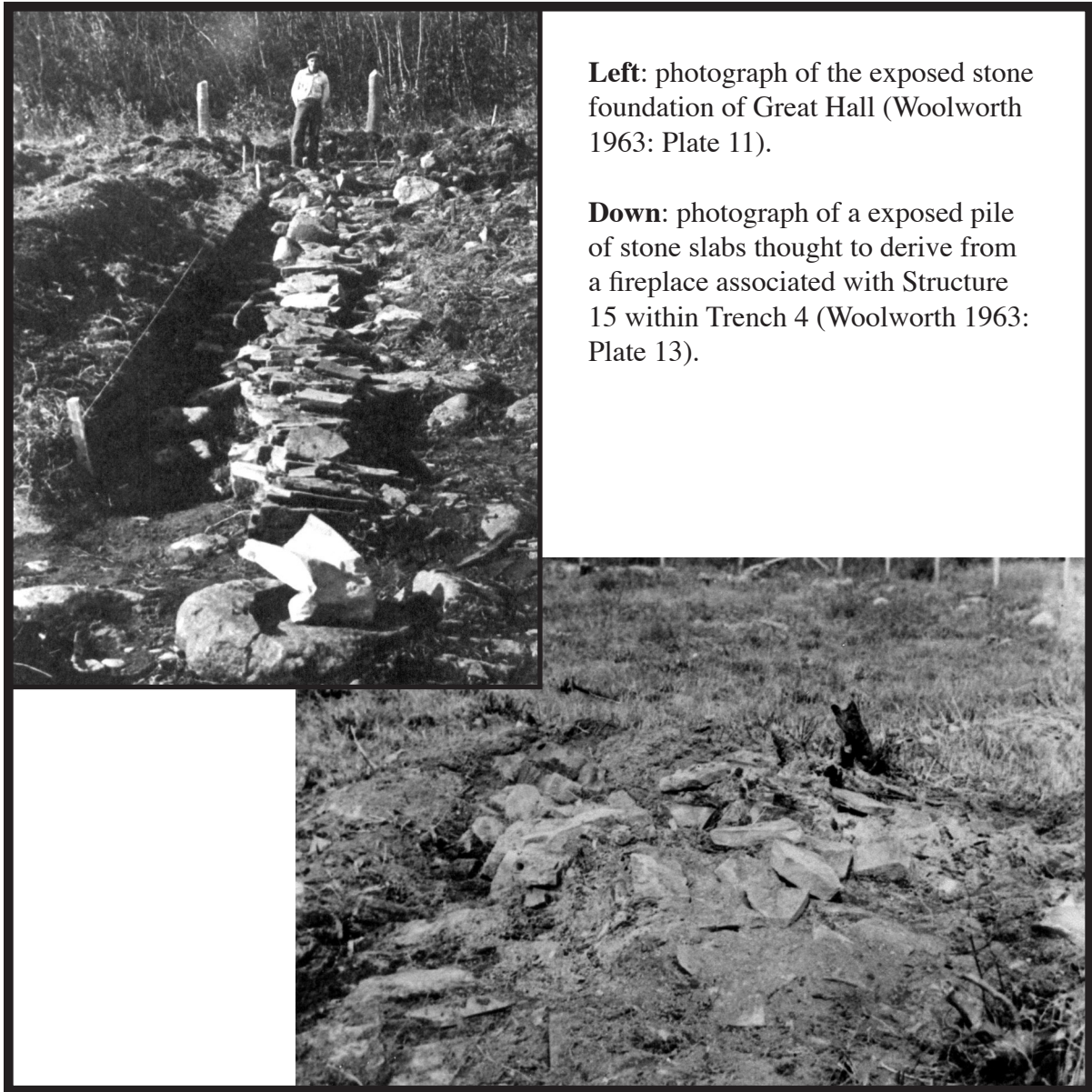
defined by foundation stones consisting of several courses of flat slate slabs, while the west one consists of unmodified 'boulders' about 1 foot in diameter (Woolworth 1963: 89-91). The building contains two U shaped stone fireplaces that appear to have had the open face oriented towards the adjacent wall. This is an odd configuration, but we note that E. Oerichbauer (1983) and D. Birk (1980) both document 'backwards' fireplaces at the Yellow River and Snake River posts. Woolworth (1963:91) also notes that the south side of this building contained a 2 or 3 inch thick apron of sand and fine gravel that extended about 10 feet out from the building wall. We have added this detail to Figure 7, although it does not appear on the original drawing. Woolworth does not provide an explanation for the four numbered circles within the confines of the building and the unlabeled circle and rectangle along the west wall of the building. He suggests that the sand/gravel apron, in concert with the elaborate foundation and two fireplaces, indicates a substantial building that was built with more care than noted with the others. He suggests that perhaps the building was the winter residence of the post superintendent who moved into this smaller structure when the cold weather of fall and winter made the Great Hall uninhabitable.

Woolworth (1963:105-106) also briefly mentions three 'soil disturbances' encountered during the excavation of the internal palisade between corners D and G. They are marked with triangles in Figure 3, are located to the south of the internal palisade, and were encountered 37 to 38.5 feet east from Corner D (possibly an intersecting trench that was 1.5 feet wide), at 28 to 32 feet east from Corner D (3.5 feet wide and 28 inches deep), and at 99 feet east from Corner D (6 feet wide and 30 inches deep) (Figure 3). Brown proposed that these features might relate to the nearby Structure 6.

Trench 8 intercepted a stone structure that may represent the remnants of a stone fireplace that was designated **Structure 8** (Woolworth 1963:93-94) immediately east of the west palisade wall (Figure 3). While no measurements or drawings are available, Woolworth describes it as consisting of squared slate slabs associated with three large flat boulders. The exploratory trenching was insufficient to identify associated building

foundations, although a large ‘post butt’ (nearly one foot in diameter) was identified about 10 feet away from the heap of fireplace stones. The position of this possible ‘post in ground’ structural member is not apparent in Figure 3, but we assume that it must have been located east of Structure 8 within Trench 8.

Trench 9 was expanded to a block excavation in order to clear the area for a planned museum structure. This area revealed



Left: photograph of the exposed stone foundation of Great Hall (Woolworth 1963: Plate 11).

Down: photograph of a exposed pile of stone slabs thought to derive from a fireplace associated with Structure 15 within Trench 4 (Woolworth 1963: Plate 13).

Figure 6 Photographs of 1936-37 excavations at Grand Portage.

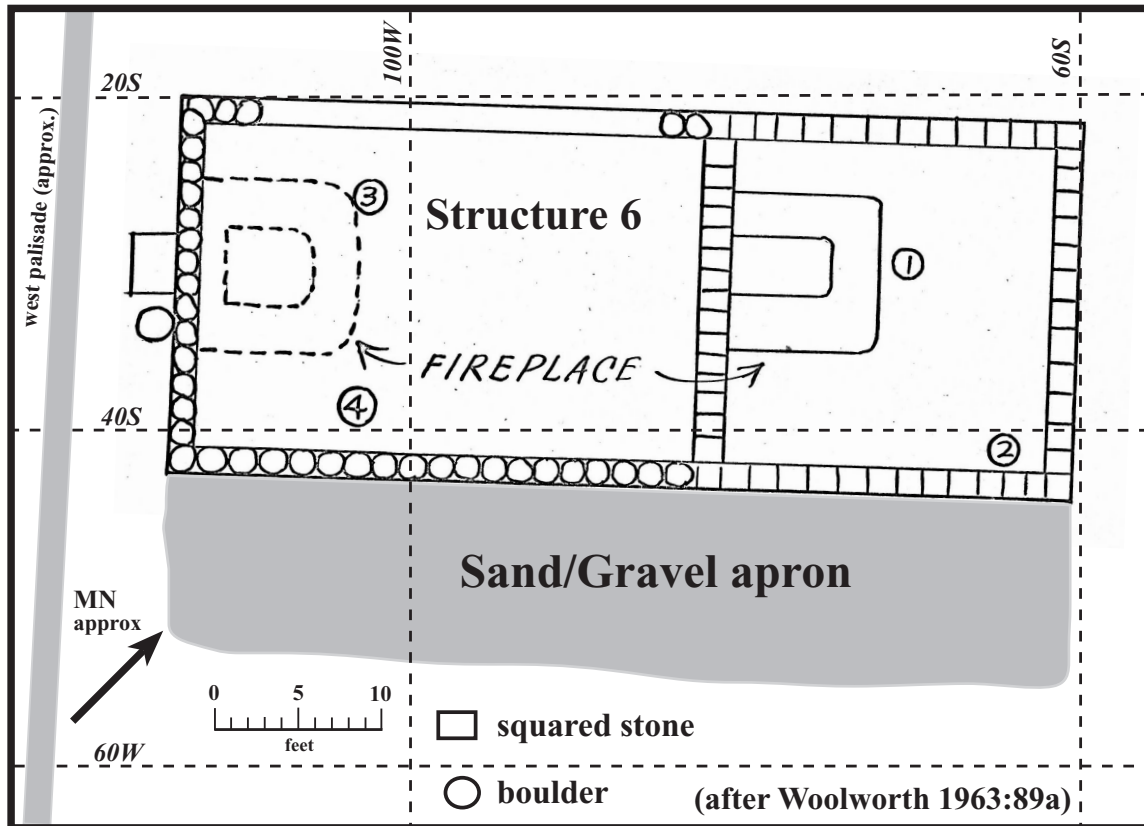


Figure 7 Detail of Structure 6, Grand Portage

the foundations of a building (**Structure 9**) and also a possible fireplace (**Structure 10**) that might define a portion of another building (Figure 3). **Structure 9** is illustrated in Figures 8 and 9. These figures derive from a 1963 tracing of the original 1937 master map of the site. A copy of this map was found in the Kleinfelder papers, but consisted of several photocopied sheets taped together and then folded. Between the photocopier distortion and the folding, the scanned version used here is warped, and has introduced more inaccuracies to Figure 8. Many of the labeled features and symbols noted in Figures 8 and 9 are presently unknown, likely because of problems with the original documentation. In any case, the building is approximately 24 feet by 23 feet, with boundaries defined by footer trenches and stone foundations. At 7 foot intervals along the footer trench there appear to have been larger pits, presumably

to receive larger upright structural members (Figure 9). This is consistent with ‘post in ground’ construction methods.

Woolworth (1963) indicates that the building is obscured by several superimposed construction events, the most notable of which is a linear trench feature (oriented east/west) that runs parallel with the north wall of the house (Figures 8 and 9). It predates the structure since the nearby fireplace and stone firebox overlie the trench (Figure 9). This fireplace is located along the north wall of the structure, with the stone firebox integrated into the building wall.

The south wall of Structure 9 is indistinct either because the construction methods shifted away from the excavation of footer trenches, or because subsequent earth removal obliterated most of the south wall (Figure 9). The remaining portions indicate a complex

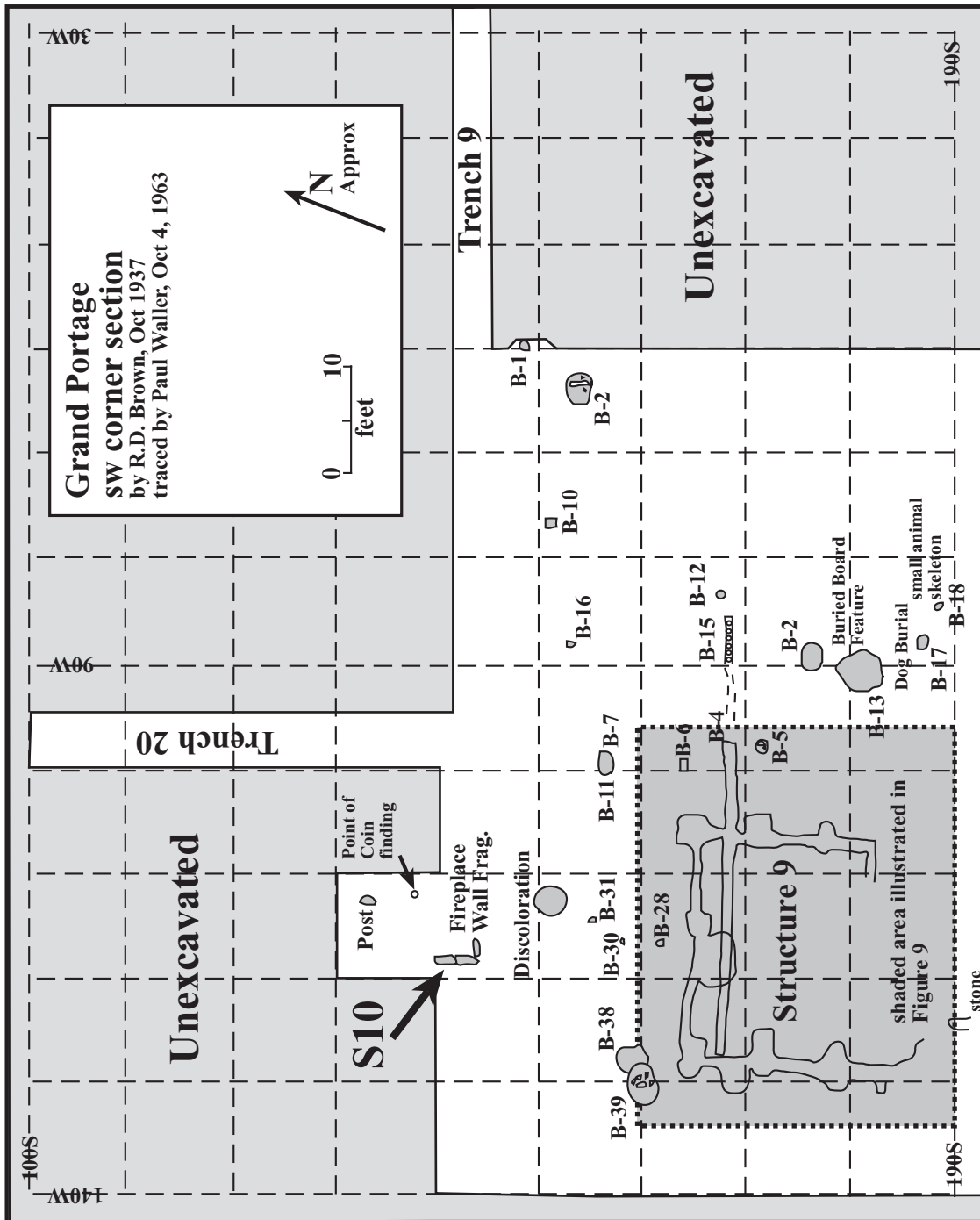


Figure 8 General plan of block excavations in southwestern corner of Grand Portage

situation whereby at least two building phases appear to be represented. It is not clear whether a complex entranceway is indicated, or whether two discrete building phases are superimposed upon one another.

In Figures 8 and 9 a number of features are identified and labeled with numeric codes

with the prefix B. We suspect that this was a feature reference system employed by the original excavators that may relate to the quadrant provenience system that was briefly employed in 1936. This may become an important clue when a more comprehensive examination of the artifact catalogue is undertaken. Woolworth (1963:87) indicates

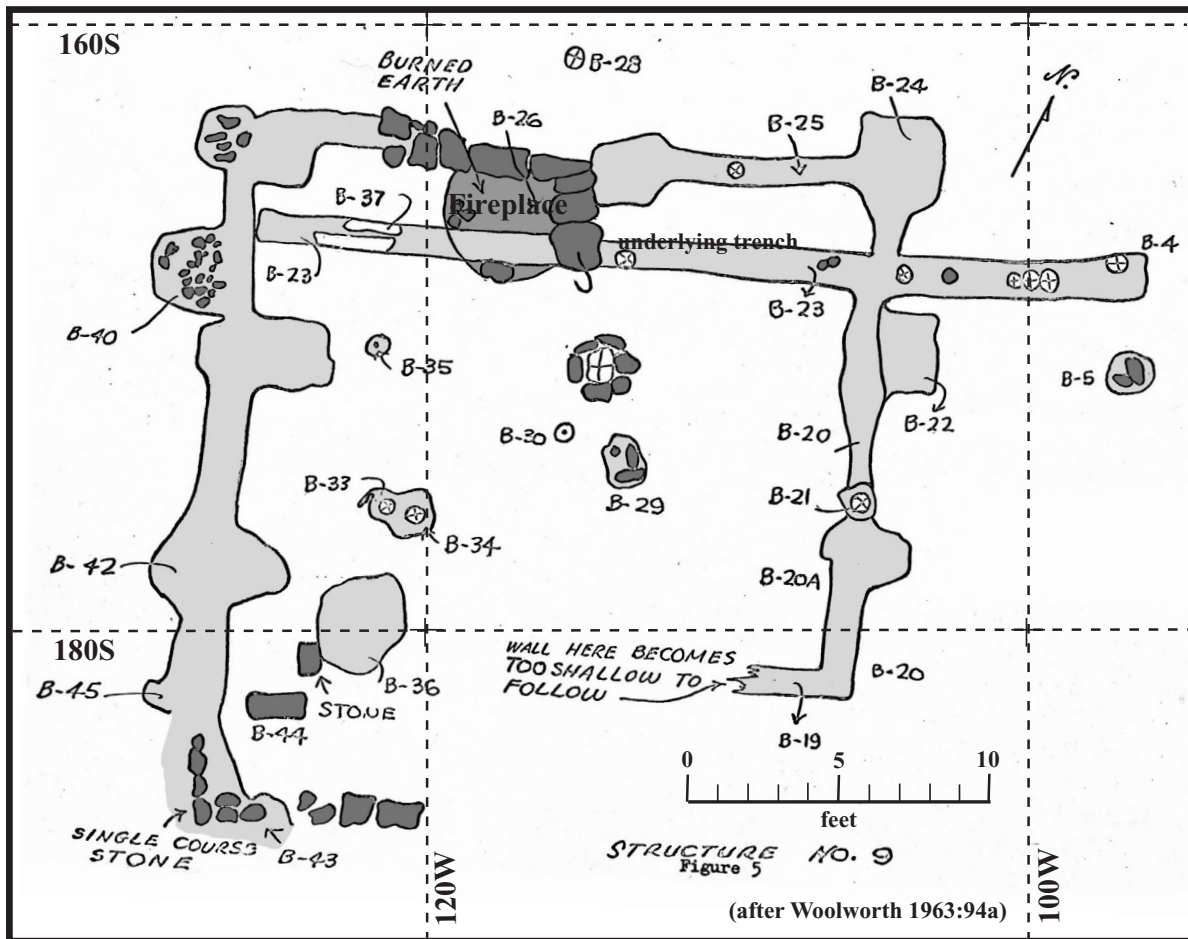


Figure 9 Detail of Structure 9, Grand Portage.

that large quantities of nails, window glass and scrap metal were recovered from this area.

Structure 10 was identified nearby (Figures 3 and 8). No detailed illustrations are available, but Woolworth (1963:98) described it as a fireplace composed of squared slate slabs, apparently with the open mouth of the firebox oriented to the east. This suggests the location of a building in the most northerly part of Trench 9, with a fireplace positioned along its western wall.

Trench 12 contains the well used to service a structure that was thought to be the Kitchen located behind the Great Hall (Figure 3), but was not assigned a feature number. This D-shaped board cribbed well was located at grid coordinates 6.5 S/91E, and

was described as ranging in diameter from 19.5 inches to 27 inches, with a maximum depth of 11 feet below surface. At about 8.8 feet below the surface, the wood plank crib was found to rest upon three superimposed and collapsed wooden barrels, which in turn, rested on sand and gravel at the base of the well. Woolworth (1963:114) suggests that this well was associated with **Structure 12** that he interpreted as an early kitchen located behind the Great Hall. His subsequent excavations in 1970-71 likely led him to revise this proposition.

Trench 13 is an extensive area (50 by 52 feet) that was excavated as a block in order to delimit the East Gate Area (Figures 3 and 10). The western edge of the excavation coincides with the east wall of the Great Hall. This trench

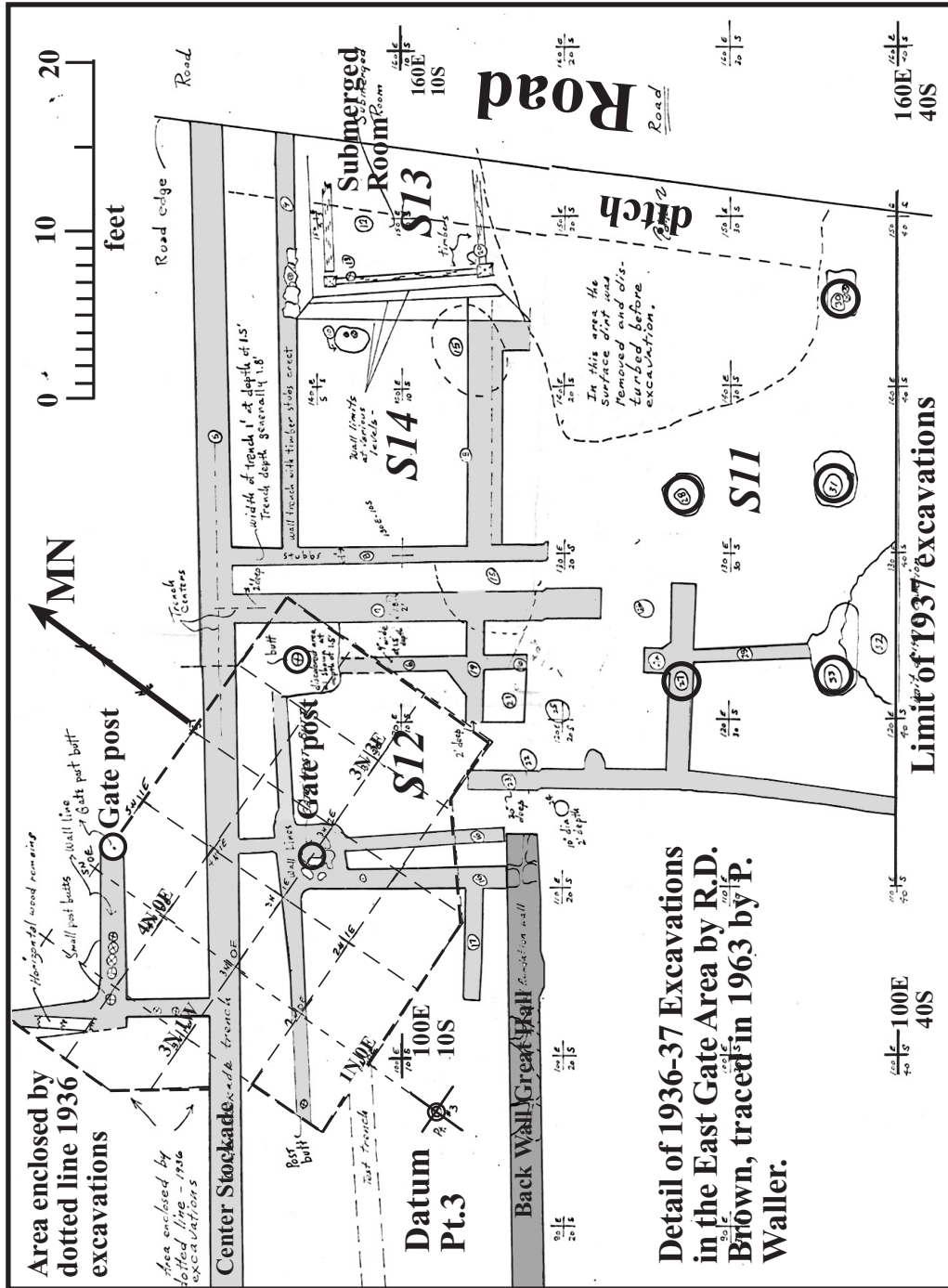


Figure 10 Trench 13 excavations in the area of corner G, Grand Portage.

is also adjacent Brown's 1936 excavation near corner G. This grid is also illustrated in Figure 10, and indicates that the point of origin was Datum 3 that was designated 0N-0E/W. The grid was developed into a block excavation 5 feet to the north of this datum, and was divided into 5 foot squares. The corner intercepts of these 5 foot squares were labeled in one digit

increments as illustrated in Figure 10. Thus, grid stake 1N0E is located 5 feet magnetic north of Datum 3, while 5N0E is located 25 feet away from the datum. It is not presently clear how each of the five foot squares was designated for artifact documentation, but we suspect that a specific corner coordinate was used to define the square. Once the appropriate

artifacts are identified in the catalogue, the provenience system might become more readily interpretable.

The remnants of five structures were identified in Trench 13 (S4, S11, S12, S13 and S14). **Structure 4** consists of very poorly documented references to possible foundations of a building or buildings encountered near corner H during excavation of the palisade. The 1936 field notes indicate that interpretation was confounded by the overlying road bed (Figure 3). Woolworth (1963:85-86) speculates that these incompletely exposed features may represent part of a blockhouse complex, or the remnants of a blacksmith shop that was said to be located in the northeast corner of the compound near corner H. **Structure 11** is located immediately to the east of the Great Hall (Figures 3 and 10). It is defined by an arrangement of five oval or rectangular pits, two of which contain posts (Figure 10). The letter-numeral codes associated with these features refer to Brown's 1936 quadrant provenience system. Perhaps these large post molds represent pilings upon which raised buildings were constructed, or alternatively, vertical uprights used in 'post in ground' construction. This is further complicated by a series of narrow footer trenches, some (but not all) of which seem to be associated with the post molds of Structure 11. This complex arrangement of pits and trenches likely represents a series of superimposed building events in a key area adjacent to the Great Hall. This is further complicated by the quality of excavation and significant disturbance caused by the nearby road. **Structure 12** is not illustrated in Woolworth's report (1963), but is represented by an arrangement of footer trenches noted in Figure 10. It likely relates to the complex of features making up the east gate at corner G. It consisted of narrow trenches and gate posts.

Structure 13 and **Structure 14** are also located in close proximity to the east gate area. This zone was very difficult to interpret because of the refurbishment and reconstruction that occurred there. Figure 10 illustrates a rectangular arrangement of footer trenches that appear to define a row house that was divided up into discrete compartments not unlike Structure 1. Structure 13 was underlain by a cellar (Figure 10). On the basis of non-archaeological emergency trenching operations conducted as a consequence of the 1969 destruction by fire of the reconstructed Great Hall, Woolworth and Woolworth (1982: 242) discount the existence of Structure 14 as a discrete structure. We are less certain, but acknowledge that the repeated construction of this area has resulted in considerable overlap of structural features and confusion.

Trench 14 ran down the central length of the Great Hall that was designated as **Structure 5** (Woolworth 1963:86) (Figure 3). This structure was first encountered in 1937, and consisted of a stone foundation wall composed of roughly square slabs of slate that were carefully laid to support the main walls of the building (Figure 6). Brown explored this wall by excavating along its length, thereby defining the position and orientation of the main building within Compound A (Figures 3 and 11). The north and west walls were the most complete, and indicate that the building was located about 17 feet south of and parallel to the internal palisade wall that defines one of the main grid baselines of the site (Figure 11). Its full dimensions are 95 feet east/west and 30 feet north/south (Figure 11), but subsequent excavations by Woolworth in 1970-71 suggest that the building was slightly longer (ca. 97 feet).

Excavation within the confines of the building consist of a series of undocumented cross trenches and Trench 14 that ran down the central length of the structure. Woolworth

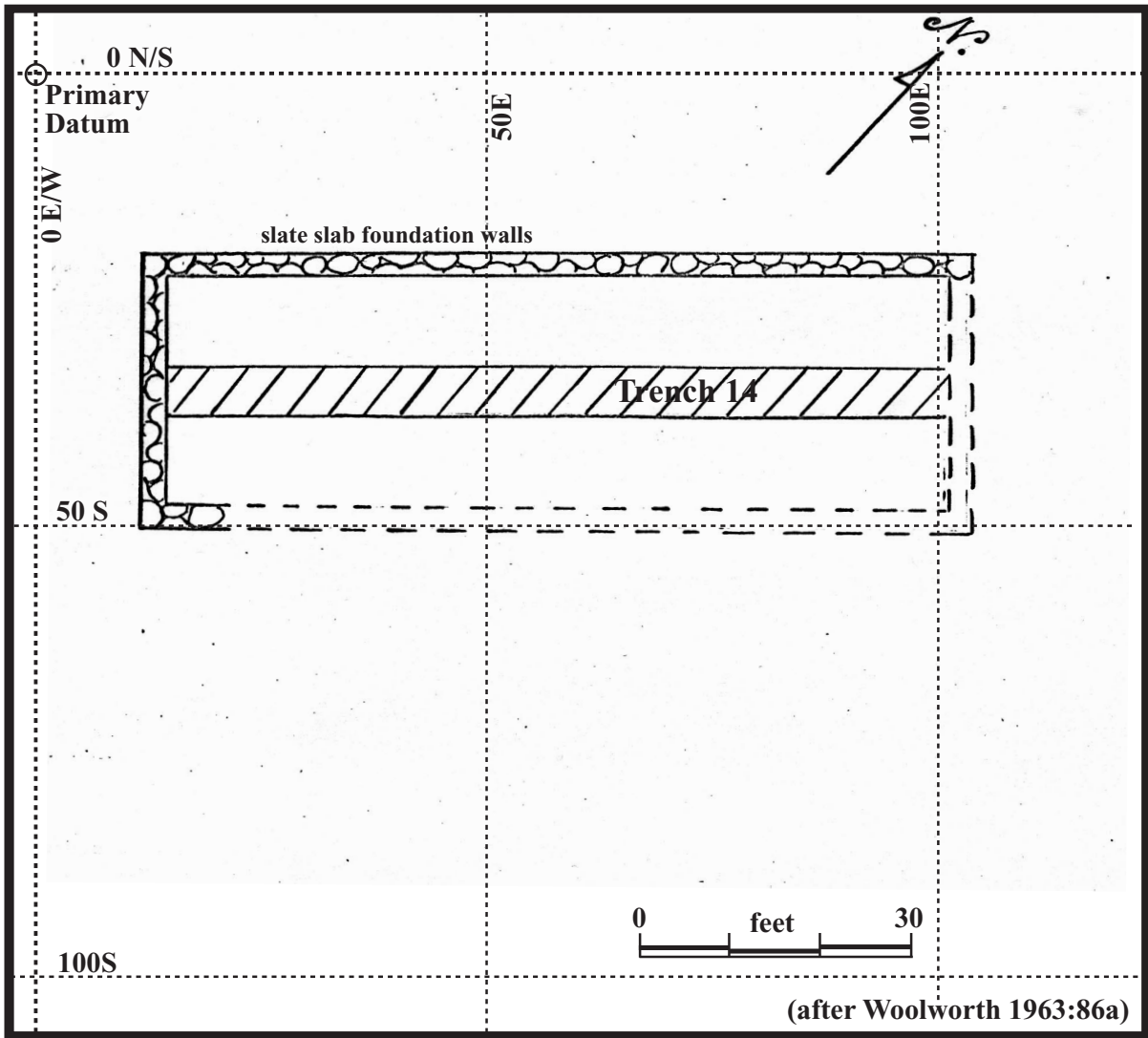


Figure 11 The 1936-37 excavations in the Great Hall, Grand Portage.

(1963) indicates that excavations within the structure were limited and rather cursory, and few artifacts and little evidence of fireplaces was encountered. As the building was reconstructed on the original site in 1938, likely much of the evidence was destroyed at that time. Subsequent excavations in the Great Hall area were conducted in the early 1970s after the destruction by fire of the original reconstruction. These are addressed more fully below.

Trench 18 is located in the southern third of Compound A, and contains an accumulation of stones in the western end (Figure 3). While

Woolworth does not offer an interpretation, perhaps it implies a building, a stone stockpile, or a collapsed chimney/hearth.

Trench 24 is located immediately south of the Great Hall, and contains a narrow clay filled trench that was also intercepted in Trench 15 (Figure 3). No feature number was assigned to it.

Trench 25 intercepts the south wall of the Great Hall near its southeast corner (Figure 3). Little information is available that describes the nature of the foundations in this area.

Trench 26 was excavated in 1937 to

explore a mound and a rectangular building (**Structure 7**) located along the west palisade of Compound C (Figure 3), was revealed (Woolworth 1963:91-92). This building is described as 12 feet east/west and 25 feet north/south, with the long axis oriented parallel to the west palisade wall. The building was destroyed in a fire, with much of the mound rubble consisting of collapsed stones from a high stone wall or a chimney. Burned wood structural members were also noted in the rock rubble. However Brown discontinued excavations as he did not have sufficient trained staff to adequately document the find, and it does not appear that Woolworth returned to complete the excavations in the 1960s as part of exploration of the stockade. Consequently, no detailed illustrations are available.

A **Drainage trench** was encountered when excavating the palisade trench between corners F and G (Figure 3). It was designed to help drain surface water away from a low area behind the Great Hall in the southeast corner of Area F (Figure 1). About 22 feet of this plank-lined drain was exposed within the compound, with an additional 28 feet extending outside the palisade. It is not known how far this drain extends east under the present paved parking lot, but it is generally assumed that it extends to Grand Portage Creek in order to drain away excess ground water from around the Kitchen and Great Hall. Subsequent excavations dating to the 1970s more fully exposed this feature, and it will be referred to again below.

With resumed interest in development of the heritage values of the property, excavations were reinitiated after the 1958 designation of the site as a National Monument. Throughout much of the 1960s these efforts focused upon exploration of localities outside of the main fort compound. We briefly mention them before returned to a more detailed discussion

of the 1970s excavation activities that occurred within and around the Great Hall and its associated Kitchen.

The 1961 Excavations

The 1961 field season initiated trench exploration outside of the main fort compound in an area east of Grand Portage Creek and north of the roadway known as the "Cook County Highway No. 17" (Woolworth and Woolworth 1982:230) (Figure 12). A field school was directed by Dr. Eldon Johnson, with supplemental excavations by J. Stoltman and A. Woolworth. These excavations are not part of the mandate of this project, but are important for our purposes because a new grid system was established at this time that involved construction of north/south and east/west baselines arranged perpendicular to one another and with the intersection point designated as 'the 0-0 point'. This resulted in a Cartesian grid designation system that is identical to those used by Brown in 1936-37 and subsequent grids dating to the 1960s and 1970s by Woolworth within the main compound of the fort. *Obviously, great care must be taken to determine the date of the excavations prior to determining where the grid designation refers.*

The 1962 Excavations

The 1962 field work also involved exploration of the area east of Grand Portage Creek and south of the Cook County Highway No. 17 (Woolworth 1982:234) (Figure 12). The investigations involved expansion of the 1961 grid system to the south, and continued exploratory trenching.

The 1963 Excavations

In 1963 Alan Woolworth returned to excavate within the proximity of the Grand Portage fort compound (Woolworth and Woolworth 1982:236). The priorities were excavation around the inner and outer perimeter of the palisades, excavation of the

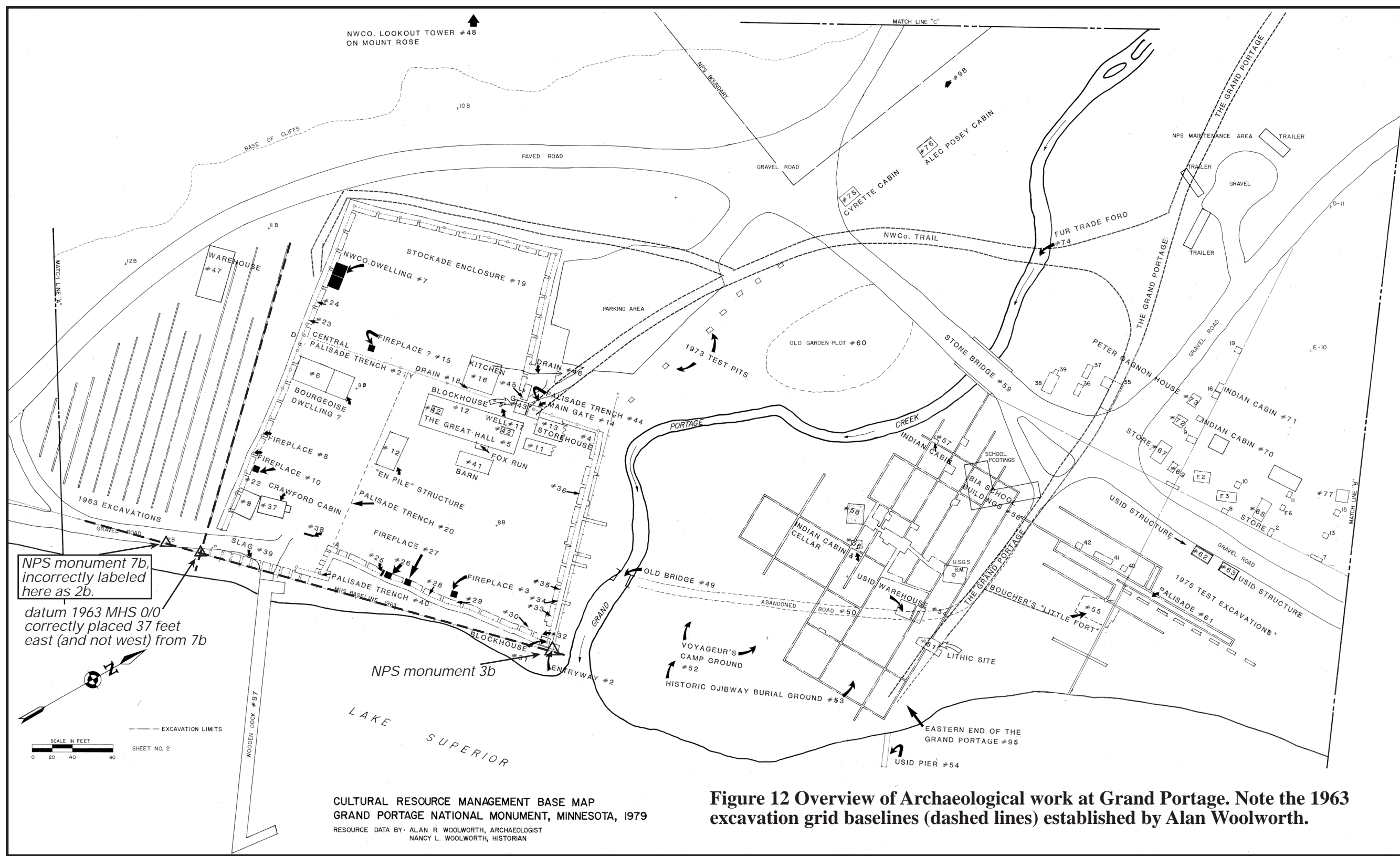


Figure 12 Overview of Archaeological work at Grand Portage. Note the 1963 excavation grid baselines (dashed lines) established by Alan Woolworth.

CULTURAL RESOURCE MANAGEMENT BASE MAP
 GRAND PORTAGE NATIONAL MONUMENT, MINNESOTA, 1979
 RESOURCE DATA BY: ALAN R. WOOLWORTH, ARCHAEOLOGIST
 NANCY L. WOOLWORTH, HISTORIAN

east gate area (adjacent to corner G), and exploratory excavations to the west of the main fort compound (Figure 13).

In anticipation of refurbishment and reconstruction of the palisade walls, Woolworth exposed 5 foot wide strips along both the inner and outer edges of the palisade walls to collect information and artifacts prior to their destruction through construction work. This allowed some refinement and reinterpretation of the stockade system that was initially developed during the 1936 and 1937 excavations. This contiguous excavation likely obliterated the last traces of Brown's 1936 cross trenches. The summary reports outlining these excavations do not specifically refer to them, but Figure 12 records several additional features or 'structures encountered along the palisade wall between corners A and X, in addition to the already mentioned Structure S3 (discovered in 1936-37) that is described as "Fireplace #3" in Figure 12. These additional features include "Fireplace #27" and features #25, #26, and #28 (Figure 12). Perhaps these features represent remnants of row house structures arranged around the inner perimeter of Compound A. We draw the reader's attention to a number of cryptic reference numbers and words noted in and around the main Compound in Figure 12. No doubt, these numbers refer to other features and localities of interest that are not described in the summary reports available to us. This suggests that some information deriving from the field notes remains to be integrated into the electronic site master plan.

In his report of the 1963-64 excavations, Woolworth (1969:23) notes that one of his first priorities was to establish a new grid system that utilized the NPS survey monuments that had been erected in 1962. These ground control points (or traverse points) were recorded relative to the stockade system in 1963 by a civil engineer named

John F. Wilkinson (Figure 14). Woolworth's primary archaeological base line was established between monuments 7b and 3b, the two monuments located between the Lake Superior shoreline and corners C and X respectively (Figure 14).

Prior to describing this grid system we review a discrepancy between Woolworth's 1969 observations and the 1963 plan produced by Wilkinson (Figure 14). Woolworth (1969) reports that his baseline was extended westward from monument 7b to encompass the zone of test trench investigation west of the main compound (Figure 12). He reports that an archaeological datum (steel stake) was established and encased in concrete 37 feet west from 'NPS monument 7b'. This datum was labeled '1963 MHS 0/0', and became the point of origin for the Cartesian grid used during the 1963-64 seasons (Figures 12 and 13). However, the distance between '1963 MHS 0/0' and NPS 3b is measured to be approximately 430 feet on the Wilkinson plan, and not 360 feet as per Woolworth's text description. In light of D. Cooper's 2001 comment that Woolworth's monument "1963 MHS 0/0" has not been relocated, we speculated in an earlier draft report that perhaps an error was made in describing its location whereby it is located 37 feet east of 'NPS monument 7b' rather than west of it as indicated by Woolworth. D. Cooper addressed this question by referring to some of the manuscript maps held the Grand Portage National Monument files, and confirmed that Woolworth misspoke himself in the 1969 report, and that '1963 MHS 0/0' is located 37 feet east and not west of 'NPS monument 7b'. These corrections are offered in Figures 12 and 14.

In any case, Woolworth (1969) notes that a 10 foot grid system was established, presumably with NPS monument 7b being labelled 0N/37W. Woolworth (1969:24)

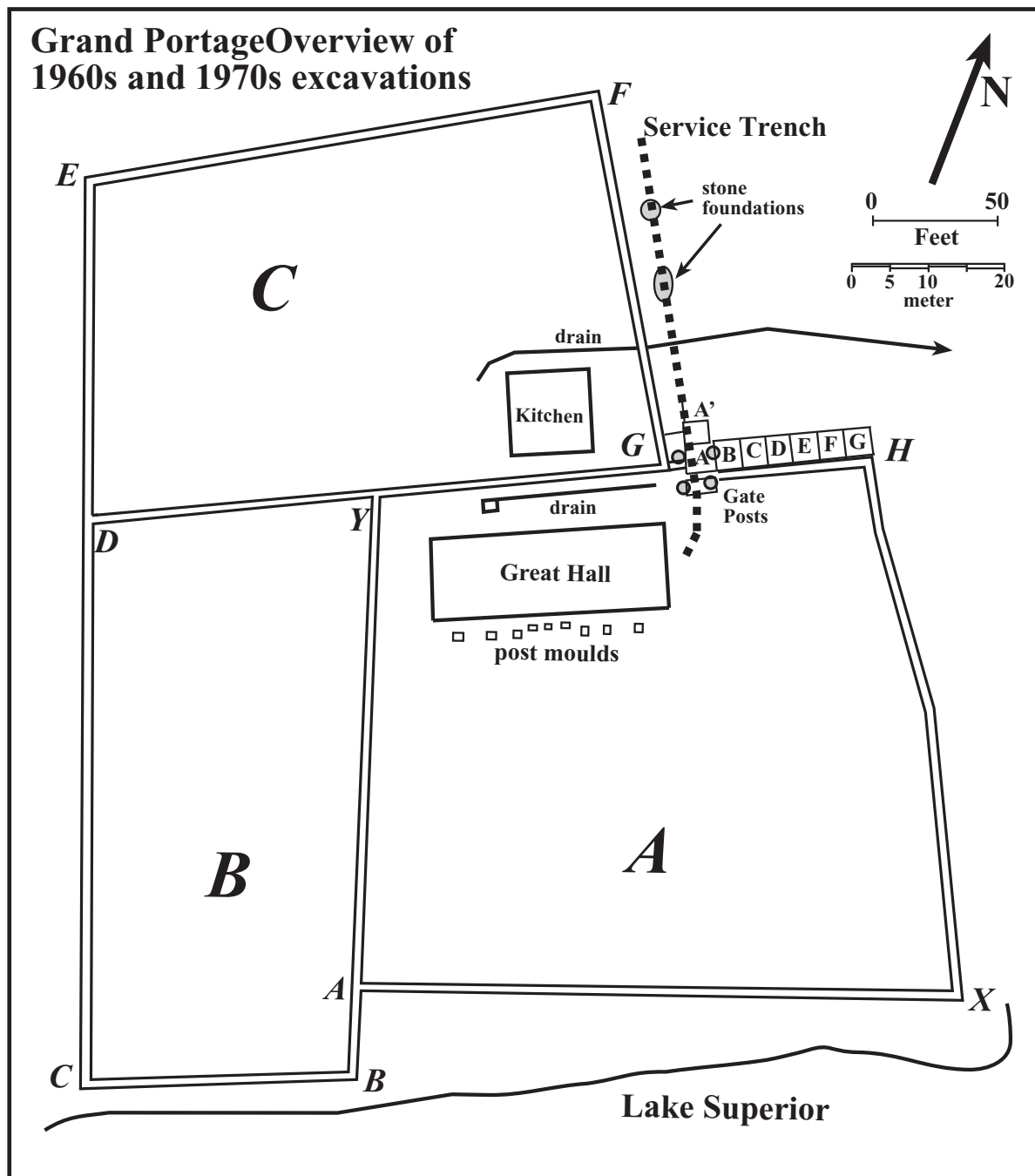


Figure 13 Overview of 1960s and 1970s excavations in Grand Portage Compound

specifically states that monument 3b (near Corner X) became 0N/360E (Figure 14). A second base line was then established running grid north from 0/0 to co-ordinate 380N/0W (Figure 14). This baseline diverged about 10 degrees west of the west palisade wall.

Woolworth also indicates that he had the

NPS monuments 3b, 7b, 2b and 11b encased in concrete, but appears to have left monuments 9b and 8b unmodified (Figure 14). The 1963-64 grid system was employed for the work on the stockade, and the exploratory trenching west of the fort compound (Figure 12), (including the fur warehouse that will not be discussed

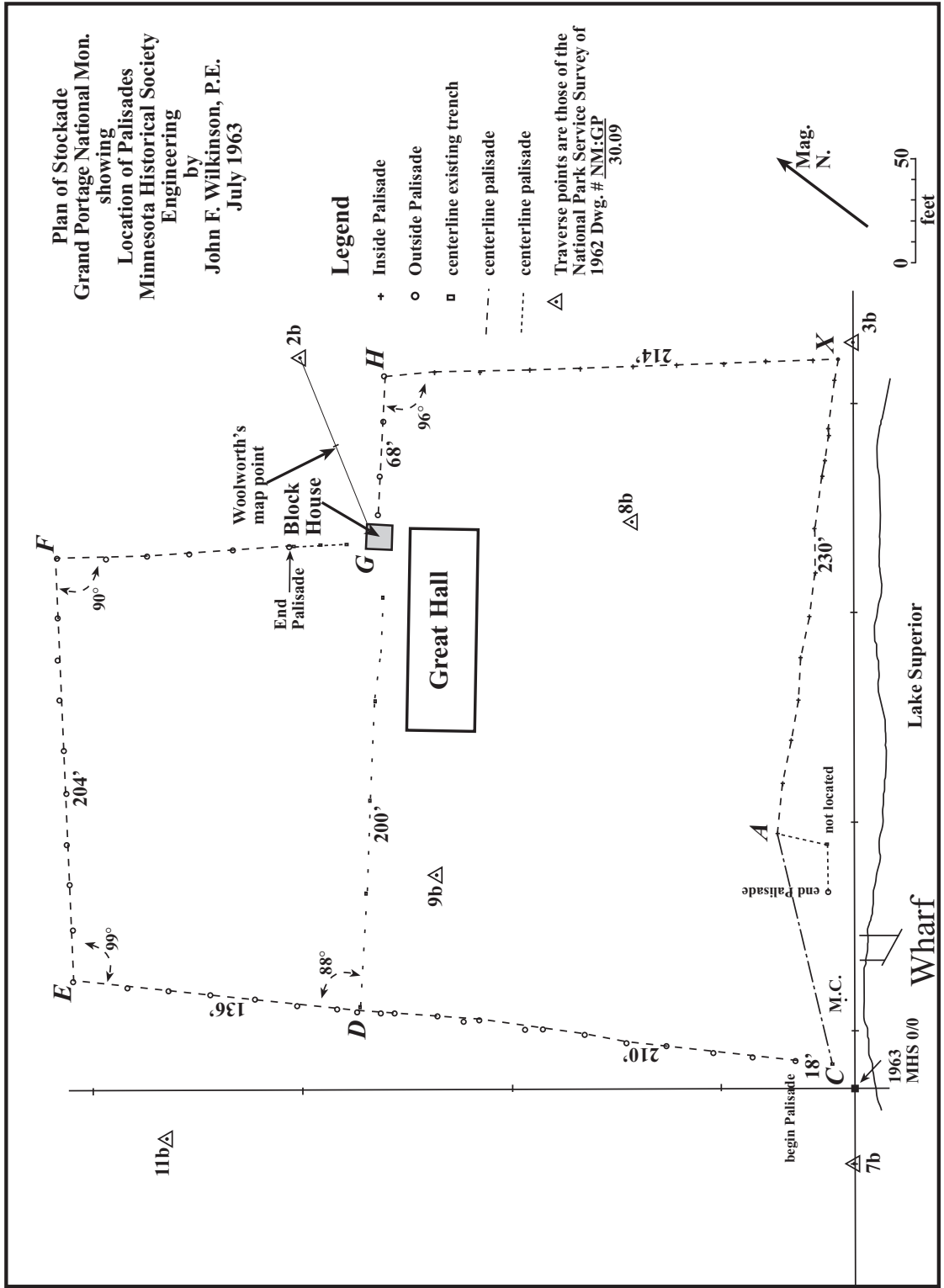


Figure 14 Wilkinson's 1963 Plan with Woolworth's 1963 grid

further here). However, he established yet another excavation grid for the exploration of the stockade walls between corners G and H (Figure 13). Because of obscured lines of

sight, Woolworth (1969:26) established a new base line laid out between the '1962 NPS 2b' monument and the northeastern foundation corner of the reconstructed blockhouse (a

distance of 85 feet) (Figure 14). A 'map station' was established midway along this base line. These key landmark points are noted on the Wilkinson map (Figures 13 and 14). As this blockhouse no longer exists, the orientation of the base line is not precisely known. He then undertook the exploration of the east gate area by establishing a series of 10 foot wide excavation units along the outside margin of the stockade from Corner G to Corner H (Figure 13). Since the 10 foot by 10 foot excavation squares lie parallel to the stockade line, they are likely oriented consistent with the other primary grid systems. These excavation units along the outer stockade wall (Figure 13) revealed hitherto unknown characteristics of the main gate, and evidence of repeated refurbishment of this key traffic area. There is no indication in the summary reports what Cartesian grid system (if any) that the excavations were conducted on. Perhaps he merely identified them by the letter code system replicated in Figure 13. These excavations were continued as part of the 1964 operations.

The 1964 Excavations

In this field season the exploration and excavation of a structure located outside and to the northwest of the stockade compound was completed. This is thought to be a fur warehouse or canoe shed (dimensions of 18.5 by 52 feet) (Figure 12). The other primary objective was to complete the exploration of the east or main gate area that was slated for reconstruction. The latter work identified the remains of four large posts forming a square (12 feet to a side) that supported the main gate and the overhead watch tower (Figure 13). Figure 15 is a composite of the sketch plans outlining the primary observations that can be gleaned from his reports. They demonstrate the complex history of refurbishment at the gate area, and suggest the presence of structures immediately outside the palisade that are

represented by 'white cedar planking', stone foundation walls, palisade walls, and drainage trenches. The provenience system used for the 1963-64 excavations is particularly difficult to interpret, with individual excavations defined by reference to the letter codes cited in Figure 13, or by their position relative to the reconstructed blockhouse. Great care will be needed to interpret and contextualize the artifact catalogue.

The 1969 Excavations

A series of emergency 'mitigative' excavations were conducted during a brief fall field season in 1969. These exploratory test pits were dug to evaluate the impact of the excavation of a sewage line along the eastern boundary of the property, but well removed from the fort compound.

Unrelated to the 1969 Woolworth excavations, J.J. Hoffman monitored backhoe operations undertaken as a consequence of the 1969 destruction by fire of the reconstructed Great Hall (Woolworth and Woolworth 1969: 242). This involved excavation of a sewage trench service line from the east Great Hall foundations, out through the main gate, and then northward between the east palisade (defined by corners F-G) and the adjacent parking lot (Figure 13). Apparently this trench was excavated about 10 feet east of the palisade, but no maps of its actual location have been found. The trench intercepted the remains of the 1964 excavations, the original fort drainage trench (Figure 13) located 38 feet northwest of Gate Post No. 1 (and at a depth 3.4 feet below the parking lot). Finally, a stone foundation was encountered '70 to 80.5 feet southeast of the enclosure corner F' (Woolworth and Woolworth 1982:243), (Figure 13) This foundation was 10.5 feet long and buried from 2 to 2.5 feet below the pre-parking lot surface. A second possible foundation stone was found in the trench ca. 49 feet southeast of Corner F and resting

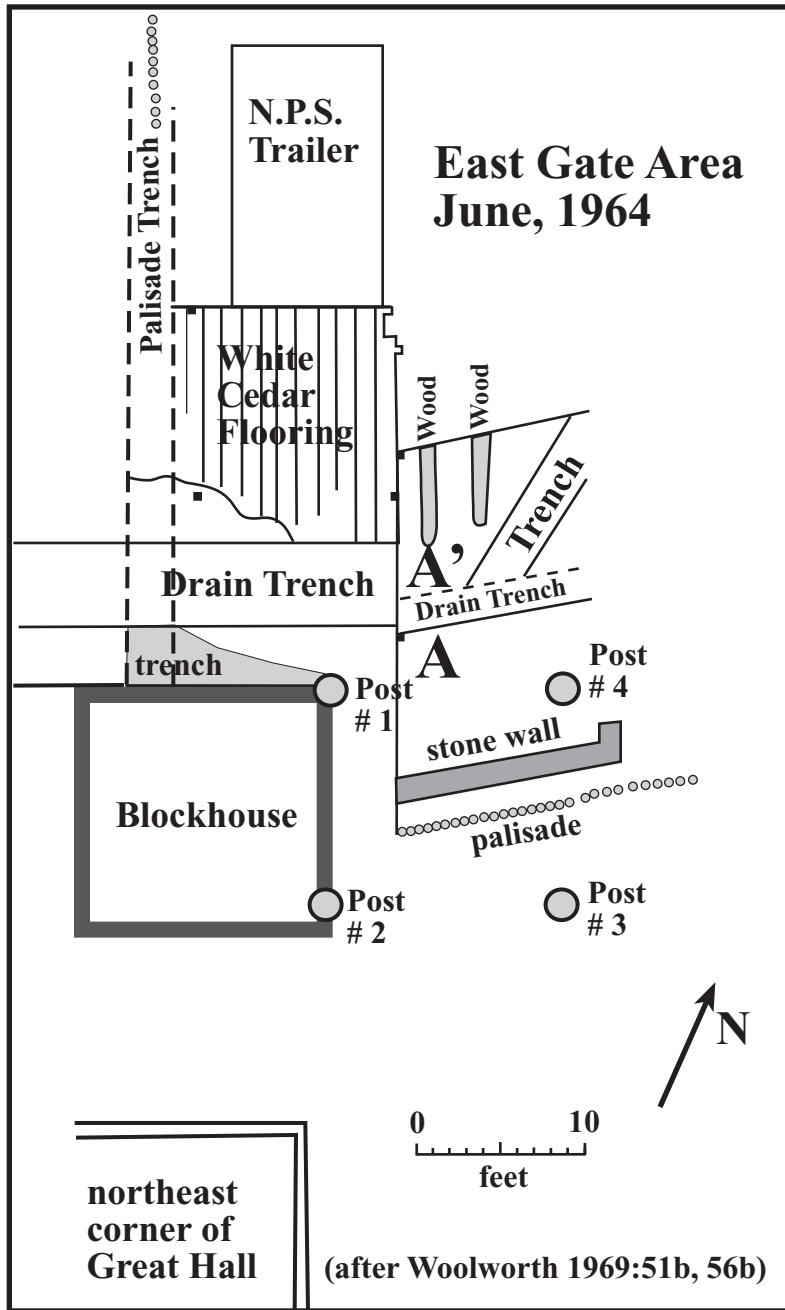


Figure 15 Composite sketch of 1963-64 excavations at the eastern gate

upon a possible buried soil about 1 to 2 feet below the pre-parking lot surface (Figure 13). It consisted of a large rounded stone set upon even larger flat stones. Woolworth and Woolworth (1982:243) note that rotted wood was discontinuously noted in association with this buried soil, and offer the perspective

the ‘East/West’ baseline being established perpendicular to the N/S baseline. The point of origin for this East/West line was also defined by the centre of the Great Hall. The interior of the Great Hall was then explored by excavating a series of east-west oriented trenches that ran down the length of the Great

that it correlates to the NWC occupation era. No other interpretation is offered, but it is clear that structures appear to lie outside the main compound, and may remain intact underneath the paved parking lot of the site.

The 1970 Excavations

As a consequence of the 1969 destruction of the first Great Hall reconstruction, Alan Woolworth undertook major salvage and exploratory excavations within and surrounding the foundations of the Great Hall in the summer of 1970. Woolworth and Woolworth (1982:244) report that, since there was no readily available datum points at this time, it was decided to establish a new grid system originating from a new 0/0 datum point located in the ‘exact center’ of the Great Hall. While it is not specified how the centre point was identified, some maps indicate that the point of intersection of lines drawn from diagonal corners of the foundation was used to identify this center point (Figure 16). A ‘North/South’ baseline as established down the long axis of the Great Hall foundations, with

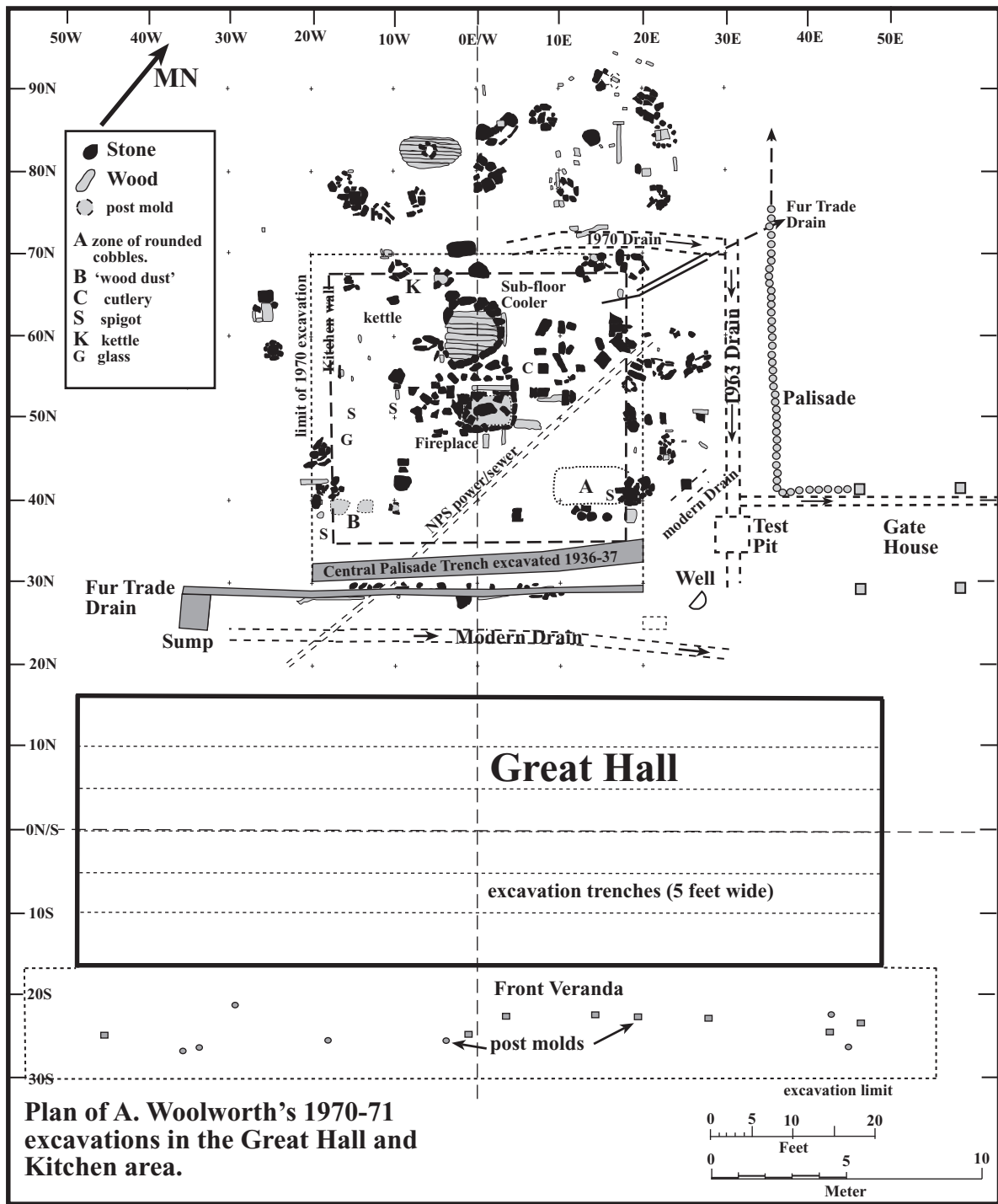


Figure 16 Great Hall and Kitchen excavations of 1970-71

Hall (Figure 16). Apparently the Great Hall foundations were excavated in their entirety using these trenches. There is no indication in the documents available to us how these trenches were designated, but presumably some reference to the grid system was

employed. Woolworth and Woolworth (1982: 244) indicate that few artifacts of fur trade affiliation were encountered, and no structural evidence of the original Great Hall was encountered. This was thought to be because of the reconstruction activities that occurred

between 1938 and 1949.

Woolworth then shifted to exploration of the south side of the Great Hall to define the front veranda that faced into the central courtyard of Compound A (Figures 13 and 16). A block excavation was cleared along the stone foundation that was 14 feet wide (north/south) and 110 feet long (east/west) (Figure 16). The top two feet of sediment yielded evidence of modern land use activities, while at about two feet below the surface, a series of fifteen post molds were found. These post molds suggest a rectangular porch that was about 10 feet wide and 95 feet long along the front wall of the Great Hall.

Attention then shifted to the excavation of a 50 foot (north/south) by 100 foot (east/west) area north of the Great Hall (Figure 16). A ten foot grid system was set up, with all artifacts collected and bagged by levels and designated square number. Again, we have not yet confirmed the nature of the designation system used for these squares other than it reflects the 1970 grid co-ordinate system. We think that the Cartesian grid coordinate of one corner of each excavation square was used to designate that square. However, some confusion exists in the artifact catalogue as it appears that different corners were periodically used to designate each square. Again, considerable care will be required in reviewing the primary documentation to determine the excavation unit designation system.

These excavations reveal the remains of a building measuring about 30 feet to a side, with porches built on its south, east and north sides. Inside the structure a stone-outlined fireplace and boulder outlined 'dry well or cooler' was discovered (Figure 16). The excavators also found a drainage trench that ran parallel with and between the Great Hall and the Kitchen (Figure 16). It originates in the vicinity of the well and ends in a sump pit southwest of the kitchen (at approximately

25N 33W in Figure 16). The western end of the major drainage trench was also noted near the north wall of the kitchen. The kitchen structure appears to have been built upon 'piers' composed of slate slabs. Presumably, these piers supported horizontal sill logs upon which the structure was built.

The 1971 Excavations

This was a brief field season (15 days) to complete the exploration and excavation of the area surrounding the kitchen (Figure 16). We have had some difficulty in determining the maximum excavation extent, therefore we leave what might be the false impression that a very large area north of the Great Hall was excavated.

While it is not clear whether the excavations north of the Kitchen were conducted in 1970 or 1971, a number of stone features are noted in Figure 16. They may represent additional structures, although they appear to be oriented at a slight angle to the apparent orientation of the kitchen piers.

The 1972 Excavations

This field season involved minor and short term mitigative exploration to determine the best route for sewer and water trenches to service the site area.

The 1989 Excavations

In the fall of 1989 the Midwest Archaeological Center conducted mitigative excavations in the Kitchen/Great Hall area in anticipation of the construction of a drain system to remove ground water from the foundations of the reconstructed buildings (Noble1990). These drains were to be placed in areas that had already been disturbed by the excavations of 1970-71, and also by a drainage line reportedly excavated in 1975 (Noble 1990:9). There remained some concern that the necessary trenching might intercept and damage presently undocumented

deposits, hence the mitigation and monitoring activities. While the interceptor drains were to be installed in the area that had already been excavated by Woolworth's 1970 and 1971 investigation of the Kitchen, the drain system was to extend south past the west side of the Great Hall, towards the shore of Lake Superior (Figure 17). This latter drain was thought likely to intercept any remnants of Structure 1 (Figure 1:S1). Consequently, Noble (1990: 2) undertook a series of test excavations in the approximate location of where the proposed drainage trench should intercept Structure 1.

Noble (1990:9) commented on the difficulty in interpreting the orientation and location of the original 1936-37 grid system. Rather than struggle with the ambiguity of the various grid systems in the short time available, the mitigation workers chose to establish a new grid system that represented the best estimate possible of the position and orientation of the original grid. To this end, they established a new point of origin (0S0W) located 'at the southwest corner of the Great Hall's front porch' (Noble 1990:10). The primary grid base line was established 18.5 feet west of (and parallel to) the west wall of the Great Hall at a bearing of '142° east of north' (Noble 1990:9). This bearing closely approximated that reported by Woolworth (1963), and it was hoped that the mitigation excavation grid would closely approximate that of the 1936-37 excavations. In figure 17 we replicate the orientation of this grid and the placement of the seven 5 foot square test excavations. We note some difficulty in reorienting and rescaling the Noble excavation illustrations on our version of the 1936-37 excavation plan. In order to accommodate these discrepancies in scale, we used the approximate placement of the Great Hall and corners G and A to achieve the 'best fit'. As the Great Hall was the primary landmark used by Noble, we minimize the error in the placement of the Great Hall in figure 17 at the

expense of that associated with the stockade lines. We concur with Noble (1990) that test pits 1 to 4 were placed in close proximity of Structure 1 (Figure 17).

These units were arranged in a 'checkerboard' pattern to maximize the exposure, and while the 1975 drainage trench excavations obscured much of the original sedimentary deposition (Figure 17), Noble (1990:14) reports that a soil unconformity was noted in the southern third of test unit 3 (S35W5) (Figure 17). He suggests that this might represent a portion of one of the 1936-37 excavation units that exposed Structure 1.

The balance of the excavations did not yield archaeological deposits relevant to the NWC occupation, but rather, reflect the re-occupation of the property in the late 19th and early 20th Centuries. Of interest for continued excavation at the site, Noble (1990) reports that sediment overburden (upwards of one foot thick) mantles much of the lower elevation areas of the site. This likely reflects recent reoccupation of the property, construction of the road bed through the fort compound, and general landscaping activities undertaken as part of the fort reconstruction. Thus, continued efforts at micro-relief mapping of the main part of the compound is likely counterproductive. As will be addressed below, we believe that the 'back' part of the compound (area C, Figure 3) remains relatively undisturbed.

The 2001 Midwest Archaeological Center Field Work

In early October of 2001, the Midwest Archaeological Center conducted an extensive geophysical remote sensing survey of most of the area within the stockaded compound (Volf 2002) (Figure 18). This involved site evaluation using both a fluxgate gradiometer and an electrical resistance meter. These assessments were conducted using a grid system originating in the southwestern (back)

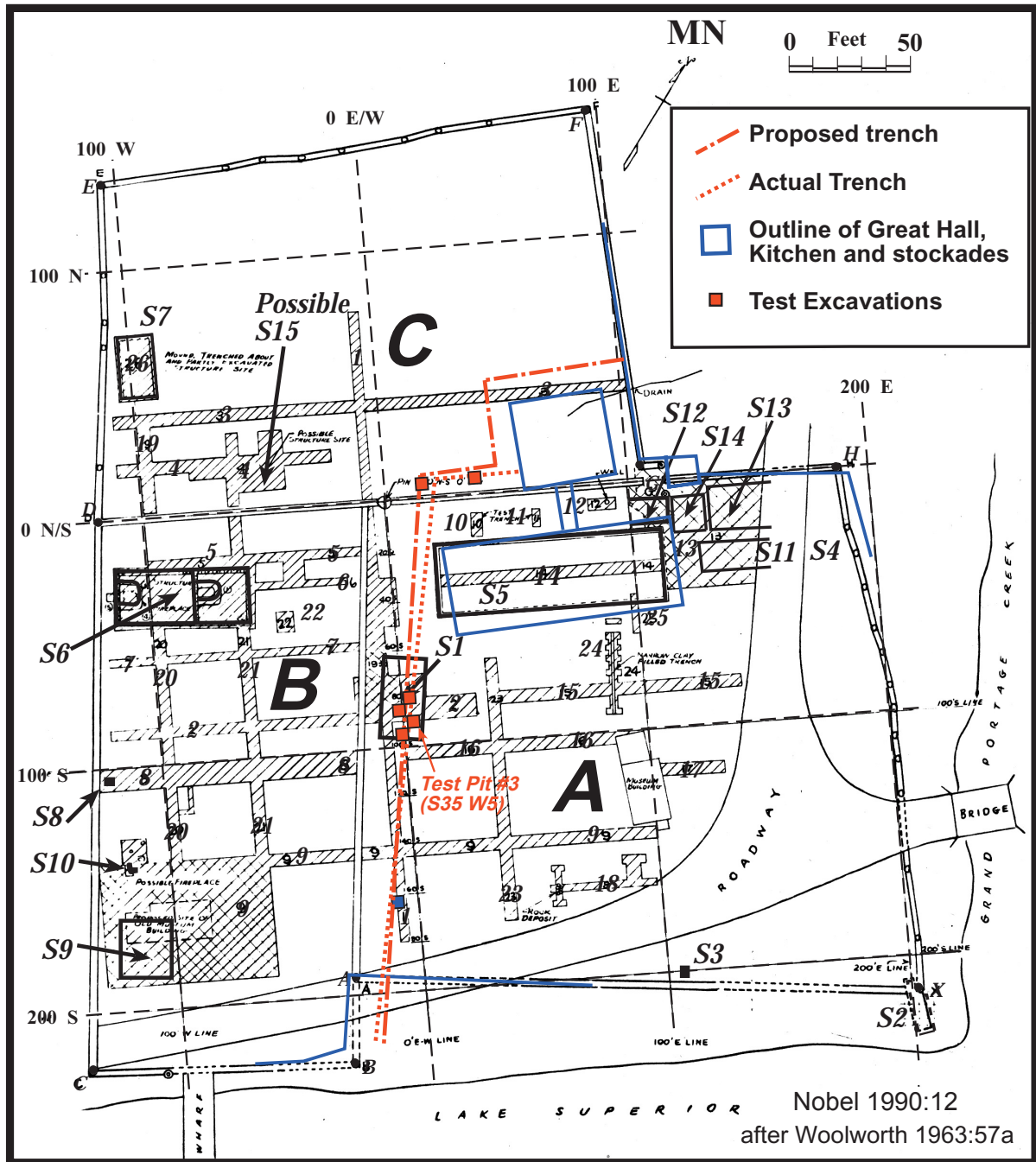


Figure 17 The approximate location of the 1989 drain trench excavations overlaid upon the 1936 excavation plan.

corner of the reconstructed palisade. This grid system originated from an arbitrary 0N 0E cartesian coordinate with a north/south baseline axis running parallel to the western palisade (25° west of magnetic north (Volf 2002:3). This grid system was also employed

during the Lakehead University field investigations, although we used a different grid designation for the primary datum. The geophysical investigations were conducted in 20 meter by 20 meter blocks using a designation system illustrated in Figure 18.

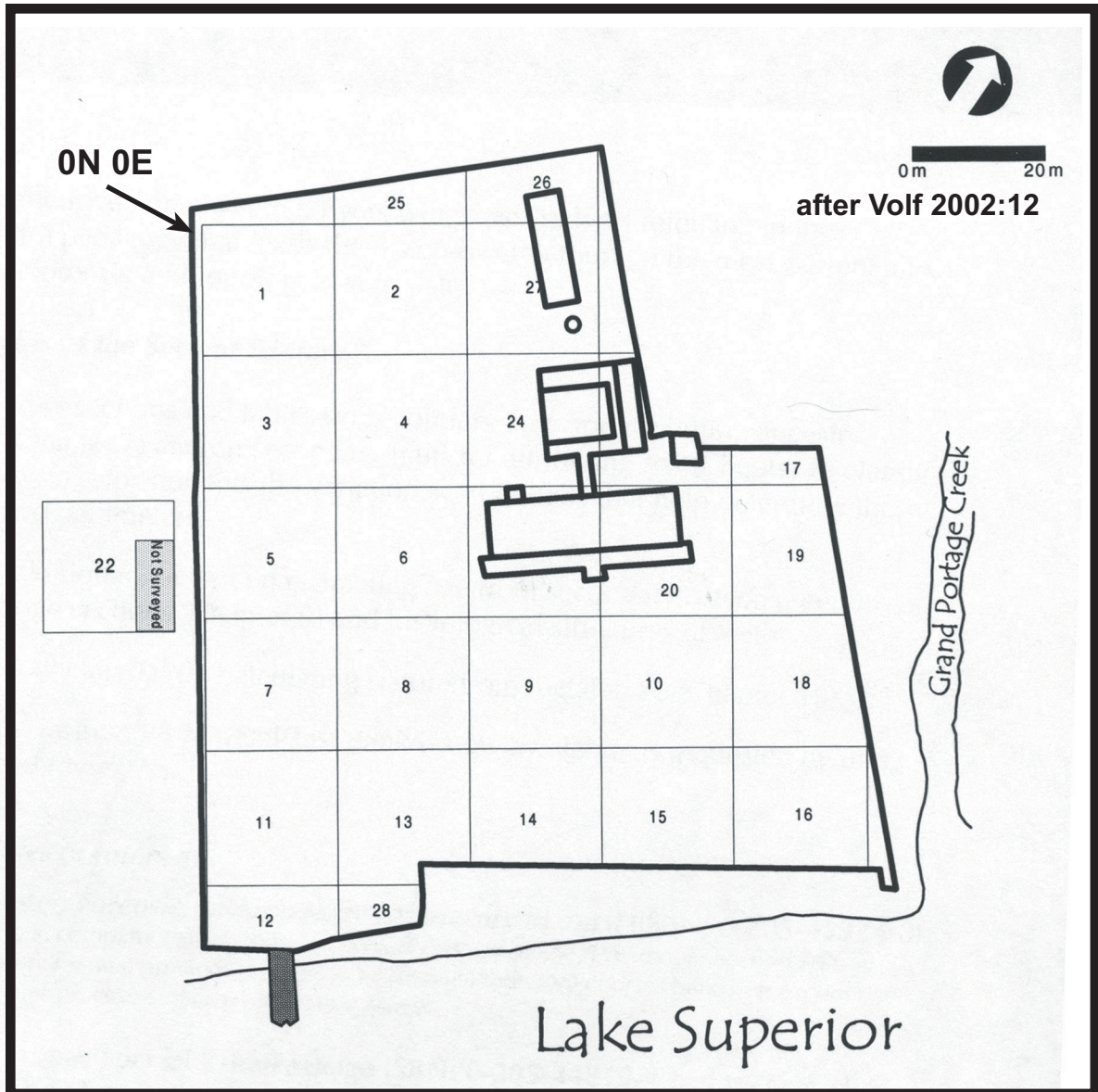


Figure 18 The block designations for the Geophysical Remote Sensing survey.

Unfortunately, the geophysical remote sensing results are rather ambiguous because of the ‘masking effects’ of naturally occurring clasts within the sediment, and because of the intensive re-use of the property since the NWC abandoned it in the early 19th Century (Volf 2002). Volf (2002) emphasizes that this masking effect does not preclude the strong possibility that fur trade deposits remain intact within the reconstructed compound, but are masked and obscured by natural and more recent cultural factors. We offer some

observations to amplify this point based upon our review of the past excavations and the micro-topography survey.

Perhaps the most immediately useful observation deriving from the geophysical survey is the identification of recent subsurface disturbances to construct water and sewage service corridors through the property that are not documented in the reports available to us (Figure 19). This information suggests that much of the area southeast and southwest

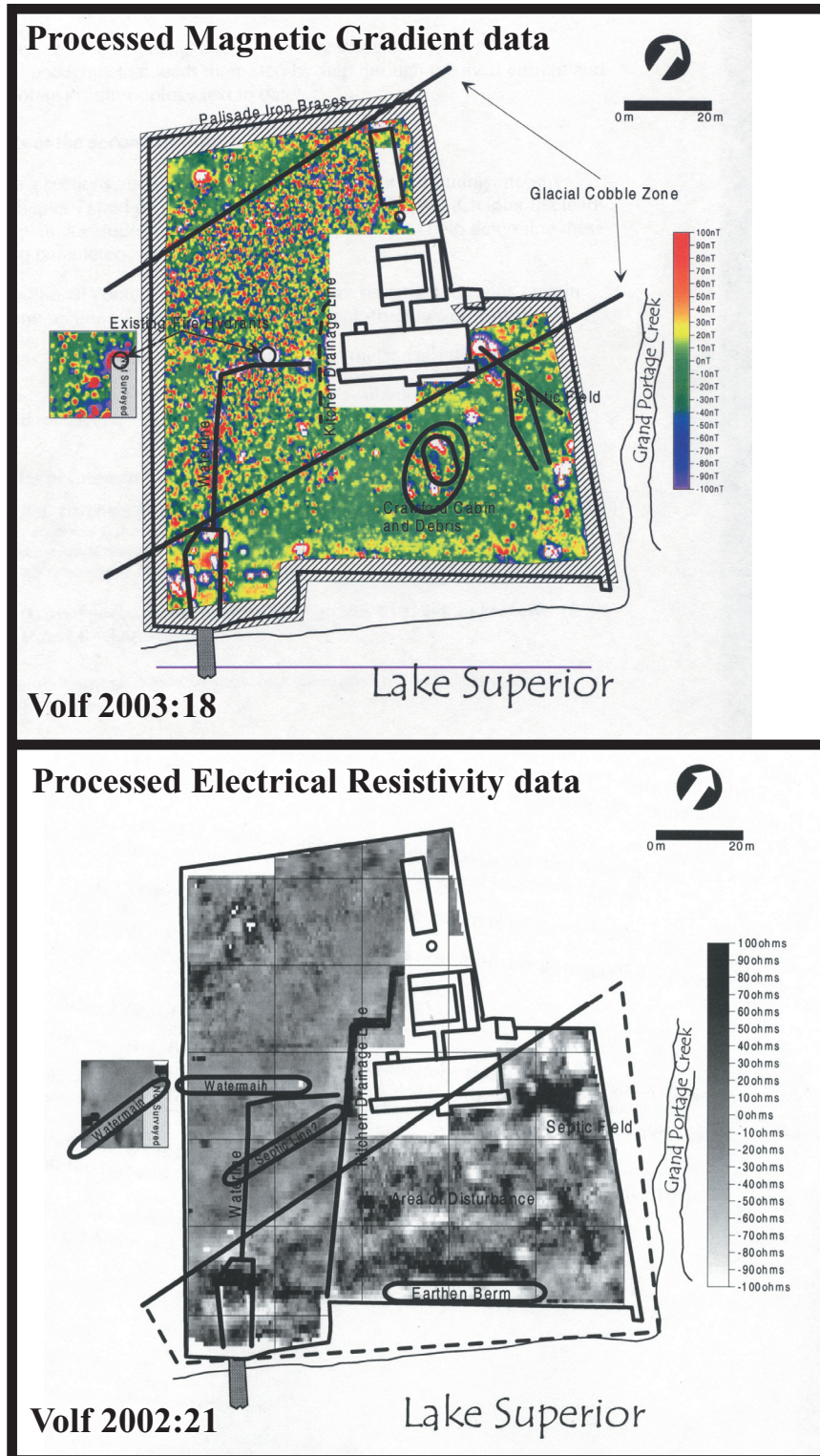


Figure 19 Interpretation of Geophysical Remote Sensing data.

of the Great Hall has been disturbed by subsurface construction activities, some of which is identifiable in the remotely sensed

geophysical data. Notable exceptions to this generalization are offered in the following section.

The 2001 Lakehead U. Field Work

A very brief field visit was undertaken by Scott Hamilton, Joe Muller and Bob Garvie (Lakehead University) in the fall of 2001. This two day visit was to gain a basic familiarity with the monument property, collect differentially corrected GPS (dGPS) ground control points within the main fort compound, and to document the micro-relief of a large portion of Compound C.

Joe Muller undertook the dGPS data collection, but unfortunately our visit coincided with overcast and generally inclement weather, and the satellite geometry was not optimal. This problem was compounded by the fact that building locations and grid stakes that were to be used as ground control points were often partially obscured from the GPS satellites by the high palisade walls and the Great Hall and Mount Rose. Despite these problems, ground control points were identified, but with insufficient resolution to permit precise three-dimensional geo-referencing to integrate the mapped 'legacy' data.

As Joe Muller left Lakehead University to take up a position in southern Ontario in the fall of 2001, development of the GIS database languished for much of the winter of 2001-02. Bob Garvie spent part of the winter of 2001-02 searching the available records and developing two electronic maps of the excavations. One addressed the balance of the compound excavations while the second documented the kitchen excavations. It was not until the spring of 2004 that a photocopied map was discovered in the Kleinfelder papers that allowed the accurate integration of these data.

The Garvie composite maps were used by James Graham when he took over the GIS component of the project in the winter of 2002-03. Graham sought to work within the uncertainty imposed by the dGPS data,

and geo-referenced the various maps, figures, grids and plans as closely as possible. This resulted in a 'best fit' approach that enabled an acceptable integration of all the extant data. The details of these GIS efforts are summarized in Appendix 1 of this report. However, we acknowledge some uncertainty that might only be mitigated by future excavation to relocate and re-establish the 1936-37 and 1970-71 grid systems. This would facilitate the construction of a new master map (perhaps using a Total Station) that can be geo-referenced using dGPS equipment under optimal satellite conditions. For the time being, we are confident that Graham's data integration will serve our purposes, particularly in light of the rather imprecise provenience of the balance of the archaeological collection.

In the spring of 2003 James Graham left Lakehead University to begin graduate school, and David Norris resumed work with the GIS project in the winter of 2003-04, however he also left to start graduate school in the summer of 2004. Clearly, GIS staff continuity at Lakehead University is an ongoing problem, and has constrained our ability to develop and refine the GIS information base.

Our 2001 visit to the Grand Portage National Monument coincided with that of the geophysical remote sensing survey team from the Midwest Archaeological Center. As noted earlier, they established a temporary grid system throughout much of the compound interior (Volf 2002). The grid orientation closely approximates those used during the 1936-37 and 1971-1973 excavations. However the earlier excavations used feet as the primary unit of measure, while the 2001 grid is measured in meters. For the sake of consistency, we utilized the 2001 grid stakes for our micro-relief mapping exercise.

The micro-relief mapping sought to address whether subtle relief changes observed

in the interior fort compound might suggest the existence of presently undocumented structures and features. We focused on the back portion of the fort compound that has been subjected to the least subsurface investigation. This surface mapping exercise collected data from ca. 2,600 square meters, and extended east and south from Corner E, to encompass much of Compound C west of the reconstructed Kitchen (Figure 20).

The primary survey stake for the geophysical survey (0N 0E) is located about one foot within the inside corner of the reconstructed stockade at Corner E in figure 18. This stake was also used as the primary grid stake for micro-topographic mapping (Figure 20), however it was inadvertently given the designation 0S 0E by the senior author. It was used as a dGPS control point, and the elevation of 190.6 m ASL was generated. This elevation was used to calculate the relief throughout the study area. The less than optimal dGPS conditions led to a higher than expected degree of imprecision in the calculated elevation of grid stake 0S0E (190.6 m ASL) (Table 1, PDOP or ‘dilution of precision’). Despite this, we chose to use that elevation in our subsequent calculations. While the senior author acknowledges some uncertainty in the ‘absolute elevations’ discussed below, the ‘relative relief change’ within the survey area is probably accurate to within 5 cm. In our view, this is sufficient to permit discussion of possible anthropogenic alteration of the slopes within compound C.

The temporary grid system used for mapping radiates grid south and east from the 0S 0E datum in a series of 10 meter by

10 meter blocks (Figure 20). This grid is approximately parallel to the reconstructed west palisade wall, but gradually diverges from the north palisade (consistent with the imperfect quadrangle defining the fort compound). A theodolite was used to refine and expand upon the geophysical survey grid, with key stakes being established at 10 meter intervals radiating out from the primary datum. Along the north/south grid axes, lines of chaining pins were established at one meter intervals. These one meter grid markers were then used as reference points between which we stretched 30 and 50 meter tapes, and nylon ropes marked at one metre intervals. This established a temporary one meter grid system, from which we collected elevation points using a laser level.

J. Muller used Trimble dGPS instruments to determine the UTM coordinates for two grid stakes used in the micro-relief mapping. This includes grid stake 0S 0E, located near stockade corner E, and Grid stake 40S 50E, located near the reconstructed Great Hall and Kitchen (Figure 20). The UTM coordinates (NAD’83) and dGPS uncertainty (PDOP) associated with these locations is presented in Table 1.

We emphasize the unfortunately high PDOP readings associated with these grid stakes, especially the 0S0E stake - our primary datum of the micro-relief survey. This measurement uncertainty significantly affects our ability to precisely integrate the micro-relief survey into the larger mapping operation. These problems will be addressed more fully below after introducing the survey methods and the interpretation of the results.

Table 1 UTM coordinates of the corner stakes of the Micro-relief mapping area

Grid coordinate	Northing	Easting	PDOP
0S0E	5315623.114	299524.35	5.9
40S50E	5315611.890	299586.984	3.1

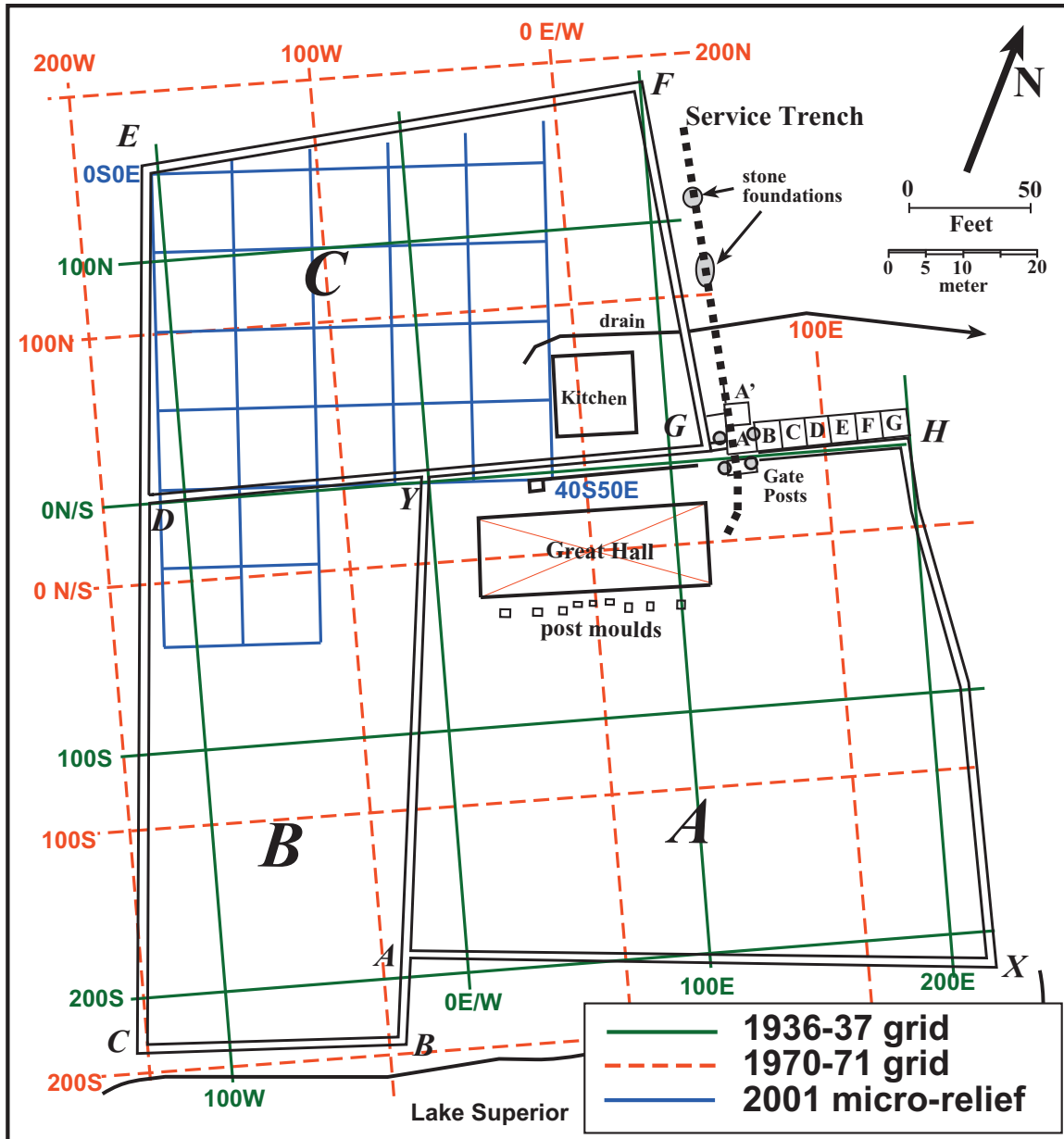


Figure 20 Micro-relief mapping grid within Compound C, with reference to the other major grid systems.

The instrument used was a Spectra-Physics 'Laserplane 220' laser level. It was mounted on a conventional theodolite tripod. When leveled, the central laser emitter rotates within the glass housing, and projects a horizontal laser beam through a 360 degree axis. Determination of the 'height of the instrument' involves simply measuring the distance from the laser beam down to the ground surface at the control point (with known horizontal and vertical provenience).

The horizontal laser beam is detected by a sensor mounted in a bracket that can be fixed to the top of a conventional stadia rod. The stadia rod operator merely raises or lowers the stadia rod until the visual or audio cues emitted by the laser detector indicate that the horizontal laser beam has been detected. Once detected, the operator then used the stadia rod to record the height of the detector above the ground surface at the point of interest. Since the stadia rod was placed at known horizontal

grid coordinates, the 3 dimensional position of the ground surface can be quickly and efficiently transcribed by the stadia operators on prepared grid forms.

These values were then entered into a computer spreadsheet program (Microsoft Excel) to be subtracted from the already known 'height of the instrument' to determine the elevation at the point of interest. While these data points were labor-intensive to collect and process, this rudimentary system enabled the rapid and accurate collection of field data using inexpensive equipment.

We also noted the distribution of cobbles and small boulders that were visible on the ground surface during the survey. These surface clasts likely affected both the magnetic and electrical resistivity surveys (Volf 2002), and are important for our interpretation.

Given the complex surface irregularities noted during the survey, no attempt was made to use automated contour mapping software. Instead, the senior author 'hand interpolated' the contour lines (at a 5 cm contour interval) using the matrix of calculated elevation points. While this hand-interpolation is time-intensive, past experience at several other post-contact sites (Hamilton 1983; Burley, Hamilton and Fladmark 1996; Hamilton and Nicholson 2000) indicates that a superior product is derived. Consistent with the 1937 Walker elevation map (Figure 1), corner E (near coordinate 0S 0E) represents the highest point within the compound, and forms part of the foot of Mount Rose. The general downslope course is to the grid southeast, and is likely bedrock controlled, with the lower portion of the compound (outside the survey area) being mantled with relic lake sediments.

The dGPS data control points enabled the approximate integration of the micro-relief map into the GIS project. The paper-based map was digitized by James Graham using

a digitizing table. The UTM coordinates of key grid stakes were calculated based upon the two coordinates outlined above. Given the imprecision associated with the dGPS results, we were forced to employ a 'best fit' approach in order to integrate these data into the larger GIS project. This involved 'warping' and 'rubbersheeting' to fit the survey area within the best representation of the fort compound available to us. This unfortunate situation is not readily notable on examination of the small-scale maps included in this report, nor in the GIS project. However, they will create problems for the unwary if future researchers seek to confirm our interpretations without considering the consequences of the computer warping activities. We have attempted to account for this in Figure 21 by including two inset maps that superimpose the micro-relief mapping grid on maps representing the 1970-71 and 1936-37 excavation grids, and by including a copy of the original unwarped map in Appendix 2.

The original micro-relief map (Appendix 2) is rather difficult to interpret given the convoluted isoclines plotted at a 5 cm contour interval. To aid in visualization, we created a Digital Elevation Model (DEM) (Figure 21). This DEM represents relief change as a 'continuous variable' rather than relying upon interpretation of the contour lines. This was conducted first within the Arcview 3.2 software (to produce a TIN representation of relief). This rather coarse-grained imagery is not particularly informative given the subtle relief changes of interest. We then extracted the contour lines from Arcview, and imported them into a raster GIS software package called MFWorks. In the view of the senior author, such raster derived GIS provides a more intuitively understandable relief model (Figure 21). This was further augmented by a broad 'color palette' used to colour code the elevation values generated by the DEM. Data interpretability is further augmented

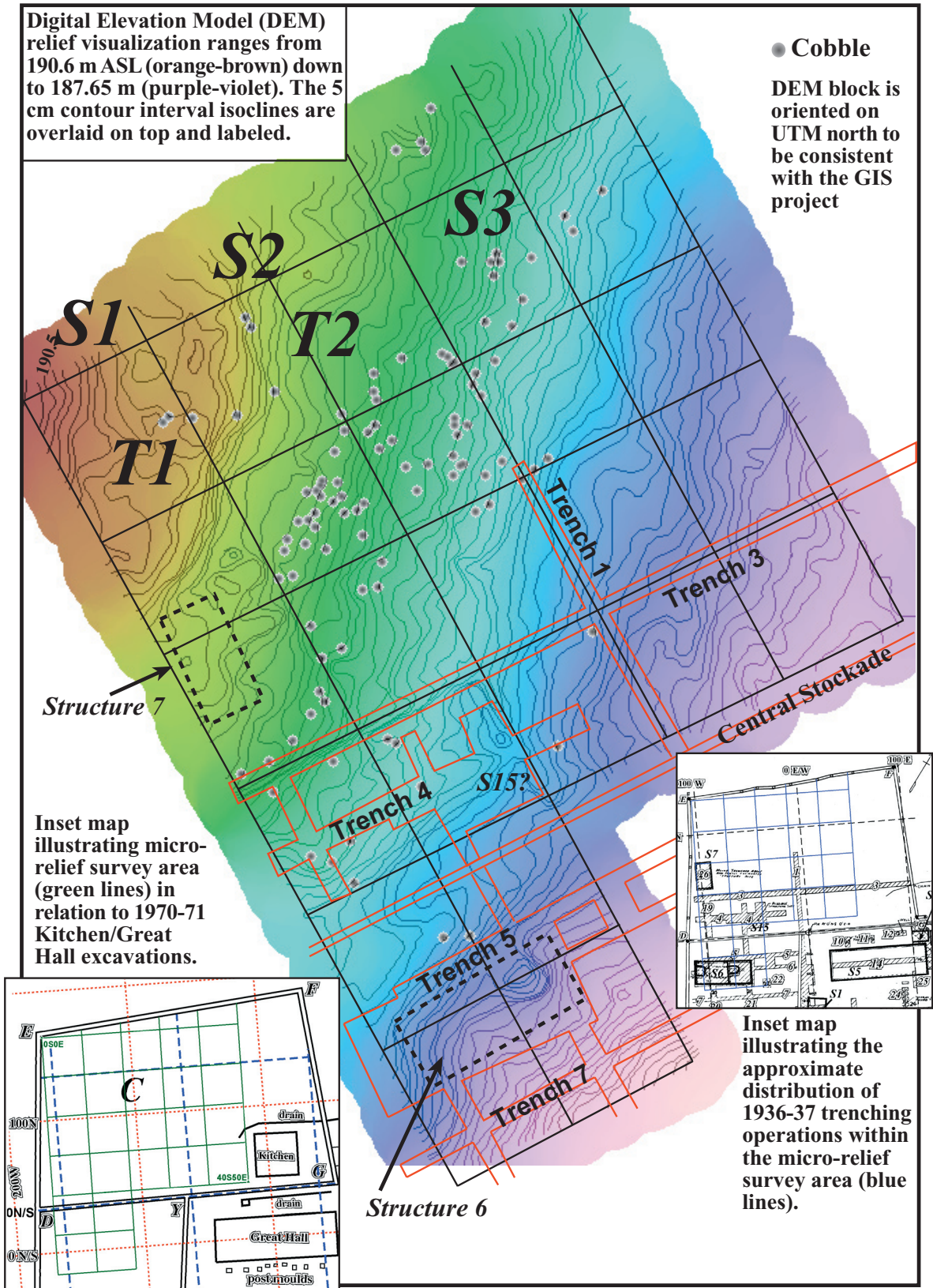


Figure 21 Microrelief mapping of Compound C

by overlaying the original isoclines and the distribution of surface rocks on top of the DEM (Figure 21). The resultant map effectively addresses our proposal that the slope was modified to permit additional structures within compound C (Figure 21).

When examining the color DEM (Figure 21), the reader will note the consequences of warping the micro-relief map to geo-reference it within the GIS project. While the original micro-relief mapping was conducted within a surveyed Cartesian grid (Figure 21), after the warping operation the intersecting grid lines do not form 90 degree angles. This distortion is particularly notable along the north-south axis. The grid lines in Figure 21 were drawn to conform to their relationship to the isoclines plotted on the original map, resulting in a series of rectanguloid grid blocks rather than the square ones that were surveyed on the site. We continue to experiment with these transformation and warping functions to try and achieve a better fit, but this might be counterproductive given the uncertainty over the UTM coordinates of key grid stakes.

We propose that the real value of our micro-relief mapping efforts is in visualization of the subtle relief variation noted in Figure 21. The reader should consider these distortions in reference to the inset maps that place the survey area within the context of Compound C. We also sought to approximately locate the 1936-37 excavation trenches and designated structures within the survey area to aid in interpretation (Figure 21). While considerable care was made to place these excavations as accurately as possible, the senior author acknowledges some imprecision due to the computer warping problem. We also note that uncertainty is inevitable since the early excavations have not been re-located on the ground, and the original datum locations are not precisely known.

In Figure 21, the spacing between

discrete contour lines is irregular, and suggest a series of subtle ‘terraces’ upon which localized depressions are noted. The most readily apparent of these terraces are located immediately downslope from Corner E, and are labeled as T1 and T2 in Figure 21. These weakly expressed terraces are defined in part by steeper slopes (S1, S2 and S3), the latter of which is littered with cobbles visible on the surface (Figure 21). We propose that this ‘terrace effect’ is artificial, and that the slope was modified to facilitate 18th Century construction activities in Compound C. That is, perhaps the comparatively steep gradient was ‘flattened’ by shoveling out sediment to produce the terraces. The excavated sediment, with its high rock concentration, was dumped downslope to create an artificial terrace platform. The non-random linear distribution of cobbles along these steep slopes may reflect the downslope displacement of sediment to create relatively flat building space. These terraces might have facilitated the construction of storage buildings on piers or high footings arranged along the slopes within Compound C.

We also note indications of the remains (or excavation footprint) of structures S7 and S6 along the west palisade wall, and the position of the hypothesized S15 structure (Figure 21). We caution the reader that apparent flat areas (particularly that associated with Trench 4) may be enhanced by the excavation activities and not by 18th Century construction. This is also apparent with the straight steep-sided slope that coincides with the western end of Trench 3 (Figure 21). We also note the approximate position of a modern pathway between the west gate and the back of the Great Hall that coincides with the Central Stockade area (Figure 21).

No excavations have ever been conducted in the area of T1 and T2 (with the exception of the exploratory excavation of Structure

7 in 1937). We propose that these zones offer the most convincing case for artificial modification of the slopes to facilitate building construction. However, we also suggest a possible construction zone to the grid northeast and northwest of the intersection of Trench 1 and 3 (Figure 21). Other potentially attractive areas are found north of the Central Stockade and east of Trench 1 in the area surrounding the Kitchen (Figure 21). Given the visually subordinate position of Compound C at the back of the fort, we propose it served to contain gardens, firewood stockpiles, and warehouse buildings (see Hamilton (1990 and 2000) for an extended discussion of fur trade post architecture). This is certainly indicated by the lack of obvious mounds and depressions that might suggest stone fireplaces, collapsed chimneys and cellar pits.

The lowland making up the grid southeast portion of the survey area was historically problematic because of the accumulation of groundwater at the back of the Great Hall and the Kitchen. This was accommodated by the construction of the drain feature described above. Given this ground water accumulation, any building, including warehouse structures, would have been raised up off the ground on stone piers or wooden pilings. Thus, structures within Compound C may not have left a significant archaeological 'footprint'. They may be defined by a sparse and discontinuous distribution of lost and discarded artifacts, and a series of stone piers, foundation posts, and footer logs. Perhaps the most immediately fruitful way of addressing this question is to compare the micro-relief map to the results of the geophysical remote sensing survey. If unconformities are noted in the areas of possible surface modification, then strategic small-scale excavation might be sufficient to address the presence, extent and function of such structures.

Subsequent to the completion of the draft

version of this report, we received a copy of the geophysical remote sensing survey report (Volf 2002). Volf (2002) noted that modern disturbances and cobbles at or near the surface obscure or mask anthropogenic anomalies deriving from the original Grand Portage. This problem is clearly the case throughout much of the southern two thirds of the fort compound. We are less certain about the zone subjected to micro-topographic mapping. Figure 22 explores the relationship between micro-relief and the magnetic gradient data by overlaying a portion of Volf's (2002:14) magnetic gradient data with the the microrelief map.

The magnetic gradient results derive from systematic collection of magnetic readings using two magnetometers arranged 50 cm vertically from one another. As the magnetic field of any location simultaneously reflects natural sedimentary and anthropogenic magnetism, plus that deriving from the upper atmosphere (diurnal variation), the absolute magnetism of any area is often less informative than the difference between the readings of the two vertically arranged magnetometers. This is because localized magnetic fields (more likely of anthropogenic origin) rapidly 'drop off' in intensity as a function of distance away from the magnetic source. Thus, small, localized and perhaps anthropogenic magnetic disturbances are emphasized when examining the gradient magnetic data.

In Figure 22 high positive gradient readings are represented in colours ranging from orange through to red, while intense negative gradient differences are represented as dark green through to blue and purple. For our purposes, both extremes may be of archaeological interest. Figures 19 and 22 reveal linear fields deriving from the iron bases of the reconstructed stockade, buried water and sewer lines, and magnetic fields that derive either from the 20th Century reoccupation of

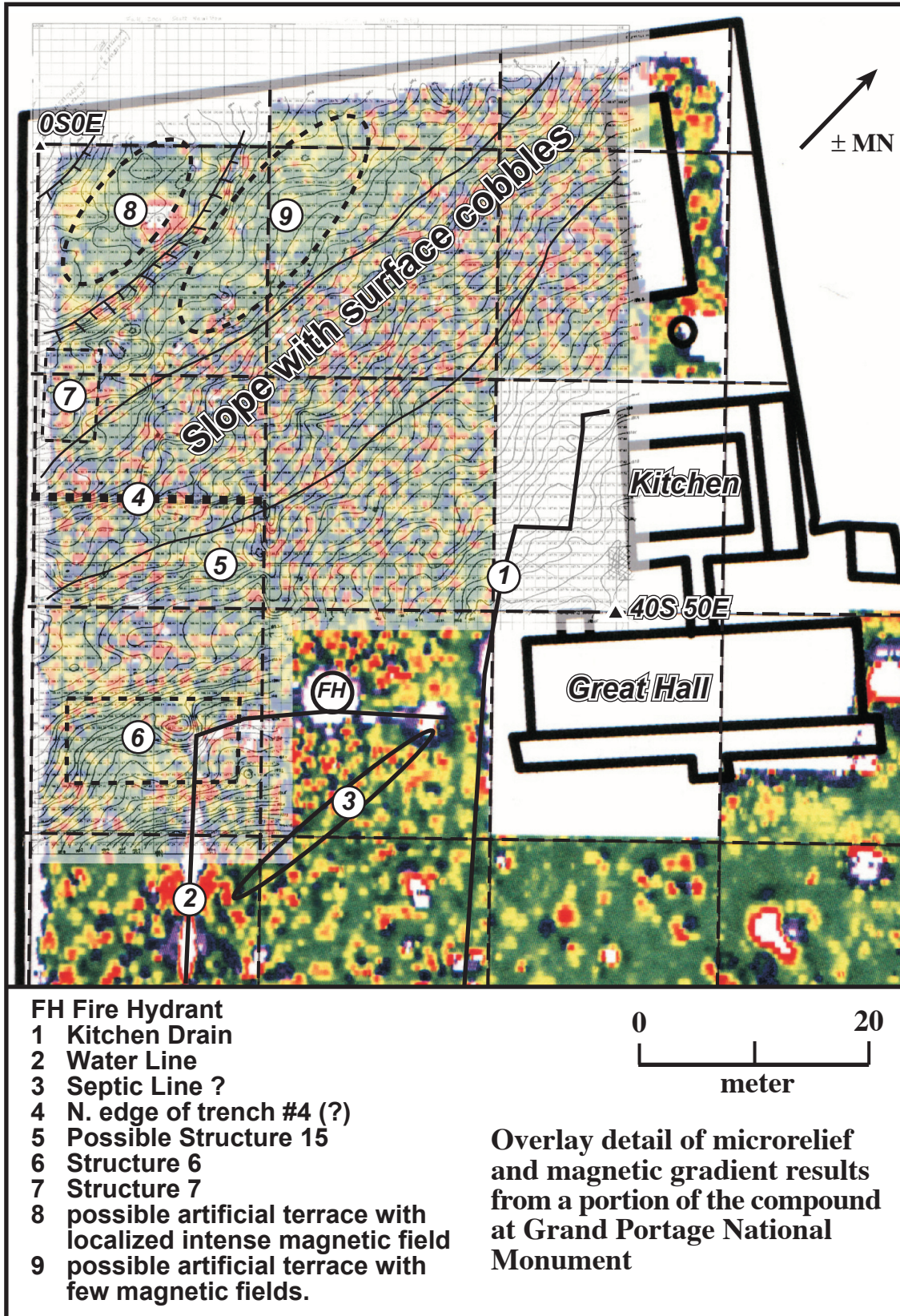


Figure 22 Microrelief overlaid on Magnetic Gradient map.

the property or the reconstruction activities of the National Parks Service (see Volf 2002). He also notes the implications of the many cobbles visible at or near the surface along the slopes within area C (Figure 22). We propose that these unmodified cobbles, might be considered as anthropogenic, and derive from the construction of artificial terraces in the back part of the fort compound. We draw the readers' attention to location 8 and 9 in Figure 22 (or T1 and T2 in Figure 21). Location 8 (Figure 22, or T1 in Figure 21) is comparatively flat (with localized depressions) and is also magnetically flat except for a rather large anomaly located at ca. 10S10E. Locality 9 (Figure 22) also is characterized as being topographically and magnetically flat in contrast to the cobble-rich slopes to the west and east. A few localized magnetic anomalies are also noted on this terrace, but no large magnetic anomaly complexes are apparent. These magnetic results are consistent with our proposal that the back part of the compound was modified to produce 'terraces' upon which buildings were built. With the possible exception of the large anomaly complex located at 10S10E (Figure 22), no stone hearth structures are suggested in the magnetic data. Perhaps this indicates that any buildings in this area were unheated storage facilities.

A useful line for further archaeological research in Compound C might involve strategic 'ground truthing' of the magnetic and topographic information using probe corers, metal detectors and small-scale test excavation.

Grid Systems employed at Grand Portage

Perhaps one of the greatest challenges to the reconstruction of the archaeological history at Grand Portage is the number of grid systems used over the years (Figure 23), and the similarity in how the cartesian grid systems were designated. The 1936-

37 excavation of the stockade system was conducted without using a formal grid, while the exploratory excavations within the compound used two different cartesian grid systems: one oriented along magnetic north (in the vicinity of corner G from a point of origin at Datum 3 as per Figure 10), and the other based upon the interior palisade that divides Compound C from B and A (Figure 3). This latter grid system is represented in Figure 23 using solid magenta lines and text. It is the basis for most of the 1930s excavations. While it was a Cartesian grid system originating from a central datum within the fort compound, the exploratory trenches were sequentially designated (Figure 3). Since the grid was structured along the primary axis of the fort stockade, it coincides closely with the orientation of most of the buildings encountered during excavations.

When excavations resumed within the compound in the early 1960s, a new cartesian grid system was established using primary datum posts established by the National Parks Service (Figure 14). The primary datum and base lines of this grid system were oriented approximately parallel with the outside front wall of the palisade, and is defined in Figure 23 by solid green lines and text. A second apparently non-Cartesian grid system was also established at this time to control the excavations conducted along the outer side of the palisade between corners G and H (Figures 13).

In 1970 when excavations were undertaken beneath and surrounding the rubble of the destroyed Great Hall, yet another Cartesian grid system was established. This time the point of origin was defined at the center point of the Great Hall foundations with the same designation as that used in 1936 and 1964. This grid system is represented in Figure 23 as dashed red lines and text.

The drain trench mitigation excavations

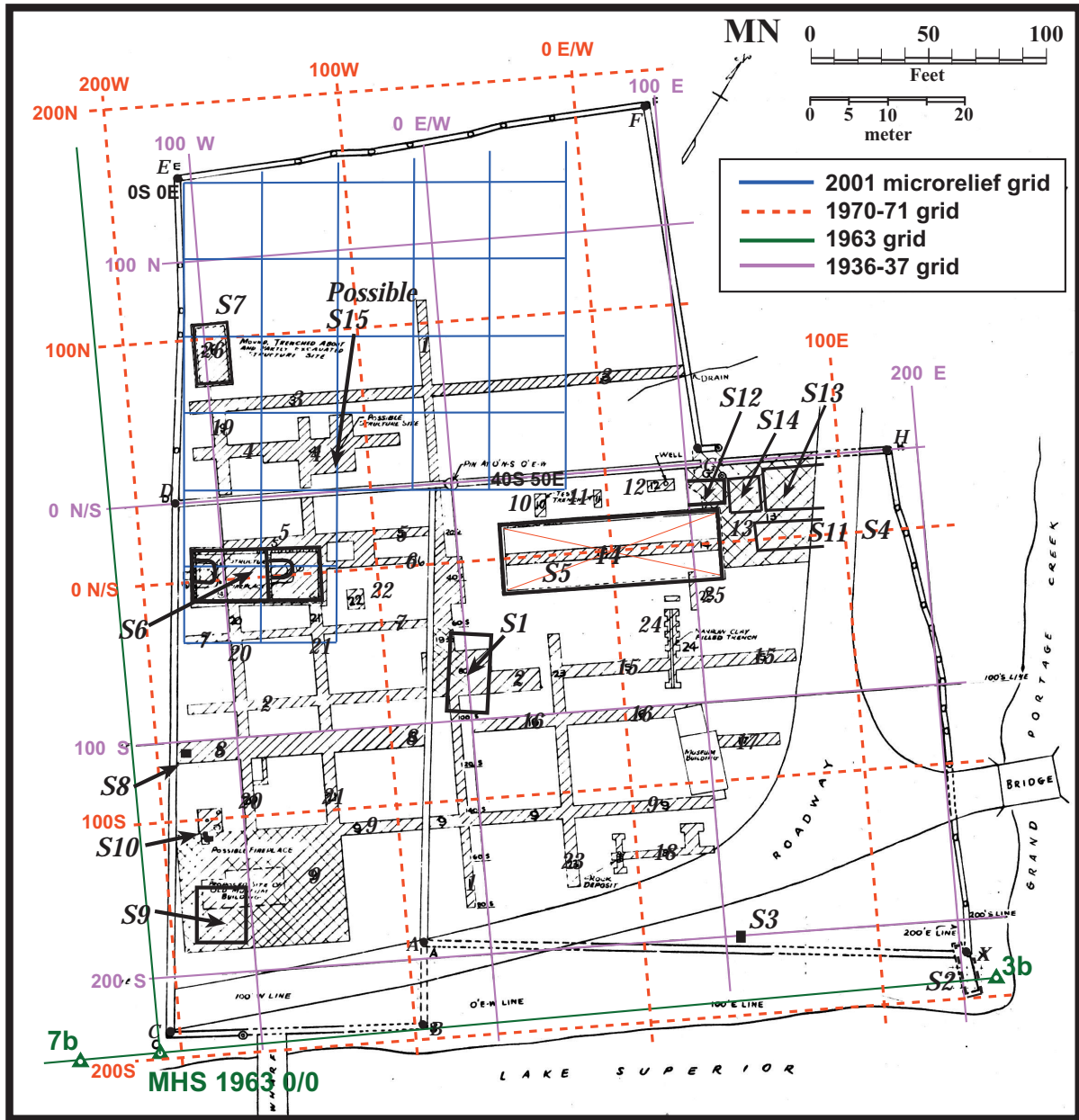


Figure 23 Grid Systems employed at Grand Portage overlaid upon 1936-37 excavations.

of 1989 (Noble 1990) also were conducted using an independently defined cartesian grid system. The point of origin for this excavation was fixed at a point at the southwest corner of the Great Hall's front porch, and was oriented approximately parallel to the original 1936-37 grid (142° east of magnetic north). As this grid is quite localized, it is not replicated in figure 23, but is illustrated in figure 17.

The 2001 topographic mapping was

conducted along a grid system oriented along the west palisade wall, and is consistent with that used for the geophysical remote sensing survey. The micro-topographic mapping grid is represented as solid blue lines in Figure 23.

When examining Figure 23, the close consistency of orientation of grid designation is evident. However, this consistency is partially a function of the cartographic

scale of Figure 23. While this is very helpful, the similarity in the cartesian grid designations requires careful consideration of the year of excavation before interpreting the provenience of the artifacts recovered from the site. While the scale of mapping

presentation makes it difficult, we offer some approximate ‘calibrations’ of the various grid systems below in Table 2. We propose that the eventual determination of a more refined set of calculations will permit the development of a master grid system for the site.

Table 2 Approximate Calibration of the various Grand Portage Grid systems.

1936-37	1963-64	1970-71	2001 (metric)
0S 0W	227N 145 E	34N 66W	42S 33E
100N 100E	334N 246E	134N 34E	
100N 100W	335N 47E	134N 166W	
200S 100W	20N 43E	166S 166W	
200S 200E	29N 341E	166S 134E	
133N 95E			0S 0E
6N 67E			40S 50E

Summary and Conclusions

This research project has taken longer than expected to complete, in large measure because of research time conflicts at Lakehead University, and difficulty in retaining student research staff with the requisite GIS expertise. This is a function of the primarily undergraduate teaching function of the institution. With no graduate program in the Anthropology Department, a succession of senior undergraduate students have been employed until they move on to graduate school. We gratefully acknowledge the support and patience of David Cooper of the Grand Portage National Monument as we have fallen further and further behind schedule. We hope that this represents the first of a series of fruitful collaborations between Grand Portage National Monument and the Dept. of Anthropology at Lakehead University.

Grand Portage National Monument represents one of the earliest examples of historic sites commemoration in the American Upper Midwest. With its inception in the mid-1930s, the excavations at Grand Portage have been ambitious in their goals, but frankly, constrained by a lack of resources and staff continuity. While the original excavators were constrained by the methodological infancy of Historical Archaeology, perhaps one of the greatest problems they faced was the limited number of trained supervisors to monitor and direct the activities of the local workers. Brown addressed this problem by curtailing some of the excavations when he lacked sufficient trained staff. This conservation ethic ensured that a significant portion of the site remained intact for future excavations.

Like most such early 'site commemorative' approaches to historic archaeology, the research goals at Grand Portage were rather narrow and one-dimensional. Namely, the

focus was on defining the spatial location and expanse of buildings in order to permit more authentic reconstruction. The archaeology merely played a supplemental role to that of historical synthesis, and the primary contribution was to aid accurate reconstruction and the recovery of artifacts to 'animate' future exhibits with finite 'pieces from the past'. There were few explicitly or implicitly anthropological research objectives underlying the research, and this strongly colors where the excavations were conducted. That is, there was a preoccupation with palisade location and exploration of the Great Hall, the primary residence of the fur trade elite. From the modern perspective, much of the archaeological research appears quite dated, and focused upon comparatively low-level research questions. It is, of course, unfair to criticize such early historical archaeological research for failing to anticipate the research priorities that were to come about 30 to 70 years later.

That being said, it is important to acknowledge that the initial archaeological priorities and practices at the site severely limit its utility for modern research. Perhaps the most serious problem for any sort of spatially-oriented analysis is the sometimes enormous size of the excavation squares (resulting in very coarse grained provenience control). In some situations the collection units of the 1936-37 trenches are in the order of several hundred square feet in extent. The collection standards are also rather coarse-grained, with backdirt screening being only sporadically done, and with screening methodologies abruptly changing when the project directors deemed that the recovery rates warranted it. In this circumstance we must assume that patterned variation in the spatial distribution and density of artifacts is as much a product of excavation method as a

reflection of the disparate activities of the late 18th Century occupants of the site.

As the GIS project proceeded, and as the senior author gained a more intimate understanding of the history of excavation at the site, we began to note subtle discrepancies in the summary reports faithfully produced over the years by Woolworth and Woolworth. We suspect that the research presented here is colored by the fact that not all of the primary excavation documentation was available for our analysis. As noted earlier, through the Kleinfelder papers held by the Ontario Ministry of Culture, we gained access to copies of some of the various summary reports outlining various years of excavations. In some cases, these summary reports offered sufficient details to interpret the archaeological procedures and recoveries. In other cases, our review of manuscript maps revealed cryptic references to excavation squares and discovered features for which we could find insufficient reference in the available texts. Clearly, some archival documentation remains to be reviewed that might substantively expand upon and clarify this report.

Perhaps the greatest challenge remaining to be addressed is the electronic catalogue of artifact recoveries. The 'spreadsheet' version of this database offered a master listing of recoveries. This ambitious curatorial effort was confounded by the spotty record keeping, disintegrating records and bag labels, inconsistently applied provenience systems, and especially, the different grid systems employed at the site over the years.

Various LU undergraduate students have been employed over the past three years to try and make sense of this information base. Our approach has been to try and deconstruct particular 'character strings' within the column(s) containing the

provenience information. Not surprisingly, this provenience information is often rather cryptic, inconsistently applied, and difficult to interpret, particularly if the year of excavation is not clear. Also problematic is that the artifact descriptions are often inconsistently applied, and synonymous descriptors for the same artifact class are used. Many record entries consist of a continuous string of information that replicates whatever information was associated with the artifacts themselves. Cumulatively, this results in a database of very limited utility because it cannot be effectively or efficiently searched by provenience unit or artifact type.

We have been exploring means of addressing this problem by systematically parsing and 'deconstructing' the descriptive fields in search of information that will enable more effective searches by provenience units. This information is then replicated in discrete columns reflecting the Cartesian coordinates. This exercise is not sufficiently advanced to present substantive results here. In large measure, this is because we have spent a great deal of time exploring the archaeological reports to determine what grid systems and descriptive terms were used to describe the location and nature of the excavations conducted over the past 68 years. With this information we can then return to the catalogue to interpret the rather cryptic provenience records. At this point we can report some progress, and that a substantial portion of the archaeological collection might eventually be assigned to an appropriate provenience unit. However, we note that such provenience units vary from as small as 25 square feet (5 foot squares) to several hundreds of square feet (5 and 8 foot wide trenches extend over 100 feet long). Clearly, past excavation standards will be insufficient to permit comprehensive analysis of the spatial distribution of artifacts within the monument property.

From our perspective, the most important research product is the systematic examination and integration of the various grid systems and excavation units, and the spatial definition of a series of GIS-based polygons representing these excavation units. As each of the polygons represent a discretely named excavation square, if we can identify the artifacts deriving from that square, it will become a comparatively simple exercise to link the artifact database to the GIS project. The actual refinement of the GPNM database, its integration into a more efficient system of electronically querying the collection database, and then spatially representing the artifact distribution within the GIS remains to be accomplished.

Finally, we collected surface micro-relief information from an extensive part of Compound C where archaeological excavation and other disturbances are the least apparent. This addressed the question whether the surviving micro-topography has utility (in conjunction with other remotely sensed data) in identifying presently unknown buried structures. Given the problems with provenience control, this approach also has some utility in identifying the remnants of old excavation trenches. This has important Cultural Resource Management implications as it might permit more systematic, strategic and non-consumptive exploration of the heritage resources on the property. This is particularly important in light of the ongoing need to maintain the subsurface water, electrical and sewage service corridors without impacting buried heritage resources.

We conclude this report by noting that while considerable archaeological research has been conducted in the fort compound since 1936, the majority of the compound remains comparatively unexplored. The excavations have encountered several discrete buildings, and the remains of collapsed fireplaces that

are oriented around the inner margins of the palisade walls. This forms a familiar pattern that is widely noted in other British North American fur trade posts of this era. Figure 24 offers a version of the 1816 sketch plan of Fort William, the North West Company depot that was built to replace Grand Portage. The palisaded compound forms a quadrangle with the most important administrative and ceremonial structures being placed along the back wall of the compound in the visually most prominent position opposite the main entrance. Other structures were arranged in visually subordinate positions along the side walls of the palisade leaving an open square or courtyard in the centre of the fortified compound. It is no surprise that Grand Portage, the most important inland trade depot of the North West Company prior to the establishment of Fort William, should conform to this organizational model. This suggests that many additional structures used for accommodation and storage, plus tradesmen's shops should be found lining the inner walls of the reconstructed Grand Portage. In this sense, our current understanding of the buildings and their functions at Grand Portage merely reflects the 'tip of the iceberg'.

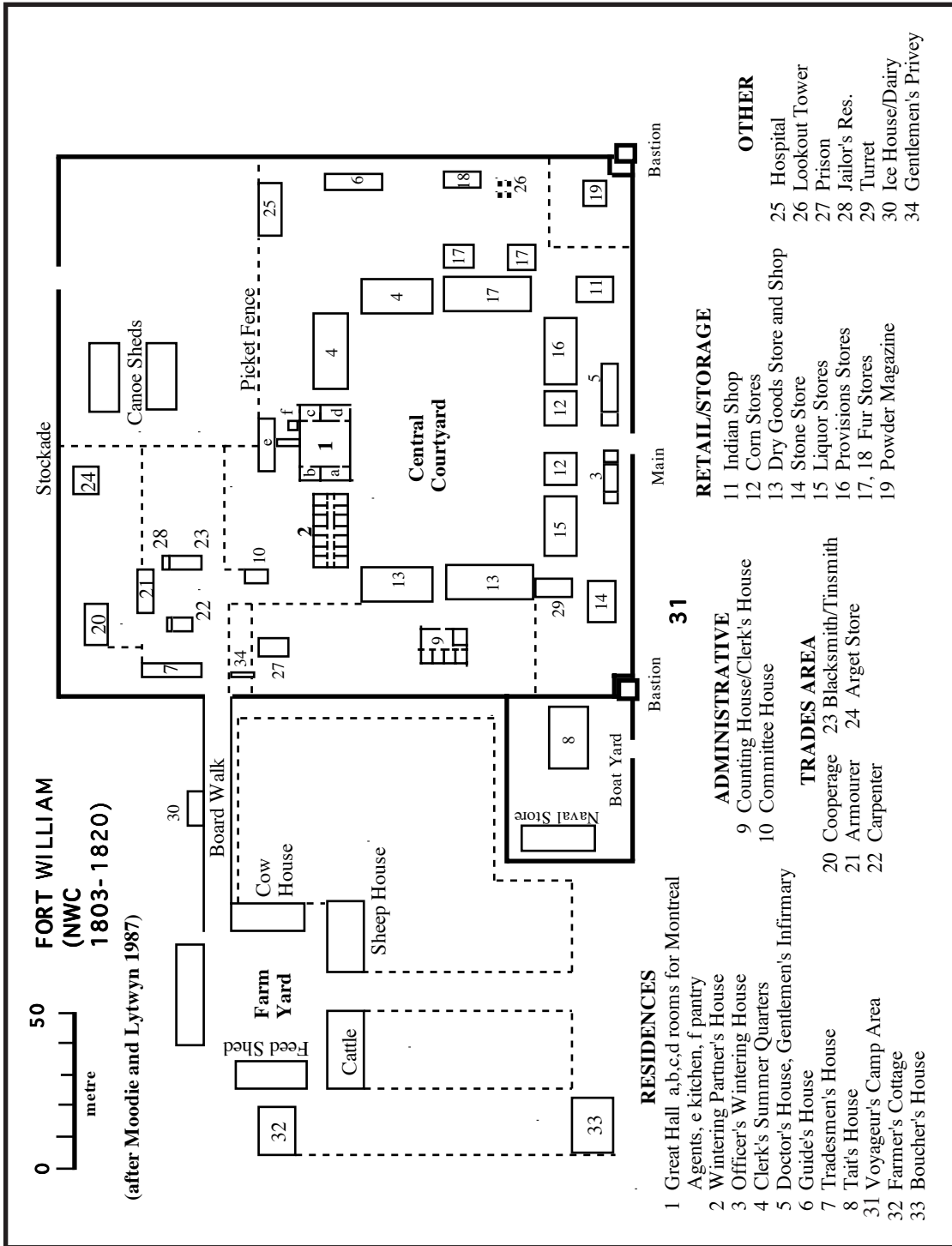


Figure 24 1816 Sketch Plan of Fort William

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Appendix 1 Introduction to the GIS database structure

The GIS component of the project involved collecting extant mapped information about Grand Portage, and integrating it within an Arcview 3.2 project. The site map was originally created in Adobe Illustrator and was exported as a Tagged Image Format File (.tiff) and saved.

The next step in geo-referencing the map was to use an extension available through ESRI's scripts page (arcscripsts.esri.com) called Image Warp 2.0. The function of this script allows the user to reference a variety of image file types (including .tiffs) to a series of user defined ground control points (GCP's). (fig. A1)

ImageWarp 2.0 Updated March 16, 1999



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Author: Kenneth R. McVay [contact author](#)
File Name: AS10118.zip
Language: Avenue
Last Modified: Mar 16 1999
Software: ArcView GIS
File Size: 1327.68 kb
Downloads: 21688

Summary:

March 16, 1999 In the recent March 12th update I neglected to add support for CAD drawings and AI coverages for the first input dialog. In this March 16 th release support for CAD and coverages has been included. ImageWarp 2.0 is an Windows 95, 98, and NT based extension that will allow you to geo-reference any image that ArcView will display to a feature theme, grid theme, or image theme. ImageWarp requires ESRI's Spatial Analyst ver 1.1 extension. ImageWarp 2.0 supports output image file types of bil, bsq, bip, jpg, and tiff. An associated header file will be created for newly warped images of types bil, bsq, and bip. For jpg and tiff output images a world file will be created with the newly warped image. ImageWarp works with 8 bit gray scale and 24 bit true color images. NEW FEATURES include Windows context sensitive help, a batch warp, restored menu,tool, and buttons bars, you can now save an ImageWarp session project, you can load a new or existing table while in a session, better dialogs and a few other things the user cannot see. If you find any problems let me know. I have chosen to put this version out with an InstallShield install program. The install directory must be your AVHOME directory. Be sure and READ the README.TXT before you install ImageWarp. If for some reason the files get installed in the wrong place just use find to find them and then copy them over into the correct folders as specified in the README.TXT. This should not happen if you specify AVHOME correctly. -peace K.

Figure A1. An overview of the functions and capabilities of the ImageWarp extension used to geo-reference the Grand Portage Site Map. (FROM arcscripsts.esri.com/details.asp?dbid=10118)

A combination of GCP's collected by Joe Muller and Scott Hamilton at the Grand Portage National Monument and GCP's generated from existing ArcView generated files (.shp) provided by the National Parks Service were used to geo-reference the image. The points

were collected using Trimble GPS units on major architectural features of the existing reconstructed fur trading post. A total of 34 GCP's were used to reference the image, and the major architectural features that served as the GCP's were features such as the stockade, the Great Hall, and existing maps of excavation trenches. After referencing the image, a report is generated by the Image Warp extension providing information regarding the accuracy of the referenced image (**fig. A2**).

Image Warp allowed the site map to be warped to conform to what are confirmed and accurate ground control points. While the image does not conform exactly to the series of shp files provided by the National Parks Service, this is a function of projection rather than an inordinate amount of inaccuracy during the warping and digitizing process.

Artifact Proveniences

Most of the information related to artifact proveniences and excavation detail has come from "GRAND PORTAGE NATIONAL MONUMENT. AN HISTORIC OVERVIEW AND AN INVENTORY OF ITS CULTURAL RESOURCES" Volumes 1 and 2, by Alan R. Woolworth and Nancy Woolworth.

In order to provide real world locations for artifacts recovered during various excavation years, an interpretation and examination of the literature and the database is required. After becoming familiar with the literature regarding the activities of the various excavation years, it is possible to interpret the proveniences provided in the Grand Portage catalog. With some knowledge of the activities of each year, it is possible to group record proveniences into categories.

The most interpretable division is to group the records by year of excavation. With knowledge of where excavations were occurring in that year, a provenience can be determined using the datum of that excavation year.

For artifacts recovered in the excavation years 1936 and 1937, the 0/0 datum was found in figures 33 and 40 on pages 229 and 228b (Vol.1) (see also main body of this report). The 0/0 datum is located between corners D&G of the fort, approximately at its center. Furthermore, additional datum points 1, 2, and 3, were found on pg.227 (Vol.1). The labeled corners of the fort are also as a source of provenience information.

The 1964 excavations involved a series of excavation squares along the stockade wall between corners G&H. Each square was given a label (A', A through G) during that year. A map of these excavation units is found on page 240 (Vol.2). Using the map, it was possible to re-create the excavation units and use these locations as a means of proveniencing the records from the 1964 excavations. The provenience for records located in these squares is determined by calculating the Universal Transverse Mercator (UTM) code for the center of the square.

For the 1970 excavations, the center of the Great Hall was used as a primary datum, as noted on pg.244 (Vol.2). From the center of the hall, the 10ft. grid was re-created and each square on the grid was labeled based on its position relative to the datum. Each 10ft grid cell was assigned a

UTM based on the center of the grid cell. It has been determined that each excavation unit was originally assigned a label based on the position of the southwest corner of the unit.

Other proveniences for records are based on information derived from the provenience contained in the original catalog. Where a range is provided in the catalog for the location of records, the center of the range is used to calculate the UTM provenience.

Examples:

1936/1937 Records:

“N.-S. TRENCH AT 40’E. 120’-150’1937,BAG 45

This record is located 40’E and 120’-150’S of the original 0/0 datum. The middle range between 120’and 150’ south is used to mark the UTM location of the artifacts (40’E, 135’S = 5315578.78N, 299605.28E).

16-30’W PNT3,MDL TRNCH EXC TO 1’BG307 9/15/36

This record is located 23’W of point #3. Point #3 is located southwest of corner G and immediately north of the Great Hall, near its eastern edge.

1964 Artifacts:

BAG 1, 6/9/64, SQ A, 0-6”

This record is located in square A, along the stockade wall between corners G&H. Square A is the westernmost square in this row. The UTM code for square A was determined from the center of the square (UTM=5315628.97N, 299602.73E).

1970 Artifacts:

CABIN, 0E - 40N, 3 - 6”, 7/8/70

Early in excavations, the area now known as the kitchen was referred to as the cabin. Excavations in 1970 were based on 10ft. grid cells derived from a datum in the center of the Great Hall. This record is located on a square 40ft north of the datum (UTM= 5315622.09N, 299588.73E).

CABIN, FIREPLACE ;INTERIOR, 3” LEVEL, 7/9/70

Using information obtained from other proveniences, it was determined that the fireplace in the kitchen was located at 0E, 50N. Therefore, any records with only a “fireplace” provenience were located in the 0E, 50N square (UTM=5315624.73N, 299587.00E).

Theme Information

Provenienced GP artifacts.shp

This is a point theme containing all of the records that to date have been plotted within the fort compound. This theme is searchable by the fields in the data table, and new themes can be

created from it with specific record information. This theme was created by saving the Excel database as a delimited text file, and then adding the table to the ArcView project. An event theme was then created using the UTM co-ordinates. This event theme was then converted to a shapefile.

Drainage Trench2.shp

This is a line theme showing the location of the historic drainage trench directly north of the Great Hall and south of the Kitchen. Although no map was discovered which showed the connection between the fur trade era drain trench and the modern drainage trench, it is believed that the two trenches shared approximately the same outlet, through east gate of the fort. The location of the trench was found on Alan Woolworth's 1970 Map #1.

Bob's Warped ai2.tif

This is a Tagged Image File (.tif) of the site map, originally in Adobe Illustrator Format. The warped reference indicates that it was spatially referenced using the Image Warp 2.0 extension from the ESRI scripts page.

Drainage Trench.shp

This polygon theme shows the location and outline of the modern drainage trench, running through the east gate.

Stockade Centre.shp

This line theme shows the location of the center of the stockade trench, as well as the center of the interior palisade and stockade.

Post Molds.shp

This polygon theme shows the location of several post-molds discovered in the excavation of the porch area, immediately south of the Great Hall. Locations for the post molds were discovered on Alan Woolworth's 1970 Map #1)

Porch Area.shp

This polygon theme shows the excavation of the porch area, immediately south of the Great Hall. The dimensions of the excavations were discovered on map created by Alan Woolworth in 1970 (Map #1).

Trenches.shp

This polygon theme shows the location and orientation of the recorded excavation trenches. This theme was created through on-screen digitizing of the referenced Bob's Warped ai2.tif file.

Structures.shp

This polygon theme shows the location and orientation of recorded buildings and features inside the fort. This theme was created through on-screen digitizing of the referenced Bob's Warped ai2.tif file.

Stockade.shp

This line theme shows the interior and exterior perimeter of the stockade around the fort. The locations for the stockade perimeters are from Bob's Warped ai2.tif file.

Rocks.shp

This polygon theme shows the location of rocks noted during the collection of micro-relief data in the northwest section of the fort.

Not on Bob's.shp

This polygon shows the location of what are assumed to be excavations. The locations of these supposed excavations are from the grpoe12.shp file from the National Parks Service.

Microrelief Contours.shp

This line theme contains the location and elevation information resulting from the 10cm contour interval micro-relief mapping of the northwest corner of the compound. This theme was created by scanning a hand-drawn contour map made by Dr. Scott Hamilton, spatially referencing the resulting .tif file using Image Warp 2.0, and on-screen digitizing the map into a new theme. The elevation data was added to the table after digitizing.

Layer 43.shp

This polygon theme show the location of excavation units labeled A', A-G from 1964. These excavation units were digitized from Bob's Warped ai2.tif.

Kitchen.shp

This polygon theme shows the location of the kitchen. The location information came from Alan Woolworth's 1970 Map #1. The map was scanned and saved as a .tif file, then referenced through the creation of a .wld file. The kitchen excavation was created through on-screen digitizing of the referenced file.

Kitchen Excavations.shp

This polygon theme represents the footprint of the kitchen excavations from 1970. Information for the creation of the theme came from Alan Woolworth's 1970 Map #1.

Gate Post Molds.shp

This polygon theme shows the location of the original east gate posts. The information for this theme came from Bob's Warped ai2.tif.

Blockhouse.shp

This polygon theme shows the location of the blockhouse. This information came from Bob's Warped ai2.tif.

71 Excavation Units.shp

This polygon theme shows the location and orientation of the excavation grid from the kitchen area, conducted in the years 1970 and 1971. The information for this grid came from Alan Woolworth's 1970 Map#1 and information from page 245 of Vol. 2.

Project Capabilities

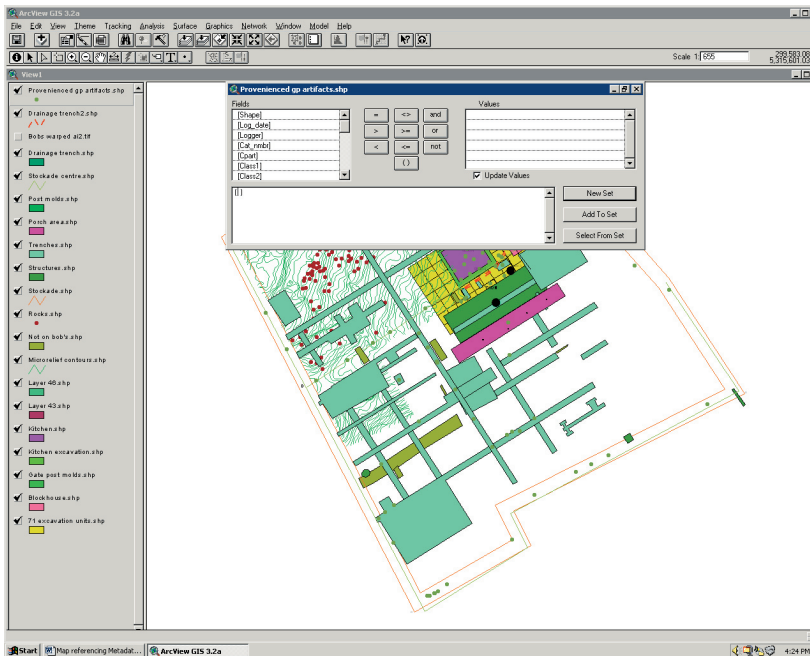
The end result of the literature and map research is a map showing the extent of excavations and some of the structures within the compound. Additionally, a database in the form of a GIS searchable spreadsheet was created.

The database is the table (.dbf) file associated with the Provenienced GP artifacts.shp theme. Using the query function within ArcView, it is possible to search for specific categories of records and examine the spatial distribution of those records within the ArcView project. The database is searchable by any of the column headers found in the original Grand Portage record database. For example, it is possible to search the database for specific descriptions of records, specific proveniences of records, or even the year that the record was catalogued.

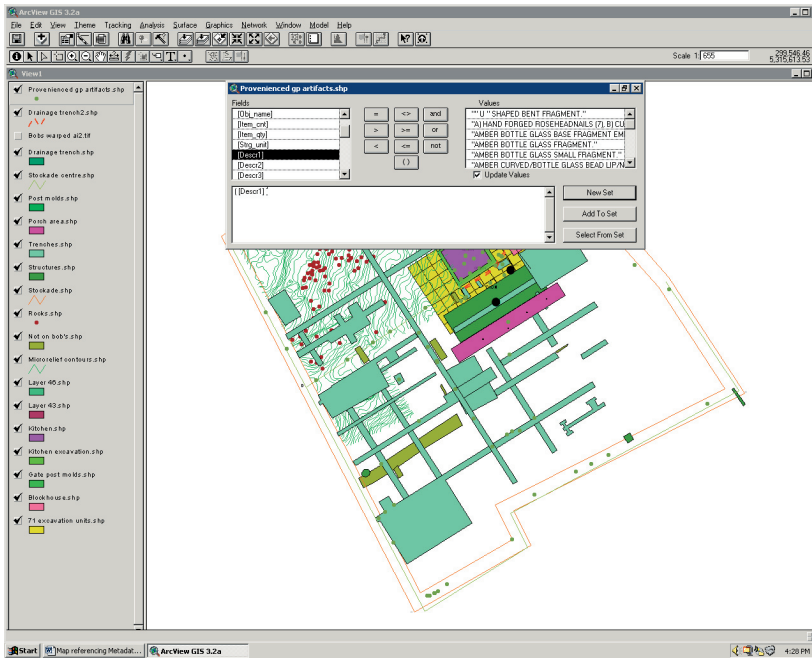
Searching for Records

To serve as an example, the database will be queried for all records with the description of Iron Common Cut Nails.

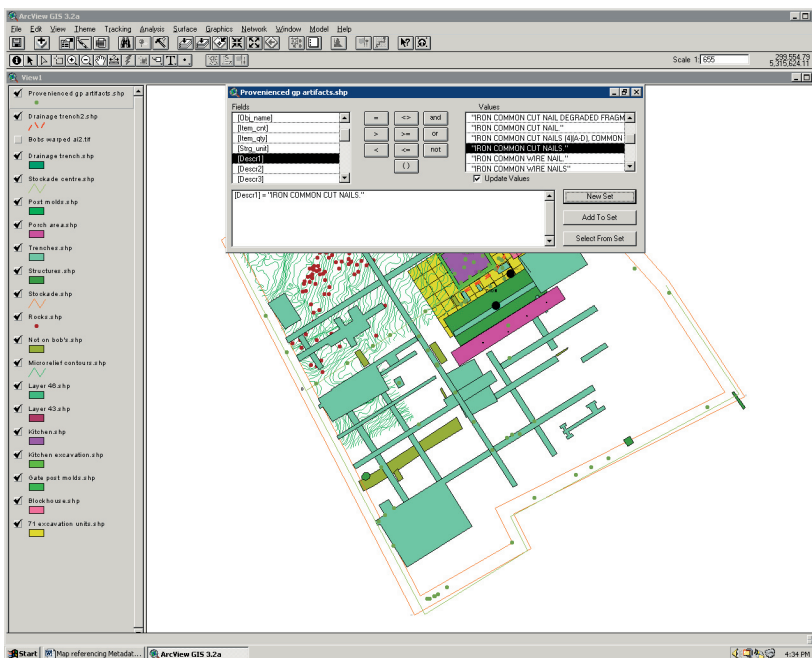
Step 1) With the Provenienced GP artifacts.shp theme active, select Theme/Query. A query box will appear showing the fields in the database that it is possible to search by.



Step 2) In the “Fields” category, scroll through the fields to find “[Descr1]”. Double-click [Descr1] and it will appear in the equation entry at the bottom of the query box. A list of corresponding values appears in the “Values” section of the query box.

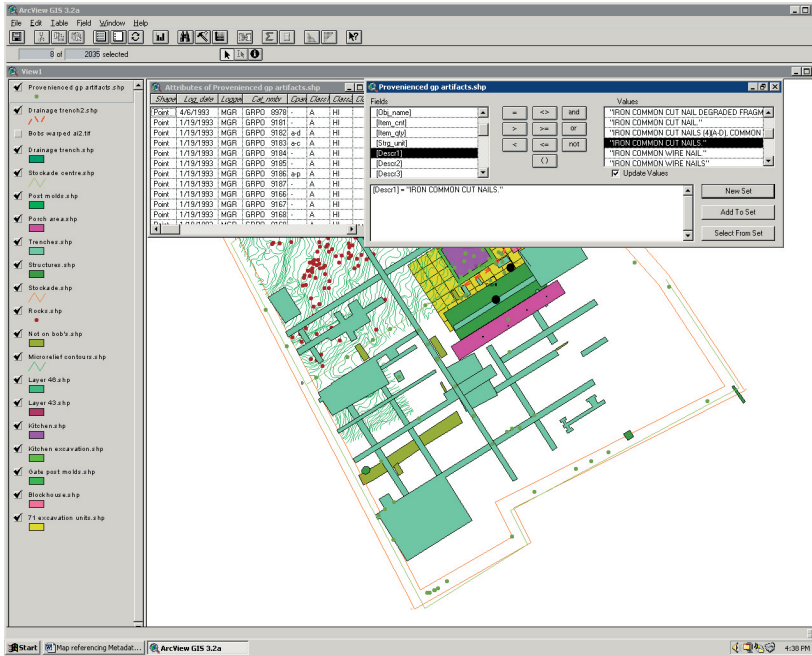


Step 3) Since ArcView is looking for a mathematical equation to conduct the search, select the = sign from the middle of the query box. The final step is to select the corresponding value for which to search. In this case, the corresponding value is “Iron Common Cut Nails”. Scroll through the values to “Iron Common Cut Nails” and double-click it so that the value appears in the equation box.

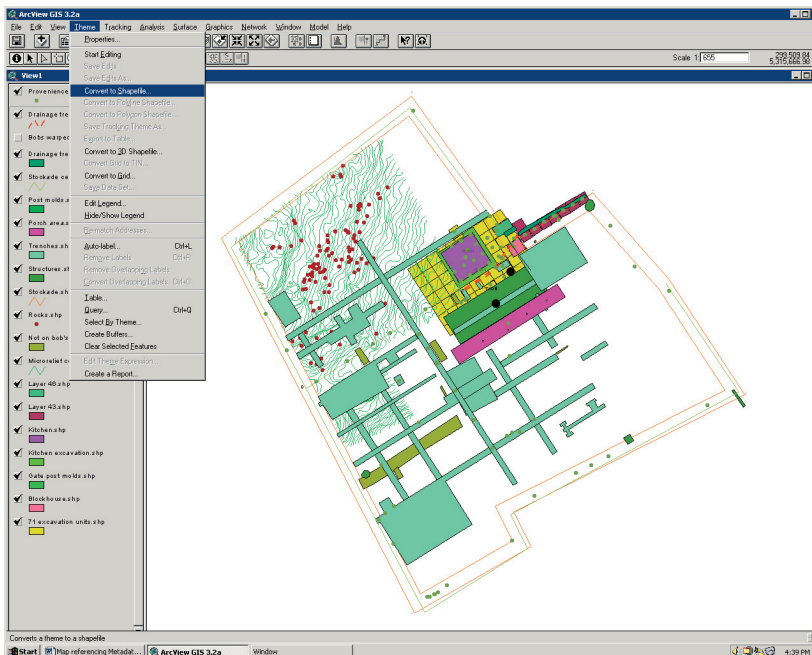


Step 4) Select “New Set” from the right side of the query box. ArcView automatically searches for all records with the equation $[Descr1] = \text{“Iron Common Cut Nails”}$. If so desired, view the

table and note that there are 8 of 2035 records with the description of “Iron Common Cut Nails”.

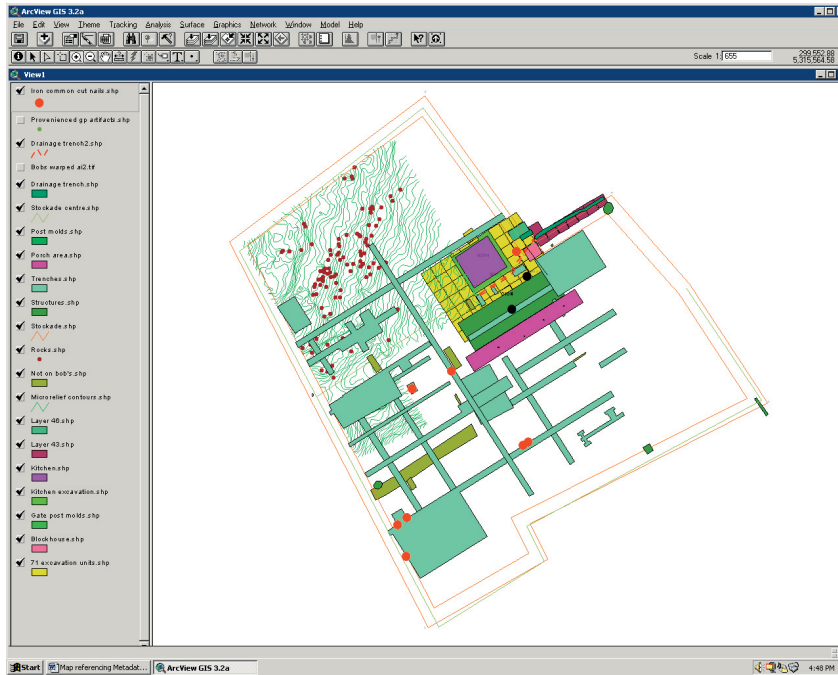


Step 5) Close the table box and the query box. Select Theme/Convert to Shapefile.



When prompted, provide a theme name and a path to the directory in which the shapefile will be stored. An example of a theme name is “Iron Common Cut Nails”. Select “OK”. When prompted, select “Yes” to add the shapefile as a theme to the view. The theme “Iron Common Cut Nails”, is added to the top of the table of contents in ArcView.

Step 6) Turn off the “Provenienced Gp artifacts” theme, and turn on the “Iron Common Cut Nails” theme. You can change the color of the theme by double clicking on the theme in the Table of Contents and adjusting its properties. For display purposes, a bright red color has been selected, and the size of the point theme has been increased to 16pnt.



The locations of all records with the description of “Iron Common Cut Nails” are now displayed as bright red dots in the ArcView project. This theme has been permanently created and can be added or deleted from the project at will.

Fall, 2001 Scott Hamilton

Grand Pasture Mired Relief

