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Class III Archaeological Survey Report: Madison Buffalo Jump State Park, Gallatin County, Montana

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CLASS III ARCHAEOLOGICAL SURVEY REPORT: MADISON BUFFALO JUMP STATE PARK, GALLATIN COUNTY, MONTANA

By

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ABSTRACT

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CLASS III ARCHAEOLOGICAL SURVEY REPORT:
MADISON BUFFALO JUMP STATE PARK, GALLATIN COUNTY, MONTANA

Chairperson: Douglas MacDonald

Through a cooperative agreement between the University of Montana (UM) Department of Anthropology and Montana Fish, Wildlife, and Parks, the University of Montana, between 17 May and 1 June 2014, conducted an archaeological inventory of the 640-acre Madison Buffalo Jump State Park. Douglas Macdonald, Ph.D. and Sara Scott, Ph.D. managed the project for each institution, respectively. Copious amounts of artifacts and features alike were recorded at Madison Buffalo Jump during the survey, including: 1) 3-4 drive lines used in the funneling of bison to jump locations; 2) bison bone concentrations below the kill/nick point on the face of the jump; 3) bone and artifact concentrations in the camp area in the creek valley west of the jump; 4) numerous lithic artifact concentrations within the gathering basin above the jump, marking the locations of prehistoric stone tool manufacture, including one possible petrified wood/chert quarry; 5) 78 stone circles in four locations surrounding the jump; 6) two probable fasting beds on a ridgetop north of the jump; 7) an Early Archaic projectile point produced from dacite sourced to the Cashman Quarry; 8) 14 additional sourced obsidian/dacite artifacts; 9) one bison bone fragment that confirms at Late Prehistoric age of the bison processing area (the only radiocarbon date yet assessed for the site); and 10) four locations of historic/modern inscriptions across the state park. Along with an overview of the current known prehistory/history of Madison Buffalo Jump, this report includes comprehensive details, maps, and descriptions of the archaeological artifacts and features that were recorded by UM during survey of the Madison Buffalo Jump.

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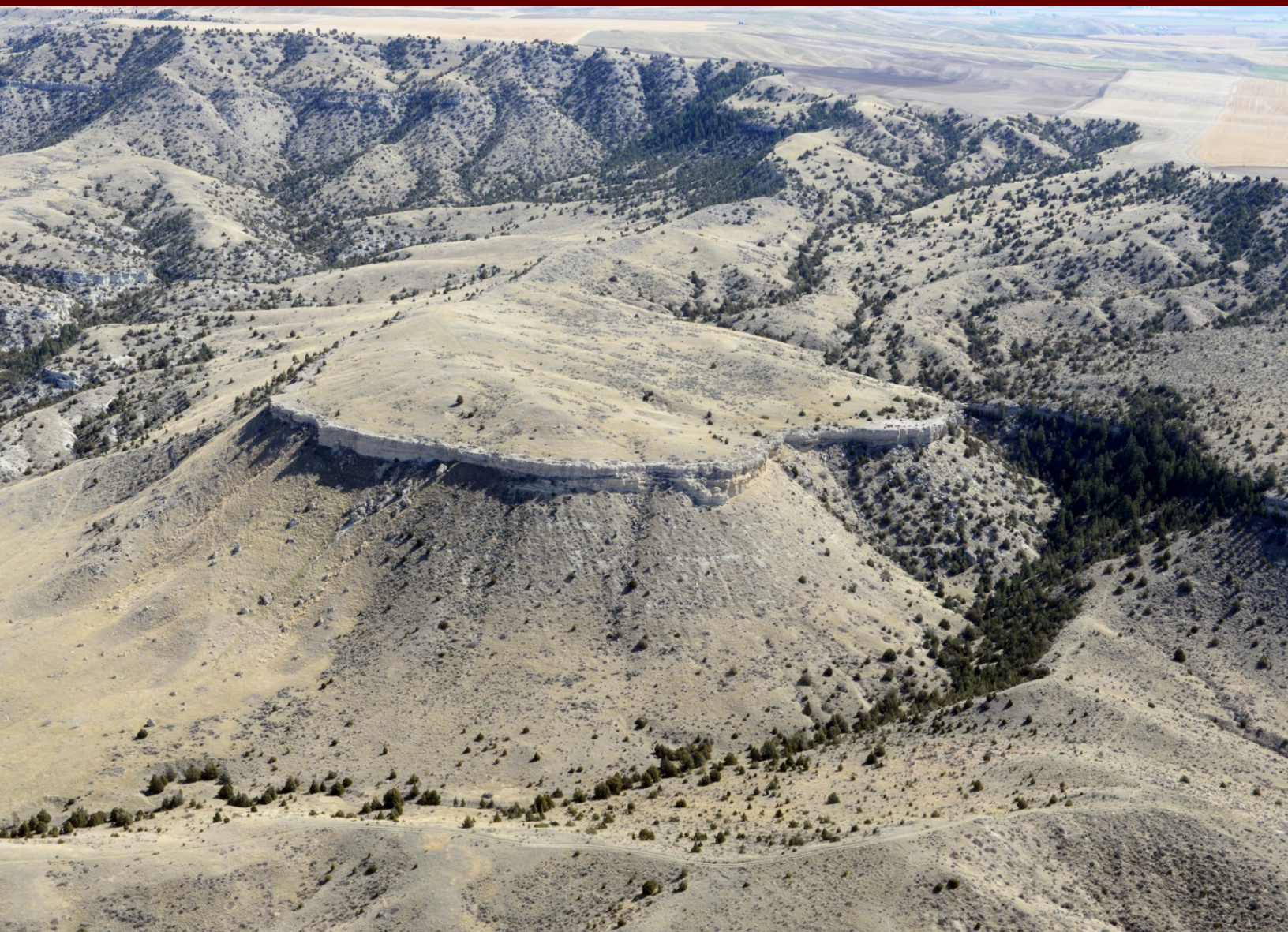
By Brandon Bachman and Douglas MacDonald, Ph.D., RPA



CLASS III ARCHAEOLOGICAL SURVEY REPORT: MADISON BUFFALO JUMP STATE PARK, GALLATIN COUNTY, MONTANA

Prepared for:
MONTANA STATE PARKS

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CHAPTER 1. Introduction

The Madison Buffalo Jump Project entailed the archaeological survey of the 640-acre Madison Buffalo Jump State Park near Three Forks, Montana (Figure 1; Figure 2), in order to identify and inventory any and all cultural resources that are visible on the ground surface. A potential undertaking that would allow Madison Buffalo Jump land to be accessed for cattle grazing was being considered by Montana Fish, Wildlife, and Parks (FWP), and since no official cultural inventory had ever been implemented at Madison Buffalo Jump, Montana FWP decided to hire UM to conduct a full scale archaeological surface survey to determine what, if any, cultural resources would be adversely affected by such an undertaking. Funding for the project was received by Montana Fish, Wildlife, and Parks (FWP); the project was conducted in accordance with the Montana Antiquities Act.

Currently, the Montana Department of Natural Resources and Conservation (DNRC) owns the land, while Montana FWP manages the state park. Since Montana FWP was the only agency, state or otherwise, they are the lead agency for this project, voluntarily initiating the survey process. Overall, the project is intended to give Montana FWP a complete surface inventory of all cultural resources present at Madison Buffalo Jump - both for their own records, and to be used as an aide in any future potential undertakings that may take place at the state park.

The UM field crew included Principle Investigator Doug MacDonald, Ph.D., RPA, as well as graduate student Brandon Bachman and Justin Pfau, M.A., Matt Nelson, M.A. (crew chief), and Elizabeth Lynch, M.A. From 17 May – 1 June 2014, the UM crew conducted pedestrian survey in the form of 2-4m transects in addition to landform survey where required, due to steeply sloped ridges and other landforms. When flakes, bones, or any other artifacts were identified, the crew scrupulously inspected the immediate surrounding area in an attempt to locate any and all additional artifacts/features; survey also included the inspection of cliff faces for rock shelters and rock art/inscriptions. In total UM surveyed the entire 640-acre (1-square mile) state park (Figure 3; Figure 4).

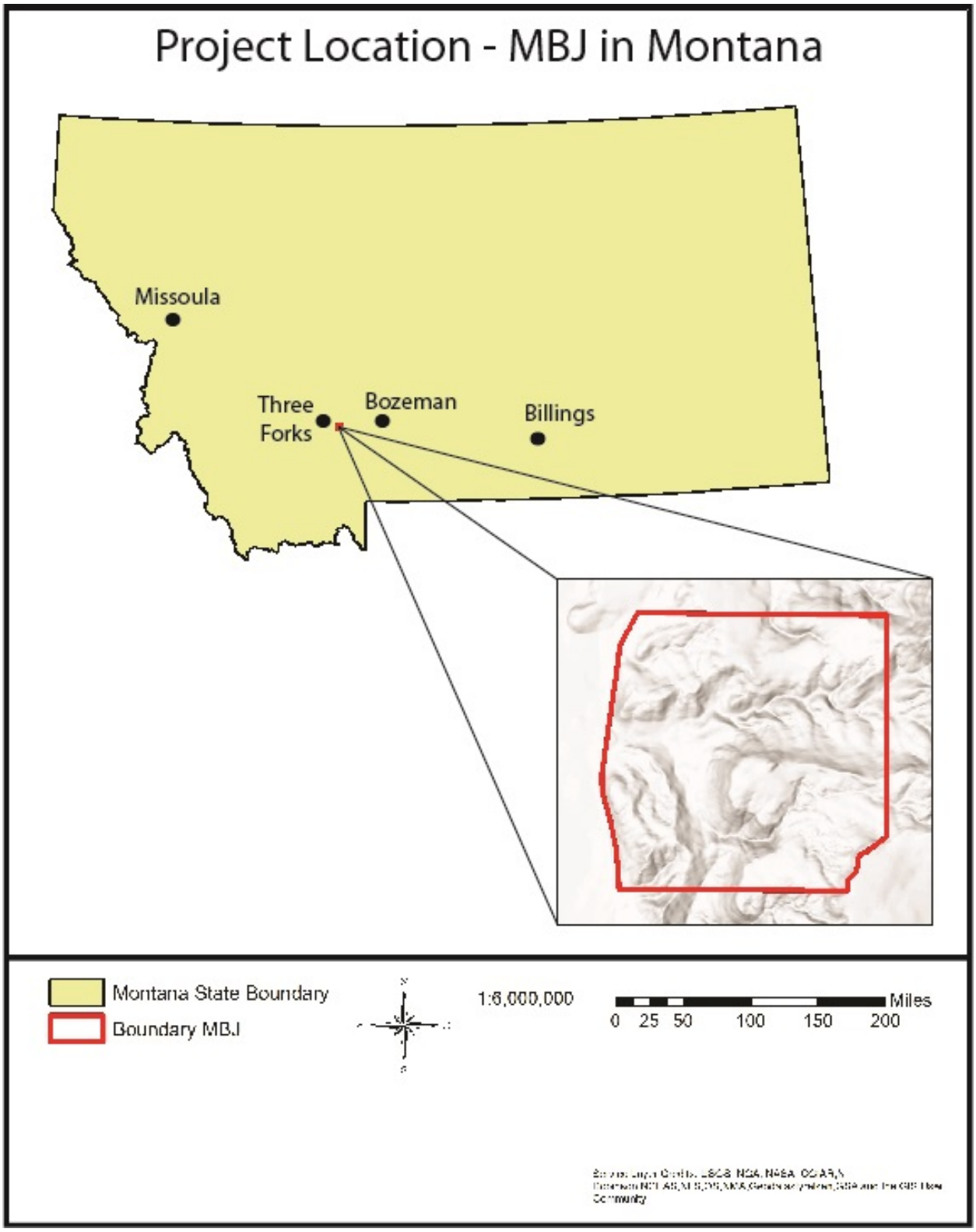


Figure 1. Map Showing the Location of Madison Buffalo Jump in Montana

(United States Department of Agriculture: Natural Resources Conservation Service Geospatial Data Gateway. https://gdg.sc.egov/GDGOrder.aspx. Accessed 2/14/2016.)

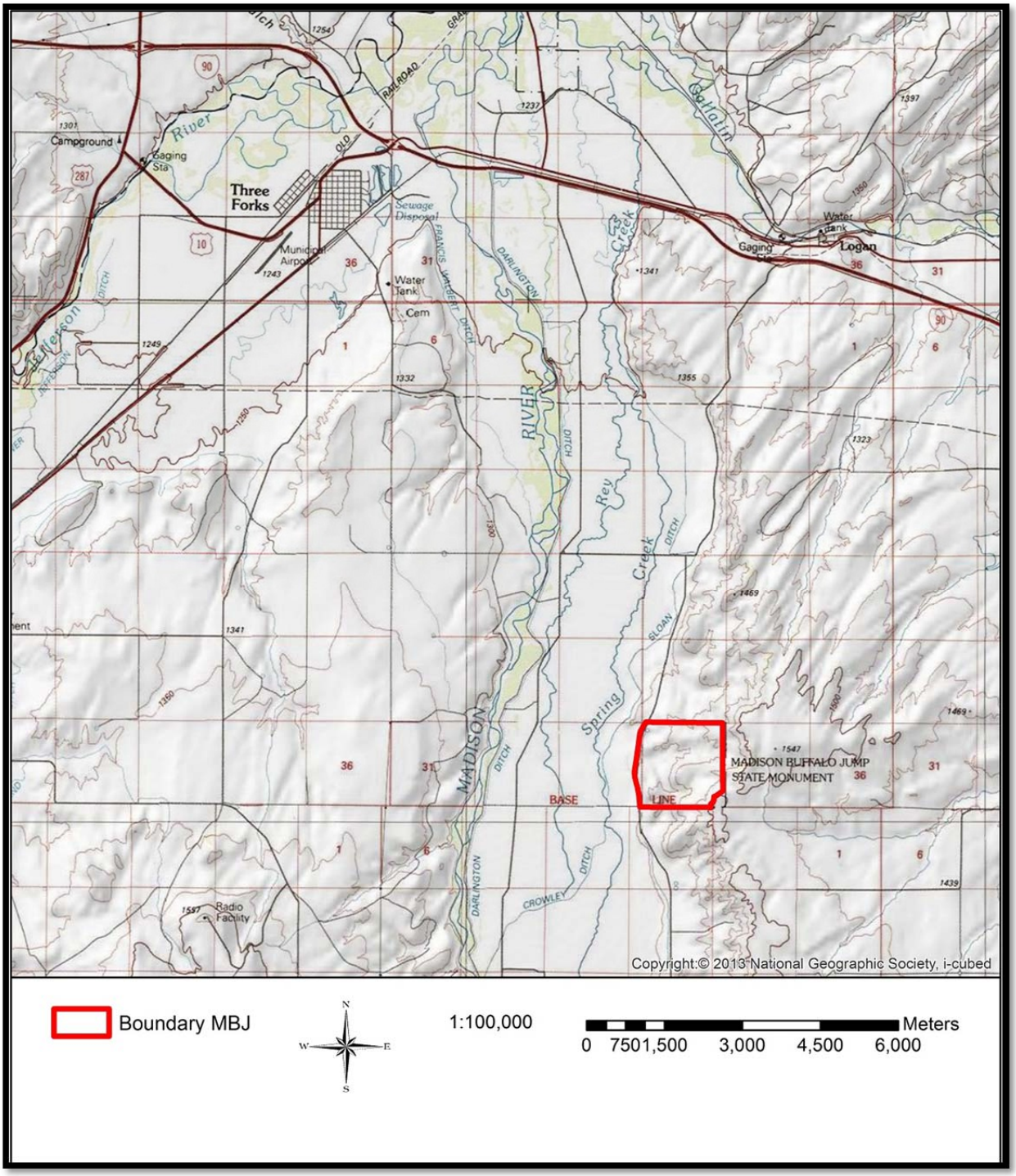


Figure 2. Topographic Overview Map of the Three Forks and Madison Buffalo Jump Area

(United States Department of Agriculture: Natural Resources Conservation Service Geospatial Data Gateway. https://gdg.sc.egov/GDGOrder.aspx. Accessed 2/14/2016.)

Summary of Results

A plethora of archaeological artifacts and features were recorded by UM at Madison Buffalo Jump, including: 1) 3-4 drive lines that were used to funnel bison to specific jump locations; 2) bison bone concentrations located below the nick point on the face of the jump; 3) artifact and bone concentrations in the processing area in the creek valley west of the jump; 4) countless lithic artifact concentrations located within the gathering basin above the jump, marking locations where prehistoric stone tool manufacture occurred, including one possible white chert/petrified wood quarry; 5) 78 stone circles in four locations surrounding the jump; 6) two fasting beds in association with the stone circles located on a ridge top north of the jump; 7) an Early Archaic projectile point manufactured from dacite; 8) A total of 15 dacite/obsidian artifacts (including the Early Archaic projectile point) that were submitted for source identification; 9) One bison bone pelvic fragment that was submitted for radiocarbon dating to be used to determine the age of the buffalo jump processing area; and 10) four locations of historic/modern inscriptions located across the state park.

Acknowledgements

Many people contributed to the success of the University of Montana survey and inventory of the Madison Buffalo Jump State Park. Principal Investigator Doug MacDonald, Ph.D., RPA, directed the fieldwork. Brandon Bachman is this report's author, with contributions by Jay Vest (inscriptions) and the principle investigator.

UM would like to thank the following for their assistance in the Madison Buffalo Jump project: Sara Scott (FWP); David Andrus (park manager at Madison Buffalo Jump and Missouri Headwaters State Parks); and the camp hosts at Missouri Headwaters State Park. Additional thanks is owed to volunteer surveyors Michael Ciani, M.A. and Michael Livers, M.A., both of whom are former UM anthropology students.

The remainder of this report provides details of our investigations of the Madison Buffalo Jump State Park, including a description of the project's environment, prehistory, prior archaeological research (Chapter 2) and detailed archaeological results (Chapter 3).

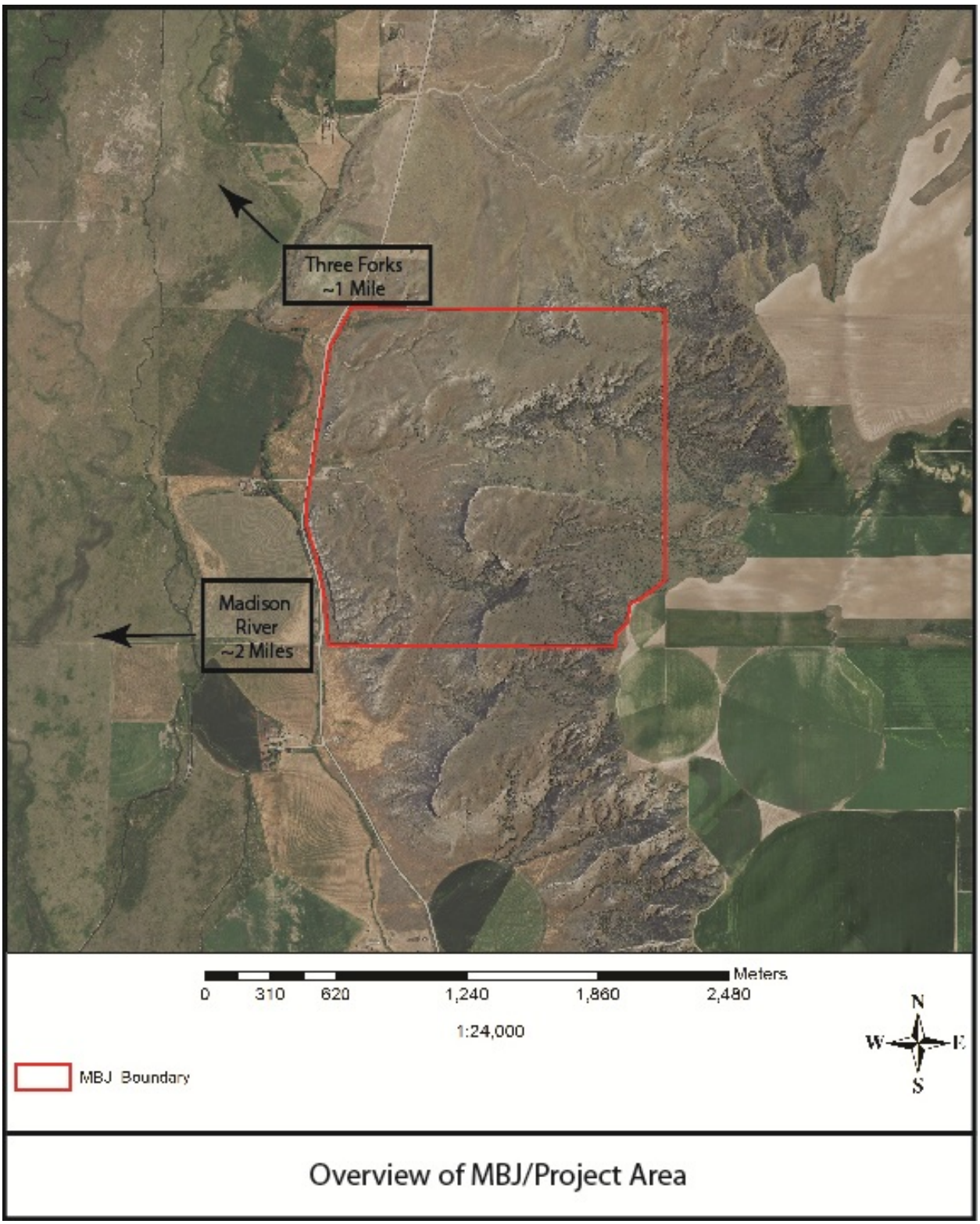


Figure 3. Overview Map of Madison Buffalo Jump State Park

(United States Department of Agriculture: Natural Resources Conservation Service Geospatial Data Gateway. https://gdg.sc.egov/GDGOrder.aspx. Accessed 2/14/2016.)

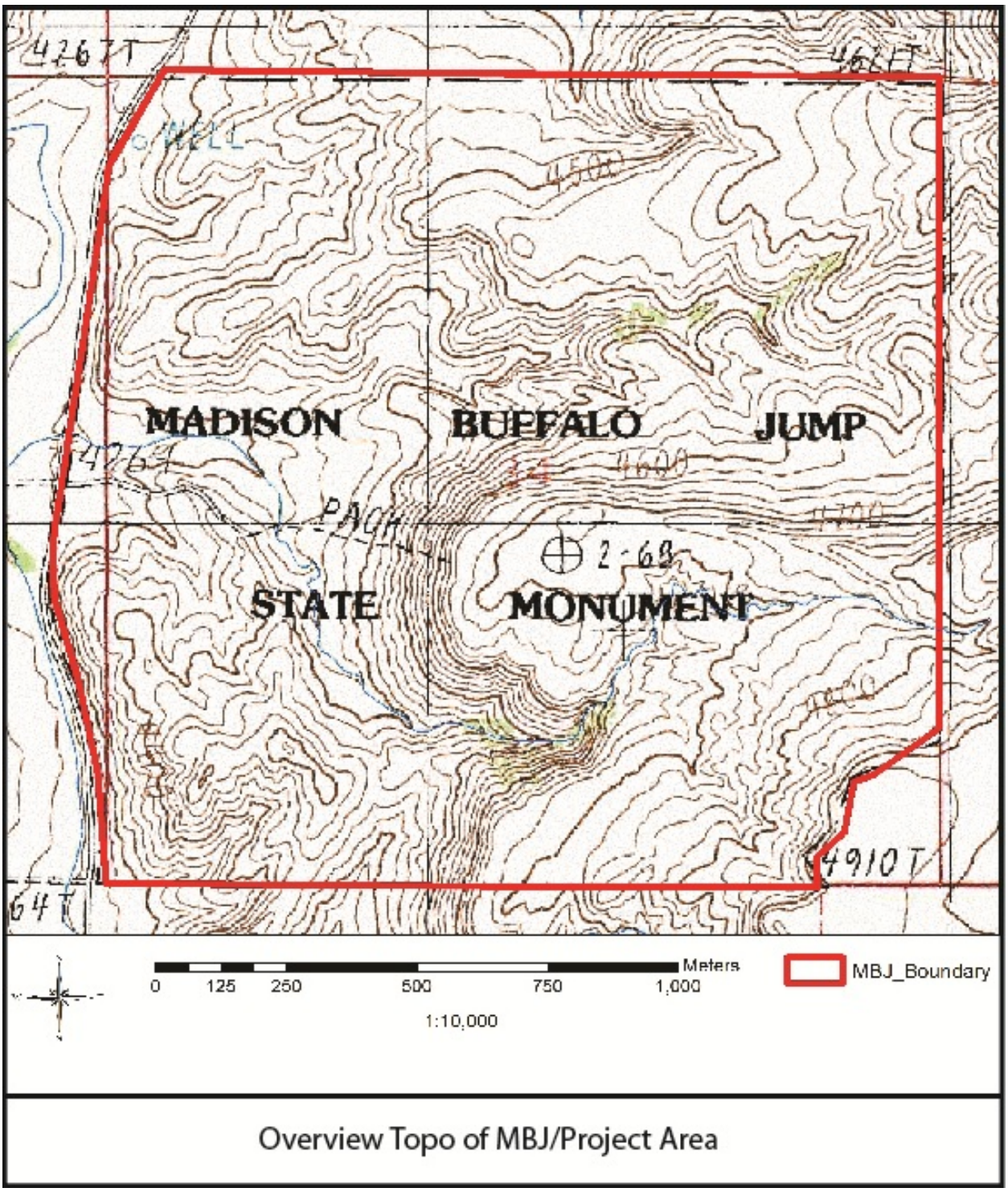


Figure 4. Topographic Overview Map of Madison Buffalo Jump State Park

(United States Department of Agriculture: Natural Resources Conservation Service Geospatial Data Gateway. https://gdg.sc.egov/GDGOrder.aspx. Accessed 2/14/2016.)

CHAPTER 2. Environment, Prehistory and Prior Research

This chapter provides overviews of the projects location, regional geology, climate, flora & fauna, history and prehistory, and prior archaeological research near Madison Buffalo Jump State Park. These sections provide context for presenting the results of archaeological research.

Project Location, Geology, Physiography, and Hydrology

The Madison Buffalo Jump State Park is located in the Three Forks basin, ca. 7 miles south of the small town of Logan, Montana, and two miles west of the Madison River; located just one mile to the northwest is the town of Three Forks. The Three Forks basin encompasses approximately 1,000 square miles (Robinson 1961) and is the location where the Gallatin, Jefferson, and Madison rivers conjoin to form the Missouri River (Berry 1943). The Gallatin and Madison rivers both originate in the northwest portions of Yellowstone National Park, along the Continental Divide, approximately 90 miles south of the Three Forks Basin (Malouf 1975); the Jefferson's source is located nearby as well. From their sources, the Jefferson River flows east and northeast through the central part of the region, while the Madison River flows north from Yellowstone National Park, through the Madison River Valley (Berry 1943); the Gallatin River lies to the east of the Madison River and flows north until it reaches Logan, Montana, where it turns west and flows to forms the headwaters of the Missouri River. The rivers each enter the basin through long and broad canyons and valleys (Robinson 1961), a topographical characteristic of southwest Montana that is shared by much of the Intermountain West (Wyckoff and Hansen 1991), and flow at altitudes near 4,000+ feet.

More precisely, Madison Buffalo Jump exists in the Madison River Valley, which is comprised of a series of elevated, sloping, terraced benches that are composed of large alluvial fans (Wyckoff and Hansen 1991). Taylor (1971:2) explains that here the Madison River has

> "Carved out a broad and fertile north-south valley some four miles wide, cut several hundred feet deep from the high plain which extends on either side. The eastern wall of the valley for some two miles on either side of the Buffalo Jump is deeply cut into ravines, rising sharply to the foot of sheer bluffs from twenty to one hundred feet in height."

Madison Buffalo Jump is located in these bluffs along the far eastern side of the Madison River Valley, and faces directly west (Photograph 1) (Malouf and Conner 1962); the river now lies on the opposite side of the valley, with a flat and open floodplain and terrace landforms

serving as a buffer. Scott (2010) measures the park at 640 acres within township 1N, Range 2E, Section 34 within the Manhattan SW 7.5 minute series USGS map.

Photograph 1. View West from the Top of the Madison Buffalo Jump, looking towards the Madison River Valley.

The geology of Madison Buffalo Jump consists of both Madison Plateau and Madison Valley Formation sandstone and conglomerate deposits; formations which are prominent landform markers south of Manhattan and Three Forks in the Madison River valley. As explained by Vuke (2003), the surface geology of the park is comprised of Madison Plateau deposits that are characterized by rounded cobbles, gravel, and/or small boulders cemented together by calcium carbonate that dates to ca. 10 million years ago (mya), which is covered by fine-grained, primarily unconsolidated sediment. These cobble deposits generally consist of hand-sized or larger orthoquartzite cobbles that can be found in excess in the hillsides of the eastern section of the park. The orthoquartzite cobbles at Madison Buffalo Jump are of moderate quality, though very few artifacts have been recovered from the park manufactured by this material; however, these cobbles comprise a large majority of the cobbles used in cairns for the drive lines and stone circles within the park.

The Madison Valley Formation stratigraphically underlies the Madison Plateau deposits. The Madison Valley Formation primarily consists of white tuffaceous sandstone and siltstone (Robinson 1961), inter-bedded with marl (Vuke 2003). Specifically, Dorr (1956) analyzed the composition of the Madison Valley Formation to be: 64% sandstone, often tuffaceous; 15% siltstone, shale, and claystone; 14% conglomerate; 5% relatively pure ash; and 2% limestone and marl, fresh-water, and small local lenses. That being, the bluffs that make-up the Madison

Buffalo Jump are comprised of inter-bedded sandstone and siltstone; not limestone, as has been previously reported (Davis and Brownell 2014; Taylor 1971).

Barstovian mammal fossils have been recorded within these deposits dating to 15 mya (Tabrum et al. 2001; Dorr 1956; Sutton 1977). UM identified one such fossil in the roof of a rock shelter at the base of Madison Buffalo Jump's rim (Photograph 2). Other previous reports document the presence of fossils, petrified wood, and beds of sandstone with chert and quartz (Mifflin 1963); though white chert/chalcedony and various colors of petrified wood are most prevalent. Both Dorr (1956) and Vuke (2003) report and abundance of petrified wood occurring at or near the base of conglomerate deposits. These deposits of chert, chalcedony, and petrified wood are exposed throughout the gathering basin of the jump to the east of the jump's rim; they were extensively procured by the Native American stone tool manufacturers residing in the area. These deposits are described in detail in the archaeological results below.

Photograph 2. Barstovian Fossil in Rock Shelter Roof at the Base of Madison Buffalo Jump.

The surface of the Madison Buffalo Jump State Park is comprised of "a series of discontinuous drop-offs created by erosional incising of the plateau, from any of which bison could have been forced or misled into falling" (Davis and Brownell 2014:2). Lapham and Ely (1905) describe the ground surface as being comprised of dissected creek valleys and upland flat areas, which include steep dissected canyons and creek bottoms. North and east of the jump area are several canyons that are deeply incised, creating a dissected landscape with

canyons, finger ridges, and occasional flats. East of these canyons are surficial deposits of the Madison Plateau consisting of an abundance of cobbles. On the park's easternmost limits are large and steep slopes containing thousands of rounded Madison Plateau cobbles; and agricultural fields are located above the park to the east, outside of park boundaries.

Photograph 3. South Portion of the Madison Buffalo Jump State Park Covered with Sagebrush. View Northwest.

The terrain of the central portion of the park is comprised of Madison Valley Formation canyons and cliffs that are generally steeply-incised canyons located between upland plateaus. The jump itself is the most prominent exposure of Madison Valley Formation sandstone. Large sections along the entire face of the jump's rim show evidence of spalling, marking the fragility of the inter-bedded sandstone; the west-facing wall of the jump is marked by multiple sections that have collapsed and subsequently rolled down the steep slope in front of the jump. In the western portion of the park the terrain is undulating and rolling with few Madison Valley Formation cliff exposures along the most western margins.

Climate, Flora and Fauna

The surface vegetation varies throughout the Madison River Valley, depending on aspect, elevation, slope, and soil conditions (Wyckoff and Hansen 1991). Specifically, the vegetation comprising the Madison Buffalo Jump State Park grasslands is characterized by a mixed grass prairie consisting of Idaho fescue, grama grass, needle grass, and wheatgrass (Wyckoff and Hansen 1991), interspersed with juniper and sagebrush clusters in north-facing walls of canyons, in addition to well-watered areas (Photograph 3). Additionally, riparian

vegetation exists along the Madison River, as well as along the tributary streams, which includes a mixture of wet grasslands and stands of aspen, cottonwoods, and willow (Wyckoff and Hansen 1991).

For over a century the Madison River Valley has been utilized by local ranchers for grazing cattle (1870 and earlier) and sheep (beginning 1870's); today, cattle are still very prevalent in the area, but sheep have all but disappeared from local livestock numbers (Wyckoff and Hansen 1991). Additional fauna within the park is vast and variable, including bobcats, cougars, coyotes, mule deer, elk, antelope, and in the past, bison. Reptiles are spread thin throughout the park, with bull snakes and rattlesnakes both observed in low densities, primarily among rocky outcrops and grassy areas with sagebrush. Finally, numerous species of birds, including crows, eagles, hawks, sparrows, vultures, and even Great Horned Owls, call the cliffs of the Madison Buffalo Jump and its surrounding canyons home (Photograph 4).

Photograph 4. Great Horned Owl Perched on a Cliff at Madison Buffalo Jump.

Three Forks has a highly variable, yet somewhat predictable climate based on the season, similar to the rest of Montana. The average yearly precipitation for the Three Forks area is roughly 16-17 inches, with approximately 1-2 inches per month typically (Lapham and Ely 1905); the area receives approximately 30 inches of snowfall annually. The daily average temperature in Three Forks is 44 degrees Fahrenheit, with temperatures exceeding 100 degrees Fahrenheit in the summer and dropping to as low as -30 during the winter. These

extreme annual changes in temperature also occur inversely; when chinook winds produce abnormally high temperatures in the winter, or in summer when arctic air masses greatly lower temperatures (Wyckoff and Hansen 1991). This area is susceptible to intensive storms year-round, including heavy thunderstorms during the summer and blizzards in the winter. In fact, UM's field vehicle was struck by lightning during a late-May thunderstorm during a fieldwork session in June, 2014.

Prehistory of the Madison River Valley

Several cultural chronologies for the greater western Montana region have been utilized to classify the prehistory of the area (see Malouf 1965; Mulloy 1958; Flint 1982; and Roll 1982). However a cross regional chronology is used here to present the areas prehistory in the broader context of other western North American hunter-gatherer cultural periods. The following classifications, adopted from MacDonald (2012), are used to denote periods of large-scale change: Paleoindian (12,000-8,000 BP), Early Archaic (8,000-5,000 BP), Middle Archaic (5,000-3,000 BP), Late Archaic (3,000-1,500 BP), Late Prehistoric (1,500-500 BP), and the Contact period (500-100 BP).

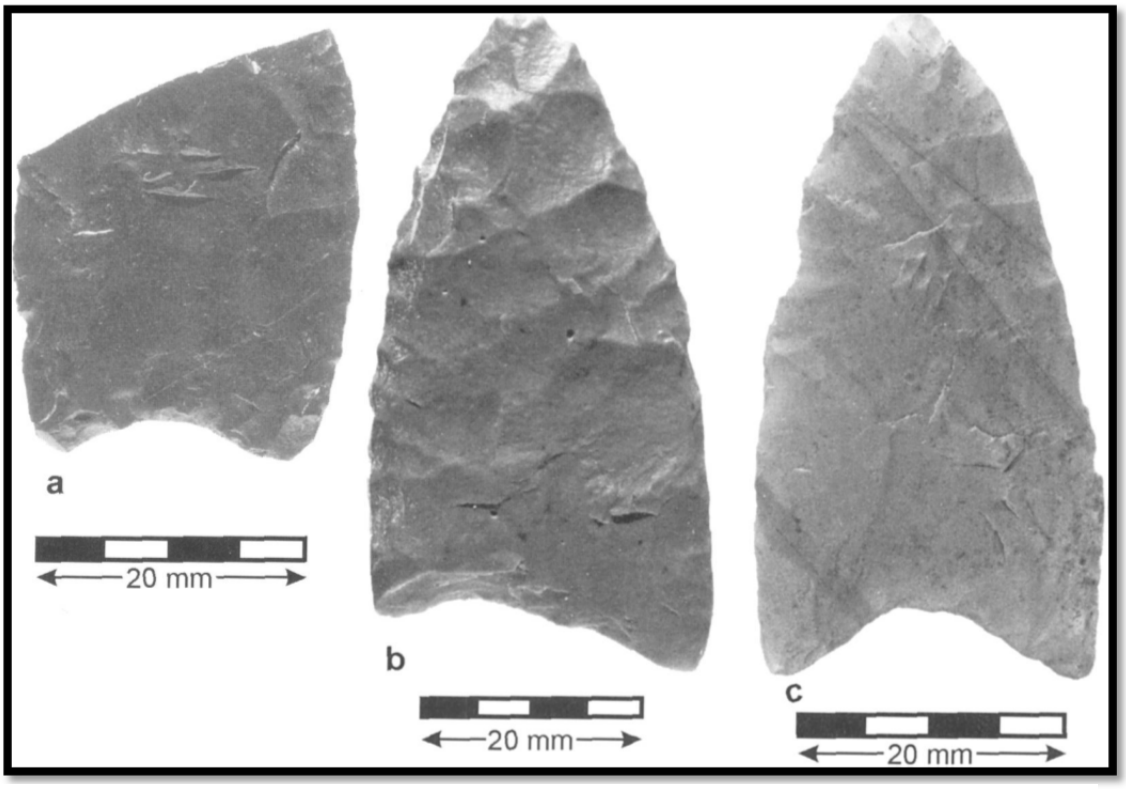
Paleoindian Period (12,000 to 8,000 years ago)

The regions earliest humans (Clovis) were highly mobile hunter-gatherers who exploited animals like Bison (*Bison bison antiquus*), mammoths and horses. Meanwhile predators like dire wolves (Canis dirus), saber tooth cats (Smilodon fatalis), and large bears (Ursus arctos) also shared the landscape with Clovis people.

Early Paleoindian lithic technology is characterized by the use of large, sometimes fluted, lanceolate spear points. Clovis points are very large, fluted projectile points; they typically contain very high quality stone obtained from distant sources. Fluted points like Clovis and Folsom have been found east of the Continental Divide, most notably at the Anzick site in Wilsall, Montana (It should be noted that plenty of fluted points have been identified west of the Continental Divide, too, even if it is not very evident in Montana). To date, studies at the Anzick site, which is a burial of a two-year old boy dating to approximately 11,000 BP, has yielded over 100 high-level craftsmanship Clovis artifacts in association (Photograph 5), such as: bifaces, blades, cores, scrapers, and projectile points (White 2015). The Wally's Beach site is a Clovis site located in Alberta, Canada (11,300 BP), about 180 km south of Calgary, just north of the

Montana border, that consists of archaeological artifacts that spans from the historic period through Clovis period projectile points, three of which have tested positive for either horse or bovid proteins (Photograph 6) (Waters et al. 2001).

Photograph 5. The Anzick Clovis Tool Assemblage as it Appears in Disdplay at the Montana Historical Society Museum in Helena, Montana. (Photo credit to: Gary Marshall/Blackfoot Media Group) (Photo taken from White 2015).



Photograph 6. Three clovis projectile points recovered from the Wally's Beach site in Alberta, Canada. (Photo from Waters et al 2001)

Folsom projectile points are considered one of the most distinctive projectile points produced in world history – the fluted Folsom point, a little smaller than Goshen, took Clovis thinning and fluting to an extremely sophisticated level, removing a channel flake that progressed from the concave base to nearly the tip of the point. The MacHaffie and Indian Creek sites are Folsom sites located north of Madison Buffalo Jump (MacDonald 2012).

Additional Paleoindian projectile point types include Goshen, Agate Basin/Hell Gap Complex, Foothill/Mountain Complex, and Cody Complex. Goshen points are large lanceolate projectile that date approximately to 10,500-10,000 years ago. Agate Basin/Hell Gap projectile point forms both utilized bifacial flaking, a technological descendant of Folsom. Agate Basin points are elongated and lanceolate, with narrow, tapered bases and slightly convex blades; Hell Gap points are similar but typically have square stems (MacDonald 2012). Foothill/Mountain points are an upland complex that postdates Agate Basin/Hell gap but features somewhat similar projectile technology; these projectile points possess concave bases rather than convex bases (MacDonald 2012). The Cody Complex (10,000-8,000 BP) is generally associated with bison hunting. This complex utilized stemmed lanceolate projectile points, including Alberta, Eden, and Scottsbluff varieties – each of which is a cultural descendant of Agate Basin/Hell Gap point styles, as evidenced by fine bifacial flaking and the use of high quality stone. Also part of the Cody Complex is a tool called a Cody knife, which is essentially an Alberta point sharpened to an asymmetrical blade and is useful in bison processing and other cutting activities (MacDonald 2012). The Mammoth Meadow site is a Cody-complex site located southwest of Madison Buffalo Jump.

Though there may not be many confirmed Paleoindian sites in Montana, many of those that are acknowledged lie in southwestern Montana. The lone archaeological Clovis site in Montana is the Anzick site located near Wilsall, Montana. Three Folsom sites have been discovered in southwestern Montana: the MacHaffie, Indian Creek, and King sites; there are also three Foothill/Mountain Complex sites in southwestern Montana: the Black Bear Coulee, Indian Creek, and Barton Gulch sites. Additionally, there are two Cody sites in southwestern Montana, the MacHaffie site and the Mammoth Meadow site (MacDonald 2012).

To this date there have been a total of 30 *known* Paleoindian projectile points that have been documented at Madison Buffalo Jump. During his excavations, Roy Austin identified two “Yuma-like” projectile points- unfluted projectile points which resemble late Paleoindian projectile points (Clark and McFadyen 1983) - from 6.5-7.5 ftbs (feet below surface). These “Yuma-like” projectile points were approximately one inch in length and were similarly compared to projectile points discovered at Whitehall Cave from the same depths (Taylor 1971). H.P Lewis and F.F.

Sparks found four additional “Yuma-like” projectile points during their time researching Madison Buffalo Jump; these points were also approximately one inch long, un-notched and about one-quarter inch wide. Two of the “Yuma-like points were recovered from the deepest bone layer in their test pit, five ftbs, while the remaining two were located on the ground surface in one of the ravines (Taylor 1971). Lastly, a very large majority of the Paleoindian projectile points that have been documented at Madison Buffalo Jump come from Dee Taylor and his excavation in 1968. It was during this excavation that Taylor and his crew recorded and collected 24 different Paleoindian projectile points- Taylor himself stated that these un-notched points must be those labeled “Yuma-like” by H.P. Lewis. Davis and Brownell (2014) referred to one of Taylor’s points as being a complete lanceolate projectile point that resembled the 8,800 year old Ruby Valley Paleoindian point, from Barton Gulch, near Dillon, Montana.

Early Archaic Period (8,000 to 5,000 years ago)

Much of the Early Archaic period is characterized by what has been called the Altithermal by Antevs (1955); a time during which there was a significant reduction in population across the region evinced by the extremely low density of archaeological sites (Pfau et al 2015). The drier, hotter environment could have created a complete reorganization of hunter-gatherer resource management strategies and a resultant shift in population demographics including reduction and dispersal. The latter could account for the low density of identified archaeological sites from this period, meaning that people were living in smaller communities, more ephemeral camps, and in diverse ecological settings. Additionally, during the Early Archaic period hunting became more of an individual event/activity rather than group events, which would result in smaller, less noticeable kill sites (MacDonald 2012). Still, there seems to be consensus that there were substantial population reductions during the Early Archaic. Some have suggested that the exploitable plant and animal resource base was expanded during this time. The climate could have resulted in resources becoming distributed more patchily-forcing some groups to reinvent food procurement strategies and alter their seasonal movement cycle. It is assumed the Plains were largely vacated in favor of mountain areas and ecotone settings (MacDonald 2012; Reeves and Dormaar 1972).

Side and corner notched projectile points appear during this period likely indicating the adoption of the atlatl during the Early Archaic (McLeod and Melton 1986). These less elaborate points were fitted with side and corner-notching with the purpose to facilitate hafting. During early portion of Early Archaic, the side-notched points continued to be rather large and bifacially

flaked (MacDonald 2012). Despite the low density of Early Archaic archaeological sites throughout Montana (n=6) (MacDonald 2012); three are found in southwestern Montana: the Black Bear Coulee, Indian Creek, and Myers-Hindman sites (MacDonald 2012). Early Archaic sites are as rare as Paleoindian sites and are also less visible because the groups relied less on bison hunting (sites of which usually have lots of easily spotted bones). A possibility for this phenomena could be due to a changing – hotter and drier – climate that the hunter/gatherers adapted to. It should also be noted that Bison antiquus goes extinct in the Early Archaic and Bison bison emerges. To this date, the only *known* Early Archaic projectile point that has been identified and documented at Madison Buffalo Jump is the dacite projectile point that was discovered by UM on the ground surface in the ravine south of the Processing area/Stone Circle area 4/southwest of the jump itself (see Chapter 3).

Middle and Late Archaic Periods (5,000 to 1,500 years ago)

The Middle Archaic period is characterized by the Medithermal, which made for a much wetter and cooler climate than what was experienced during the Early Archaic period (MacDonald 2012). There was a continuing trend of diversifying food sources and a steady increase in site numbers compared to the Early Archaic. The climate likely favored conditions for increasing bison herds on the Plains.

Middle Archaic point types from this period include Oxbow and McKean. McKean complex artifacts include Duncan, Hanna, McKean lanceolate, Mallory side-notched, and Yonkee points. Mallory side-notched and Yonkee points are found in western Montana. McKean complex artifacts are typologically more commonly found in the region compared to all other earlier point types. Taylor (1973) notes that points made during this period are more crudely constructed than their eastern counterparts. Malouf (1965) posited that this may be due to western Montana points being older than the eastern varieties. These points are bifurcates, meaning they have indented, or concave, bases – and are more or less all identical point varieties from the Middle Archaic period and do not represent a sequence in point technology. In general, Oxbow points are smaller, squat versions of the larger, lanceolate McKean points that have convex to straight blades – both are smaller than Early Archaic. Both have a concave indentation on the base that resembles a notch – very often but not always McKean points will also have side-notches (MacDonald 2012).

At the Sun River site, near Great Falls, Montana, Oxbow points have been dated to 5,200 BP putting the existence of this type slightly earlier in Montana than places farther east

and north (McLeod and Melton 1986). Middle Archaic Archaeological sites present in southwestern Montana include the Myers-Hindman, Rigler Bluffs, and Airport Rings sites. To this date there have been no definitive Middle Archaic projectile points identified or recovered/documented from Madison Buffalo Jump.

During the Late Archaic period it is likely that there was an increase of communal hunting, which is suggested by larger sites, faunal remains, and the presence of traps and pounds for bison, antelope, sheep, and deer. Bison hunting emerged as the dominant subsistence pattern for the people of Montana, though deer, pronghorn and bighorn sheep were also hunted (MacDonald 2012). Groups were probably highly mobile evinced by widespread trade items including lithics and pottery, along with the high quantities of stone circles found in Montana dating to this period. The use of stone circles began to be utilized during this period in order to facilitate the high mobility of bison hunting; thus, Hunter/Gatherers began to increase their use of portable hide structures, or tepees (MacDonald 2012).

Two types of projectile points, Pelican Lake and Besant Projectile Points, are the most diagnostic artifacts from this period (MacDonald 2012). The large corner-notched projectile points, generally referred to as Pelican Lake points, appear during this period and are found throughout the Late Archaic. Corner-notched points attributed to this type are numerically the most common type found in Montana (McLeod and Melton 1986). Specifically, Pelican Lake points are deeply corner-notched with straight blades and straight bases; the blade is triangular and the finely made notches are narrow, elongated, and U-shaped. Pelican Lake points were well manufactured and some blades were even serrated, though most lack this attribute (MacDonald 2012).

Although not very common in the region, Besant points are found during this period as well. This type occurs temporally later than Pelican Lake but the two types overlap; Corner-notched Pelican Lake points utilized throughout the period; side-notched Besant points used approx. from 2,000-1,300 years ago (MacDonald 2012). Use of Besant style points extends into the beginning of the Late Prehistoric. This point type is generally not as finely manufactured as Pelican Lake varieties and often has triangular to lanceolate blades with straight to convex blade shapes, with the maximum width being at the shoulder, and simply produced U-shaped side notches; the point base is concave to straight but occasionally convex (MacDonald 2012).

Late Archaic archaeological sites are spread all throughout Montana, ranging from its far northwestern Rivers to the southeast corner, with three of note in southwestern Montana: the Schmitt Quarry, Antonsen Bison Jump, and Yellowstone Bank Cache sites (MacDonald 2012).

Though not common, some Late Archaic sites have yielded both Pelican Lake and Besant points from the same cultural deposits.

Surprisingly, only a handful of Late Archaic projectile points have been identified and documented at Madison Buffalo Jump. Charles Kinsey claimed to have collected a variety of projectile points, of which Malouf and Conner (1962: 14) state could be typologically dated back to "early Forager times, not more than 4,000 years ago." During his 1968 excavations Taylor also found two Late Archaic projectile points, which he described as being triangular shaped with corner notching, basal indentation that were manufactured from thin flakes and utilized delicate pressure flaking (Taylor 1971). Of this phenomena, Davis and Brownell (2014: 8) state: "The absence of projectile points in these collections that are diagnostic for the Middle period is remarkable…Suffice to conclude that the dominant occupation at and use of Madison Buffalo Jump was associated with the final period in regional history."

Late Prehistoric Period (1500 to 500 years ago)

The Late Prehistoric Period is a time in which bison were increasingly exploited by Montana hunter-gatherers. Bison were most prolific east of the Continental Divide, which is the cause for this escalation in bison hunting, with many more locations used for hunts that often consist of hundreds of animals, as opposed to dozens. Further, it is probable that mobile groups equipped with bow and arrow technology made seasonal forays east to hunt large herds. There are hundreds of buffalo jumps in Montana that date to the Late Prehistoric period (MacDonald 2012). Plant species were certainly an important resource and root roasting ovens increase in use during this time (Arthur 1968) to process camas, biscuit root, and bitterroot.

It was during this period that nomadic peoples in the Mission River Valley of western North Dakota and eastern Montana began to settle down and live in permanent villages (approx. 900 years ago) (MacDonald 2012). Stone circles (tepees) also gained dominance during the Late Prehistoric; more precisely, stone circles found in fairly close proximity to bison kill sites mark the locations of base camps used during buffalo hunting. The increased numbers of stone circles, buffalo kill sites, and Late Prehistoric arrow points suggest an increase in human population in the region during the Late Prehistoric Period (MacDonald 2012).

The introduction of the bow and arrow is the defining technological achievement that characterizes the beginning of the Late Prehistoric period, and was utilized for hunting bison, deer, elk, and other game. The bow and arrow allowed for the use of smaller projectile points that were more easily produced in bulk and did not necessarily require large pieces of high-quality stone (useful for frequently traveling bison hunters). The Avonlea point is the earliest

representative of this technology in Montana. Avonlea points are a transitional point type between the larger Archaic atlatl point and the very small arrow point introduced approx. 1,300 years ago (MacDonald 2012). Dates for Avonlea points are several hundred years older in northwest Montana than in the southeast part of the state, possibly suggesting their diffusion from the north (McLeod and Melton 1986). Avonlea arrow points used in Montana were finely manufactured, with very shallow side or corner notches, a convex to straight blade, and a slightly concave base (MacDonald 2012).

From approx. 1,200-300 years ago, the predominant style of projectile point is the very small Late Prehistoric side-notched point, which was typically manufactured with shallow notches and a straight base; blades were typically straight to slightly convex, with a triangular shape (MacDonald 2012). Late Prehistoric arrow points, which are found in the hundreds and thousands at Late Prehistoric sites, are easy to identify because of their small size and are only found at sites younger than 1,500 years ago. On average they are often half, and sometimes a quarter of the size of Archaic atlatl points.

There are hundreds of Late Prehistoric archaeological sites that have been identified across Montana; at least four of note which can be found in southwestern Montana: site 24DL470, Airport Rings, Six Point, and our very own Madison Buffalo Jump (MacDonald 2012). Based on the *known* archaeological evidence, Madison Buffalo Jump was most heavily and consistently utilized during this period. Late Prehistoric projectile points have been found by many of the prior studies at Madison Buffalo Jump; most notably, Charles Kinsey, H.P. Lewis and F.F. Sparks, and Dee Taylor. Based on the knowledge gained from Taylor's report (1971) it is known that Kinsey recovered a minimum of four Late Prehistoric projectile points (photo from Taylor 1971: 11); additionally, Taylor (1971: 13) informs that Lewis and Sparks collected "several specimens of 'ordinary' (triangular, side notched) points…Our copies of the Lewis manuscript does not include any drawings or photographs." Lastly, Taylor himself recorded and collected a total of 12 Late Prehistoric projectile points. According to Taylor (1971), these points were triangular shaped with shallow side notching, straight to concave bases and showed evidence of fine pressure flaking and retouch. It is almost certain that more projectile points from this period have been observed and collected from Madison Buffalo Jump, but due looting/collecting, accompanied with the lack of proper documentation and record keeping, much of the archaeological evidence that was once present at Madison Buffalo Jump is lost to the ages.

Based on projectile point typography, Davis and Brownell (2014) conclude that Madison Buffalo Jump was most heavily utilized relatively late in prehistoric/pre-contact times, most likely

from 450-200 BP. The bison bone sample (FS-11, a bison pelvis fragment) that UM collected from 15 centimeters below ground surface (cmbs) in the trail blowout in the Processing Area/Stone Circle area 4 was returned with a calibrated radiocarbon age of AD 1650 (~350 BP). This date, along with, though significantly more recent than, Les Davis' obsidian hydration dates of artifacts from Madison Buffalo Jump which dated to between 670 and 1440 BP, supports the increased use of Madison Buffalo Jump during the Late Prehistoric period (Davis and Brownell 2014).

Contact Period (500-100 BP)

Ten thousand years of rather conservative cultural change in the region was drastically altered in the span of a few centuries for hunter-gatherers. The introduction of the trade gun, horse, and eventually Euro-American's into the region are the hallmarks of the Proto-historic period (Pfau et al 2015). The horse led to increased mobility and competition between groups. Euro-American population expansion in the east forced many previously Woodland oriented peoples onto the Plains. The trade gun and horse made bison hunting an efficient and reliable resource procurement strategy. The large-scale population movements brought with it increases in warfare and raiding as groups vied for territory and acquisition of horses and guns. But perhaps the most significant impact on Native Americans during this period was the plethora of diseases including smallpox and cholera that greatly reduced indigenous populations. Many of these consequences of Euro-American expansion affected Indians before they had even seen a Caucasian person.

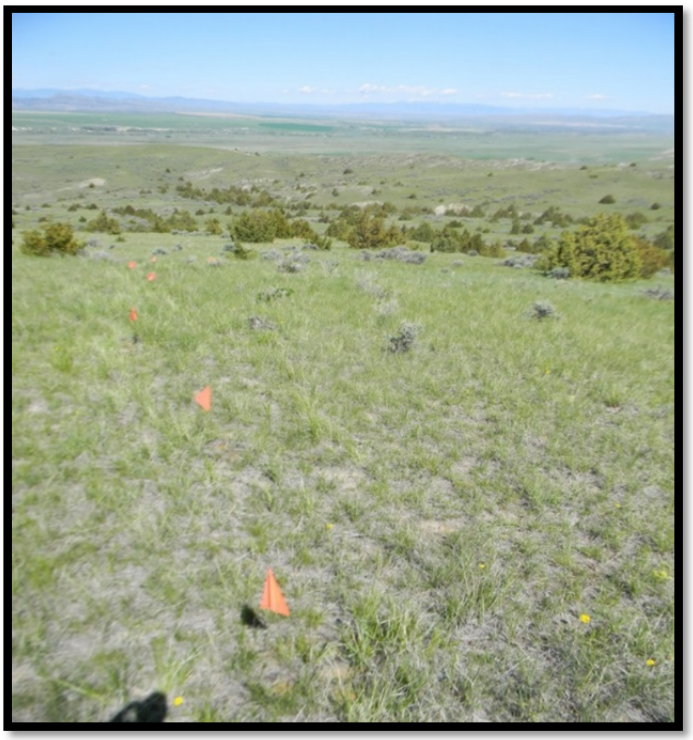
Western Montana was one of the last regions in the country to be explored by European-Americans. Two French fur traders, LeBlanc and LaGasse, may have been the first whites in western Montana in 1801-although there is no written record of this so it remains speculative (McLeod and Melton 1986). The first documented account of white contact in the region is that of Lewis and Clark in 1805 (McLeod and Melton 1986).

History of the Madison Buffalo Jump

Hunter-gatherer populations from all over the northern Plains and northern Rockies continuously utilized the Madison River Valley for thousands of years. The Madison River provided a natural corridor for the migration of animals as well as for the peoples who followed resources along the valley between its confluence with the Missouri River near Three Forks, Montana and its headwaters in Yellowstone National Park, Wyoming. It is likely that Native

Americans used the Madison River for millennia for this very reason; as a migration route between the many important resources of the Missouri Headwaters Ecosystem and the Greater Yellowstone Ecosystem. Though we know that both the Madison River Valley and Madison Buffalo Jump were utilized for thousands of years, the earliest occupants of the site have yet to be identified; however, this hasn't stopped previous researchers of the site from speculating as to what group(s) it could have been.

Over the years the Madison Buffalo Jump has been a site of interest for local archaeologists, and though there have been many varying views and hypotheses regarding the occupation and utilization of the jump, it has been widely accepted that five attributes attributed by archaeologists to bison jumps were operative at Madison Buffalo Jump in Pre-contact times (Malouf and Conner 1962; Taylor 1971; Davis and Brownell 2014). The five attributes present at Madison Buffalo Jump are: 1) a grazing/gathering area; 2) drive lines (Photograph 7); 3) the jump-off itself; a primary butchering area; and, 5) occupation areas.



Photograph 7. Southern Boundary of Drive Lane (Drive Line 2); with Top of the Jump in the Background. View Northwest.

Grazing/Gathering Area

The gathering/grazing area at Madison Buffalo Jump is located above the jump-off and extends in all directions except for west (the jump); this area spanned an area of many square miles, especially to the east and southeast (Malouf and Conner 1962). In addition to this area, the bison probably also lived in the Madison River breaks in the bottomlands and over the Madison River valley. Many archaeologists believe that corralling the bison into the

grazing/gathering area is the single most important aspect of the utilization of buffalo jumps, and this is especially true for Madison Buffalo Jump. According to Dr. Dee Taylor (1971), “The most difficult part of the drive operation must have involved a careful movement of the bison herd west along the plains until the animals had passed over the valley rim and down onto the drive plateau.” Until reaching this point, depending on the drive line construction and use, the bison could have run off in almost any direction and escaped.

Drive Lines/Lanes

”In many bison jumps the most obvious drive lanes are formed by small rock cairns arranged in V-shaped lines which converge at the cliff’s edge” (Taylor 1971). The rock lines at Madison Buffalo Jump follow this composition. Prior research and surveys conducted at Madison Buffalo Jump identified three rock lines; two of the lines are located on top of the jump, and were used to funnel the bison towards the jump precipice, or nick point/jump-off. Dr. Carling Malouf (1962) identified nine small cairns in the area on top of the jump (Rock Line 3). This drive line is aligned parallel to the north rim of the promontory on which the jump is located. The cairns consisted of anywhere from 2-4 visible stones and were placed approximately 10 feet apart from each other along a general east-to-west direction. Taylor (1971) postulated that these cairns were probably used to support vertical poles from which held bits of fur or hide, or fluttered feathers.

A reconnaissance conducted by the Fish and Game Department (Taylor 1971) initially identified segments of the other two additional drive lines. One drive line (Rock Line 2) consisted of cairns that were 6-9 inches high and extended for over one-quarter of a mile east of the jump; the cairns were situated anywhere from 6-20 feet apart. This drive line begins the peninsula-shaped drive plateau/gathering basin. Another shorter row of rock cairns were identified even further east, located at the edge of the canyon lip; however, the land east of Rock Line 2 is now farmland.

The Jump-Off

The cliff upon which the jump-off is located was formed by the weathering edge of the thick formation of soft, chalk colored limestone (Photograph 8). On top of this formation, the land dips towards the east and forming the surface of the gathering/grazing area (Taylor 1971). A vertical drop forms the initial jump-off, though the actual distance of vertical drop has been debated. Malouf believed the vertical drop to be 30 feet, while Taylor estimated the drop to be 35-40 feet, and H.P. Lewis claimed it to be 75 feet; in actuality, the vertical drop is approximately 25-40 feet in the main jump area (USDA). Following the initial vertical drop, is a

steep, rocky slope that continues for approximately another 150 feet before finally tapering off with a slight slope for another 200 feet leading down into a dry stream bed (Malouf and Conner 1962). If the initial drop did not kill the bison, then the steep rocky slope almost surely would; and if not, the animals would be severely injured.

Photograph 8. Buffalo Jump Drop-off and Steep Slope. View Northeast.

Primary Bone Deposit

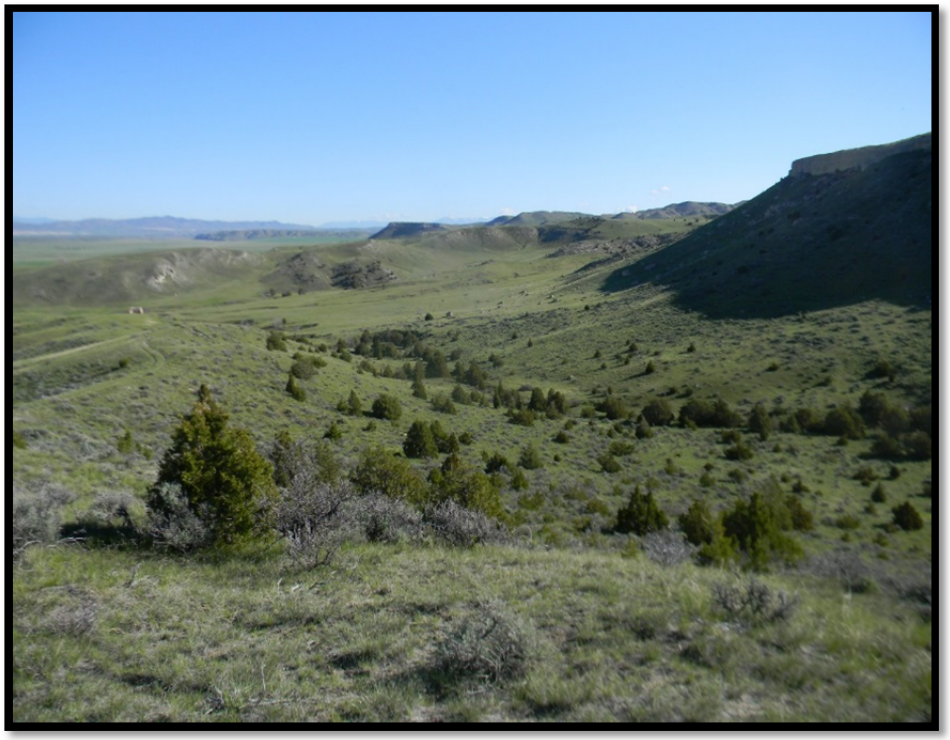
Prior research identified very few bones or bone fragments directly at the base of the cliff/jump-off; this was to be expected due to the steep slope. More and more bone fragments were discovered throughout the steep slope, with the largest deposits recorded at the base of the steep inclined slope; indicating that at least the majority of the bison had continued to roll down the slope after the initial impact from the vertical drop. The injured bison were killed, if necessary, where fallen, most likely by the use of stone axes and heavy cleavers; some of the bison were skinned, their leg bones disarticulated, and select portions of the carcass packed and relocated down to the main occupation area for further processing (Taylor 1971).

Occupation/Habitation Areas

There are two areas of occupation present at Madison Buffalo Jump: one area is located on what has been identified as the North Ridge, and the other, the Lower/Primary Occupation and Processing area, existing downslope from the jump. The North Ridge occupation area is

lies north of the jump across the intervening ravine on a sloping promontory; it is approximately one-quarter mile from the kill site. Initial investigation of this area led to the identification of "several score" stone circles (Taylor 1971). There are no known excavation reports regarding subsurface materials in this area, and Taylor also mentions that bone does not appear to be as abundant in this area compared to the Lower Occupation/Processing area.

The Lower Occupation and Central Processing area (Photograph 9) is located approximately 1,000 feet west and downslope of the jump itself. There is a gully/creek bed that cuts through the center of this area, running roughly in a northwest direction; stone circles are situated on both sides of this stream bed, though most are found on the southern side. Malouf (1962) identified these stone circles as being single-course stone circles. Intermixed among the stone circles in this area were many different kinds of artifacts, such as: stone projectile points, chips, flaking debris, domestic tools, and bone fragments. Additionally occasional simple potsherds were discovered, which attests to the recentness of occupation at Madison Buffalo Jump (due to the Late Prehistoric use of ceramics in the region); as does the appearance of side-notched projectile points found beneath stone circles in the Lower Occupation/Processing area, a type of projectile point used by almost all of the tribes in the northwest Plains during the Late Prehistoric Period (1,500-300 BP) (Taylor 1971). A few "lense type" fire hearths were identified in this area as well (Davis and Brownell 2014).



Photograph 9. Lower Processing Area in Between the Interpretive Center and the Buffalo Jump. View North.

Previous Archaeological Work at Madison Buffalo Jump

For almost a century the Madison Buffalo Jump has been an area of immense popularity for both collectors and archaeologists alike. Unfortunately, due to the former, many important archaeological artifacts were recovered without any form of documentation, contextual or geographical, and taken to be part of personal collections. Of the primary bone deposit area, Lew Napton proclaimed "Most of the deposit is a chaos of pits and trenches dug by relic hunters (Taylor 1971)." Taylor then goes on to inform that very few of those artifacts that were collected as a result of these activities are available for study. Due to this fact our "known" history of Madison Buffalo Jump is certainly incomplete and more than likely skewed or less than absolutely accurate, since it has been obtained through secondary resources. Napton upholds this feeling with his statement, "One is left with the observation that probably there was more excavation done at the site which is unknown and not described than there is that we know about" (Taylor 1971). A troubling fact after learning of the excavations that *are* known to have taken place…and their usually less than stellar documentation regarding excavation details.

Charles A. Kinsey

The first known excavations to take place were conducted by an amateur collector named Charles A. Kinsey, and extended over a number of years during the 1930's. Around 1935, Kinsey dug a pit into the primary bone deposit on the slope, from which he claimed to have recovered a large variety of points (Malouf and Conner 1962). Malouf claimed that some of these points could be typologically dated to Early Forager times, as far back as 4,000 years ago (2,000 BP). Regarding an interview with Kinsey, Lew Napton wrote,

> "Judging from Kinsey's photographs, his major excavation was more than 30 square feet. Kinsey informed the author that he found two distinct bone layers: an 'upper' layer 2 feet thick, and a 'lower' layer some 3-5 feet thick. Each layer contained side-notched projectile points. Kinsey also discovered a 'bottom layer,' as he called it, which contained fragments of projectile points larger than those found in the overlying layers" (Taylor 1971).

Two samples were drawn from obsidian projectile points of the Kinsey collection and sent to be analyzed via X-Ray Fluorescence (XRF) in order to determine source affinity and geochemistry; results determines the obsidian was procured from Obsidian Cliff Plateau in Yellowstone National Park (Davis and Brownell 2014); obsidian artifacts were also dated using the Obsidian Hydration method, the results of which indicate a Late Prehistoric age (to be discussed later). In addition to projectile points, the Kinsey collection contains cutting, scraping, piercing, and butchering tools (Davis and Brownell 2014).

Roy Austin

The exact date of excavation is unknown although Austin "seemed quite familiar with the site in 1939 when apparently he directed a crew from the Carnegie Institute to it" (Taylor 1971; on Lewis's notes from 1947). Among artifacts discovered by Austin and his crew were "Yuma-like" specimens, recovered from a depth of 6.5-7.5 feet beneath the surface (Napton 1966). These slender chipped stone "Yuma-like" projectile points measured to be about an inch, or slightly longer, in length, possessed a general triangular shape, and were notch-less (Taylor 1971); Austin and his Carnegie crew similarly compared these projectile points, and their depths, to artifacts identified at Whitehall Cave in 1939.

H.P Lewis and F.F. Sparks

During the summer of 1940 H.P. Lewis and F.F. Sparks excavated a six foot deep pit in the "central portion of the kill," the primary bone deposit, and recovered two of the Yuma-like points from the deepest bone layer (Taylor 1971). Lewis described their best example of this type of point, which was made from petrified wood and found at a depth of approximately five feet beneath the surface, as being an inch long and not more than one-quarter inch wide at the base; the point was blunt and it contained no notches. Lewis and Sparks also discovered two more "Yuma-like" points on the surface in one of the ravines. In addition to the "Yuma-like" projectile points found, Lewis and Sparks collected several "ordinary," triangular, side-notched points as well as scrapers and blades; they were also the first to note the presence of buried hearths in the gully walls, though there are no drawings or photographs of the hearths (Taylor 1971).

Lew Napton

Dr. Lew Napton was the first to "make a career" out of investigating the Madison Buffalo Jump, conducting research or reporting on the site for over 20 years. Napton's first experience at Madison Buffalo Jump, in 1944, involved recording his observations on the stone circles and drive lines located on the drive plateau, on top of the jump (Taylor 1971); in addition to discovering that the midden (primary bone) deposit extended for 200 meters downslope from below the jump-off, noting that this area had already been heavily looted (Davis and Brownell 2014). In 1949, Napton mapped a portion of the stone circles in the lower/occupation/processing area, located west of the jump and primary bone deposit; during this time he also extended a trench across his "Ring One," which he described as being made from double-course construction, approximately 12 feet in diameter, and partly overlapped by another similar stone

circle (Taylor 1971). This trench was 5 feet wide by 15 feet long but not even 1 foot deep, because he only found one “basically diamond-shaped” projectile point; Napton did note an abundance of petrified wood and splintered bone.

In both 1950 and 1957, Napton again conducted survey, mapping, and testing at Madison Buffalo Jump, though only one map has ever been seen regarding these investigations and it is unknown what, if anything, was recovered from the test trenches. During the summer of 1958 Napton excavated what is known as “Test Pit I,” supervised by Dr. Carling Malouf. Within the pit Napton interpreted a series of distinct strata layers comprised of bison bone, each approximately 1-1.5 feet thick (Davis and Brownell 2014); Napton’s thoughts on the area was that uncontrolled digging had ruined most of the bone deposits at Madison Buffalo Jump. During this field session Napton also discovered two hearths that were eroding out of the gully bank in the lower occupation and processing area. One hearth lied 1 foot below the surface and the other was at 1.5 feet, while both hearths contained some flaking debris and burned bone but lacked any significant artifacts (Taylor 1971). Lastly, at some point Napton dug another pit into the primary bone deposit and recovered 6 projectile points; the date for this excavation is unknown, and Napton did not report the stratigraphy of the trench nor did he describe the points that he collected. (Taylor 1971).

Carling Malouf

In 1958 Dr. Malouf took members of a Montana State University (today’s University of Montana) archaeology class to Madison Buffalo Jump and excavated a total of 10 sampling trenches (Malouf and Conner 1962). Two trenches, known as pits “B” and “I” (the trench Napton excavated), were dug into the primary bone deposit area. Both of these trenches contained three well-defined layers of bone deposits, with each being divided by an intervening layer of sterile soil; flaking debris was also found in each bone layer. The bones in the top layer were in the best condition, with some bones still partially articulated and some vertebrae still properly aligned; a core basalt knife was recovered at a depth of 12 inches. A sterile layer of soil existed from 20-29 inches below the surface. The next bone layer was between 30-36 inches; the bones in this layer were in a more advanced state of decomposition than those in the earlier layer, also present was a thin black line of organic material, indicating that something had been burned. Between 37-42 inches was another sterile layer. From 45-50 inches more bones appeared, these bones were in an even more fragile state of decomposition; at 50 inches below the surface was another thin line of organic debris and burned bones.

None of the bones in the lowest layers were found to be articulated suggesting waste of the articulated skeletal elements in the higher levels and indicating that an economic surplus probably characterized the economy of Madison Buffalo Jump for later occupants (Malouf and Conner 1962). Another interesting note of the bones in this area was the apparent lack of head bones; this could be due to the fragile nature of head bones, or it could indicate that the head bones were deliberately broken in order to obtain the brains which played an important role in the process of tanning hides (Taylor 1971). Malouf (1962) reported that the projectile points recovered from Pits "B" and "I" were comprised of three shapes: un-notched triangular points, corner-notched points, and side-notched points. Excavation details were not given for the other eight trenches, which were placed along the terraces of the lower occupation and processing area.

In addition to the trenches dug in 1958, Malouf (1962) was the first to document the presence of "several score" stone circles that were located on a hilltop approximately one-half mile north of the jump (now referred to as the North Ridge), in association with a plethora of flaking debris, mostly of petrified wood. Also identified on this North Ridge area were two "unusually large rock piles," which Malouf postulated to be old forts or eagle-catching pits; however he tells that these rock features had already been looted, and stated that it is impossible to truly know. What is described as a crude mano, along with a potential second type of mano, were also discovered by Malouf on the North Ridge in an area of stone circles. Malouf did not find any metates to match with the mano(s); however, through ethnology of the region it is known that special stationary stones were not prepared to accompany the grinding hand-stones (Malouf and Conner 1962). There also remains the potential that these could have been utilized for hide working (Adams 1988).

Drs. Malouf and Conner are responsible for procuring one of the three known assemblages from Madison Buffalo Jump that display the wide array of artifacts present at the state park; this assemblage consists of points, scrapers, knives, chips, and flakes. This collection is now housed in the McGill Museum at the Montana State College – now the Museum of the Rockies - (Malouf and Conner 1962).

Dee Taylor

As a practice, archaeologists divide artifacts into classes, which are broad categories that are based off of one or more shared attributes. Additionally, the artifacts in a class can be subdivided into types, which is a grouping of artifacts possessing two or more similar attributes (form, size, function, etc.) (Dunnel 1986). In 1968 Dr. Taylor conducted excavations at Madison

Buffalo Jump and, as a result, produced one of the three known artifacts assemblages from Madison Buffalo Jump, along with the assemblages of Kinsey and Malouf/Conner. Taylor divided the artifacts from his assemblage into three classes: artifacts made from chipped stone, abraded or ground stone, and ceramics.

Class: Chipped Stone

The chipped stone artifacts Taylor (1971) collected from Madison Buffalo Jump were comprised of fine-grained basalt, chalcedony, chert, obsidian, petrified wood, and quartzite. Taylor was able to divide the chipped stone artifacts from Madison Buffalo Jump into four types: projectile points, blades, scrapers, and drills/perforators.

Type 1: Projectile Points

Taylor subdivided the projectile points recovered from Madison Buffalo Jump into four sub-types. Sub-type 1 consisted of triangular shaped, side-notched projectile points possessing either straight or slightly concave bases. For projectile points in this sub-type, the maximum width lies across the base; edges of the blades were either straight or slightly excurved, and showed evidence of fine pressure flaking and retouch.

Projectile points grouped into sub-type 2 are triangular shaped with corner notches. These points had straight or slightly excurved blades, and basal indentation; they were prepared on thin flakes, with evidence of delicate pressure flaking on the blade edges. Neither of the two points in this sub-type have symmetrically placed notches.

Sub-type three consists of projectile points with an asymmetrical vaguely triangular shape with a rounded base and shallow, open side notches. There was only one point in this sub-type and Taylor presumed that is was originally meant to be made into a point such as those from sub-type 1, but didn't quite get there.

Un-notched projectile points comprise Taylor's sub-type 4. The projectile points in this sub-type were further reduced into four types. Sub-type 4a projectile points (4 specimens) have a triangular shape and indented base; their blades are straight or slightly excurved, with the maximum width being at the base. 6 specimens make up sub-type 4b and are triangular shaped with straight or slightly excurved blade edges and straight bases; the maximum width for these points is at the base. Sub-type 4c consists of 11 specimens with a triangular shape, straight or slightly excurved blades, and round bases. Lastly, sub-type 4d is comprised of 3 specimens possessing shouldered points and straight or slightly indented bases. Only one of these specimens was complete; with straight blades that form a sharp shoulder with the tapering base.

Type 2: Blades

Blades are general utility tools that are used for cutting and occasionally scraping, and were generally made on thicker flakes than projectile points (Taylor 1971). Blade edges, like some projectile points, can be and usually are retouched by pressure flaking, allowing for repeated re-sharpening. The blades collected by Taylor were divided into two sub-types. 7 blades were placed into sub-type 1; these blades are relatively thin with straight or slightly curving edges and either straight or rounded bases. Sub-type 2 consists of 6 thick blades that are irregularly shaped, but generally ovate in form. These blades were percussion shaped with pressure flaking on one or both edges. Taylor (1971) presumed that the blades in this sub-type were help in the hand and used for heavier cutting and chopping.

Type 3: Scrapers

Scrapers are tools used to scrape and thin animal hides (Schultz 1992); however, they may have also been used for bone and wood working (Boszhardt and McCarthy 1999). Taylor (1971) was able to divide the scrapers recovered from Madison Buffalo Jump into two sub-types: plano-convex scrapers, and side scrapers. Plano-convex scrapers possess a flat, sharp-edged bottom that was rubbed over the skin; 9 of the 14 scrapers identified were plano-convex in form. The remaining 5 scrapers were considered side scrapers. Side scrapers are usually large enough to hold in the hand instead of being hafted; however, the Madison Buffalo Jump collection is unusual seeing as 4 of the 5 scrapers in this sub-type are very small (Taylor 1971).

Type 4: Drills/Perforators

Of the artifacts Taylor collected from Madison Buffalo Jump, 9 specimens fall into this type. These tools generally possess a long, nearly cylindrical pointed shaft and a flared or expanded base (Taylor 1971); and were used for drilling holes in stone or to perforate animal hides (Patterson and Ebersole 1992).

Taylor's collection contained 18 additional artifact fragments that were too incomplete to accurately classify.

Class: Abraded or Ground Stone

Artifacts placed in this class are constructed from stone that is not easily chipped, and instead are shaped and modified by combinations of flaking, pecking, grinding, pounding, grinding, drilling, and/or incising (Wright 1992). Taylor's collection from Madison Buffalo Jump contained two ground stone artifacts: a pipe, and a single stone bead.

Taylor (1971) believes that the pipe was intended to be a smoking pipe, but since the bottom part of the bowl is missing there is no way to know definitively. According to Taylor the pipe was never used, and appeared to be broken during the drilling of the bowl; he describes

the external surface of the pipe as smoothed, with a marked ring around the bowl just below the lip.

The stone bead is flat and disc-shaped with a highly polished surface and edges, leading Taylor (1971) to believe that it was probably part of an ornamental string; it is broken, though the breakage probably occurred post-manufacture.

Class: Ceramics

In contrast to most of the artifacts recovered from Madison Buffalo Jump, ceramics are highly diagnostic for reconstructing history and determining cultural identity (Taylor 1971). During the initial excavation, Taylor (1971) thought they recovered six ceramic sherds, though the University of Montana's geologist informed otherwise; in fact, only one was an actual potsherd. This sherd was identified within a trench placed between stone circles in the lower occupation/processing area, at six inches below the surface, and was part of a rim.

The lip of the sherd was rounded with a body that had a slightly out-curved body below the rim. The exterior surface was smooth with a few visible striations, while the interior surface was rough and pitted. Temper used in the sherd is a course, gravelly black sand or obsidian or basalt (largest visible particle in 5mm in diameter), and the paste used was dark grey/black.

In 1960, members of the Montana Archaeological Society found 4 ceramic fragments near what was Dr. Malouf's Pit "D" (Napton 1966). None of these ceramic sherds were diagnostic, though in private conversations, Dr. Malouf consistently referred to the sherds as "Shoshone" (Taylor 1971); a diagnosis that Taylor agreed with.

CHAPTER 3. Archaeological Survey Results

This chapter discusses the methods and results of survey of the 640-acre state park by the University of Montana during the final two weeks of May, 2014; UM conducted an archaeological survey and inventory of the Madison Buffalo Jump State Park for Montana State Parks. The ultimate goal of this inventory was the identification and mapping of the surficial archaeological artifacts and features in the park in order to facilitate their cultural resource management.

Archaeological Survey Methods

From 17 May through 1 June 2014, UM conducted the survey, inventory, and mapping of the 640-acre Madison Buffalo Jump State Park, a need presented by Scott (2012), to see what artifacts, if any, would be adversely affected if the land were to be used for cattle grazing. Survey was completed by using a combination of transect and landform survey. In areas of steep slopes and low-to-moderate archaeological potential, UM conducted pedestrian survey along landforms conducive for the preservation and protection of archaeological sites; this included survey of ridge tops and examining cliff faces for rock shelters and rock art. In areas yielding high archaeological potential that were also relatively flat and open, UM conducted survey in controlled transects that were spaced 2-4 meters apart.

UM examined the entirety of Madison Buffalo Jump for archaeological sites. The surface and landscape was investigated extremely carefully by walking slowly and stopping to assess in greater detail at any sign of cultural activity or area of high potential. As artifacts and features were identified, the survey team conducted close interval survey around the initial discovery spot, working outwards to identify more exact boundaries of artifact distribution. Once acceptable boundaries are established and each artifact is marked with flagging, the team delegates the documentation process.

Photographs were taken throughout the survey process in order to document the site setting, as well as for all artifacts and features encountered. GPS coordinates were logged at all artifact locations, features and distinguishable landmarks. Sketch maps were made using measuring tapes, compass and graph paper, and later digitized with GPS coordinates using Adobe Illustrator software. Generating digital maps and report preparations took place at the University of Montana between July 2014 and May 2016 by the primary author of this report.

Surface Survey Results

Surface survey of the Madison Buffalo Jump State Park yielded a multitude of archaeological findings. This section provides the details of these locations and their recommendations, as well as presents photos, maps and GPS data for each location. For the purposes of this report, the results have been divided into four separate sections: 1) buffalo jump features; 2) stone circles; 3) stone tool manufacture areas; and 4) inscriptions.

Buffalo Jump Features

Most of the Madison Buffalo Jump archaeological features have been previously identified and documented by Malouf (1962), Taylor (1971), Davis and Brownell (2014), among others, as described above. As presented by these authors, any bison jump is comprised of five working factors: the grazing/gathering area, drive lines/drive lane, the jump off/nick point, primary butchering/bone deposit area, and occupation/processing areas. Past work at Madison Buffalo Jump has yielded excellent information surrounding the lower occupation/processing area (Taylor 1971), but little information has been collected regarding the drive lines and primary bone deposit/butchering areas. In reaction to this, the results presented in this section will exclusively cover the four drive lines, gathering basin/drive lane, and primary bone deposits.

Drive Lines

As reported by Davis and Brownell (2014), past research at Madison Buffalo Jump had identified two central areas of drive lines. One drive line was identified on top of the jump, located along the northern rim of the jump; another drive line had been identified along the southern rim boundary, above the jump and to the east. Unfortunately, these prior recordings at Madison Buffalo Jump failed to provide specific details relating to cairn numbers and locations, quantities and composition of the stones comprising the cairns, or drive line length. In response, this report provides these additional details in regards to the two known drive lines, as well as provide the same information on two "new" drive lines not previously reported (Figure 5). The first being located on a ridge north of the jump, and the other aligned parallel to the existing drive line on the northern rim of the jump. All four drive lines identified by UM are described below.

Drive Line 1

Drive Line 1 is located in the area of Madison Buffalo Jump that UM has referred to as the "North Ridge." The North Ridge is an upland flat located approximately 500 meters north of the jump that contains 38 stone circles and two rock features (each of which will be discussed in

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approximate location of this drive line; however, they do not provide specific details such as the drive lines exact location, number of cairns associated with the line, or the distance than the drive line spans. In response, UM made it a point to remedy these shortcomings.

UM first encountered Drive Line 2 when a crew member identified one of the drive line's cairns while conducting standard pedestrian survey of the far eastern slopes of the park boundaries (Photograph 11). Following the initial identification of the stone cairn, comprised of small to medium sized visible cobbles, UM meticulously inspected the immediate area around the cairn. Ultimately, this intensive examination yielded the identification of an additional 58 cairns. While only a few of the cairns for Drive Line 2 contain single large cobbles, the majority of them vary in quantity, containing anywhere from 2-11 small to medium sized cobbles (Photograph 12). The functional need for cairns consisting of several rounded cobbles largely supports the interpretive vision that the cairns were likely used to support a post for the drive line. The cairns of Drive Line 2 are all (primarily) comprised of the local, readily available orthoquartzite cobbles existing in the Madison Plateau surface gravels abundantly present in this area of Madison Buffalo Jump.

Photograph 11. Cairn from Drive Line 2 at Madison Buffalo Jump.

The 59 cairns that comprise Drive Line 2 (Table **3**) extend from the far eastern boundaries of Madison Buffalo Jump (at a farm field) for approximately 369 meters, or one-quarter mile, in a general east-west direction, essentially to the rim of the buffalo jump. Cairns were generally placed anywhere from 4-8 meters away from each other, though occasionally

there would be a gap of 25-40 meters between cairns. Drive Line 2 acted as a marker for the southern boundary of the gathering basin/drive lane, and as a physical boundary for the bison entering the gathering basin/drive lane from the east through the open meadows (meadows that are now farmland). Located approximately one-quarter mile to the north is a natural ridgeline that is believed to have served as a natural, northern boundary for the gathering basin/drive lane (Figure 5). Drive Lines 3 and 4 appear to be a final extension of the drive lane, funneling the bison from the top of the jump toward the nick point and over the jump.

Of the four drive lines that UM identified at Madison Buffalo Jump, Drive Line 2 was, by a large margin, the most substantial both in length and importance. The drive line served as a boundary to keep the bison within the gathering basin/drive lane and move them toward the jump. This was made possible thanks to the substantive composition of the many well-built cairns. The construction and maintenance of this substantial drive line was due to the lack of any acceptable natural boundaries to serve as a southern boundary for the gathering basin/drive lane, such as the ridgeline used for the northern boundary. Without a drive line situated in this location it is very likely that many of the bison would have wandered off and avoided the push through the drive lane by escaping to the south.

Photograph 12. UM Crew Member Marking Cairns from Drive Line 2.

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Photograph 14. Flagged Cairns for Drive Lines 3 (left) and 4 (right) on Top of the Madison Buffalo Jump. View West.

Gathering Basin/Drive Lane

As presented as the blue shaded area in Figure 5, the Gathering Basin, otherwise known as the Drive Lane, covers the area between Drive Line 2 to the natural ridgeline located approximately one quarter mile north of Drive Line 2, and expands east from Drive Lines 3 and 4 to the eastern boundary of Madison Buffalo Jump; an area that encompasses approximately 145,000 square meters, or 36.5-acres (the darker shaded area in Figure 6); in the past the Drive Lane would have extended further east into the area now used as farmland (partially shown as the lighter blue shaded region in Figure 6). At Madison Buffalo Jump this space is widest on its eastern edges, stretching north of Drive Line 2, up one-quarter mile to the natural ridgeline/northern boundary (Photograph 15; Photograph 16); this area gradually narrows as it progresses west, forming a funnel into Drive Lines 3 and 4, ultimately leading to the jump precipice. However, unlike most other buffalo jump gathering basins/drive lanes, which are spacious and flat, Madison Buffalo Jump's gathering basin consists of extremely undulating terrain (Berry 1943).

In the case of most buffalo jumps, bison herds were rushed into the gathering basin, through the drive lines, and pushed further through the drive lane and over the jump precipice in one go (Taylor 1971). If this drive process were utilized at Madison Buffalo Jump, due to the harsh terrain of its gathering basin, the bison likely would not have made it to the jump, but instead would have been driven through one of the several steeply-incised drainages that lead away from the jump. It is for this reason that it is much more

likely that one of two other drive processes took place at Madison Buffalo Jump. Once herded into the gathering basin the bison herd, in its entirety, would have likely been slowly ushered through the steep drainages and into the more open meadow on top of the jump that exists just before the precipice, from which the bison could then be driven off in one final push.

Photograph 15. South Boundary of Gathering Basin/Drive Lane (Drive Line 2). View Northwest.

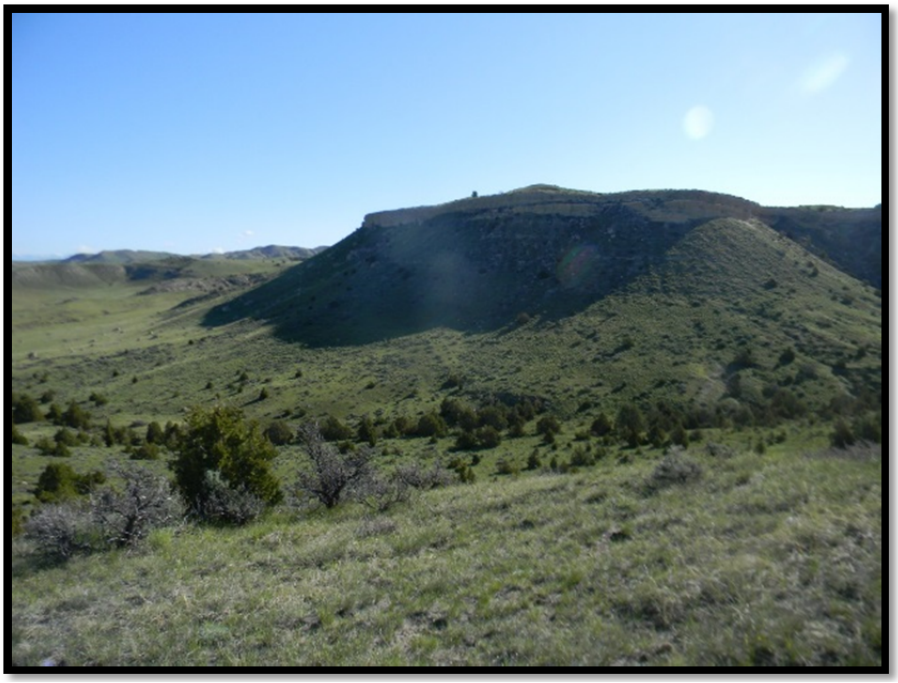
Regardless of which method was actually incorporated by the Native Americans occupying Madison Buffalo Jump, it is apparent that the drive process was a very complex one requiring an extremely high level of coordination which consisted of multiple, smaller staging events prior to the ultimate kill event. In either case, once the bison herd was coerced into the gathering basin/drive lane, Native Americans, due to the complex drive process, potentially could have retained the bison there for several days leading up to the kill event.

Photograph 16. View North from the Southern Boundary of the Gathering Basin Looking at the Natural Northern Boundary Ridgeline.

Although the gathering basin/drive lane is arguably one of the most important aspects of a successful buffalo jump, since it is the area where the bison are gathered together before the process begins, there is generally little visible archaeological evidence which exists in these areas (Wirth 1964). At Madison Buffalo Jump, the only archaeological evidence present was an occasional, dense lithic scatter and the cairns comprising Rock Line 2. However, just south of the gathering basin, and Drive Line 2, exists a possible prehistoric quarry (discussed below) consisting of thousands of flakes – this would have allowed for the production of stone tools while simultaneously offering an excellent vantage point from which to keep an eye on the bison, while still keeping a safe distance.

Primary Bone Deposits

As it is shown in Figure 6, the area shaded yellow is the approximate location of the primary bone deposits of the Madison Buffalo Jump. This area encompasses the land along essentially the entire face of the jump (Photograph 17). This high-density area of bone fragments surrounds the state park trail that begins at the base of the actual jump location/precipice and increases in concentration as the trail winds down the steep slope toward the lower occupation and processing area, or Stone Circle Area 4 (to be discussed later), though there is a lack of bone in the center of the slope where many prior excavations have taken place. Several other previous researchers of the Madison Buffalo Jump (Malouf and Conner 1962; Taylor 1971; Davis and Brownell 2014) have identified the primary bone deposit as being in this same area. Table 6 shows GPS location data for all surficial bone deposits.



Photograph 17. View Looking Northeast at the Madison Buffalo Jump. The Shaded Area Represents a Large Portion of the Primary Bone Deposits.

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Photograph 18. Variety of Bone Fragments Identified within the Primary Bone Deposit Area that is Located beneath the Jump Precipice.

During the recording process, UM focused extra attention on attempting to discern specifically what kind of bone the fragments encountered belonged to, than in documenting their sizes. However, this was not a simple task due to the fragile nature of the bones; of the 246 total bones recorded, 243 were determined to be bison bone fragments, though the kind of bone was not discernable, and two were unidentified mammal bones. A large variety of bone types does exist among the 20 individual bones and bone fragments that were identifiable, which included: one small rodent skull (found in one of the drainages in the gathering basin); five fragments of bison enamel; four bison tooth fragments; one bison vertebrae; four bison long bones; two bison rib fragments; one bison carpal; and one Barstovian era fossil (as previously discussed), along with two of the unidentified bison bones which were noted as being possibly fossilized. Additionally, two bison bone fragments (FS - 10 and 11) were recovered from a blowout in the trail west of the primary bone deposit, one of which was a larger shoulder fragment that was submitted for radiocarbon dating (to be discussed in greater detail in a later section).

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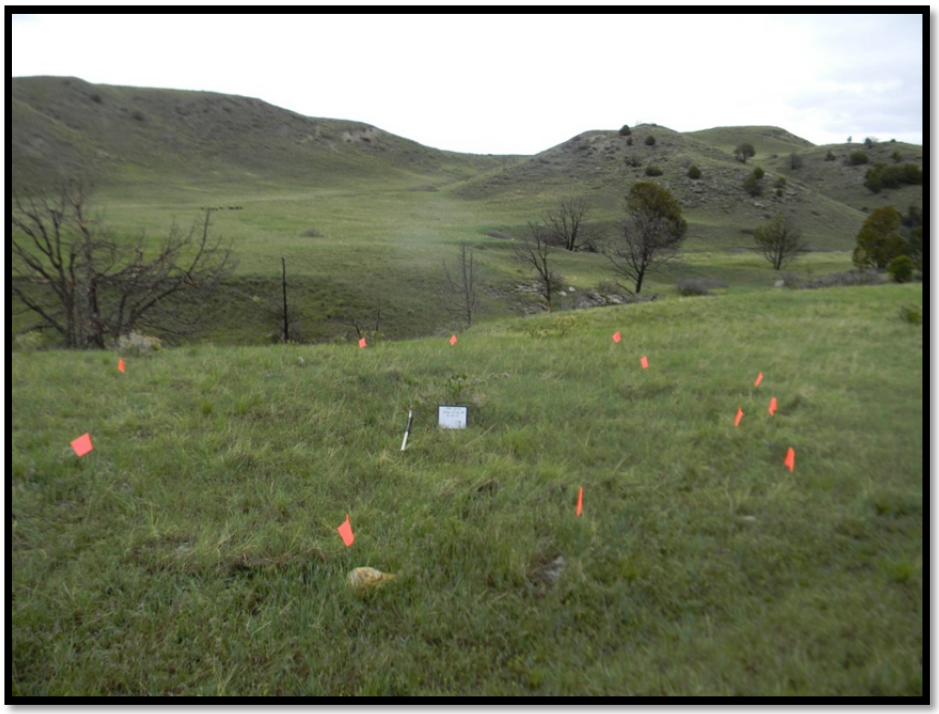

Photograph 19. Stone Circle 1 at Madison Buffalo Jump.

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Stone Circle Area 2

Located in the north ridge portion of the project area is stone circle area 2 (Table 8), upslope and to the northeast of Stone Circle 1. Many of the previous researchers of Madison Buffalo Jump have identified the presence of stone circles in the area, though none documented them in detail. For this reason, UM surveyed the entire north ridge area, identifying a total of 38 stone circles (Stone Circles 2-39) (Photograph 20; Photograph 21; Photograph 22; Figure 9; Figure 10), encompassing an area of 17,510 square meters of this upland flat landform.

The stone circles located in area 2 varied in terms of size with diameters ranging from 3.5 (Stone Circle 8) - 7 meters (Stone Circle 4); though they were remarkably consistent for the most part, with the majority of stone circles measuring ca. 4-5 meters in diameter. The average diameter for stone circles in area 2 measure ca. 4.8 meters, very close to the average of all stone circles documented at Madison Buffalo Jump in 2014. Stone circles in area 2 greatly varied in the number of rocks used to construct each stone circle; ranging from 27 rocks (Stone Circle 10) to 106 rocks (Stone Circle 20), with the average for stone circles lying in area 2 being 55 rocks. When doors are distinguishable, they are generally present somewhere along the east facing edge of the circle (Figure 11); however, a few of the stone circles had either no gaps or too many to be able to discern where the door could have been. The multiple gaps in the rocks might be evidence of recycling by later occupants of the site.

Photograph 20. Stone Circle 16 on the North Ridge, with the Madison Buffalo Jump in the Background. View Southwest.

Photograph 21. Stone Circle 36 on the North Ridge. View West.

Photograph 22. Stone Circle on the North Ridge. View Northwest.

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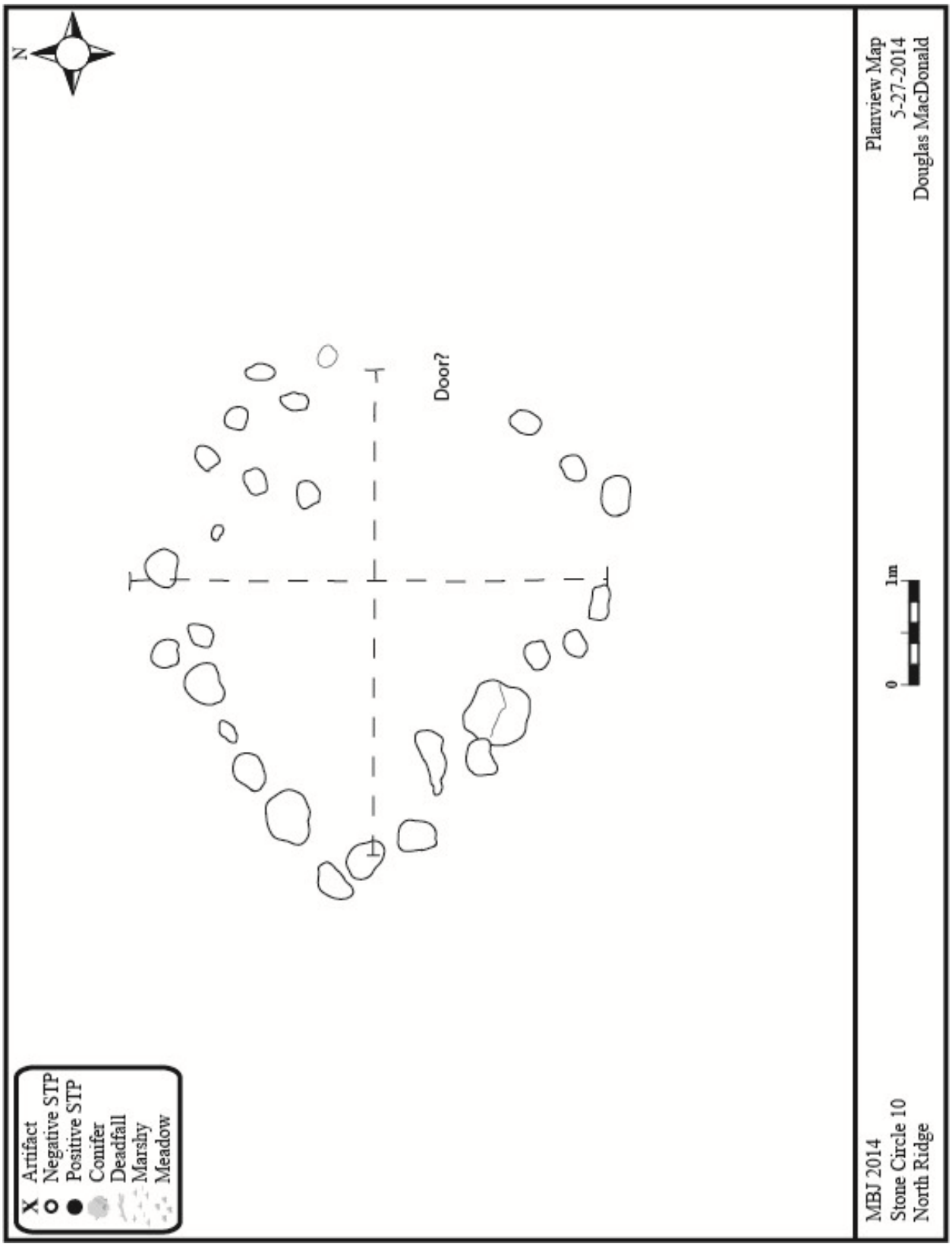

Figure 9. Plan-view Map of Stone Circle 10 Located on the North Ridge.

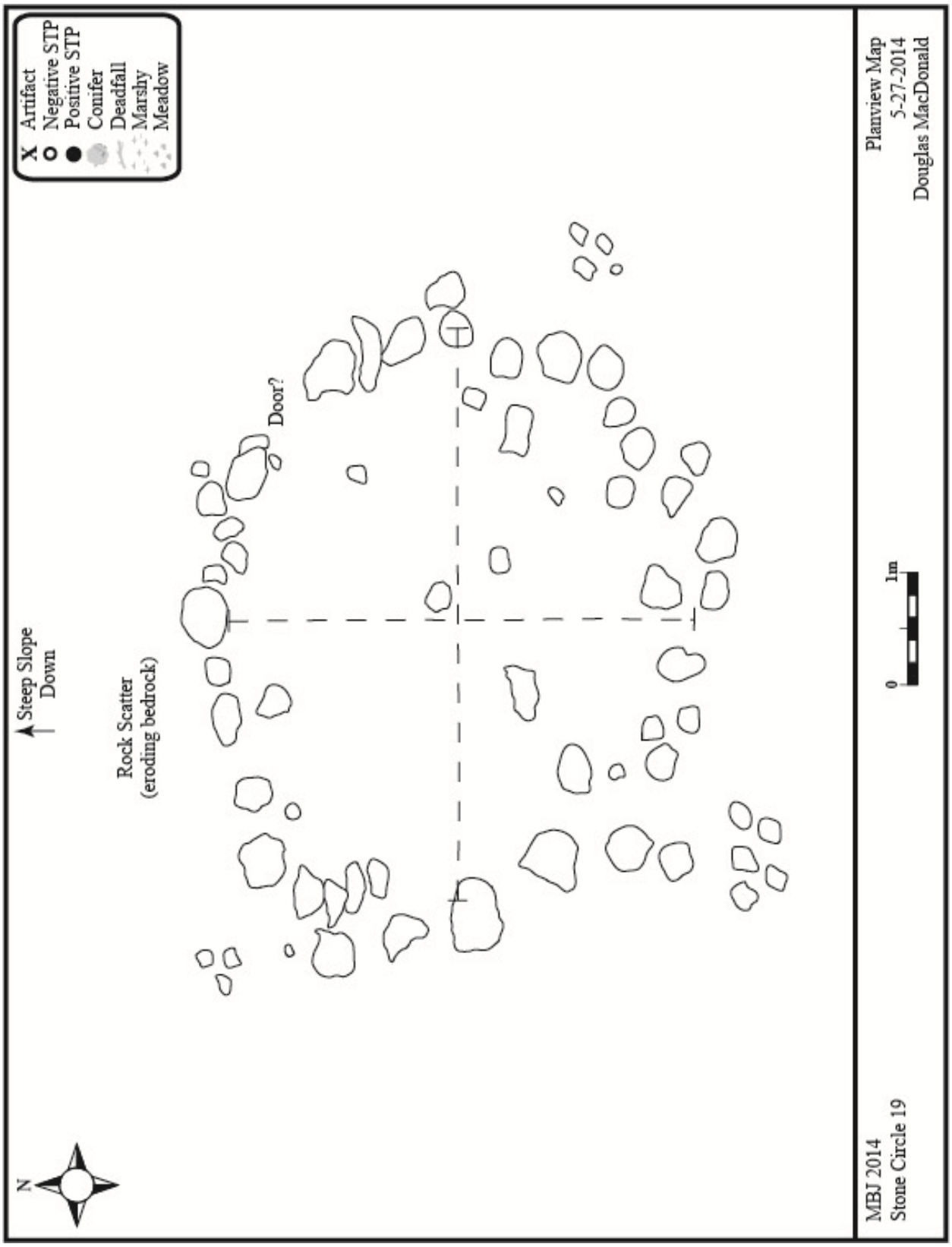

Figure 10. Plan-view Map of Stone Circle 19 Located on the North Ridge.

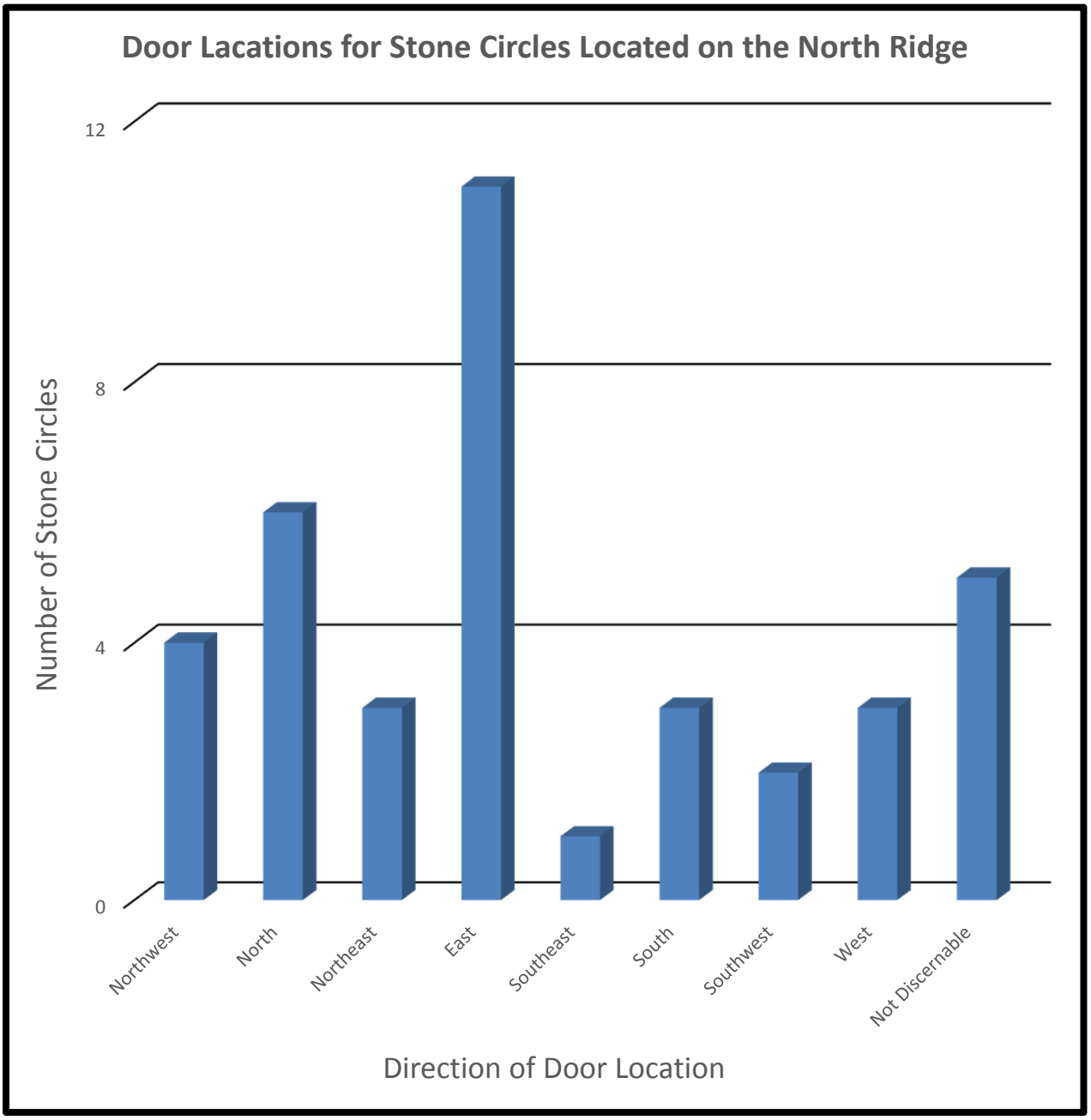

Figure 11. Bar Graph of Door Locations for Stone Circles on the North Ridge.

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Various white chert and petrified wood concentrations are present in association with 10 of the stone circles located within area 2. Stone Circle 33 contained 18 flakes, Stone Circle 23 held six flakes, three flakes were present within Stone Circle 35, and Stone Circle 34 contained two flakes; while Stone Circles 9, 11, 31, and 32 possessed one flake each. Additionally, Stone Circle 7 contained two tan orthoquartzite cobbles and one broken/shattered limestone cobble; one black orthoquartzite cobble lied within Stone Circle 13, though another black orthoquartzite cobble rested approximately three meters east of the stone circle.

Located on the northwest edge of the ridge, approximately 100 meters downslope from the stone circle concentration area is Drive Line 1 (discussed above). Two rock features (Rock Features 1 and 2) are also present in this area (Photograph 23; Photograph 24; Figure 12), with their locations marked on Figure 7. These rock features have been identified by numerous prior researchers, though each has carried their own perspective as to the actual function that was served by these features. Dr. Malouf believed the rock features to be old forts, or perhaps eagle catching pits; while Dr. Taylor made the claim that they were ceremonial structures, with an emphasis towards sweat lodges (Taylor 1971). Another hypothesis, presented by Dr. Lewis, takes the stance that the rock features are the remnants of graves (Taylor 1971). Below, we discuss an alternative explanation, that the features are fasting beds.

Photograph 23. Fasting Bed (Rock Feature 1) in Stone Circle Area 2 with the Madison Buffalo Jump in the Background. View South.

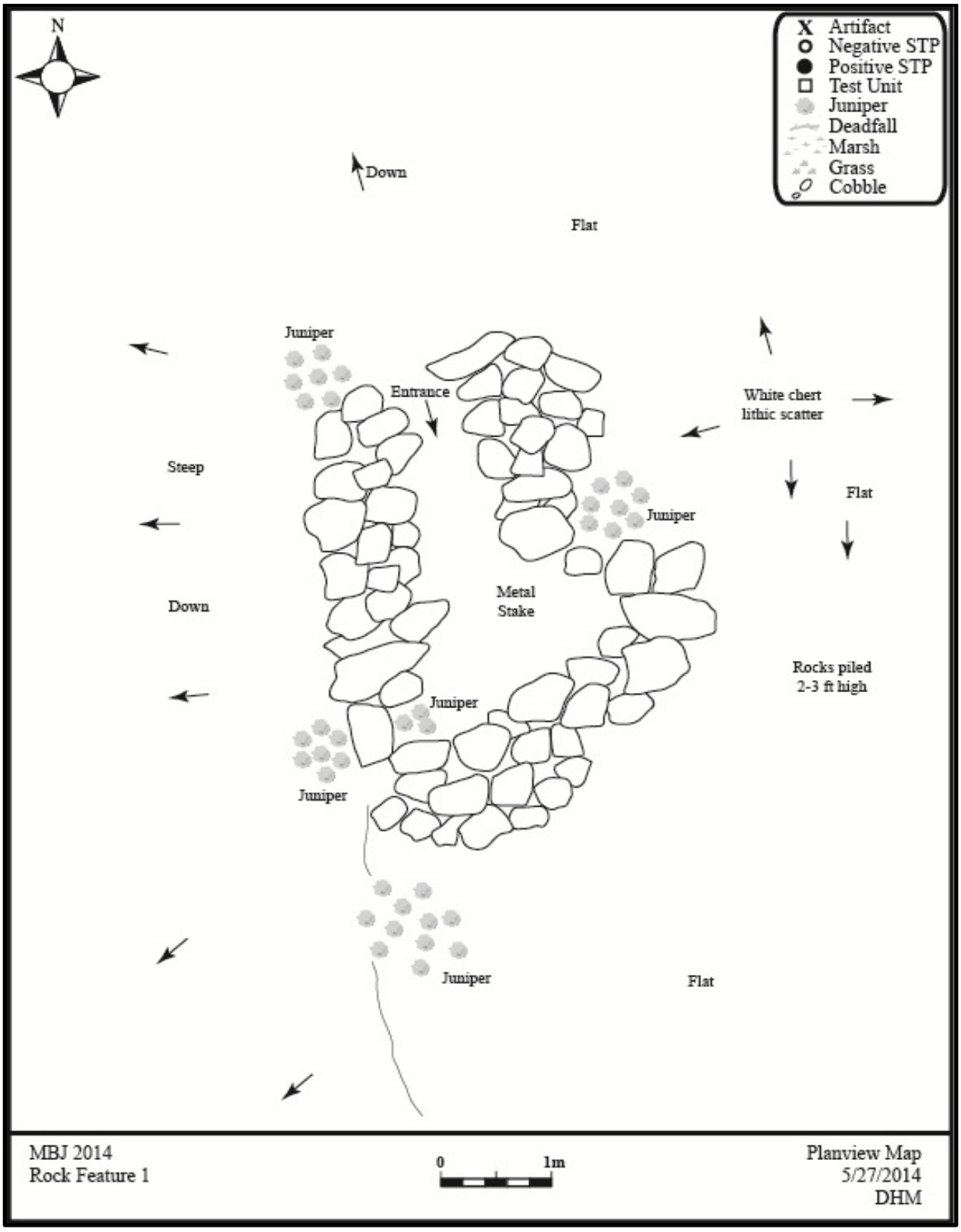

Figure 12. Planview Map of Fasting Bed (Rock Feature 1) Located on North Ridge.

For many regional Native American tribes, spiritual powers are used in all aspects of life, but especially in warfare, hunting and healing. For the Apsaalooke/Crow specifically, one of the tribes known to have cultural ties with the Madison Buffalo Jump area, fasting has been an important cultural practice, for both men and women, throughout their history (Brien 2015). Fasting is a voluntary process that involves going without food or water for a set number of days, usually 3-4, in hopes of encountering a spiritual helper given by the creator; or the ritual is completed to fulfill a vow (Brien 2015).

In fact, according to Brien (2015), much of the Crow landscape is related to fasting (Clouds Peak, Medicine Wheels, Pryor Mountains). Fasts are carried out in special places that have unique geological characteristics such as the summits of mountains, high points in the landscape, or thermal features. Although fasting was practiced by both men and women, the process for each was much different. When men would fast they would go up to a high place, and build a rock bed; women would usually fast at home (Brien 2015). After selecting a suitable location the faster will build a rock structure known as an *Alaxape/bed*; the bed will either be in a U shape, or some cases in an oval shape – it appears like it was the faster's preference. These fasting beds become much like family landmarks; extremely important places in the history of each family.

Many (all) of the fasting beds recorded by Brien are located along the ridgetop/highest points of the Dryhead vista in the East Pryor Mountains of south-central Montana. Given the location of the structures- both in relation to the ridge edge and the stone circles in this area (Figure 8), their sizes (Figure 13), and architectural similarity to the fasting beds discussed by Brien (2015), it seems reasonable that these two rock features at Madison Buffalo Jump might be fasting beds. While we cannot determine cultural affiliation, it is known that both the Crow and Shoshone (Thomason 2010; Jilek 1982) used such structures and could have produced the ones at Madison Buffalo Jump. As discussed above, fasting is an important cultural practice for both groups, in all aspects of life, and thus certainly would have been practiced for such a momentous occasion such as a large scale bison hunt. Additionally, Brien's (2015) findings allowed him to confidently postulate that circle or oval shaped fasting beds are thought/appear to be reservation era (newer) beds; this age determination concurs with Late Prehistoric use of the lower occupation/processing area. Lastly, present around the eastern flank of the most prominent hunting blind (Rock Feature 1) is a thick lithic debitage concentration consisting of white chert and petrified wood; this is also very close to the easternmost stone circles in the area.

Photograph 24. Fasting Bed (Rock Feature 2) in Stone Circle Area 2. View Northwest.

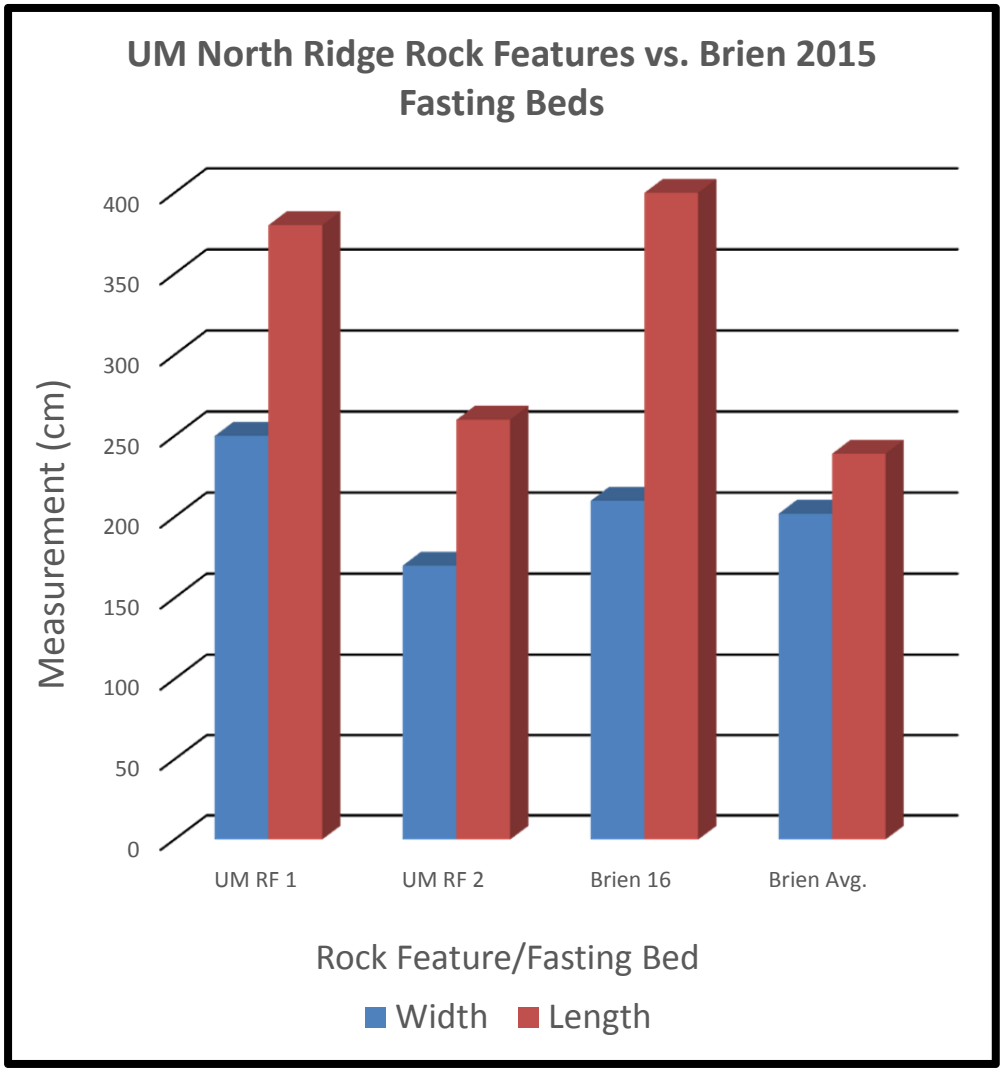

Figure 13. Bar Graph Comparing UM Rock Features 1 and 2 from Stone Circle Area 2/North Ridge to Brien's Fasting Beds (2015).

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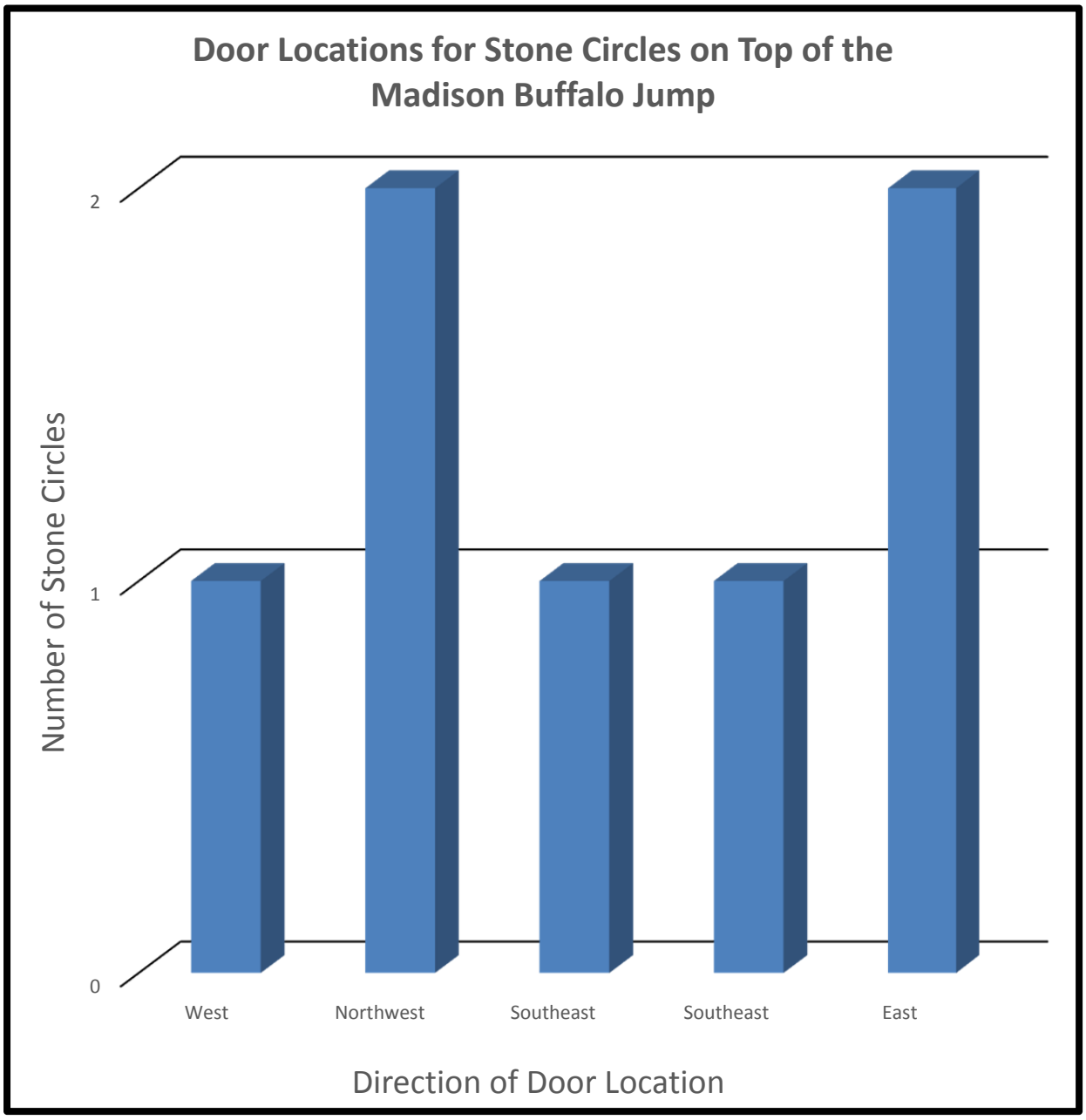


Figure 15. Bar Graph Showing Door Direction Locations for the Stone Circles on Top of the Madison Buffalo Jump/Stone Circle Area 3.

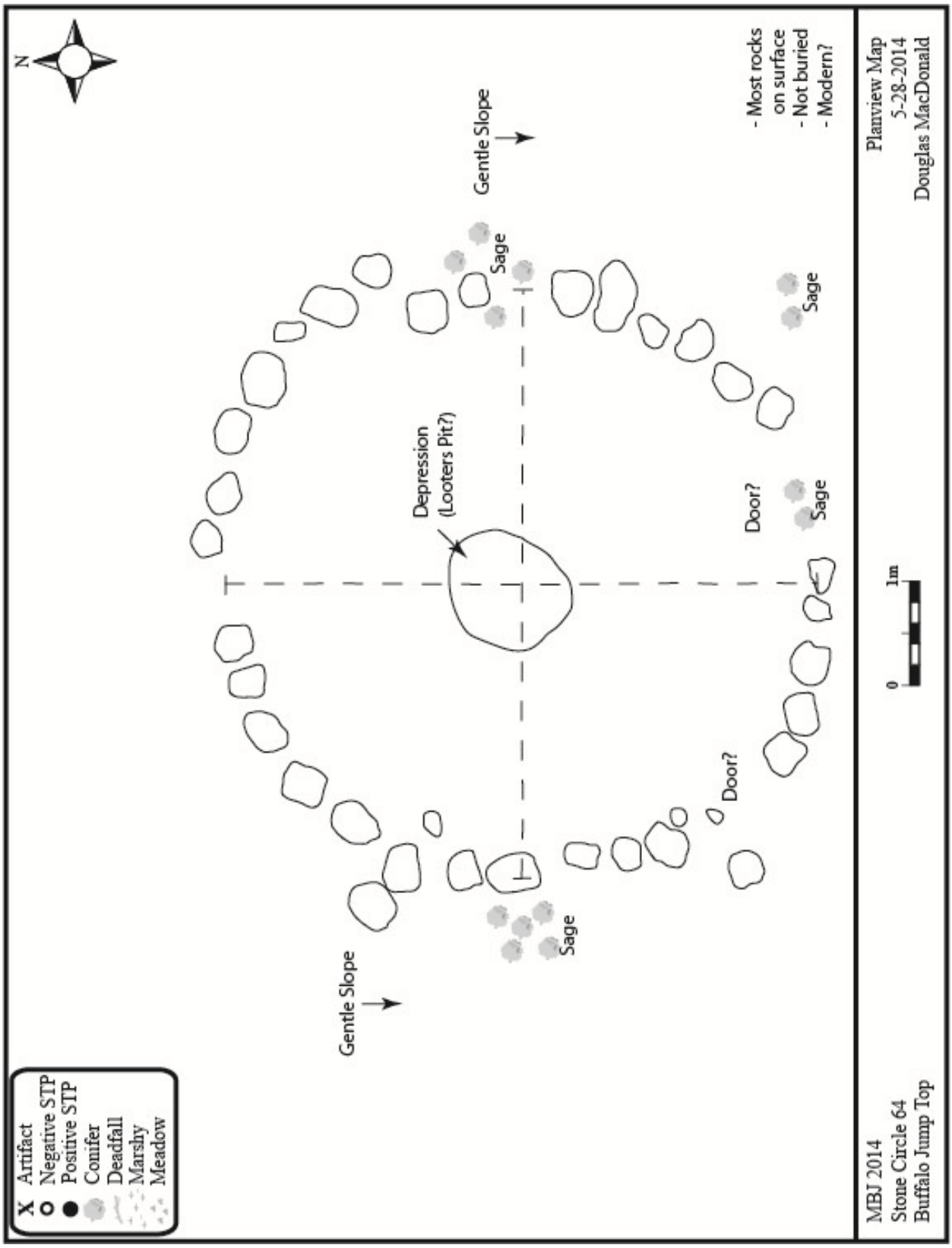
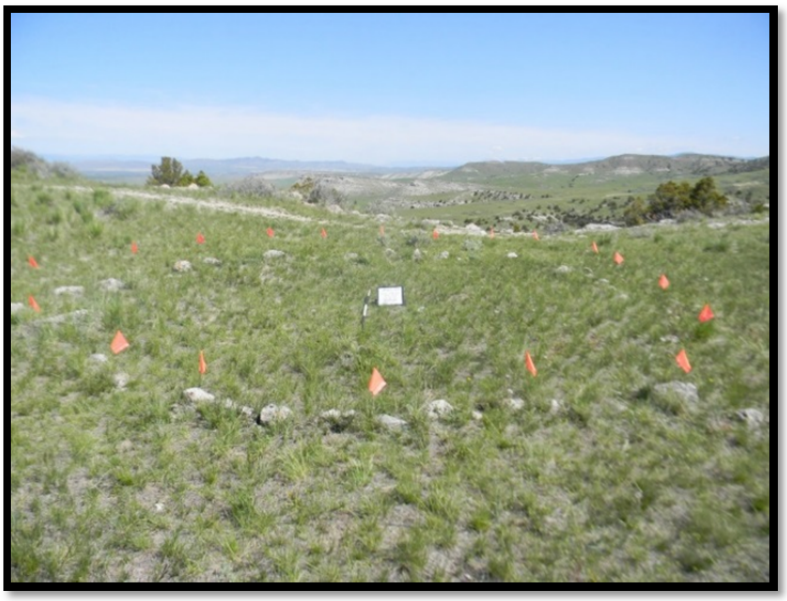


Figure 16. Planview Map of "Refurbished" Stone Circle in Area 3.



Photograph 25. "Refurbished" Stone Circle in Area 3, on top of the Madison Buffalo Jump. View North.

Additionally, lying east of the stone circles in this area near the edge of the top of the jump, is a linear depression surrounded by cobbles (Rock Feature 3). This depression measures ca. 2 meters in length, and most resembles the size and shape of a burial. Rock Feature 3 is also marked in Figure 8 and Figure 14. Photograph 26 shows this possible burial feature. No bone was observed at this location.

Photograph 26. Linear Depression, and Possible Burial (Rock Feature 3), Located on Top of the Madison Buffalo Jump in Stone Circle Area 3. View Northeast.

Stone Circle Area 4

Stone circle area 4, also referred to as the 'Lower Occupation and Processing Area' (Figure 17), is the most well-documented of any stone circle area at Madison Buffalo Jump, with a detailed map of some of the stone circles implemented by Taylor (1971). As part of the fieldwork conducted in 2014, UM remapped the distribution of the remaining visible stone circles in the area (Figure 19; Figure 20), counting a total of 32 (Stone Circles 40-59; 68-79) present in this dry creek bottom setting located below the Madison Buffalo Jump to the west. Figure 7 shows the locations of each stone circle. This area is interpreted as being the camp and processing area, and has been a primary area of focus for most of the previous archaeological work at Madison Buffalo Jump, including numerous excavations conducted by Malouf, Napton, and Taylor (Photograph 27).

The stone circles in area 4 are very similar in size to each other (Table 10), with the majority of the circles measuring ca. 5 - 5.5 meters in diameter; the average diameter for the stone circles in area 4 measure ca. 5.1 meters, making them the largest in the park. A few of the stone circles measure larger than the average for the area however, these circles also appear to have been refurbished at some point given their locations within a heavily visited area of the park. The variety in the number of rocks present and visible constituting the stone circles in area 4 are very similar to those stone circles located in area 3. The average number of rocks used for the circles in area 4 equals 29; with a range from 11 rocks (Stone Circle 51) to 58 rocks (Stone Circle 58). When distinguishable, such as those in area 2, the doors for the stone circles in area 4 are generally present along the eastern edge of the circle (Figure 18); also similar to those in area 2, were a few stone circles possessing either no gap or too many to confidently assess the location of a proper doorway.

Photograph 27. Stone Circle in Area 4 at Madison Buffalo Jump, with Dry Creek Bed and Blowout in the Background. View North by Northeast.

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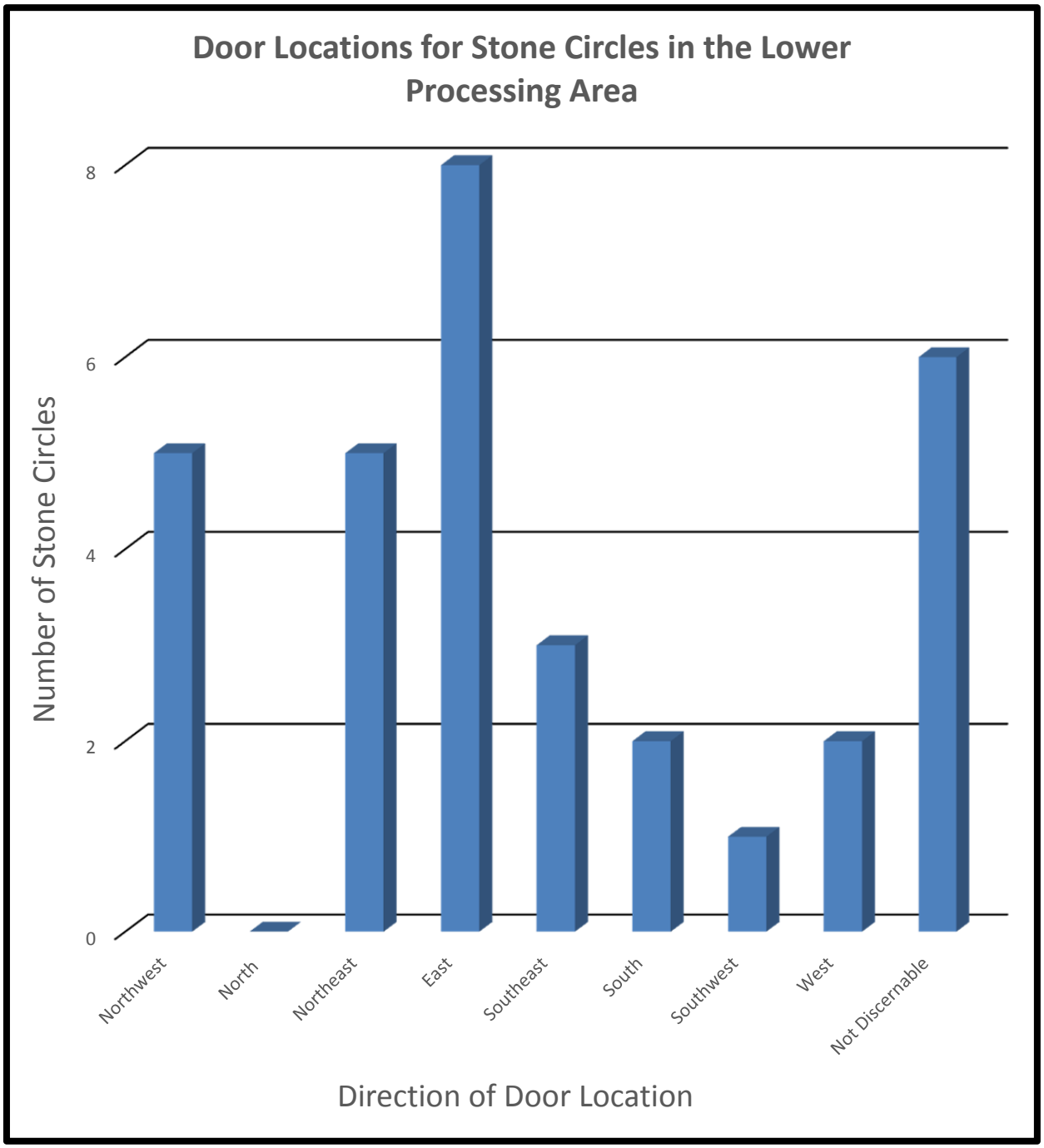

Figure 18. Bar Graph Showing Door Locations for the Stone Circles in the Lower Processing Area at Madison Buffalo Jump.

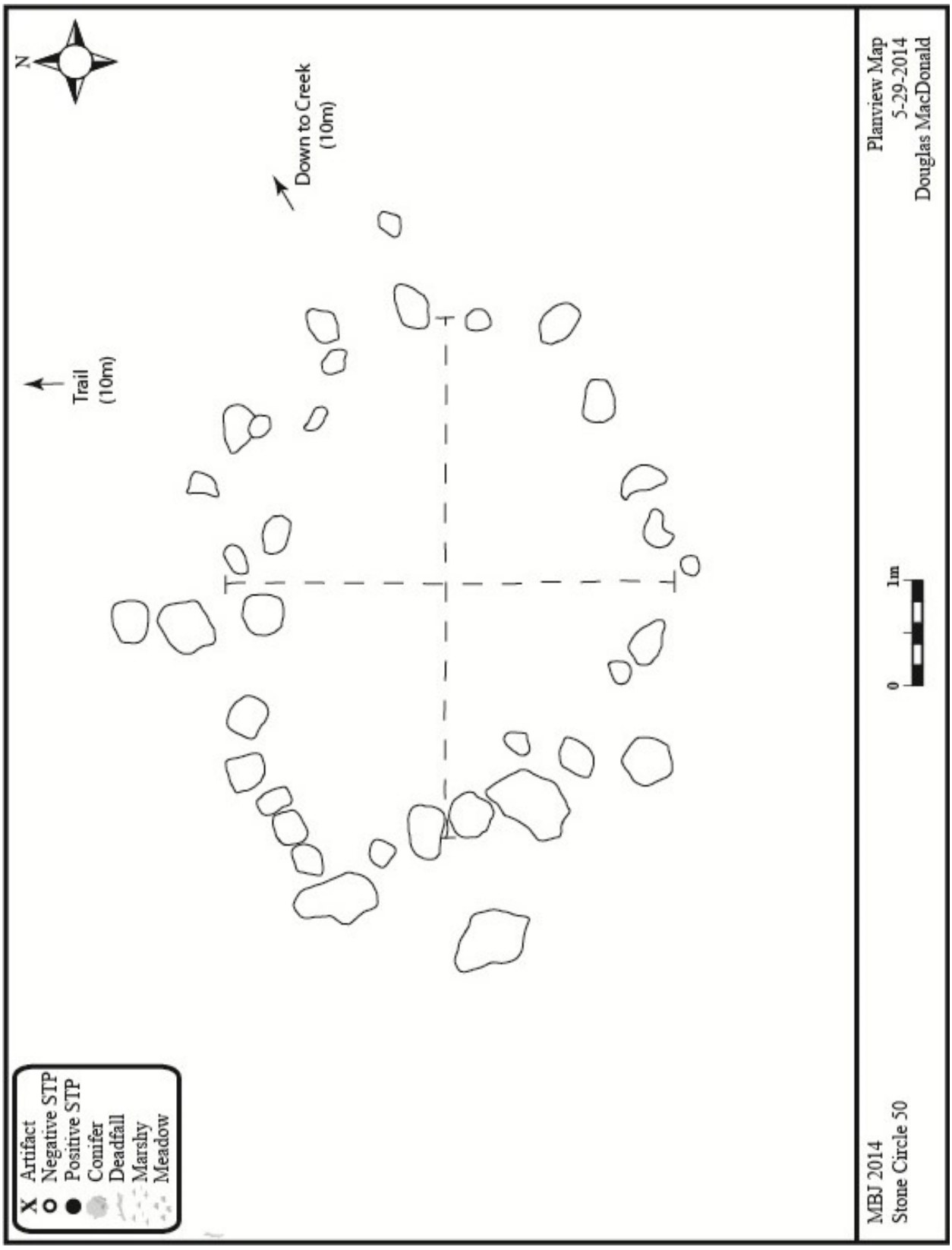

Figure 19. Plan-view Map of Stone Circle 50 in Area 4 at Madison Buffalo Jump.

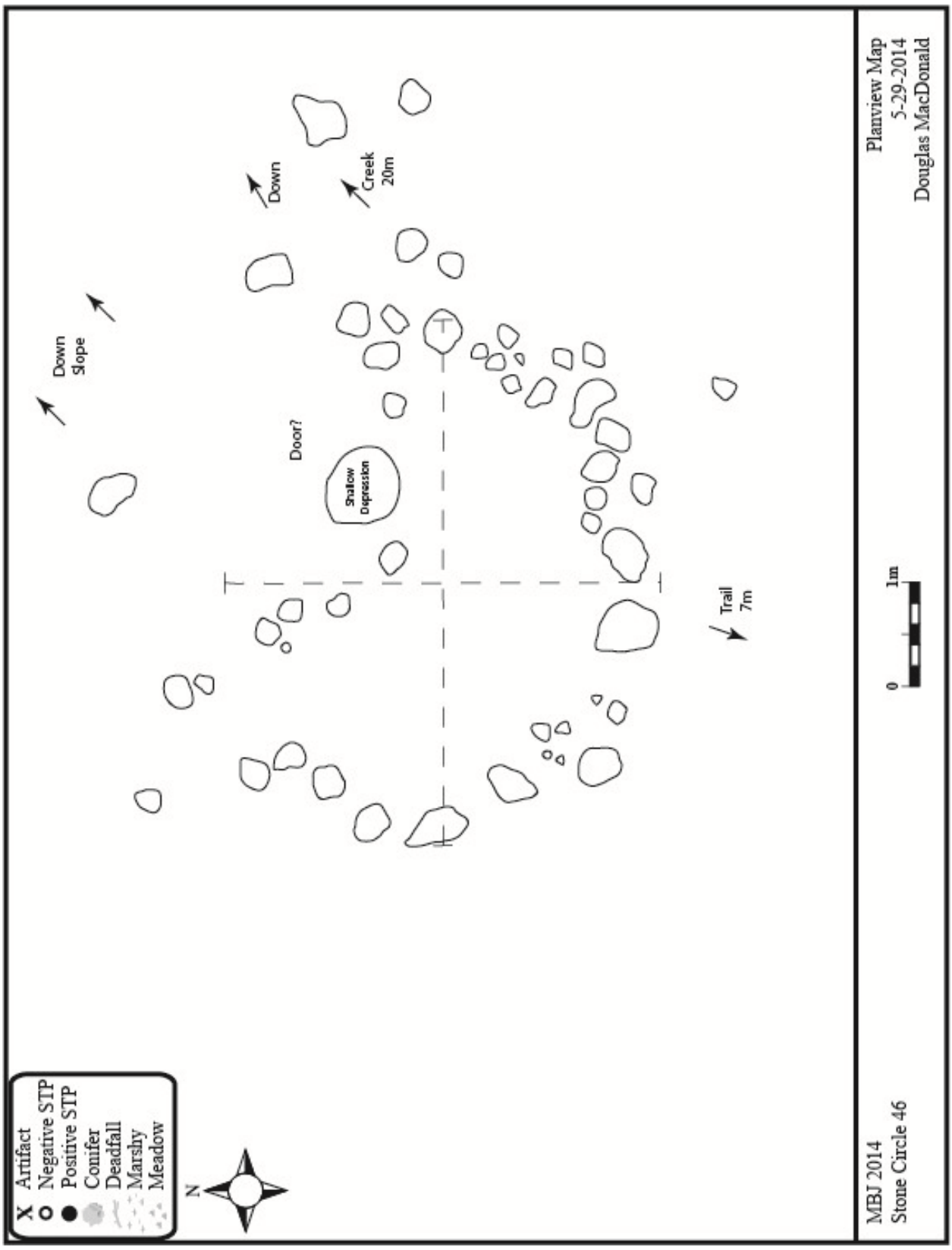

Figure 20. Plan-view Map of Stone Circle 46 in Area 4.

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Of the stone circles in this area, four were found to contain artifacts within their boundaries. Stone Circle 51 contained one orthoquartzite cobble, while Stone Circle 52 held one flake. Within Stone Circle 58 was one black worked orthoquartzite cobble and one shattered red orthoquartzite cobble; one shattered red orthoquartzite cobble was found in Stone Circle 76, as well. In addition to the artifacts lying within circle boundaries, Stone Circle area 4 contains dense concentrations of flaking debris and bone fragments that are eroding out of the creek terrace margins that separate the two main clusters of stone circles in this area; a tan orthoquartzite scraper, the only one identified by UM at Madison Buffalo Jump, was also identified in this vicinity (Photograph 28).

Photograph 28. End scraper Identified within Stone Circle Area 4 at Madison Buffalo Jump.

Stone circle area 4 is adjacent to the primary creek drainage at Madison Buffalo Jump and flows from an area south of the jump in a northwesterly direction passing below the jump to the west; from here the creek continues west outside of the boundaries of Madison Buffalo Jump heading towards the Madison River. At the time of UM's fieldwork no water was observed in the creek, yet it is clear that water was present and did flow during the snow melt in early spring. Out of the 32 stone circles in the area, approximately 75% (24-26) are located on the terrace west of the creek, while the remaining 25% (6-8) lie to the east and northeast of the creek.

A significant portion of the creek-side was heavily eroded just below the west-side stone circles (Photograph 29; Figure 22; Figure 23; Figure 24); this is due to water running off from the main hiking trail through the area down into the creek. UM documented this erosional area, and in the process collected two bone samples and one charcoal sample from what appeared to be an undisturbed deposit. One bone sample (FS-11) was submitted for radiocarbon dating. The bone sample (a bison pelvis fragment shown in Photograph 30; Figure 21) was discovered at 15 centimeters below ground surface (cmbs) and has a calibrated radiocarbon age of AD 1650 (300 BP) (Lab number – Beta-388917); the 1- range dates from AD 1640-1660 (310-290 BP), and the 2- dates range from AD 1525-1795 (425-155 BP). This date coincides with Les Davis' obsidian hydration dates of artifacts from Madison Buffalo Jump which dated to between 670 and 1440 BP; both dates support the utilization of Madison Buffalo Jump during the Late Prehistoric period (Davis and Brownell 2014).

Photograph 29. Creek Blowout in Stone Circle Area 4. View East.

Photograph 30. Bone Sample Collected from the Creek Blowout in Stone Circle Area 4 at Madison Buffalo Jump.

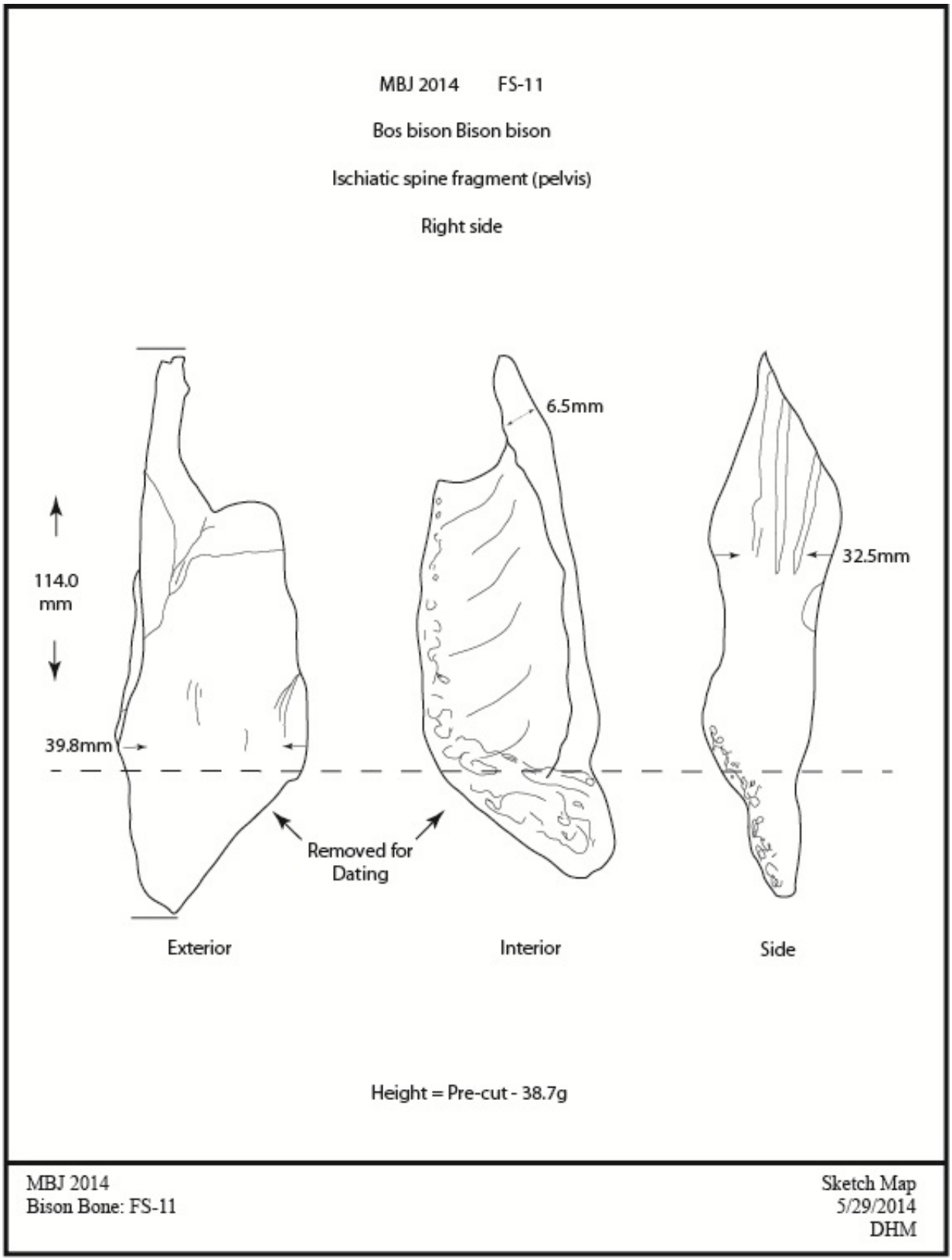

Figure 21. Sketch Map of Bison Pelvic Bone (FS-11) Recovered from the Creek Blowout in Stone Circle Area 4

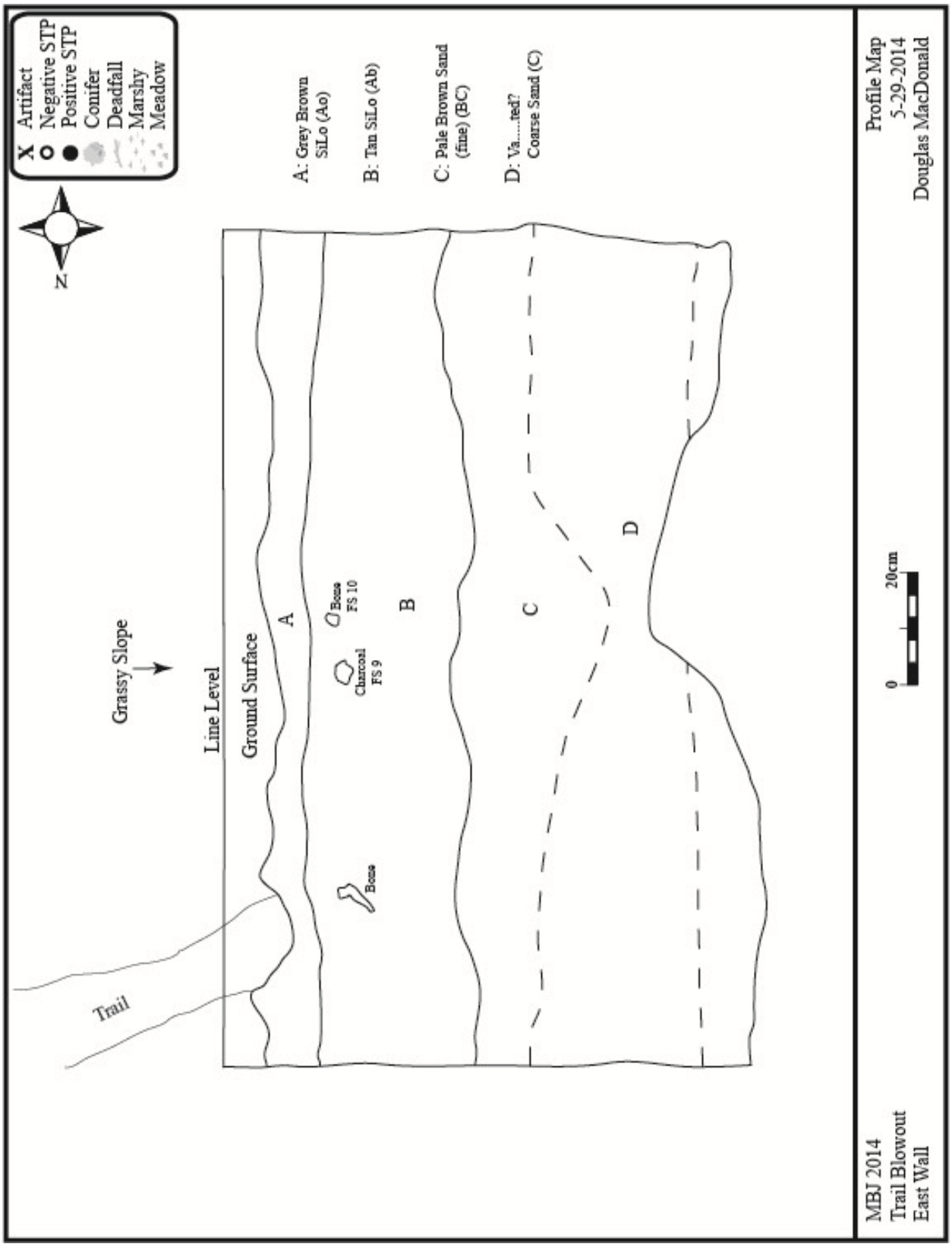

Figure 22. Profile Sketch of the East Wall of the Creek Blowout in Stone Circle Area 4.

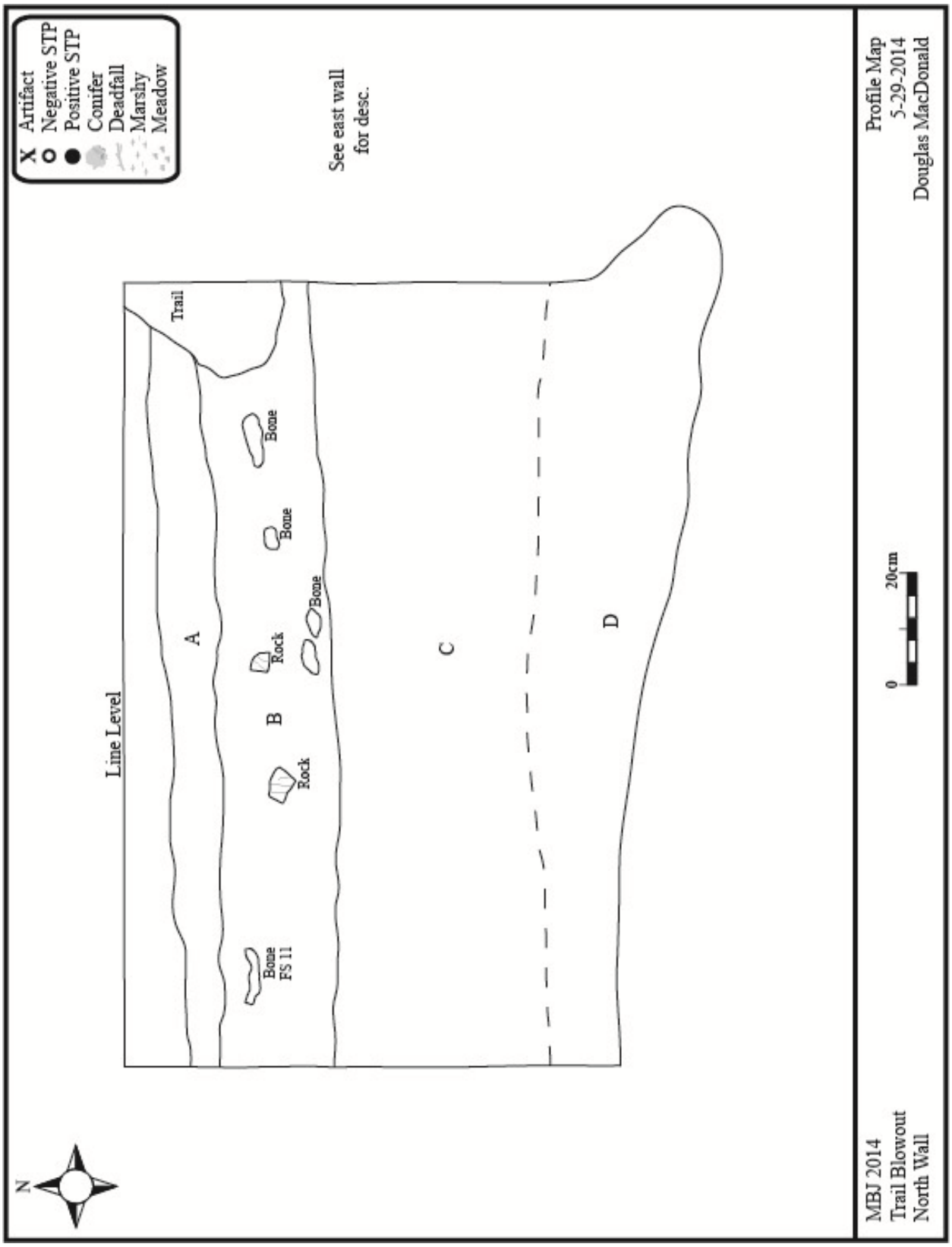

Figure 23. Profile Sketch of the North Wall of the Creek Blowout in Stone Circle Area 4.

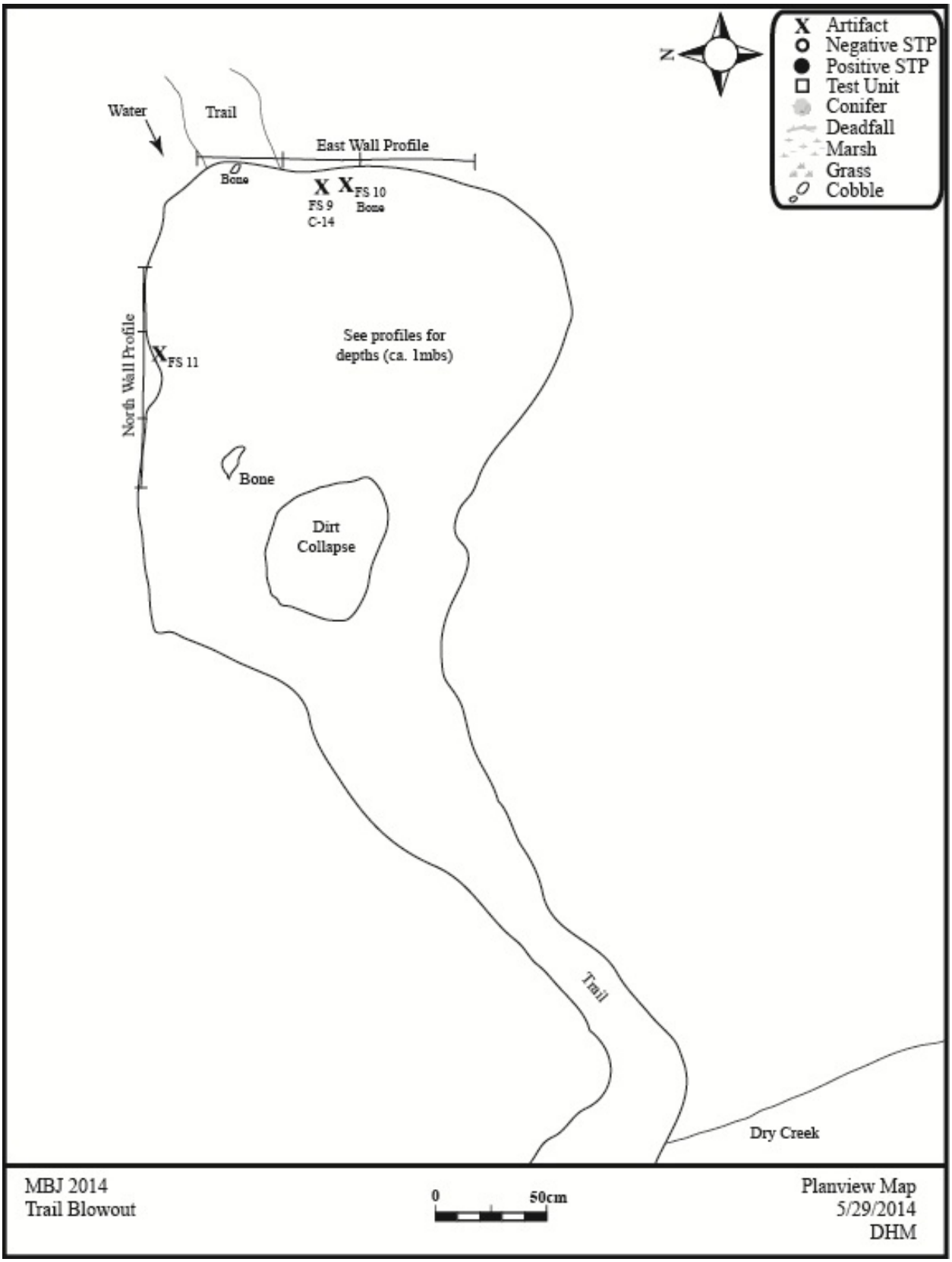

Figure 24. Plan-view Map of the Creek Blowout in Stone Circle Area 4.

Stone Tool Manufacture Areas

Throughout Madison Buffalo Jump lies a large amount of stone tool manufacturing areas, with the majority being located within the Madison Valley Formation deposits above the jump itself and to the east of the jump. Figure 25 shows the locations of lithic artifacts at Madison Buffalo Jump.

In total, 456 individual flakes were recorded by UM at Madison Buffalo Jump (not including flakes recorded from the quarry area). As discussed below, a large majority of the flakes identified at Madison Buffalo Jump were produced from white chert or petrified wood; specifically, flaking material identified by UM includes: chert (white and other colors); obsidian; orthoquartzite; petrified wood reddish, orange, grey/brown/tan, etc). No diagnostic flakes were identified at any of the lithic concentrations located within Madison Buffalo Jump.

Quarry

The primary areas of stone tool manufacture are located just to the southwest of Drive Line 2, as shown below in Figure 25. White chert and various colors of petrified wood are found eroding from the hill slopes of the Madison Valley Formation deposits in this area. One major lithic manufacturing area contained three large pits that are either prehistoric quarry pits (Photograph 31), or possibly the locations of looters pits associated with the dense lithic concentration. The size of this quarry area consists of 43 meters north-south by 43 meters east-west, encompassing a total area of 1,849 square meters. Table 11 records descriptive and location data for lithic artifacts in the quarry area.

Photograph 31. UM Crew member in One of the Quarry Pits with a 2-Meter Measuring Stick.

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Non Quarry Lithic Scatter Analysis

Besides the quarry, there are several additional lithic concentrations throughout Madison Buffalo Jump. These areas include the top of the buffalo jump and to the east of it, the North Ridge, and the Lower Occupation/Processing area. All recorded lithics identified within the park are marked on Figure 25. These various lithic concentrations mark the locations of stone tool manufacture, and their precise GPS locations and descriptions are presented in Table 12.

Each of the four areas of stone circles also contains significant amounts of stone tool manufacture flaking debris, as well as some tools. As shown in Figure 25, numerous flakes were identified directly adjacent to Stone Circle 1, with many more recorded just south of Stone Circle Area 4/Lower Processing Area, especially in the ravine/dry creek bed. Stone Circle Area 4 is also the location of the end scraper, discussed above; this find, along with the copious amounts of bone fragments in the area, supports the claim that Stone Circle Area 4 was also the Primary Processing area following a kill event.

Stone Circle Area 2 also contained a sizeable amount of flaking debris scattered throughout. These flakes, similar to the rest of Madison Buffalo Jump, were produced from either white chert or various colors of petrified wood. The largest concentration of flakes in this area was situated near Fasting Bed 1 (Rock Feature 1). The final area containing a high density of lithic artifacts at Madison Buffalo Jump is adjacent to Drive Lines 3 and 4 on top of the jump near the northern rim. This area covers most of the southern and western portions of the top of the jump, and encompasses approximately 35,000 square meters and consists of primarily white chert and petrified wood flakes, similar to the rest of the flakes identified at Madison Buffalo Jump. The flakes documented here were comprised overwhelmingly of white chert, with some petrified wood. With the Quarry area so near to the top of the jump, and consisting of the same raw materials, it is highly plausible that the flakes on top of the jump were almost exclusively produced from materials collected from the Quarry. This is also the portion of the park most densely covered with lithic debitage.

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Examining the material types of the artifacts sourced from Madison Buffalo Jump can reveal patterns in stone tool preference in the Madison River Valley, as well as trade/movement patterns. Due to the high density of naturally occurring chert and petrified wood, it is not surprising to find that the primary source for lithic manufacture observed at Madison Buffalo Jump is comprised of these materials. However, the presence of both obsidian and dacite artifacts, each procured from multiple, different sources stemming from the southwest tells us that these more "exotic" raw materials were desired as well, despite the distance that must have been traveled to obtain them. Either these materials would have been acquired through trade with another group or tribe already residing in the areas where these materials naturally occur, or they were collected by the groups that utilized Madison Buffalo Jump during their migratory cycle of the Great Plains - such as the Shoshone, who were known to have used these raw materials as well occupy the regions to the south of Madison Buffalo Jump. Also, the fact that the sourcing completed by Richard Hughes (2014) provided details that multiple flakes came from an unknown dacite composition, similar to that of the Cashman Quarry, informs that there is most likely an undiscovered (by modern peoples) dacite quarry nearby.

Photograph 33. Early Archaic Side-Notched Projectile Point (FS-5) Produced from Dacite Found at Madison Buffalo Jump State Park.

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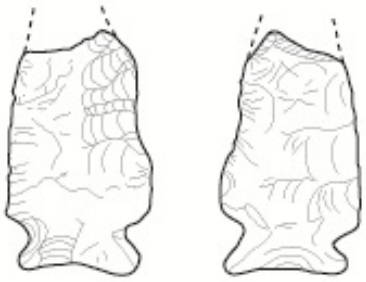

Early Archaic Dacite
Projectile Point

MBJ 2014
Early Archaic Dacite
Projectile Point

Sketch Map
5/22/2014
MDC

Figure 27. Early Archaic Dacite Projectile Point from Madison Buffalo Jump.

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Historic/Modern Aspects of Madison Buffalo Jump

The following section is a brief overview of the historic artifacts and features identified by the UM crew at the Madison Buffalo Jump. Figure 28 shows the locations of all historic finds. A more detailed and in-depth report on the Historic associations with the park will be included in the Final Report, including a GPS table regarding all historic inscriptions. For the purpose of brevity in this professional paper, we include only a summary here.

The Madison Buffalo Jump contains much more archaeological information aside from prehistoric artifacts. Historical inscriptions can be found carved into the limestone rock, scattered throughout the area. These historic inscriptions, sometimes referred to as historical "graffiti", or anything over fifty years old, can help tell us a story about those who came before; those who left their mark, announcing "We were here". If one is to fully comprehend the complete history of an area, interpretation of historical inscriptions plays a key role in understanding the use of the land over the last century (Urbaniak 2014). However, before delving into the plethora of inscriptions located at the Madison Buffalo Jump, there were also a handful of both modern and historic artifacts that were recorded at the state park. The modern/historic aspects of Madison Buffalo Jump can be divided into four categories: modern aspects, hearths, historic artifacts, and historic inscriptions.

Modern Aspects

Modern Inscription Area

UM discovered one area of modern inscriptions is present on the jump face, located approximately 0.25 miles south of Historic Inscription Area 2 (Photograph 35). This area of inscriptions lies in a wooded section of the canyon rim upon a mostly hidden wall. Along this wall is a series of three mushrooms with associated initials and names (ex: "COYOTE"). The inscriptions cover a ca. 50m stretch of this hidden wall, and most likely mark the locations of personal "experiences" during the modern era. No dates were found among the inscriptions in this area in order to be used to determine the precise ages of the inscriptions, but it is likely that they were produced within the last 30 years.

One modern shelter/lean-to was discovered in the same area of the park that the modern inscriptions can be found (Photograph 34). Specifically, it is located almost directly below the modern inscriptions, in a drainage (Coordinates: N: 5070770, E: 0464135). There were no other artifacts associated with this structure.

Photograph 35. Modern Mushroom Inscriptions Carved into the Wall of what UM Named the "Mushroom Shelter" at Madison Buffalo Jump.

Photograph 34. Modern Shelter Located in a Drainage below the Modern Inscription Area.

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Photograph 36. Historic Hearth 1 at Madison Buffalo Jump.

Photograph 37. Historic Hearth 2 at Madison Buffalo Jump.

Photograph 38. Historic Hearth 3 at Madison Buffalo Jump.

Photograph 39. Modern Hearth at Madison Buffalo Jump.

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Historic Inscriptions at Madison Buffalo Jump

There are three areas of historic inscriptions and one area of modern inscriptions at the Madison Buffalo Jump that were identified by the UM crew during this project, as identified in Figure 29. The final technical report will include more details of these inscriptions.

Historic Inscription Area 1

The first area of historic inscriptions lies in a steeply-incised canyon north of the jump itself. In this area two inscriptions are etched into a thin (ca 15cm tall) and long band of white chalky sandstone that is located within the layered sandstone of the Madison Valley Formation. The inscriptions read “C.A. Kinsey, 4-26-1936” (Photograph 42) and “LT CK 44” (Photograph 43). Both inscriptions lie within the same stratigraphic layer of chalky sandstone, though the Kinsey inscription is located ca. 15m southeast of the latter inscription. These are the only two inscriptions that were documented in the area. Charles A Kinsey is recognized as being the original excavator of many of the archaeological features at the Madison Buffalo Jump beginning in the late 1930’s (Davis and Brownell 2014).

Photograph 42. “C.A. Kinsey” Inscription in a Canyon North of the Jump. View Northeast.

Photograph 43. "LT CK 84" Inscription in Canyon North of the Jump.

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Historic Inscription Area 2

Historic inscription area 2 is located along the south-central rim of the jump itself, and has yielded only one inscription to date. In 1996 Mavis and John Greer identified what they described as an “A” or a tepee that was inscribed in one of the rock shelters along the jump face. Upon further survey and examination UM identified the majority of what appears to be an indecipherable name. This name begins with a “G”, with the “A” as the second letter. The remainder of the name is severely worn and is very difficult to decipher, though it may show the name “GAUCHER” (Photograph 44).

Photograph 44. Historic Inscription “GAUCHER” on the Face of the Madison Buffalo Jump.

Historic Inscription Area 3

Historic inscription area 3 is the most substantial area of inscriptions at Madison Buffalo Jump. This area is located on a large stretch of sandstone escarpment just south of the park entrance. The sandstone face stretches for ca. 0.5 miles to the south with approximately 70 historic inscriptions in most of the rock shelter outcrops along the walls. The function of these shelters was most likely to provide protection from the weather by ranchers for the last century or so. Of the numerous amounts of inscriptions, several sets of initials were present; but initials ending in “W” and “M” are the most prevalent. Additionally present are several inscriptions of brands that are interspersed among the inscriptions along the wall. The final report will also include background research on the inscriptions in order to determine their relationship to prior landowners.

CHAPTER 4. Summary and Recommendations

Through a cooperative agreement between the University of Montana (UM) Department of Anthropology and Montana Fish, Wildlife, and Parks, the University of Montana, between 17 May and 1 June 2014, conducted an archaeological inventory of the 640-acre Madison Buffalo Jump State Park; this report provides a detailed analysis of the results of said investigations of the archaeological survey. Douglas Macdonald, Ph.D. and Sara Scott, Ph.D. managed the project for each institution, respectively. In closing, UM was able to make significant contributions regarding both the prehistoric and historic knowledge of Madison Buffalo Jump. Copious amounts of artifacts and features alike were recorded at Madison Buffalo Jump during the survey, including: 1) a potential, previously undocumented, drive line, and exact locations for each cairn of each of the four drive lines existing at Madison Buffalo Jump today; 2) bison bone concentrations below the kill/nick point on the face of the jump, increasing in density further down the slope leading to the Lower Processing area; 3) numerous bone and artifact concentrations in the camp area in the creek valley west of the jump (Lower Processing area), including one tan orthoquartzite scraper; 4) countless lithic artifact concentrations within the gathering basin above the jump, marking the locations of prehistoric stone tool manufacture, including one possible petrified wood/chert quarry- all of which were meticulously inspected and recorded by UM; 5) 78 stone circles in four locations surrounding the jump that were GPS recorded, photographed and plan-view mapped – a descriptive analysis was also conducted of each of the 78 stone circles, including: number of stones, the facing direction of each stone circle's entrance, and size of each circle; 6) two probable fasting beds on a ridgetop north of the jump near Stone Circle area 2 on the North Ridge; 7) an Early Archaic projectile point produced from dacite sourced to the Cashman Quarry; 8) 14 additional sourced obsidian/dacite artifacts that were sent in to Richard Hughes for source identification; 9) two bison bone fragments, including one bison pelvic fragment (FS-11) that was submitted for radiocarbon dating, that was returned with a calibrated radiocarbon age of AD 1650 (300 BP), which confirms Late Prehistoric age utilization of the bison processing area (the only radiocarbon date yet assessed for the site); and 10) four locations of inscriptions spread across the state park- UM photographed and recorded each individual inscription vis GPS coordinates.

Recommendations

As illustrated above, there have been many previous researchers fascinated with the Madison Buffalo Jump, and these researchers did an excellent job in giving us a starting point from which current researchers can use to begin delving deeper into the incredible history of the jump; however, there is still much to be done in order to fully understand the jump's past. Luckily, some prior researchers have very clearly reported what they believed to be informational deficiencies that are presented regarding credible evidence from the site, in addition to giving recommendations for future work that must be conducted in the park to improve these deficiencies. Specifically, Davis and Brownell (2014) and Taylor (1971) are responsible for the bulk of these recommendations; the one recommendation agreed upon by both is that it is imperative to utilize modern mapping techniques to record the remaining archaeological features, such as the drive lines, "eagle-catching pits" or hunting blinds, and the stone circles.

Taylor (1971) believes that further excavation is essential to gather additional data regarding the functional interrelationships between elements in the jump complex, including details about the Native American tribes who utilized it; this must be done through the collection of artifacts and other diagnostic materials located within the deepest deposits in the primary buttering area. Additionally, Taylor (1971) states that the majority of researchers assume that Madison Buffalo Jump was utilized in the autumn, and an analysis of a collection of bison jaws should be conducted, while noting the presence or absence of fetal or young calf bones, to determine the age of the calves at death, indirectly indicating the time of year they died. As far as for stone circle documentation, Taylor (1971) expresses his dissatisfaction with the apparent lack of stratigraphy on the lower habitation/processing area, claiming that a few centrally located deep test pits would clarify once and for all if there are deeper artifacts in that area; he also stresses the importance of conducting a series of systematic excavations of the stone circle area located on the North Ridge (Stone Circle area 2), a task that has yet to be conducted.

Davis and Brownell (2014) had many recommendations as well, such as officially marking the inscription on the jump face on the Montana Fish, Wildlife, and Parks base-map. They also note that the descriptions and analysis of the stone circles are "spotty at best," mentioning that even their specific locations on the ground is unclear from available maps, and therefore better recording is required. Also brought to light by Davis and Brownell (2014) is the fact that no attempt has been made to radiocarbon date any removed bones from Madison Buffalo Jump; also, none of the previously recovered sediments were analyzed to determine

proxy data - from which clues to climatic-environmental conditions might be elicited. Lastly, Davis and Brownell (2014) reported that due to inadequate funding, the bison bones recovered by Taylor were not analyzed satisfactory and consequently, easily obtained data regarding bison population were not identified; unfortunately these faunal remains are no longer available for study at the University of Montana. They do explain that many of these basic data deficiencies can be resolved by conducting a multi-year archaeological field school, and supported their claim by referring to the work completed at the First Peoples Buffalo Jump.

Conclusion

The University of Montana's completion of the current project contributed to and resolved some of the informational deficiencies regarding the Madison Buffalo Jump's past; but there is still much that remains to be done. Multiple areas such as the North Ridge, Lower Occupation/Processing area, and Primary Bone Deposit still require test excavations, in order to identify as many artifacts and diagnostic materials as possible. At a basin level, the precise ages of the various Madison Buffalo Jump features needs to be determined. Also, the interrelationship of the features needs to be further assessed.

As of now it is believed that three separate groups of native Americans have ties to the jump – the Shoshone, Crow, and Blackfeet, in that order. Based on the lithic sourcing completed by UM, in addition to the findings of potential Intermountain ceramics, it is entirely plausible that the Shoshone indeed utilized Madison Buffalo Jump at some point in time. Additionally, based on comparative similarities to Crow fasting beds, the Crow also could have been connected to the jump. Lastly, due to the relatively late radiocarbon dating results returned to UM, the Blackfeet are also strong contenders to have been the most recent occupants of Madison Buffalo Jump. Further excavations an analyses of the stratigraphy for both the occupational and processing areas will help aid archaeologists determine, more precisely, which Native American groups utilized Madison Buffalo Jump throughout history, and when.

Madison Buffalo Jump is rich in its record of Native American life and prehistoric bison hunting, in addition to its record of historic Euro-American use through inscriptions. Upon completion of the survey, inventory, and analysis of Madison Buffalo Jump and its artifacts and features, it is obvious that the Madison Buffalo Jump State Park should be preserved in its current state and carefully developed further in order to provide a more complete picture of its value in terms of both Native American and Euro-American use in the past.

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Appendix A

Artifact Sourcing Report and C-14 Dating Report

Geochemical Research Laboratory Letter Report 2014-49

Energy Dispersive X-ray Fluorescence Analysis of Artifacts from the Madison Buffalo Jump (24GA314), Montana

June 17, 2014

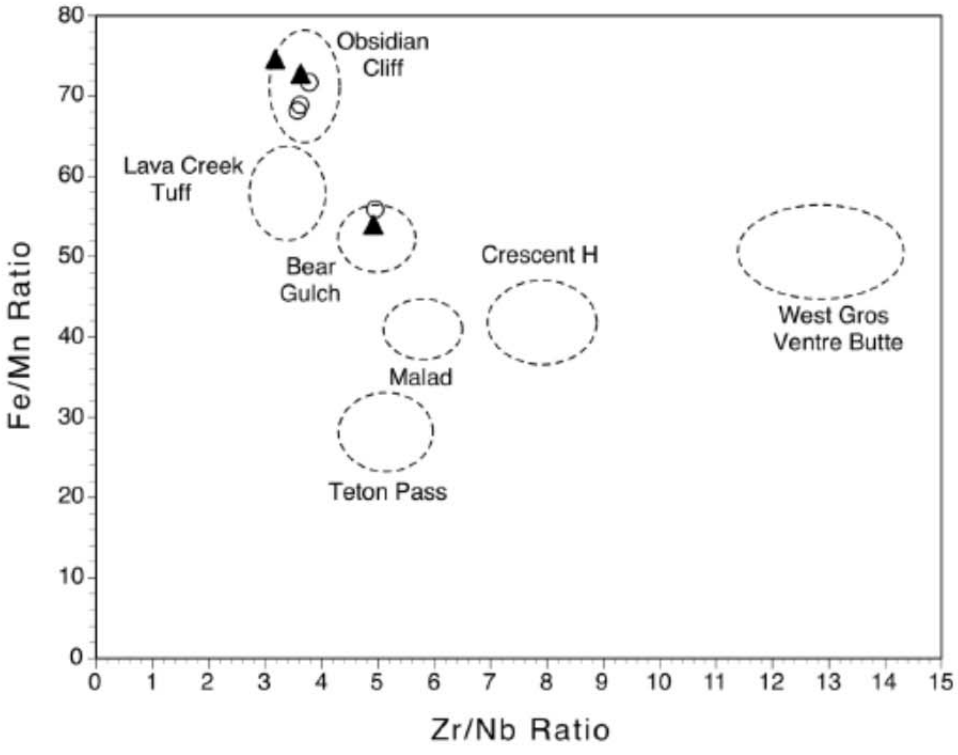
Dr. Doug MacDonald
Department of Anthropology
University of Montana
Missoula, MT 59812-5112

Dear Doug:

This letter contains tables and figures presenting energy dispersive x-ray fluorescence (edxrf) data generated from the analysis of 15 artifacts from the Madison Buffalo Jump (24GA314), Montana. The edxrf research reported herein was completed pursuant to your letter request of June 2, 2014. Laboratory equipment, quantitative analysis protocol and excitation conditions, and comparative literature references applicable to the analysis of these specimens are, except as noted, the same as I reported for samples from sites 24YE355 and 24YE356 (Hughes 2008).

Figure 1

Fe/Mn vs. Zr/Nb Ratios for Obsidian Artifacts from 24GA314



Dashed lines represent range of variation measured in archaeologically significant geologic obsidian source samples from the Rocky Mountains area. Filled triangles plot specimens listed in Table 1; open circles plot artifacts in Table 2. Dacite flake (XRF # 8) not plotted.

Table 1

Quantitative Composition Estimates for Artifacts from 24GA314

Cat. Number	Trace Element Concentrations										Ratio		Source (Chemical Type)
	Zn	Ga	Rb	Sr	Y	Zr	Nb	Ba	Ti	Mn	$Fe_2O_3^T$	Fe/Mn	
XRF # 1	nm	nm	255 ±5	6 ±2	85 ±3	170 ±4	49 ±3	nm	nm	nm	nm	73	Obsidian Cliff
XRF # 2	nm	nm	64 ±3	749 ±10	15 ±2	170 ±4	15 ±2	1762 ±38	nm	nm	5.90 ±.08	89	Unknown dacite
XRF # 4	nm	nm	64 ±3	747 ±10	13 ±2	169 ±4	14 ±2	1822 ±38	nm	nm	5.91 ±.10	92	Unknown dacite
XRF # 5	nm	nm	68 ±4	752 ±10	17 ±2	174 ±4	16 ±2	1684 ±36	nm	nm	5.94 ±.08	95	Unknown dacite
XRF # 6	nm	nm	90 ±4	843 ±12	33 ±3	195 ±5	12 ±2	1723 ±38	nm	nm	10.36 ±.08	71	Unknown dacite
XRF # 7	nm	nm	258 ±5	3 ±2	86 ±3	171 ±4	55 ±3	nm	nm	nm	nm	75	Obsidian Cliff
XRF # 11	nm	nm	80 ±4	633 ±10	17 ±2	305 ±5	12 ±2	nm	nm	nm	3.68 ±.04	49	Cashman dacite
XRF # 12	nm	nm	77 ±5	696 ±10	19 ±3	320 ±5	12 ±2	2353 ±38	nm	nm	4.24 ±.05	55	Cashman dacite
XRF # 14	nm	nm	181 ±4	43 ±3	47 ±3	306 ±5	60 ±3	708 ±30	nm	nm	nm	54	Bear Gulch
XRF # 15	nm	nm	78 ±4	671 ±10	21 ±2	316 ±5	14 ±2	nm	nm	nm	3.85 ±.04	52	Cashman dacite
U.S. Geological Survey Reference Standard													
RGM-1 (measured)	nm	nm	145 ±4	105 ±3	27 ±3	220 ±4	9 ±3	796 ±22	nm	nm	1.86 ±.02	63	Glass Mtn., CA
RGM-1 (recommended)[a]	32	15	149	108	25	219	9	807	1600	279	1.86	nr	Glass Mtn., CA

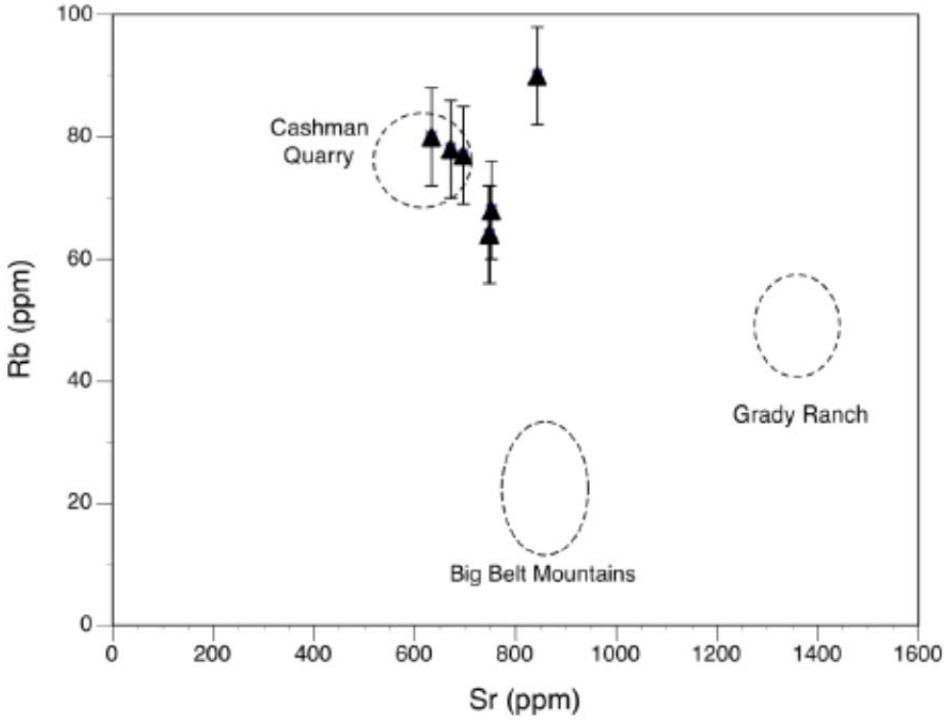
Values in parts per million (ppm) except total iron [in weight %] and Fe/Mn intensity ratios; ± = 2 σ expression of x-ray counting uncertainty and regression fitting error at 120-360 seconds livetime. nm= not measured. [a], (Govindaraju 1994).

Ten of the specimens you sent were large enough to generate reliable quantitative composition estimates. Three of these were obsidian. Table 1 and Figure 1 show that two of these artifacts were fashioned from Obsidian Cliff material, and that the other matches the chemical profile of Bear Gulch obsidian. Seven of the eight dacite artifacts you sent also were large enough for quantitative composition analysis. Edxrf data (in Table 1 and Figure 2) show that three of these specimens have the same chemical composition as Cashman dacite, but that the other four have trace element compositions quite different from the Cashman Quarry (Baumler et al. 2001: Table 2;

Hughes 1998b), Grady Ranch (Rennie et al. 2008: Figure 6) and the Big Belt Mountains (Hughes 2000). Artifacts # 2, # 4 and # 5 appear to represent the same chemical type, with sample # 6 different from these three.

Figure 2

Rb vs. Sr Composition of Non-Obsidian Artifacts from 24GA314



Dashed lines represent range of variation measured in archaeologically significant non-obsidian geologic source samples from the Rocky Mountains area. Filled triangles plot specimens from Table 1. Error bars are two-sigma (95% confidence interval) estimates for each specimen.

Table 2

Integrated Net Count Rate Data for Artifacts from 24GA314

	Element Intensities							Intensity Ratios						
Cat. no.	Rb	Sr	Zr	Σ Rb,Sr,Zr	Rb%	Sr%	Zr%	Fe/Mn	Rb/Sr	Zr/Y	Y/Nb	Zr/Nb	Sr/Y	Source (Chemical Type)
XRF # 3	571	10	662	1243	.459	.008	.533	68.9	57.1	2.6	1.4	3.6	.04	Obsidian Cliff
XRF # 8	803	253	747	1803	.445	.140	.414	105.7	3.2	7.7	1.4	10.4	2.6	Unknown dacite
XRF # 9	390	119	1118	1627	.240	.073	.687	55.9	3.3	8.5	.6	5.0	.9	Bear Gulch
XRF # 10	550	5	635	1190	.462	.004	.534	68.2	110.0	2.7	1.3	3.6	.02	Obsidian Cliff
XRF # 13	630	12	714	1356	.465	.009	.527	71.7	52.5	2.8	1.4	3.8	.05	Obsidian Cliff

Elemental intensities (peak counts/second above background) generated at 30 seconds livetime.

The other five specimens you submitted were too small to generate reliable quantitative composition estimates so, as I have done previously, I analyzed them semi-quantitatively using the analysis protocol specified in Hughes (2010). Table 2 and Figure 1 show that three of these artifacts fall within the Fe/Mn vs. Zr/Nb ratio parameters of Obsidian Cliff glass, and that one artifact is most similar to Bear Gulch volcanic glass. Based on Fe/Mn data, specimen (XRF # 8) appears to represent an unknown variety of dacite.

Combining data from quantitative (n= 10) and integrated net intensity analysis (n= 5), this analysis determined that five artifacts were made from Obsidian Cliff obsidian, and two others were manufactured from Bear Gulch glass. Three of the dacite artifacts you submitted were manufactured from Cashman material, but the geological/geographic counterparts for the other five could not be determined.

I hope this information will help in your evaluation of the significance of this material. Please contact me at my laboratory ([650] 851-1410; e-mail: rehughes@silcon.com) if I can be of further assistance.

Sincerely,

Richard E. Hughes, Ph.D., RPA
Director, Geochemical Research Laboratory

REFERENCES

Baumler, Mark F., Cora G. Helm, Steve Platt, Patrick Rennie, and Stan Wilmoth
2001 Assault on Basalt: The Cashman Quarry Site, Madison County, Southwestern Montana. **Archaeology in Montana** 42 (2): 1-26.

Govindaraju, K.
1994 Compilation of Working Values and Sample Description for 383 Geostandards. **Geostandards Newsletter, Special Issue** XVIII.

Hughes, Richard E.
2000 X-ray Fluorescence Analysis of Basalt Samples from the Big Belt Mountains (Indian Flats locality), Located about 25 miles northeast of Helena, Montana. Geochemical Research Laboratory Letter Report 99-112. Portola Valley, CA.

2008 Energy Dispersive X-ray Fluorescence Analysis of Obsidian Artifacts from 24YE355 and 24YE356 in Yellowstone National Park, Wyoming. Geochemical Research Laboratory Letter Report 2008-104 submitted to Doug MacDonald, University of Montana, November 15, 2008.

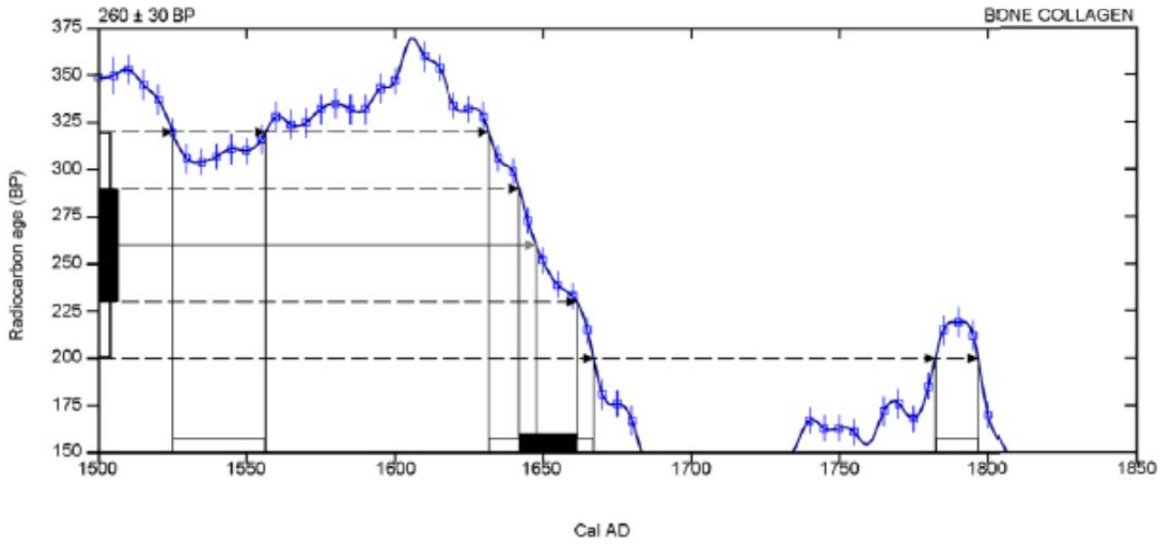
2010 Determining the Geologic Provenance of Tiny Obsidian Flakes in Archaeology Using Nondestructive EDXRF. **American Laboratory** 42 (7): 27-31.

Rennie, Patrick, Mark F. Baumler, Cora G. Helm, Richard E. Hughes, M. Damon Murdo, Steve Platt, and Stan Wilmoth
2008 Grady Ranch (24CL2013): A Newly Characterized Dacite Procurement Locality in West-Central Montana. **Archaeology in Montana** 49 (1): 1-13.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -18.7 o/oo : lab. mult = 1)

Laboratory number	**Beta-388917**
Conventional radiocarbon age	**260 ± 30 BP**
2 Sigma calibrated result **95% probability**	**Cal AD 1525 to 1555 (Cal BP 425 to 395)** **Cal AD 1630 to 1665 (Cal BP 320 to 285)** **Cal AD 1780 to 1795 (Cal BP 170 to 155)**
Intercept of radiocarbon age with calibration curve	Cal AD 1650 (Cal BP 300)
1 Sigma calibrated results 68% probability	Cal AD 1640 to 1660 (Cal BP 310 to 290)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

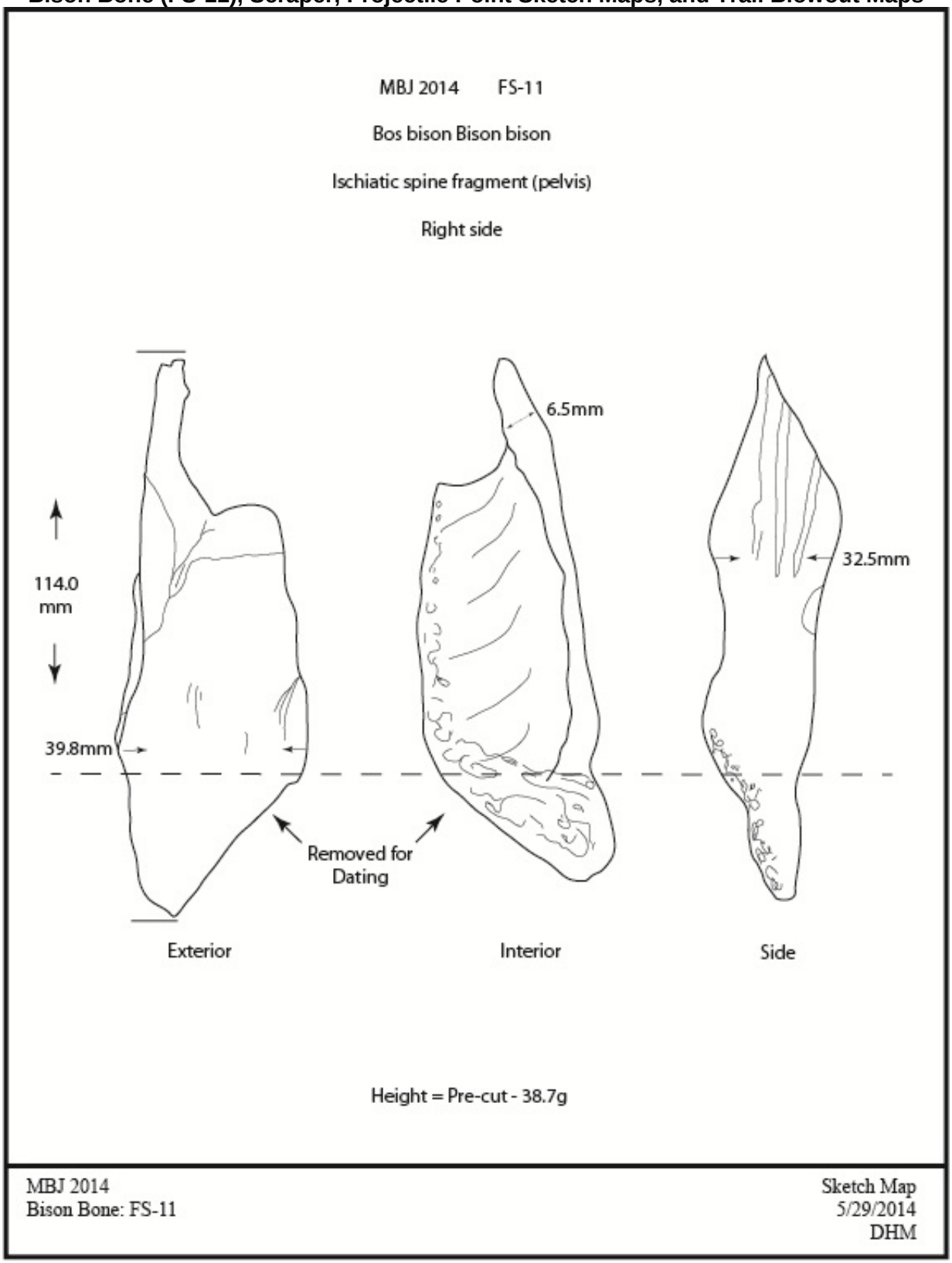
References to INTCAL13 database

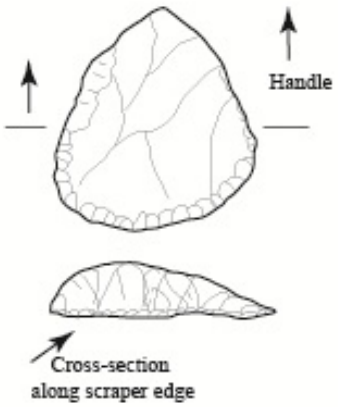
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887.

Beta Analytic Radiocabon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

Appendix B

Bison Bone (FS-11), Scraper, Projectile Point Sketch Maps, and Trail Blowout Maps





~60° working bit angle; hafted in handle

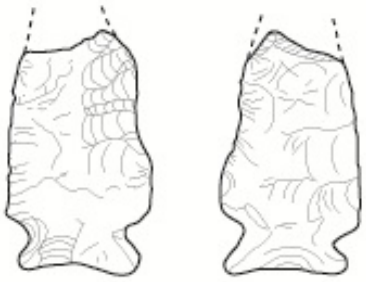
Tan-brown chert/petrified wood

Opaque

Bulb still present on opposite face

MBJ 2014
Flake 88 - Endscraper
In Draw Near Blowout

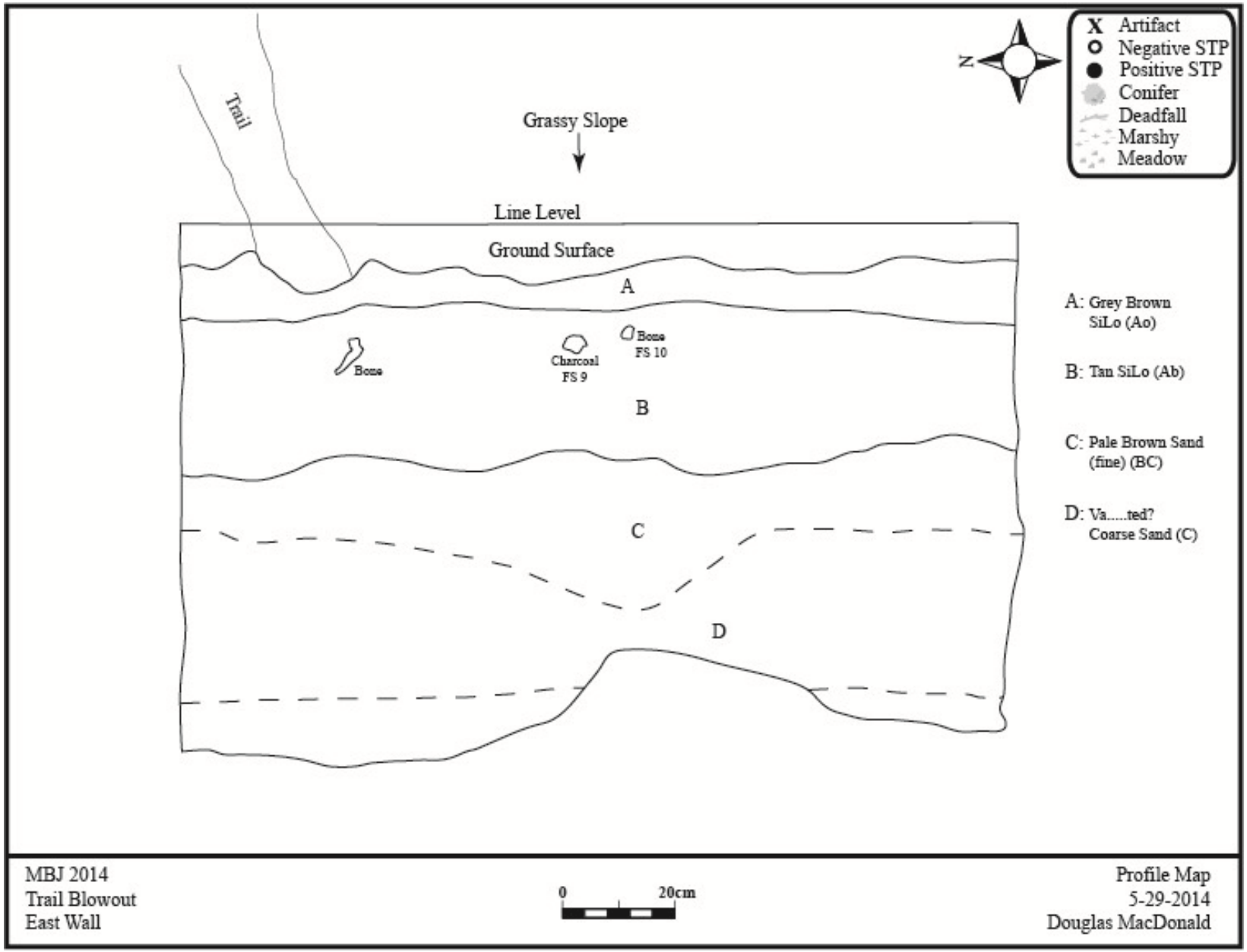
Sketch Map
5/26/2014
DHM

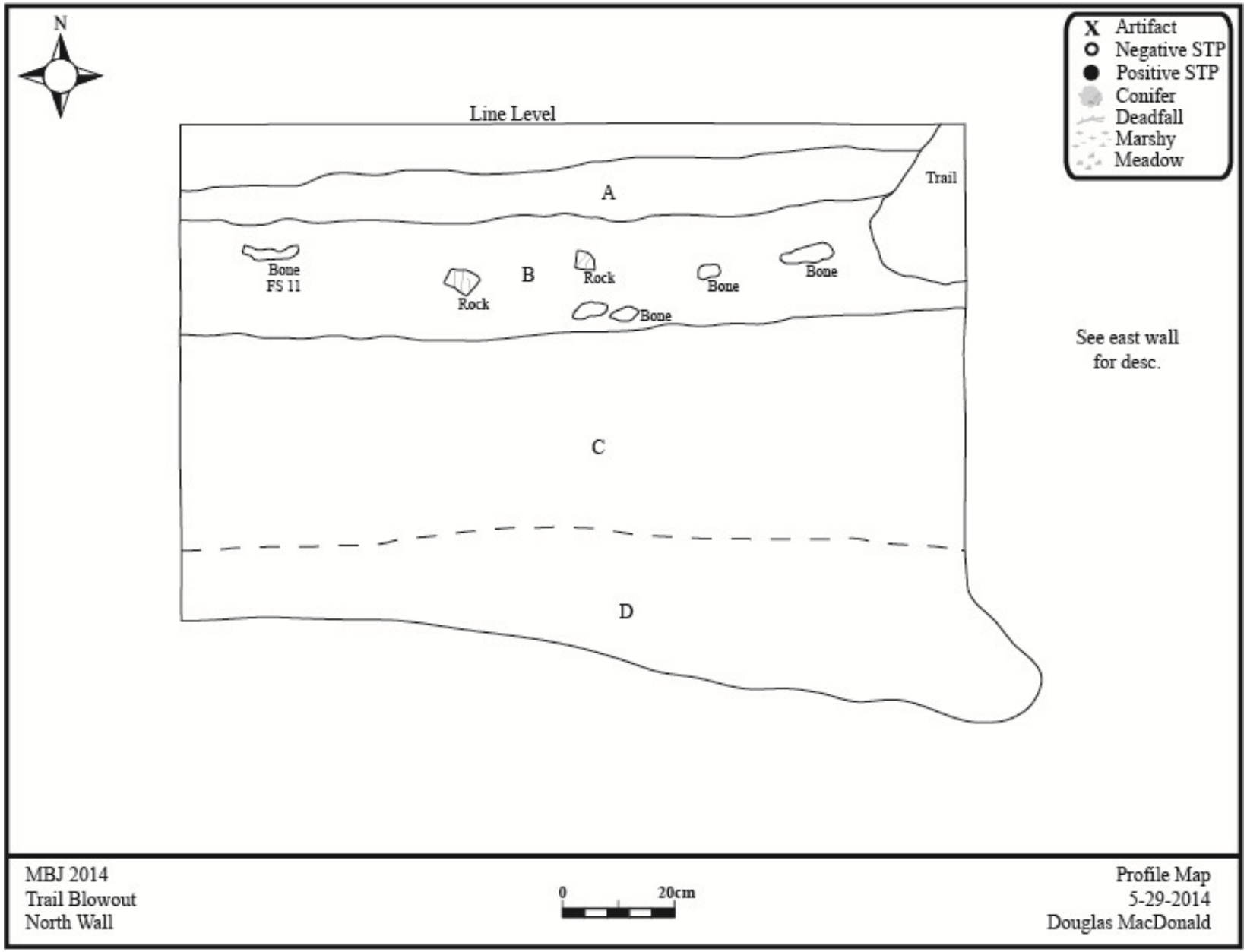


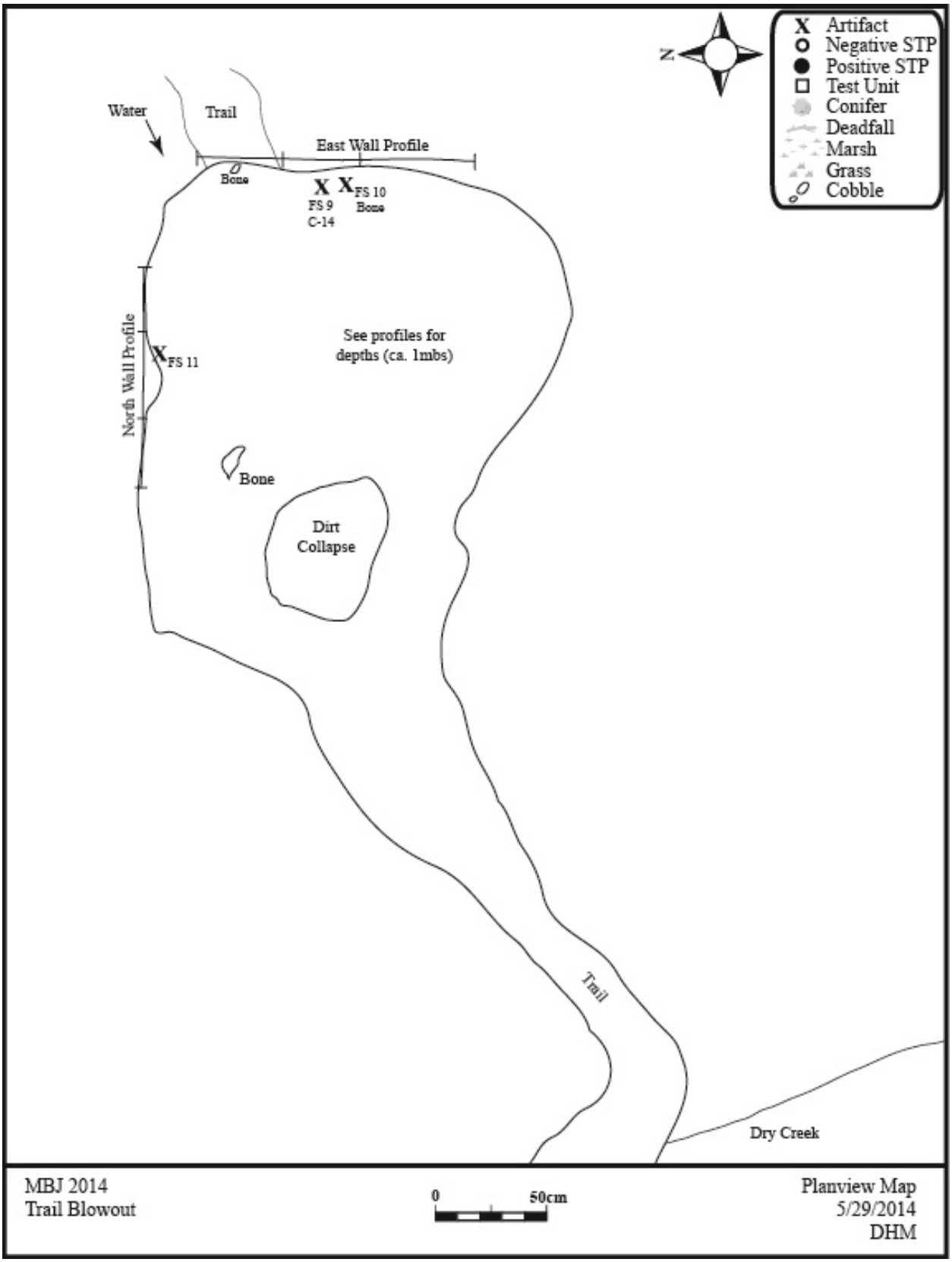
Early Archaic Dacite
Projectile Point

MBJ 2014
Early Archaic Dacite
Projectile Point

Sketch Map
5/22/2014
MDC

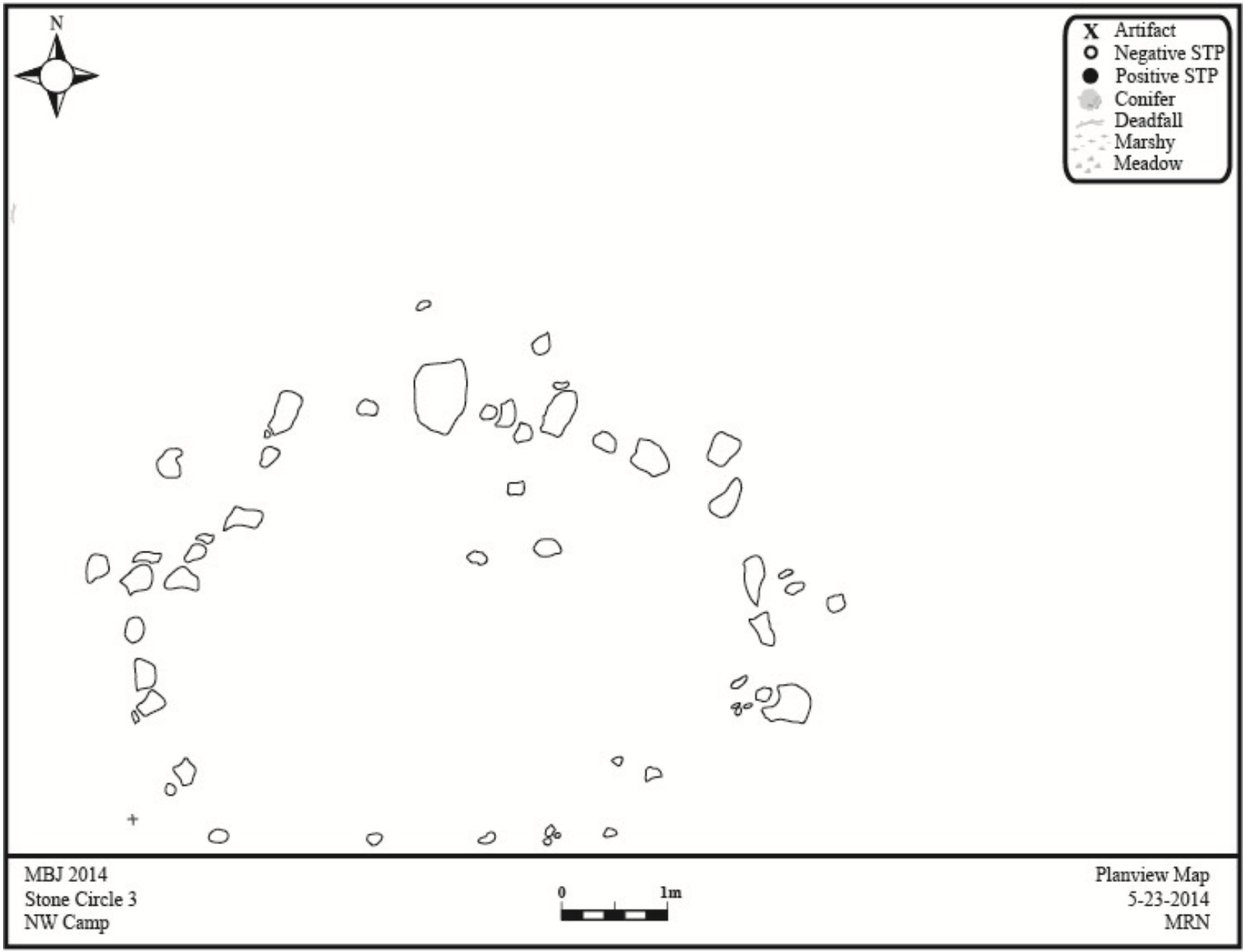

Trail
Grassy Slope
Line Level
Ground Surface
A
B
C
D
Bone
Charcoal
FS 9
Bone
FS 10
N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
A: Grey Brown SiLo (Ao)
B: Tan SiLo (Ab)
C: Pale Brown Sand (fine) (BC)
D: Va.....ted? Coarse Sand (C)
MBJ 2014
Trail Blowout
East Wall
0
20cm
Profile Map
5-29-2014
Douglas MacDonald

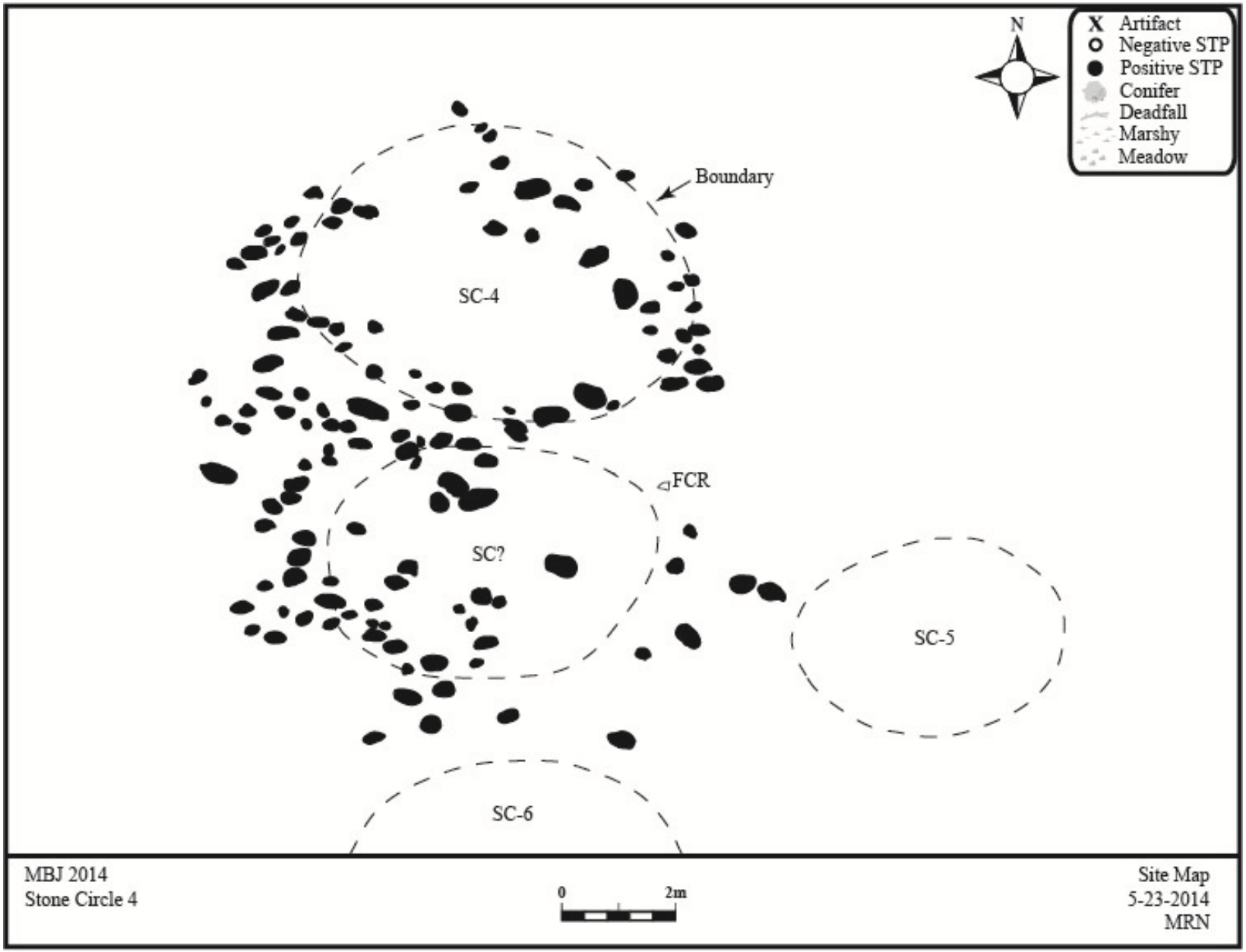

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Line Level
Trail
A
B
C
D
Bone
FS 11
Rock
Rock
Bone
Bone
Bone
See east wall
for desc.
MBJ 2014
Trail Blowout
North Wall
0
20cm
Profile Map
5-29-2014
Douglas MacDonald

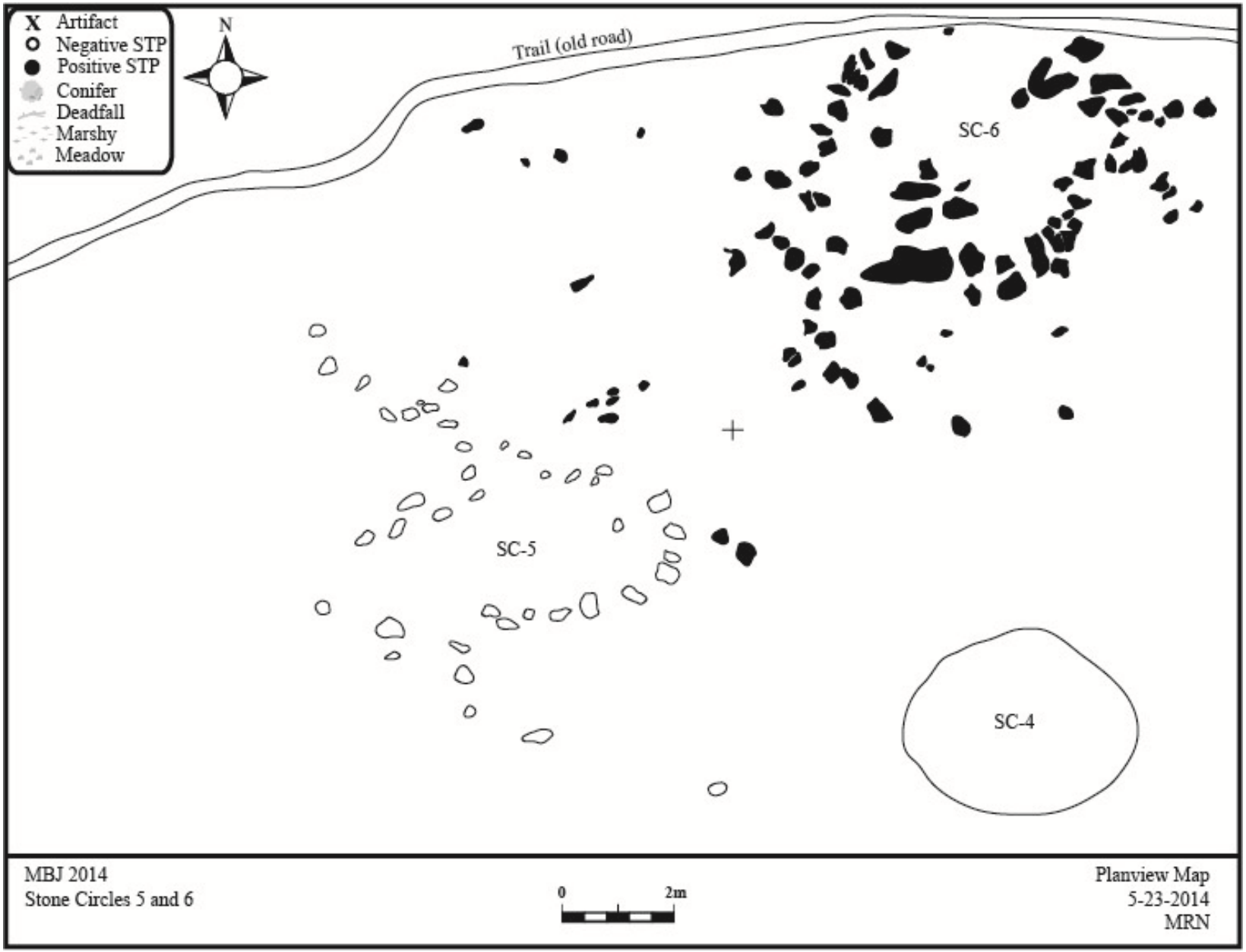

N
Artifact
Negative STP
Positive STP
Test Unit
Conifer
Deadfall
Marsh
Grass
Cobble
Water
Trail
East Wall Profile
Bone
FS 9
C-14
FS 10
Bone
North Wall Profile
FS 11
See profiles for
depths (ca. 1mbs)
Bone
Dirt
Collapse
Trail
Dry Creek
MBJ 2014
Trail Blowout
0
50cm
Planview Map
5/29/2014
DHM

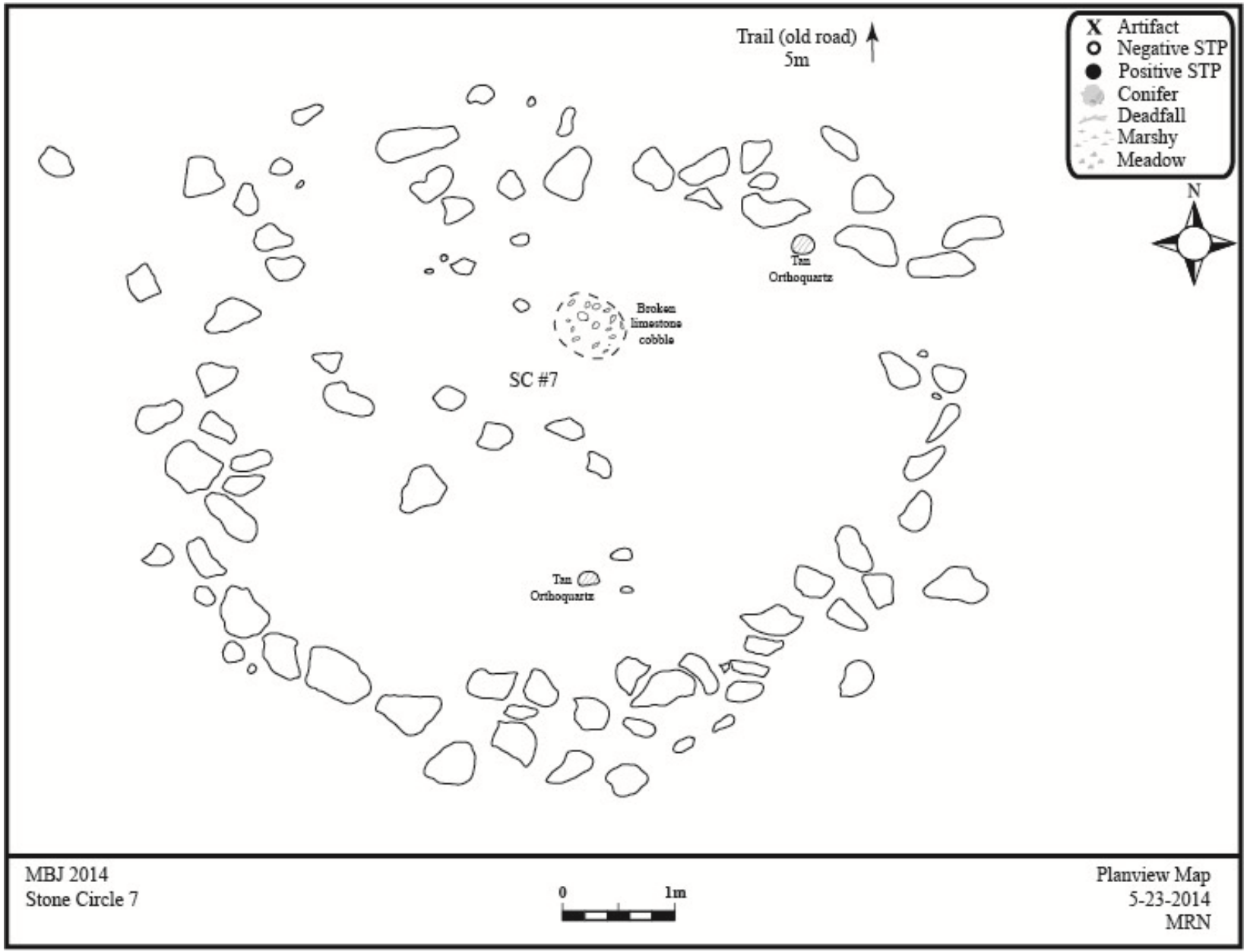
Appendix C

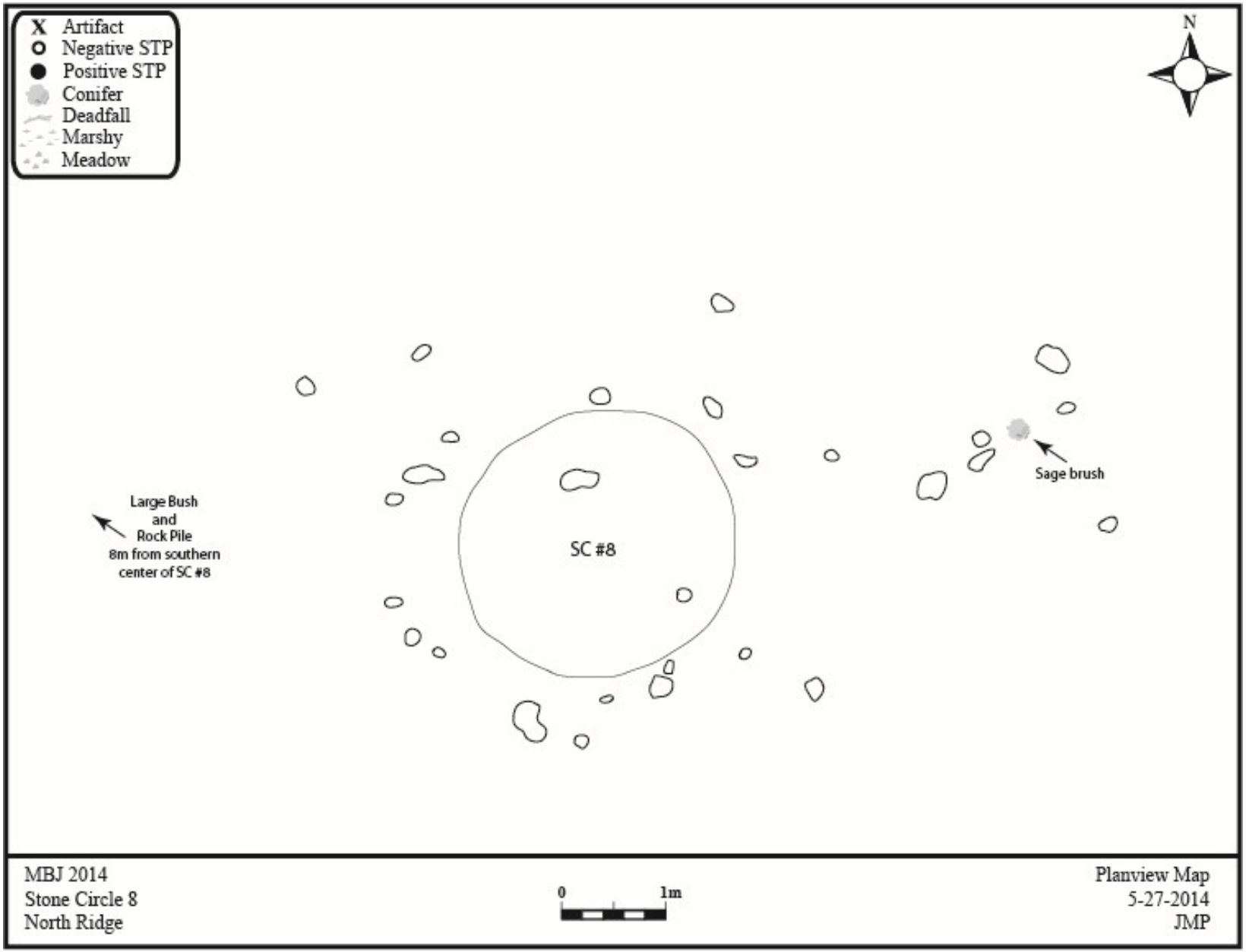
Stone Circle and Rock Feature Plan-View Maps

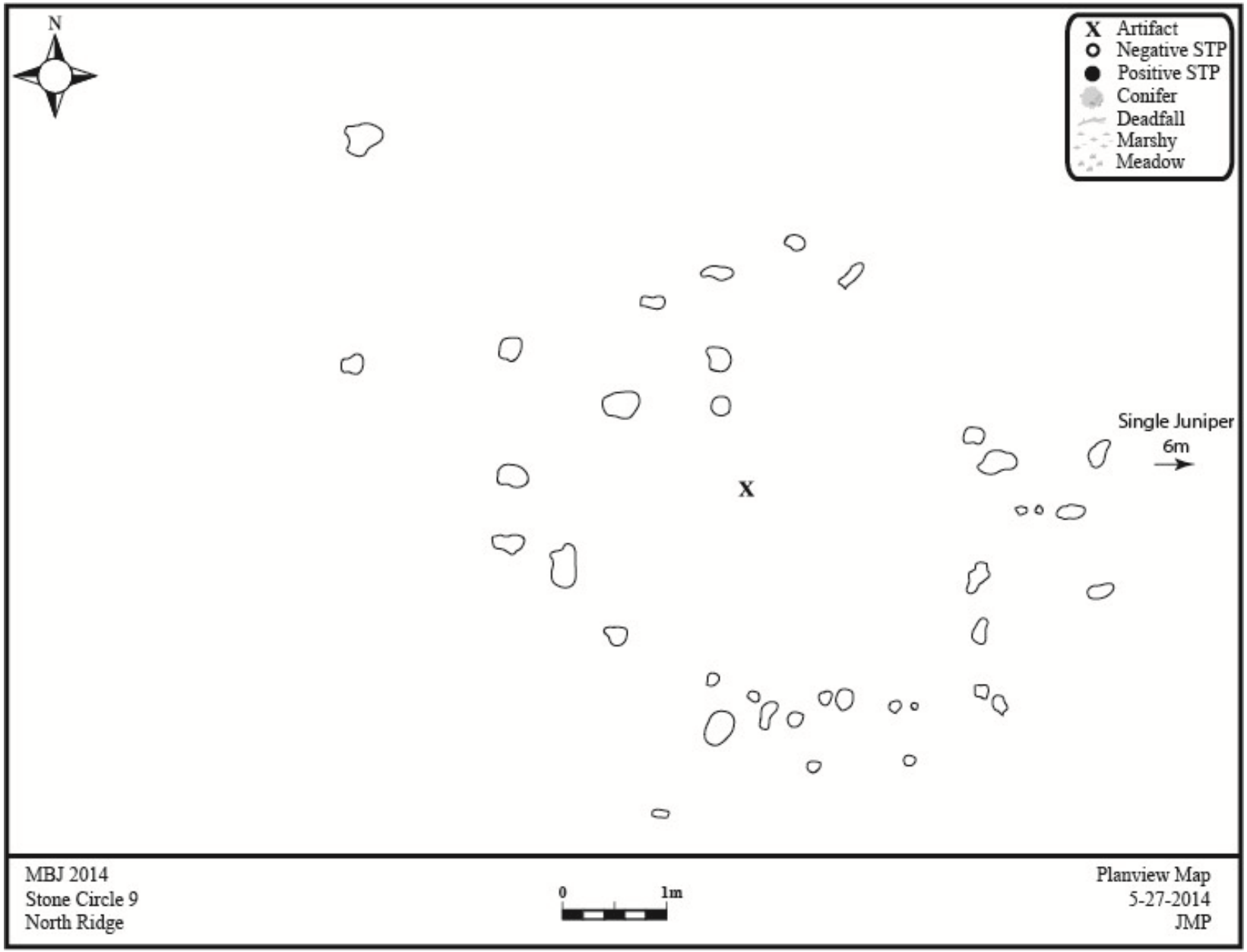

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
MBJ 2014
Stone Circle 3
NW Camp
0
1m
Planview Map
5-23-2014
MRN

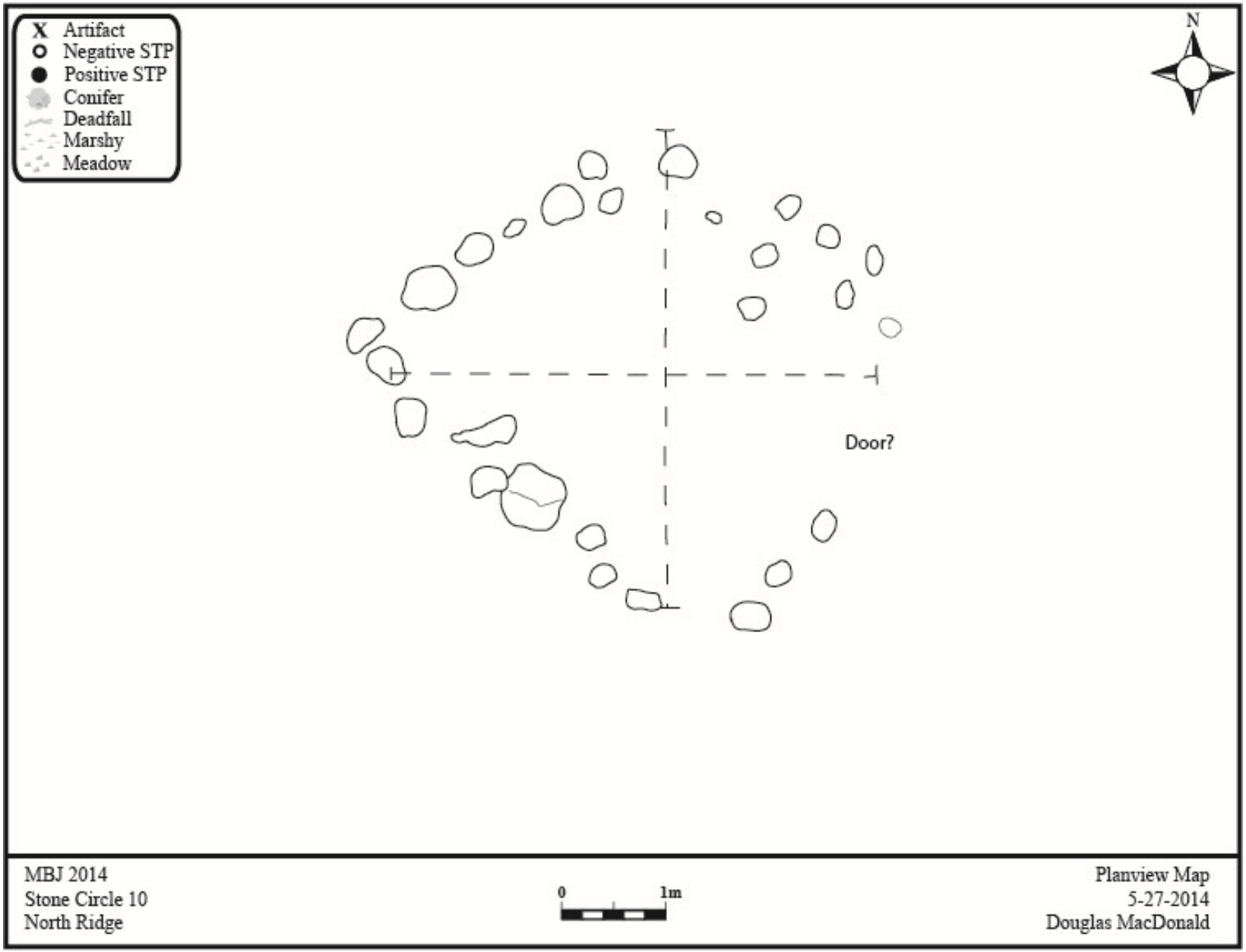

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Boundary
SC-4
FCR
SC?
SC-5
SC-6
MBJ 2014
Stone Circle 4
0
2m
Site Map
5-23-2014
MRN

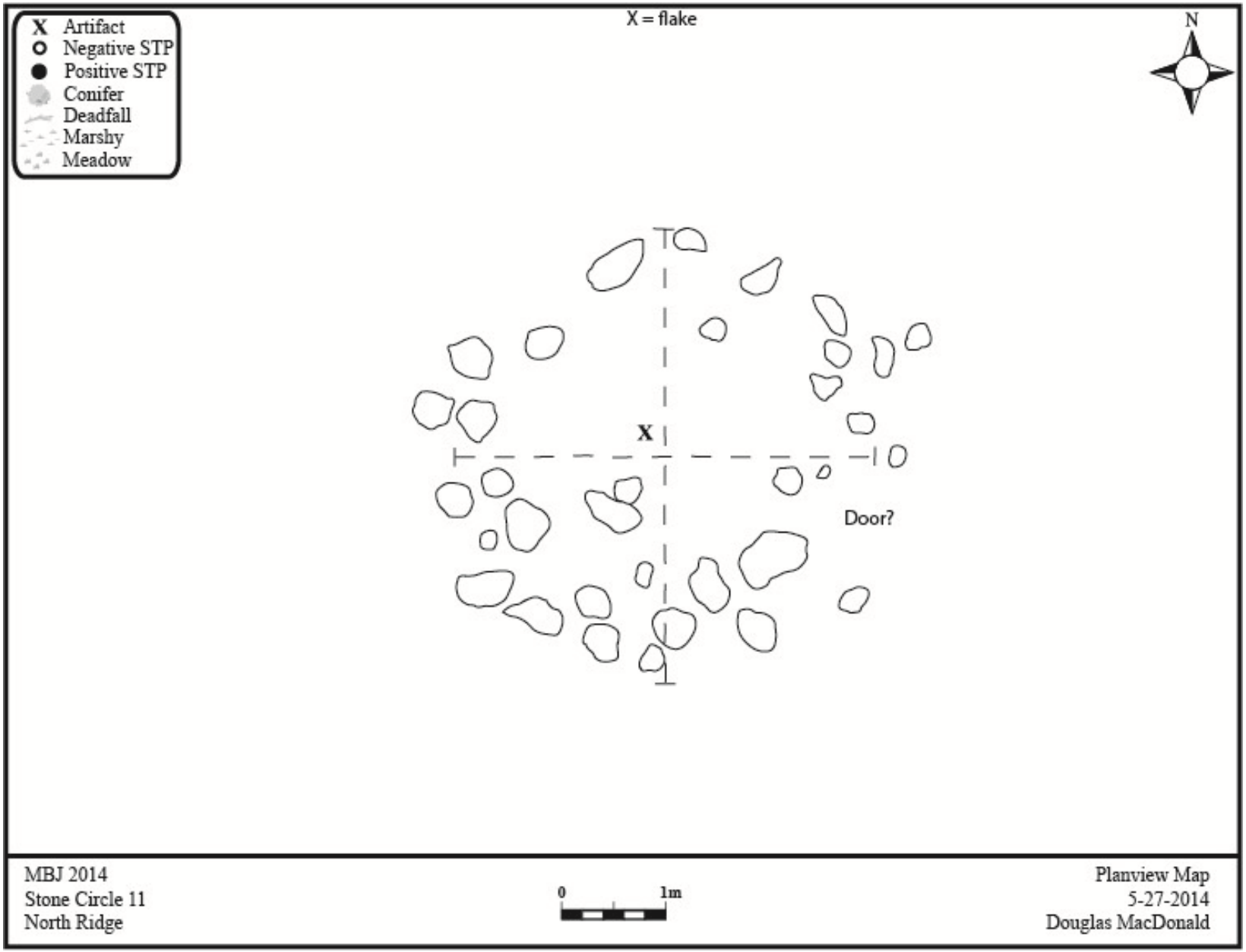

X Artifact
O Negative STP
● Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Trail (old road)
SC-6
SC-5
SC-4
MBJ 2014
Stone Circles 5 and 6
0
2m
Planview Map
5-23-2014
MRN

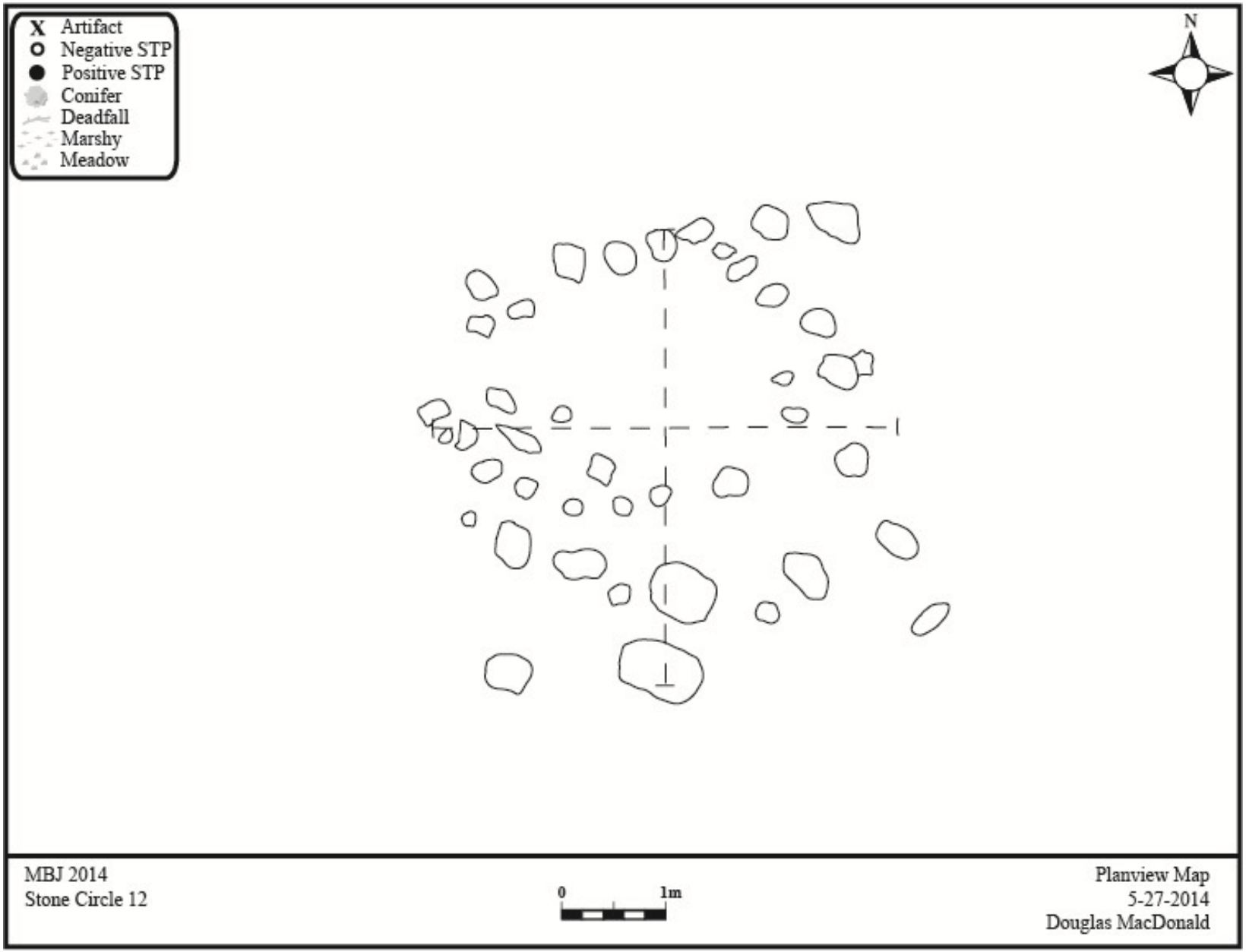

Trail (old road)
5m
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Tan
Orthoquartz
Broken
limestone
cobble
SC #7
Tan
Orthoquartz
MBJ 2014
Stone Circle 7
0
1m
Planview Map
5-23-2014
MRN

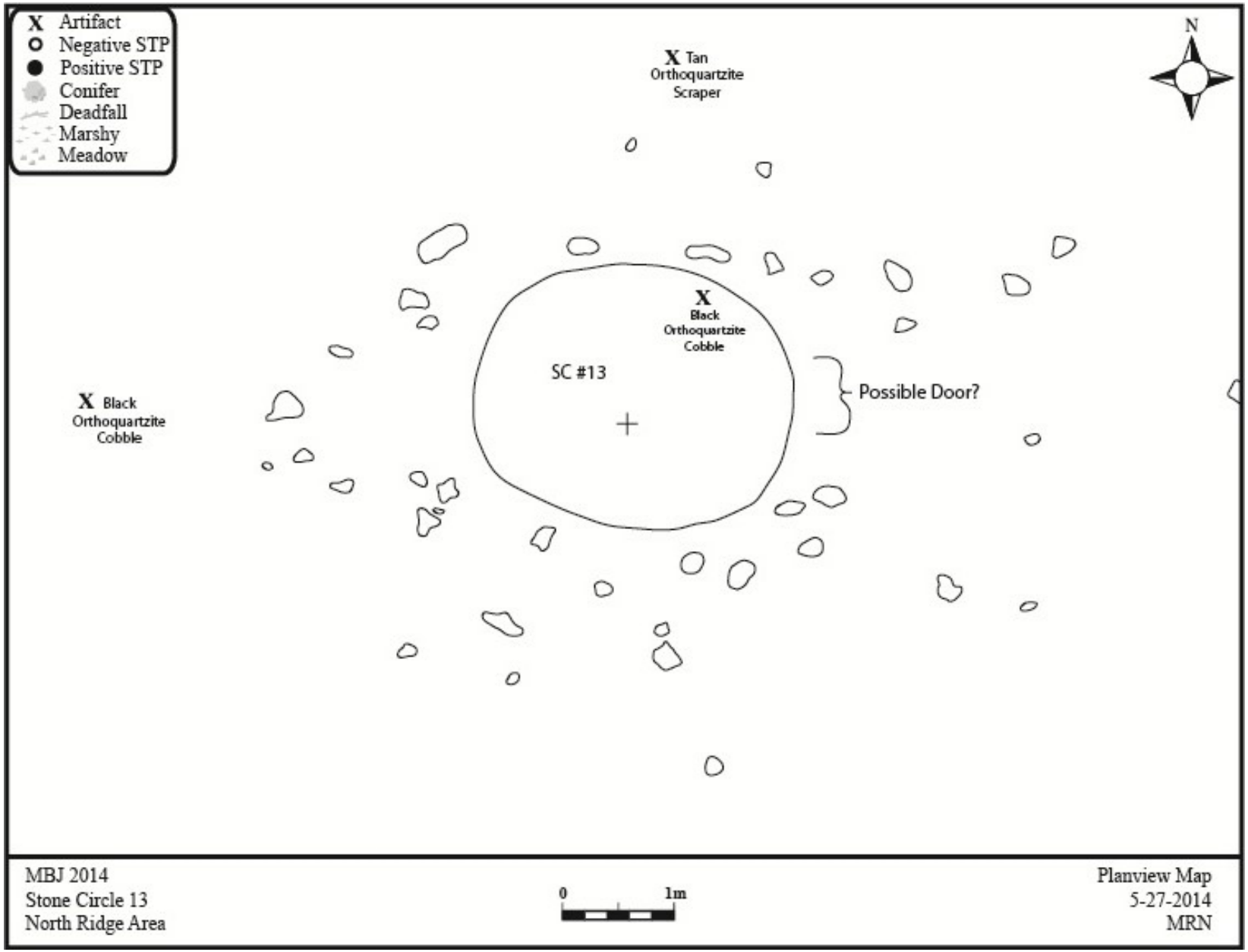

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Large Bush
and
Rock Pile
8m from southern
center of SC #8
SC #8
Sage brush
MBJ 2014
Stone Circle 8
North Ridge
0
1m
Planview Map
5-27-2014
JMP

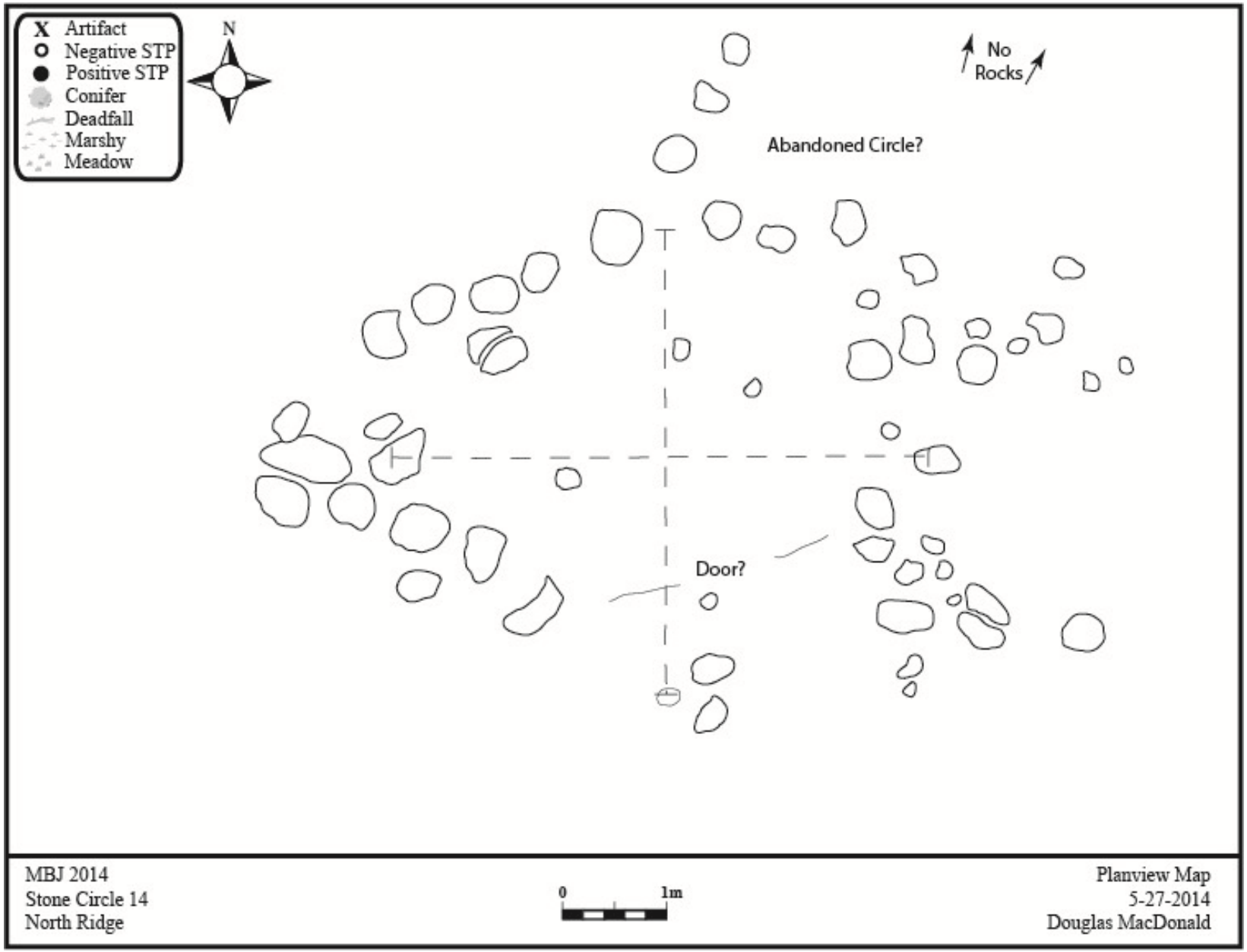

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Single Juniper
6m
X
MBJ 2014
Stone Circle 9
North Ridge
0
1m
Planview Map
5-27-2014
JMP


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
MBJ 2014
Stone Circle 10
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

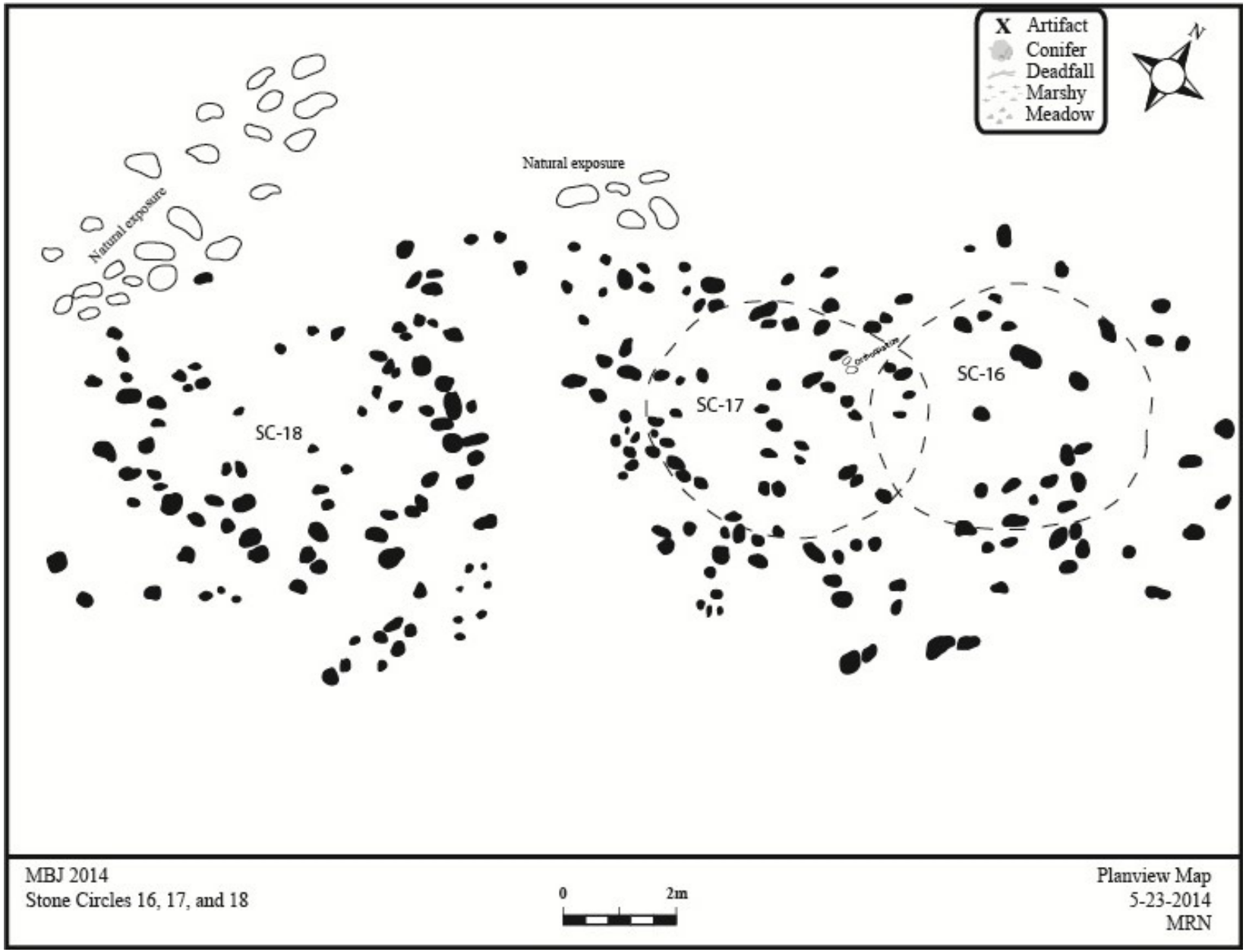

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
X = flake
N
X
Door?
MBJ 2014
Stone Circle 11
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

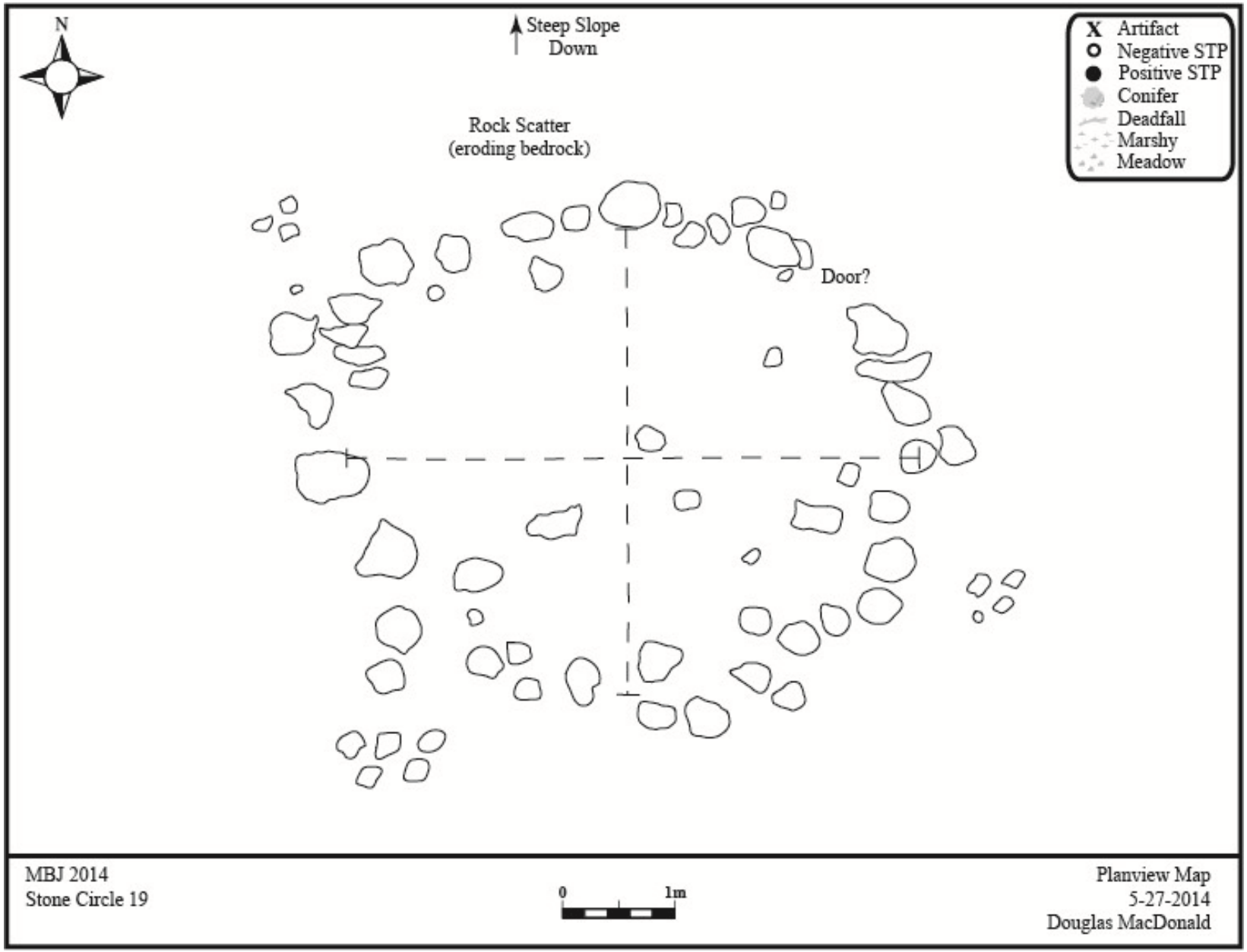

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 12
0
1m
Planview Map
5-27-2014
Douglas MacDonald

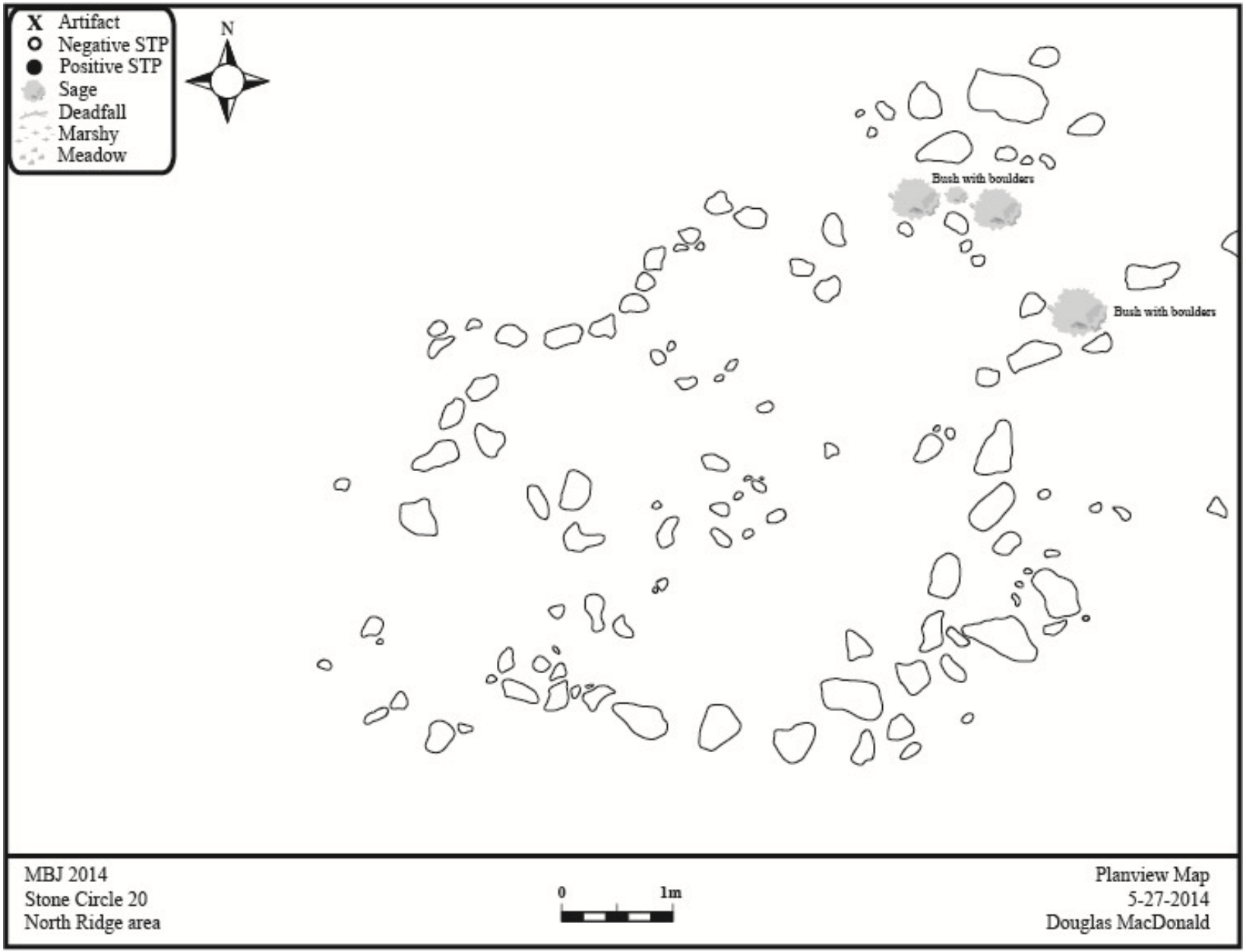

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
X Tan Orthoquartzite Scraper
X Black Orthoquartzite Cobble
SC #13
Possible Door?
X Black Orthoquartzite Cobble
MBJ 2014
Stone Circle 13
North Ridge Area
0
1m
Planview Map
5-27-2014
MRN

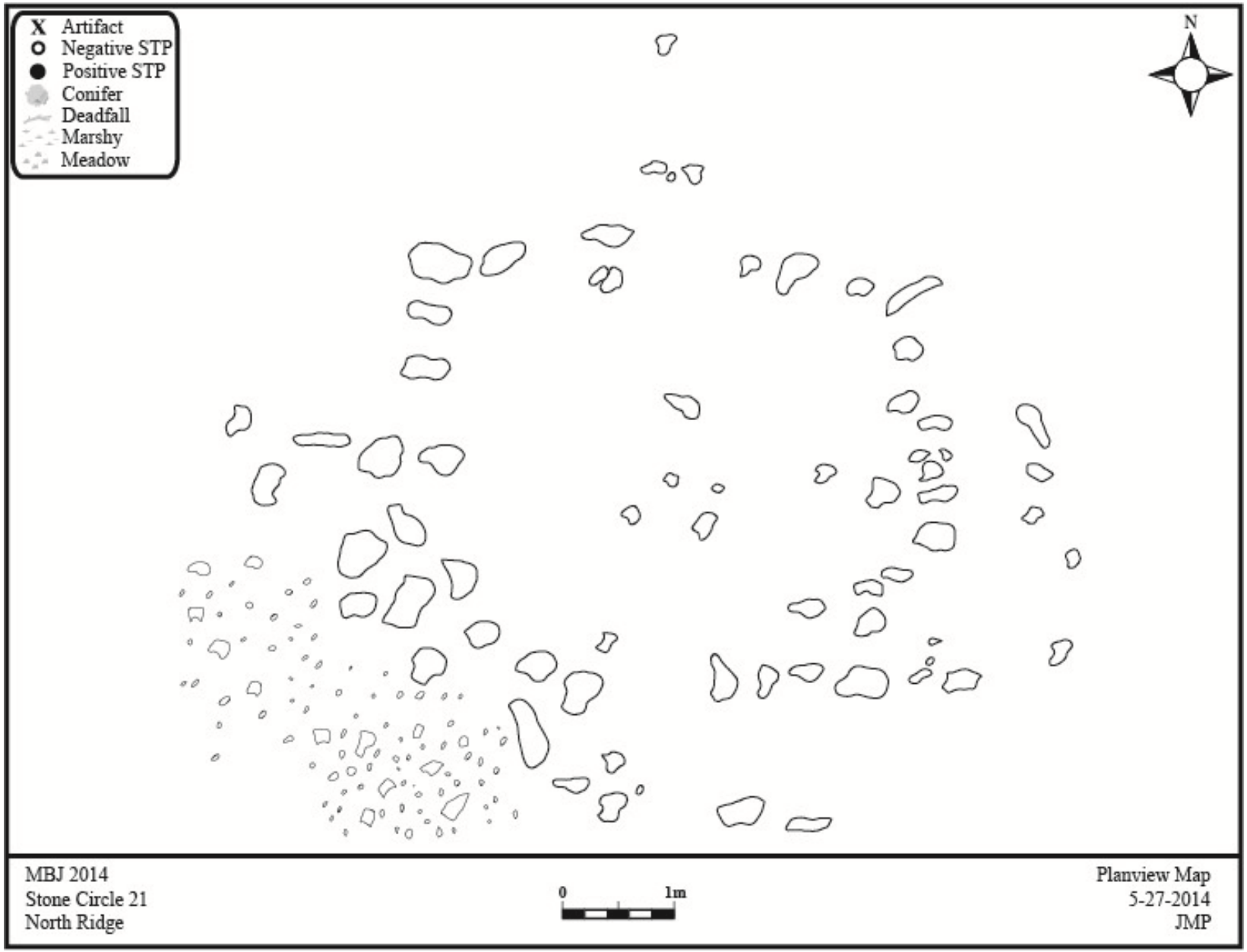

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
No Rocks
Abandoned Circle?
Door?
MBJ 2014
Stone Circle 14
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

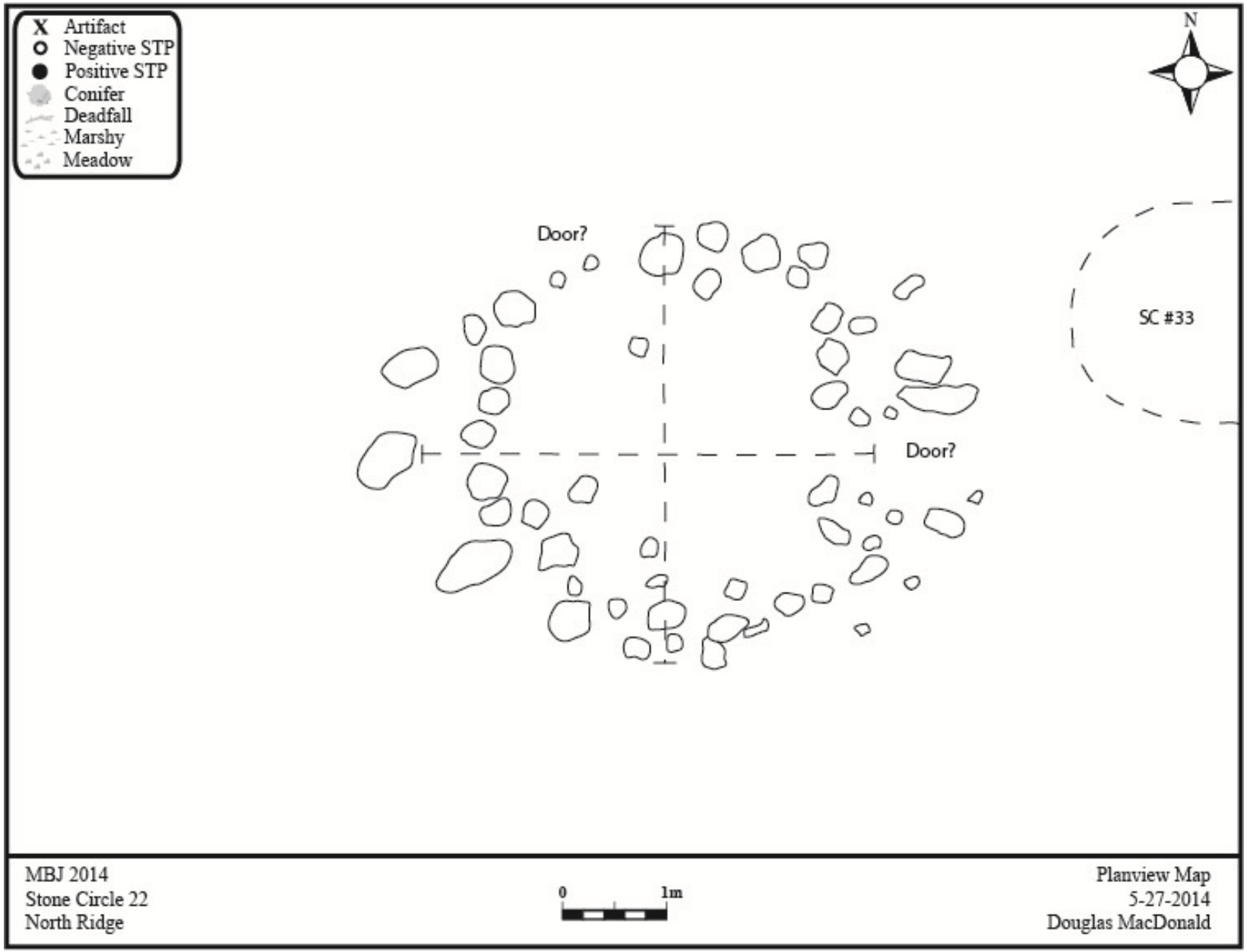

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 15
0
1m
Planview Map
5-23-2014
Douglas MacDonald

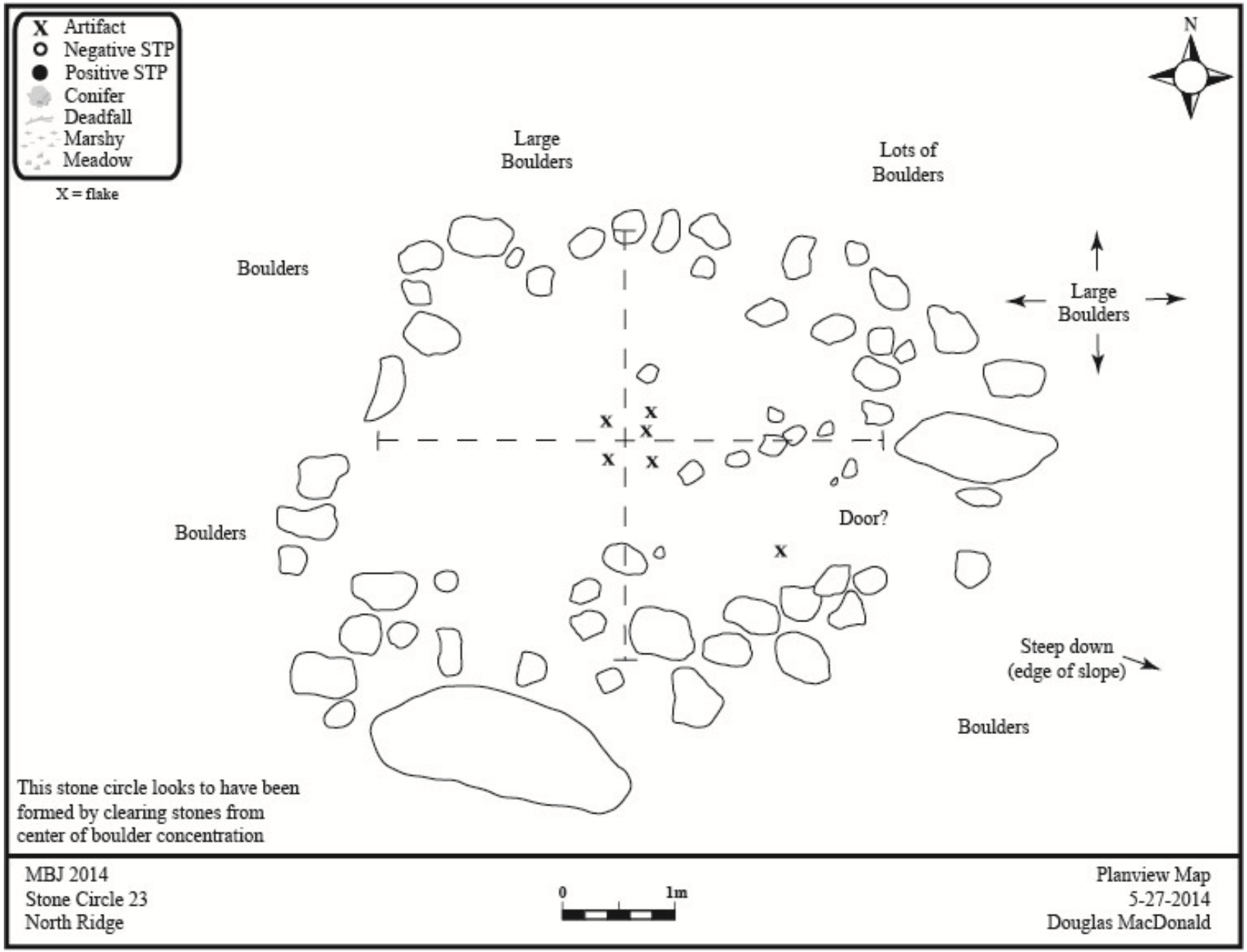

X Artifact
Conifer
Deadfall
Marshy
Meadow
N
Natural exposure
Natural exposure
SC-18
SC-17
SC-16
MBJ 2014
Stone Circles 16, 17, and 18
0
2m
Planview Map
5-23-2014
MRN

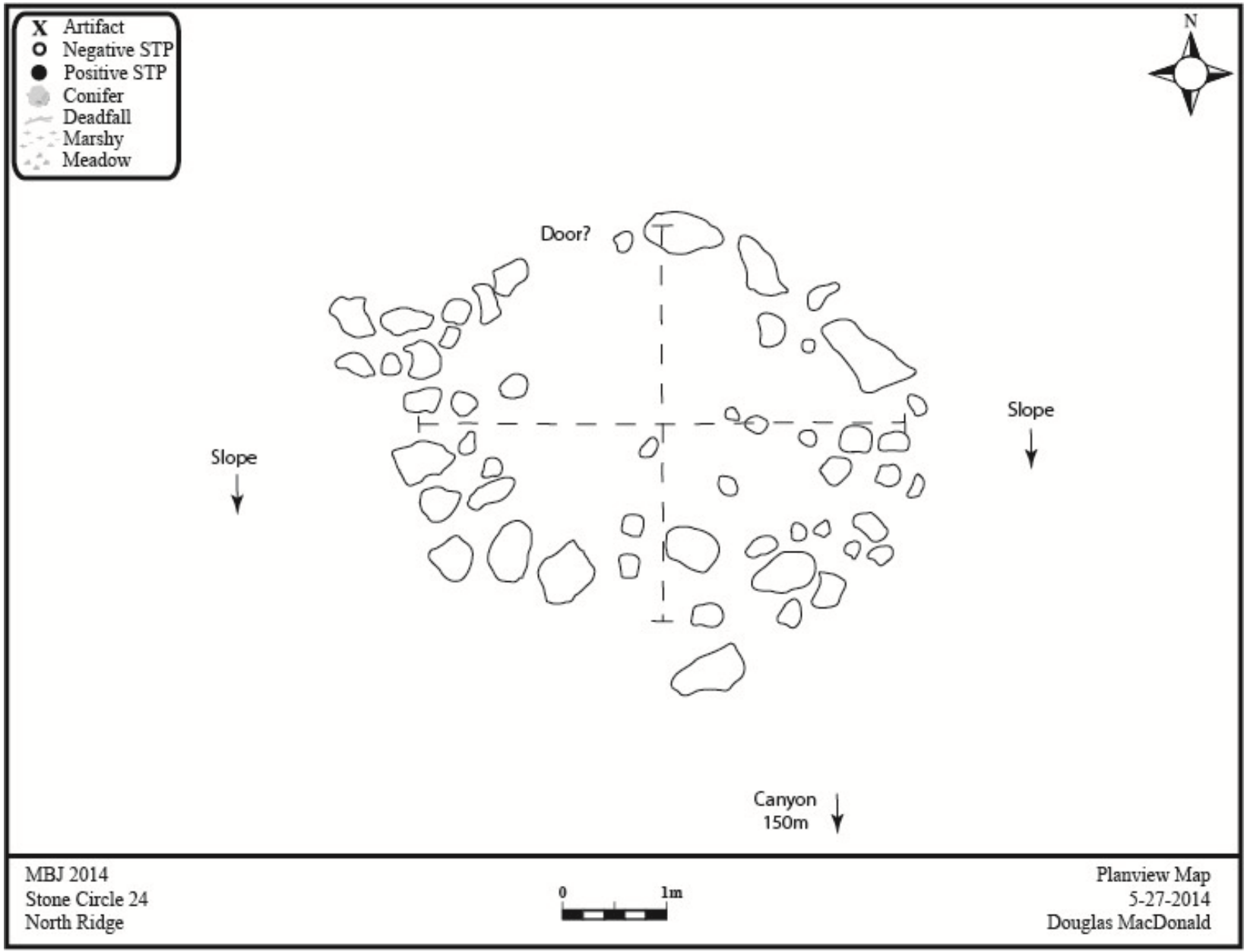

N
Steep Slope
Down
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Rock Scatter
(eroding bedrock)
Door?
MBJ 2014
Stone Circle 19
0
1m
Planview Map
5-27-2014
Douglas MacDonald

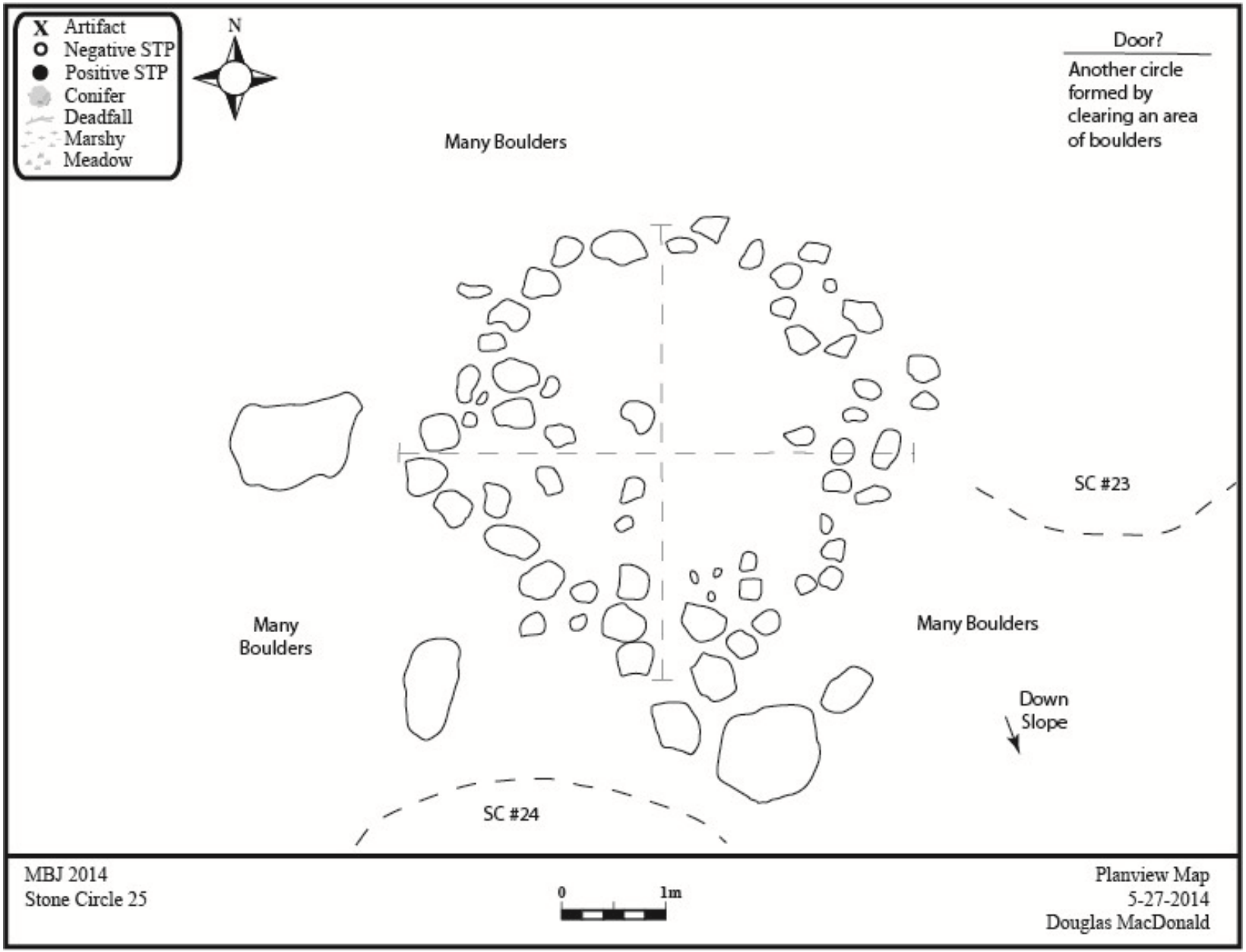

X Artifact
Negative STP
Positive STP
Sage
Deadfall
Marshy
Meadow
N
Bush with boulders
Bush with boulders
MBJ 2014
Stone Circle 20
North Ridge area
0
1m
Planview Map
5-27-2014
Douglas MacDonald

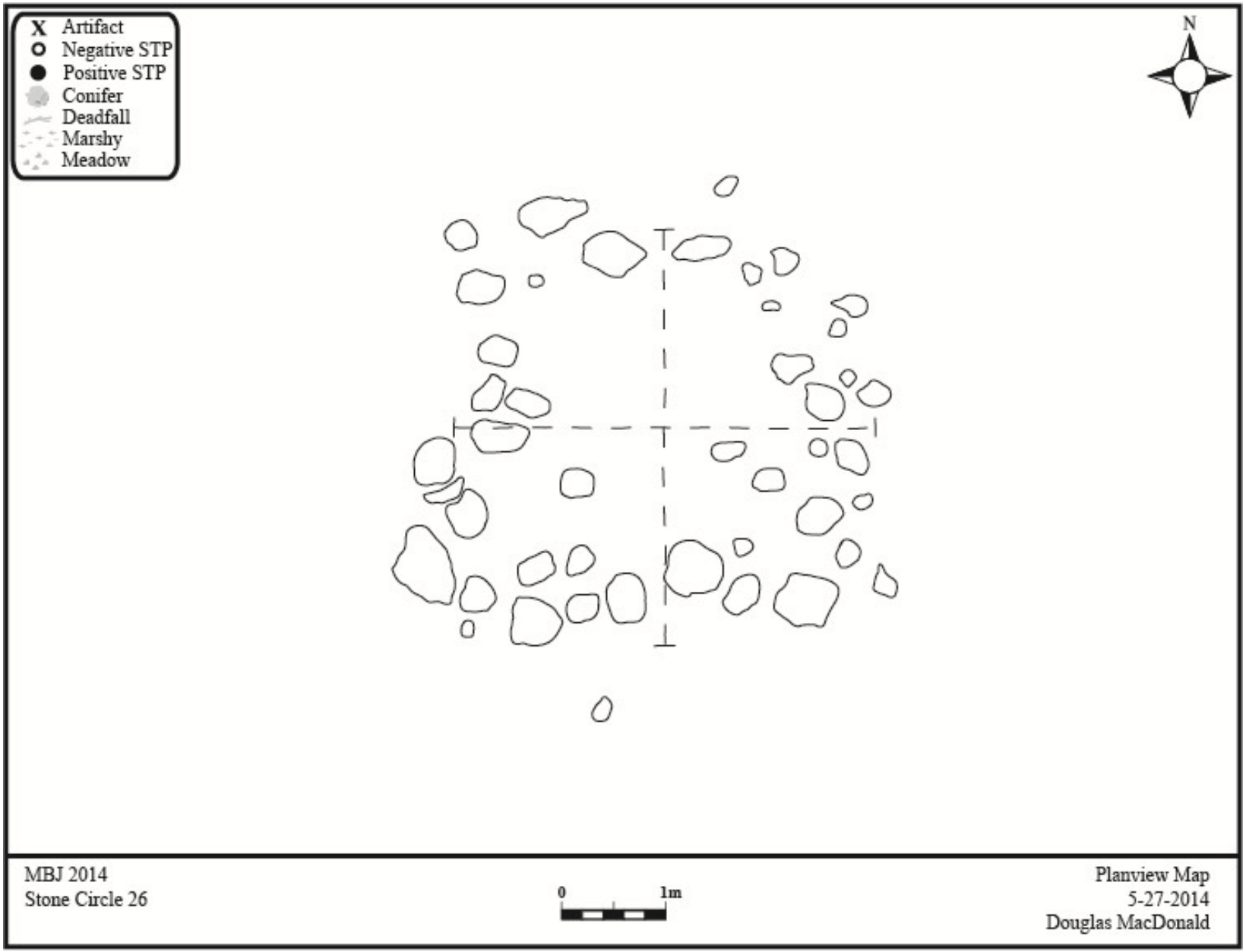

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 21
North Ridge
0
1m
Planview Map
5-27-2014
JMP


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
Door?
SC #33
MBJ 2014
Stone Circle 22
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
X = flake
N
Large Boulders
Lots of Boulders
Boulders
Large Boulders
Boulders
Door?
Steep down (edge of slope)
Boulders
This stone circle looks to have been formed by clearing stones from center of boulder concentration
MBJ 2014
Stone Circle 23
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

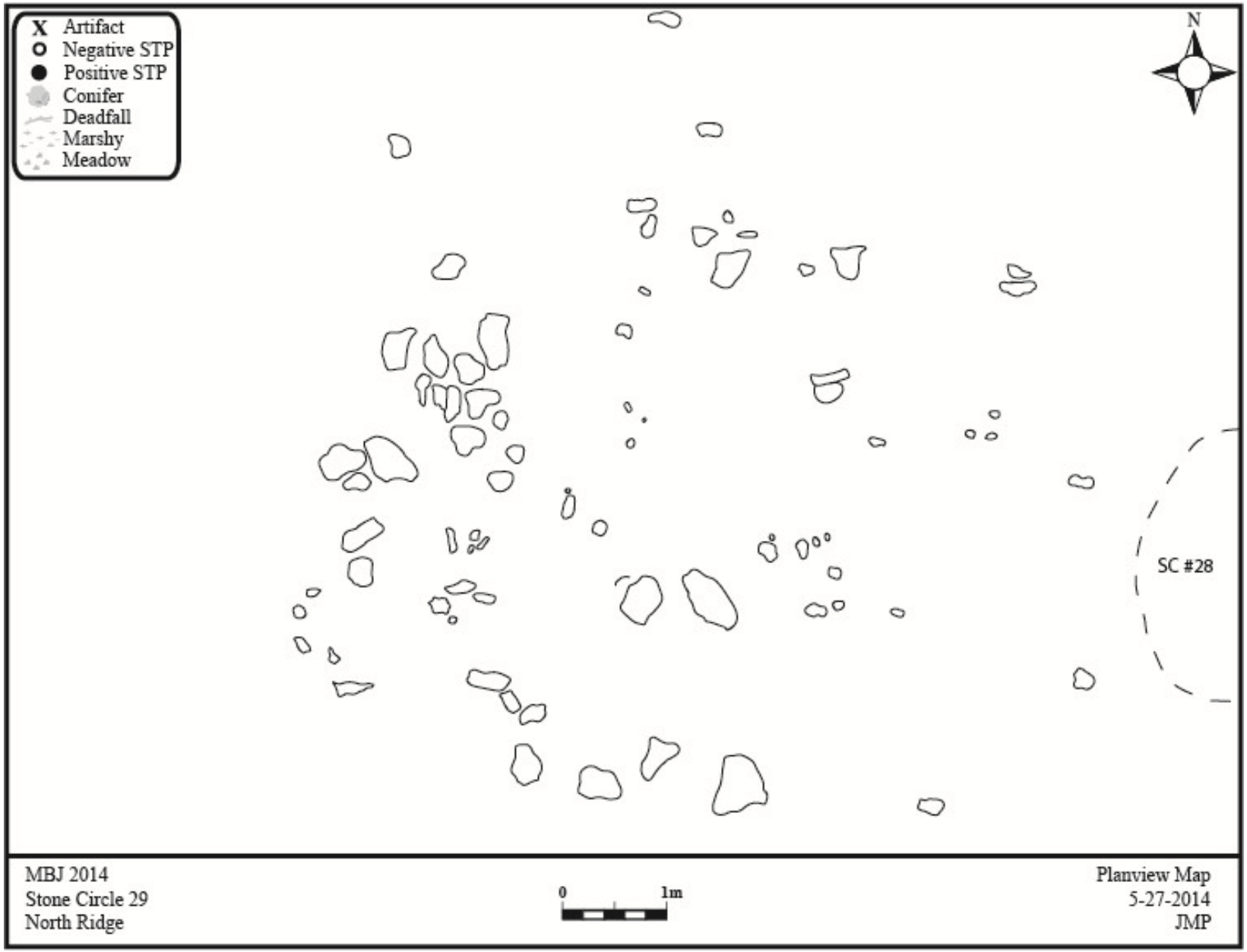

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
Slope
Slope
Canyon
150m
MBJ 2014
Stone Circle 24
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
Another circle formed by clearing an area of boulders
Many Boulders
SC #23
Many Boulders
Many Boulders
Down Slope
SC #24
MBJ 2014
Stone Circle 25
0
1m
Planview Map
5-27-2014
Douglas MacDonald

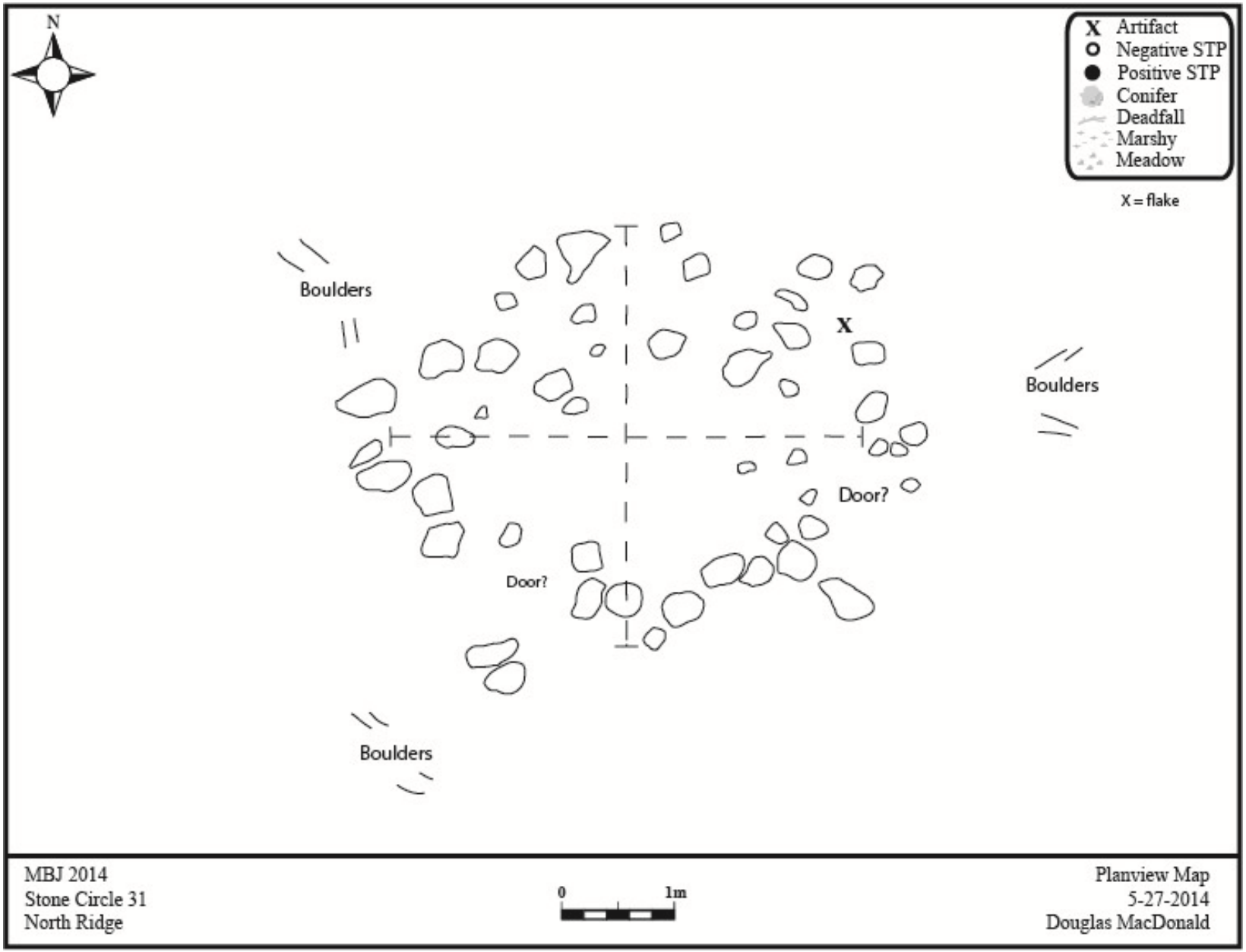

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 26
0
1m
Planview Map
5-27-2014
Douglas MacDonald

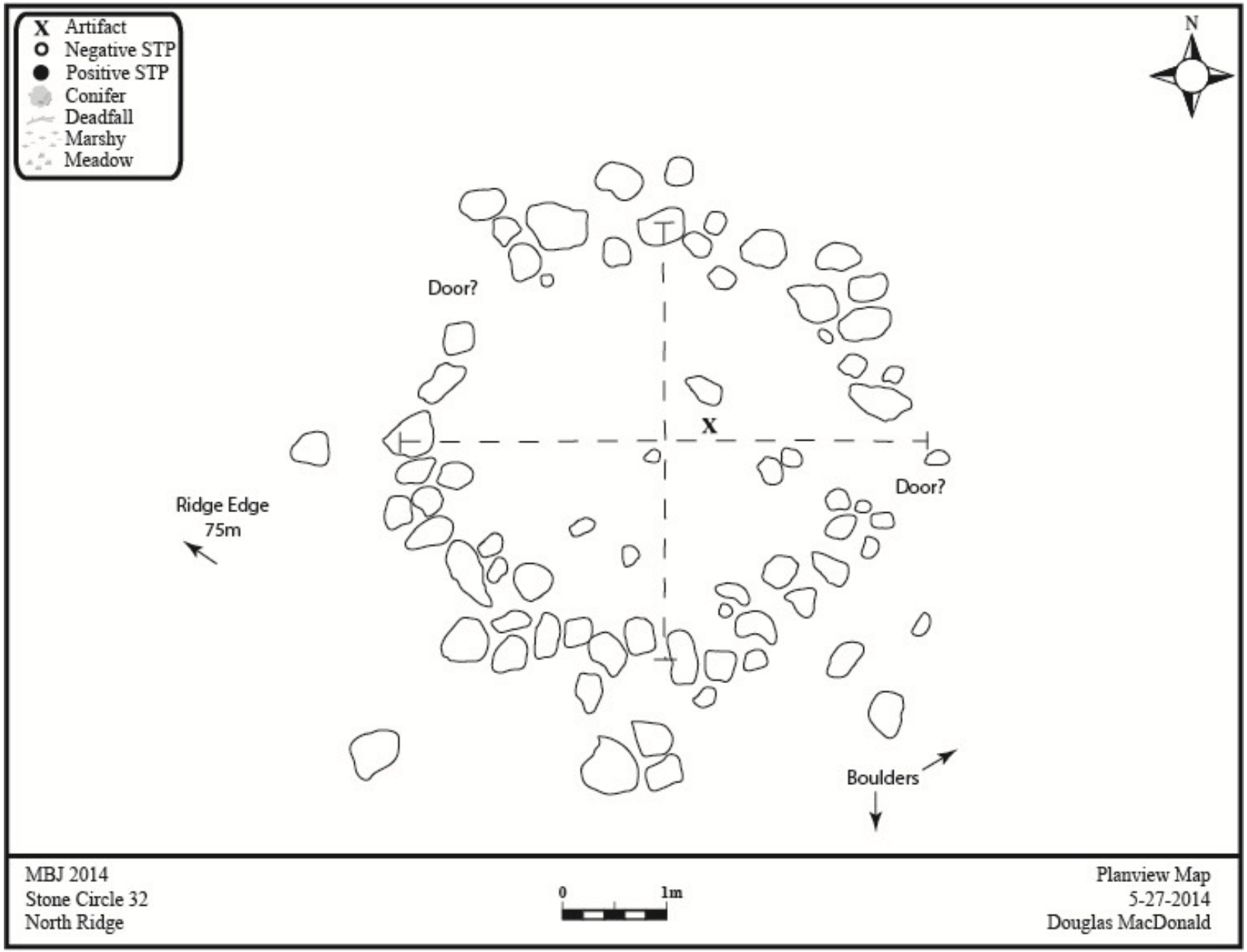

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 27
0
1m
Planview Map
5-27-2014
JMP

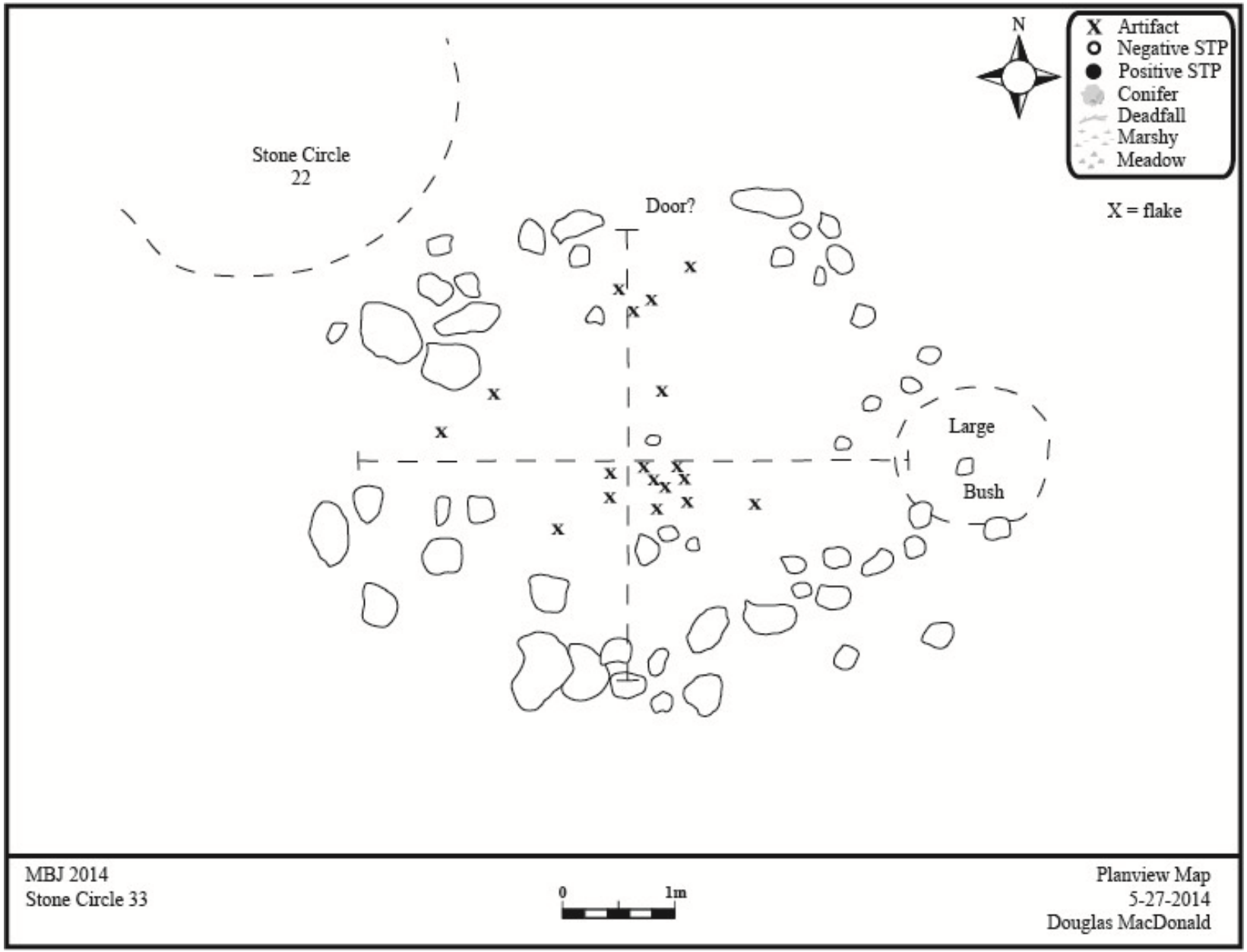

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
SC #26
Depression
MBJ 2014
Stone Circle 28
North Ridge
0
1m
Planview Map
5-27-2014
JMP

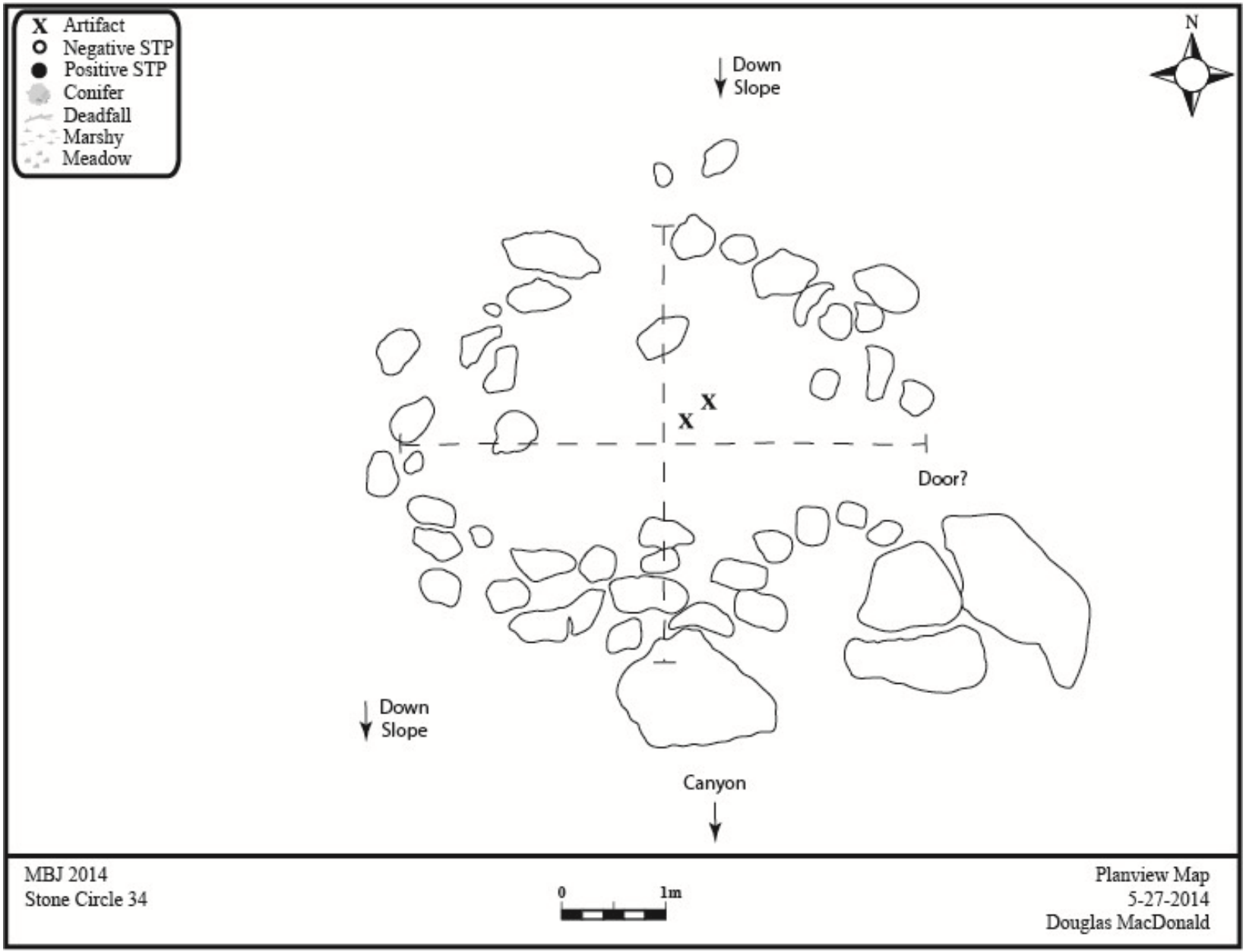

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
SC #28
MBJ 2014
Stone Circle 29
North Ridge
0
1m
Planview Map
5-27-2014
JMP

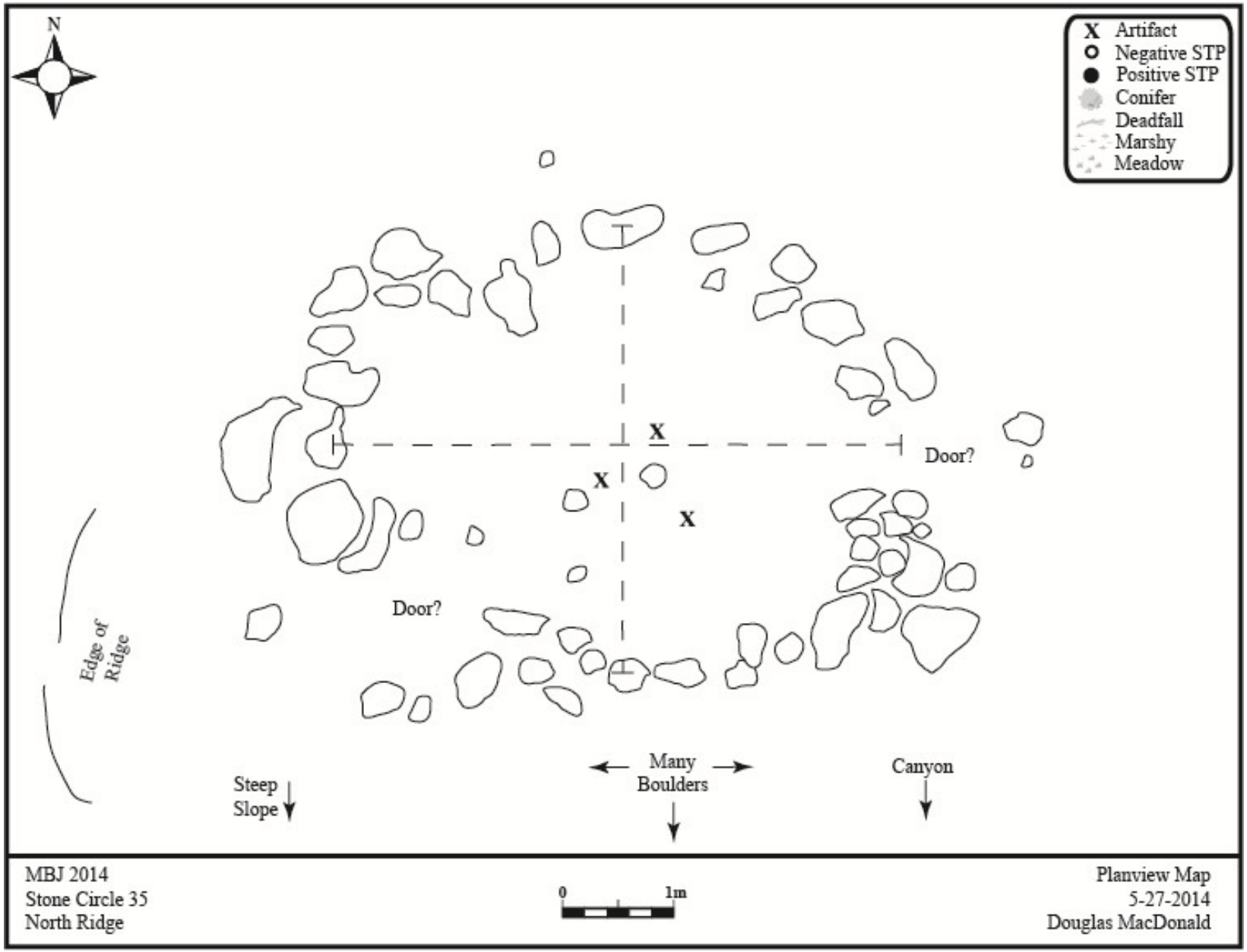

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
SC #28
N
Boulders
Boulders
Boulders
SC #31
MBJ 2014
Stone Circle 30
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

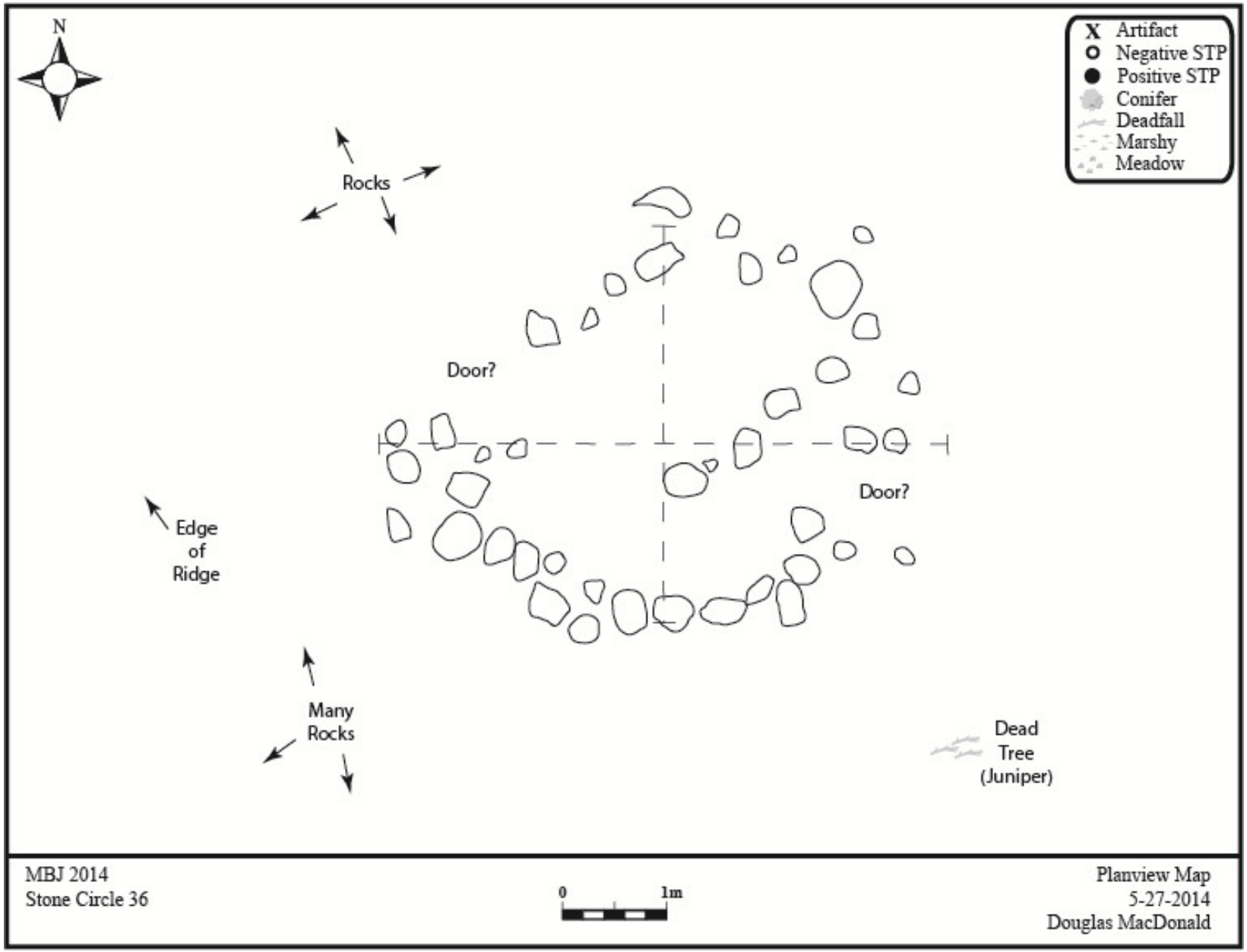

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
X = flake
Boulders
X
Boulders
Door?
Door?
Boulders
MBJ 2014
Stone Circle 31
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
X
Door?
Ridge Edge
75m
Boulders
MBJ 2014
Stone Circle 32
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

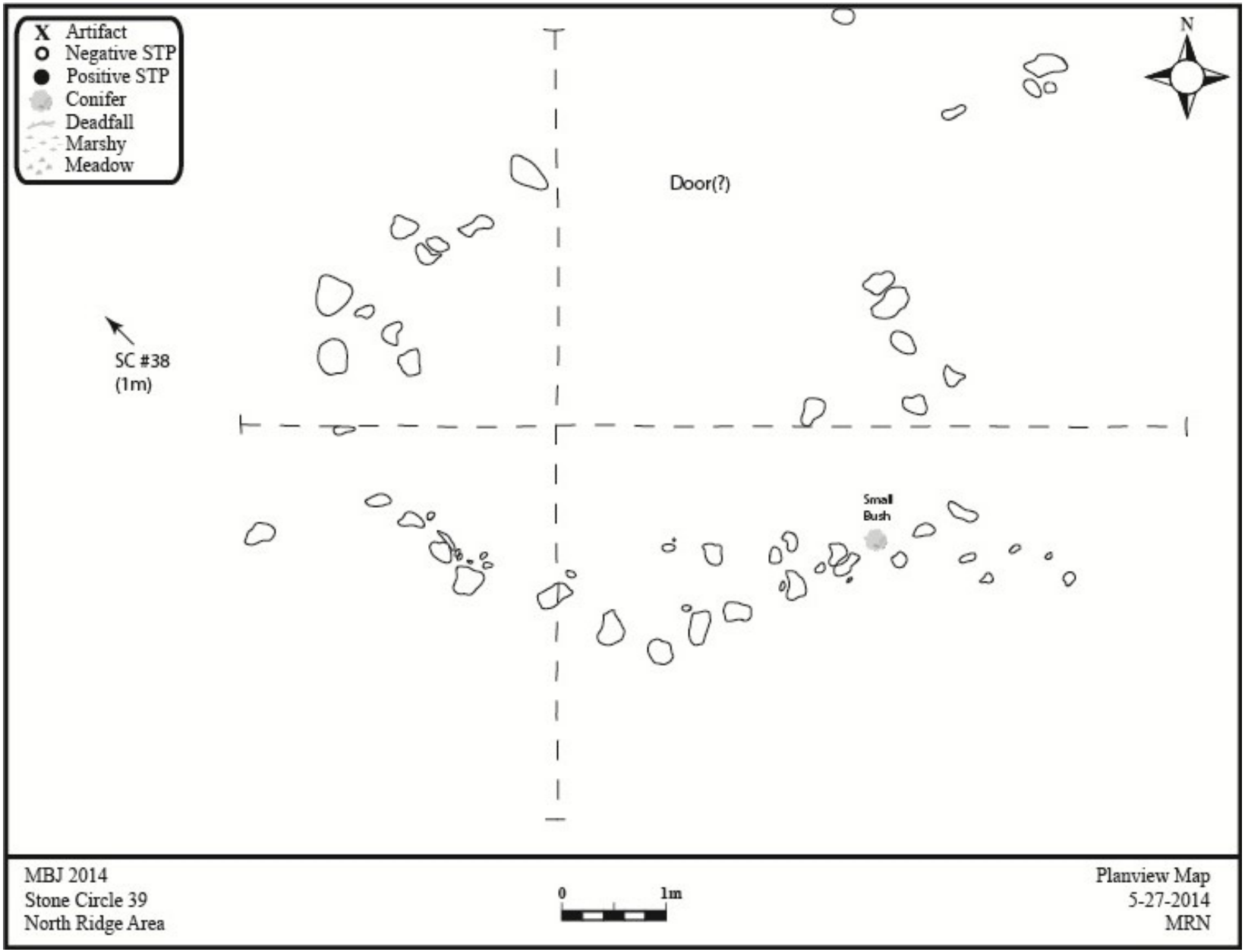

N
Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
X = flake
Stone Circle
22
Door?
Large
Bush
MBJ 2014
Stone Circle 33
0
1m
Planview Map
5-27-2014
Douglas MacDonald

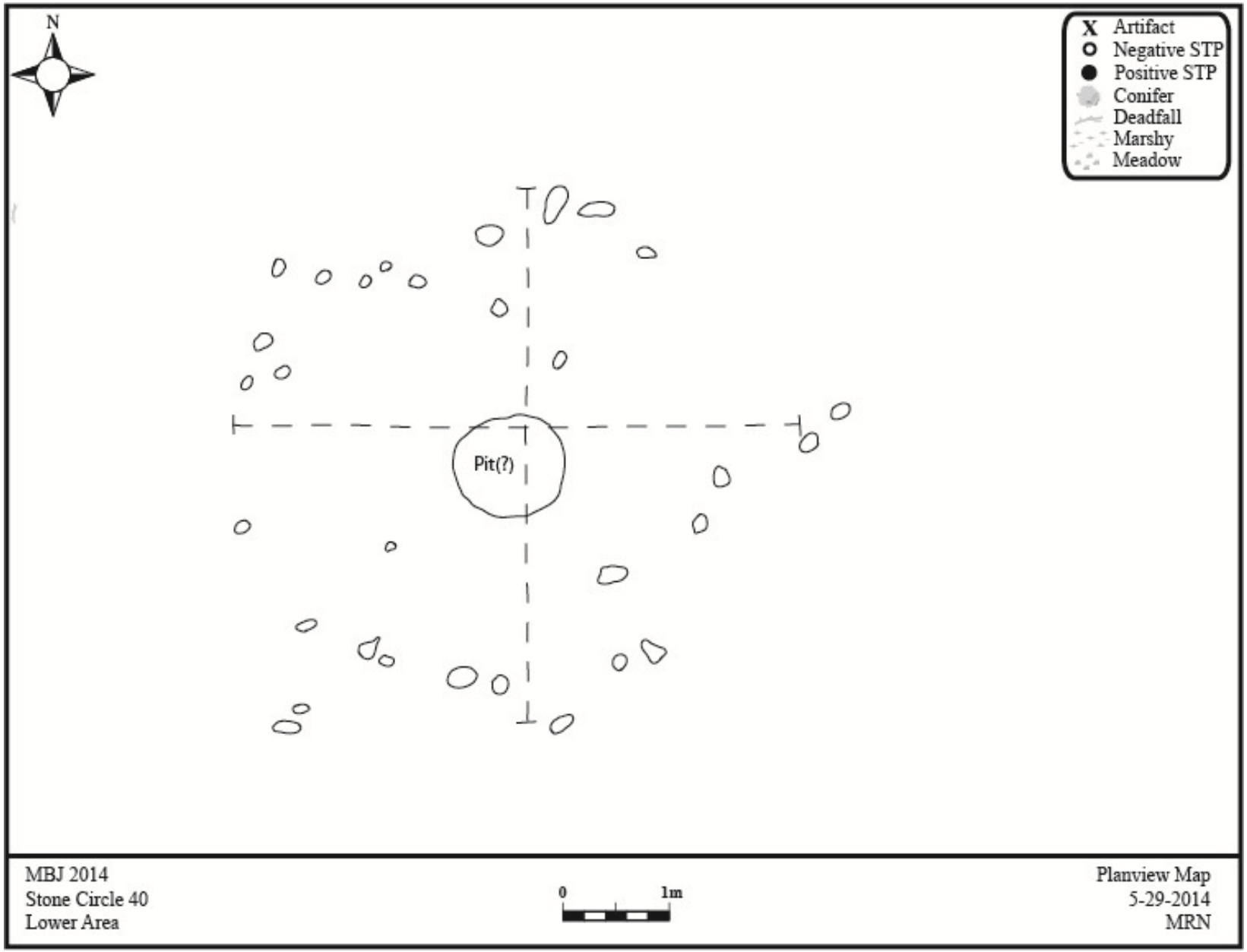

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Down Slope
X
X
Door?
Down Slope
Canyon
MBJ 2014
Stone Circle 34
0
1m
Planview Map
5-27-2014
Douglas MacDonald

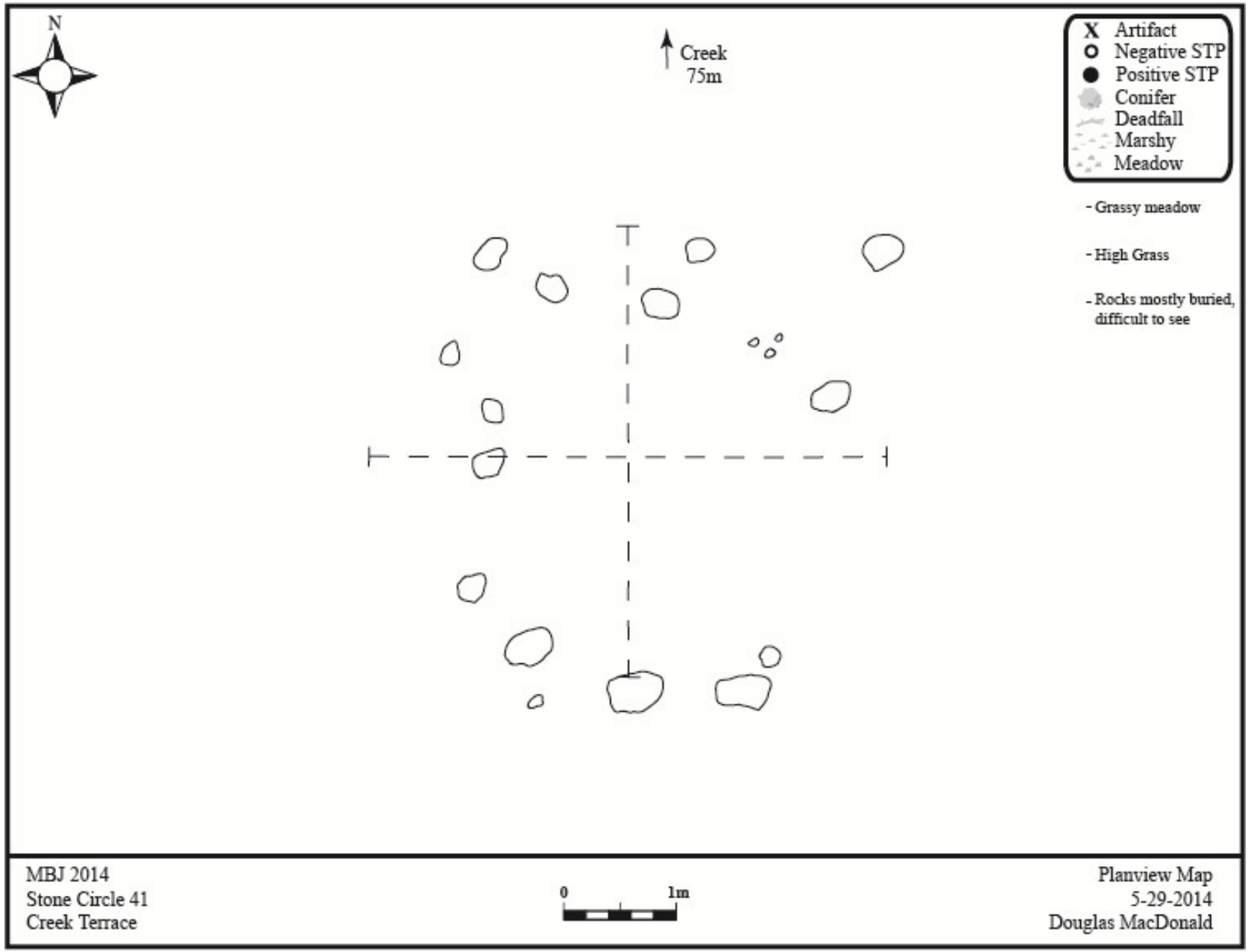

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
X
X
X
Door?
Door?
Edge of Ridge
Steep Slope
Many Boulders
Canyon
MBJ 2014
Stone Circle 35
North Ridge
0
1m
Planview Map
5-27-2014
Douglas MacDonald

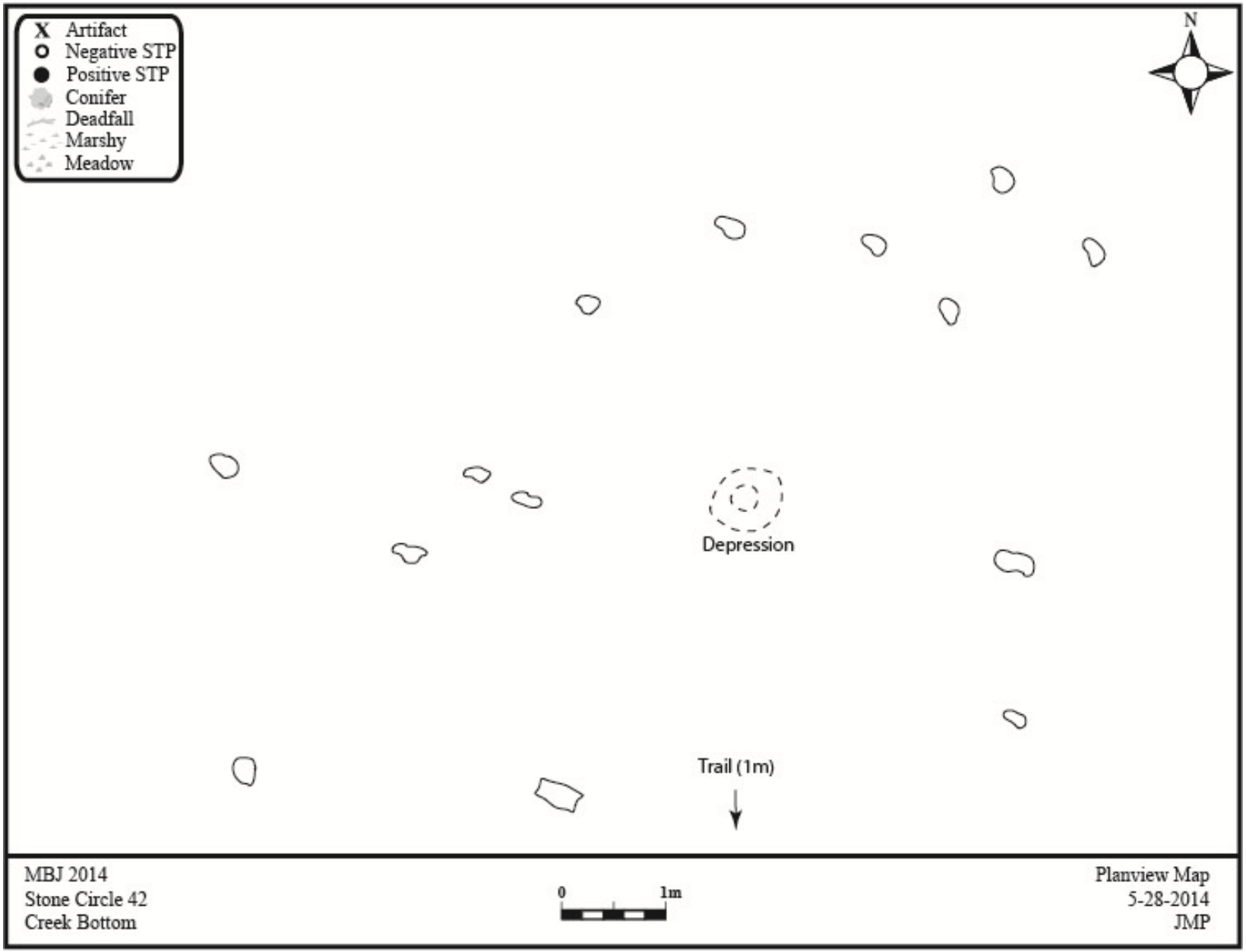

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Rocks
Door?
Door?
Edge of Ridge
Many Rocks
Dead Tree (Juniper)
MBJ 2014
Stone Circle 36
0
1m
Planview Map
5-27-2014
Douglas MacDonald

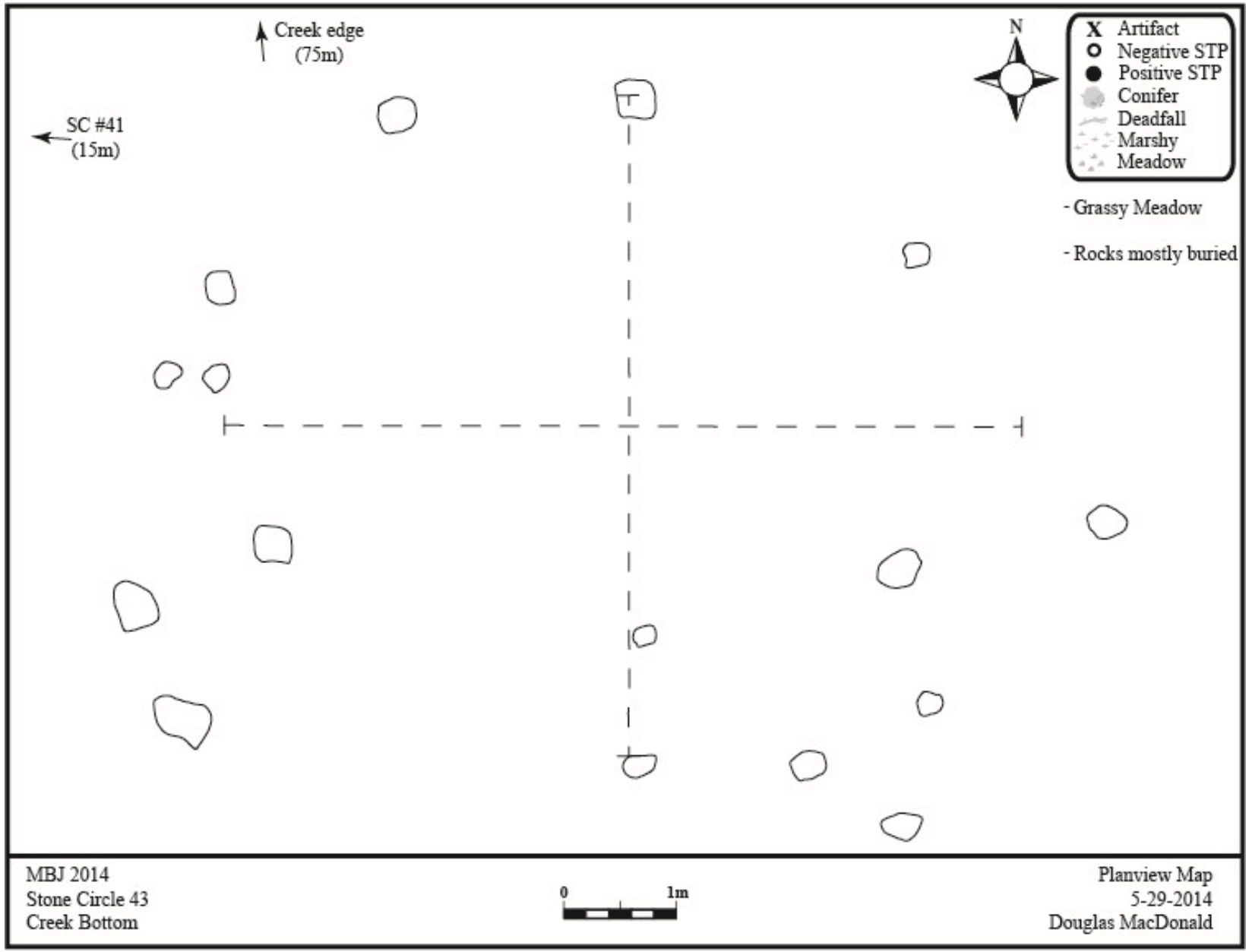

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
SC #39
1m
SC #38
MBJ 2014
Stone Circle 38
North Ridge Area
0
1m
Planview Map
5-27-2014
MRN

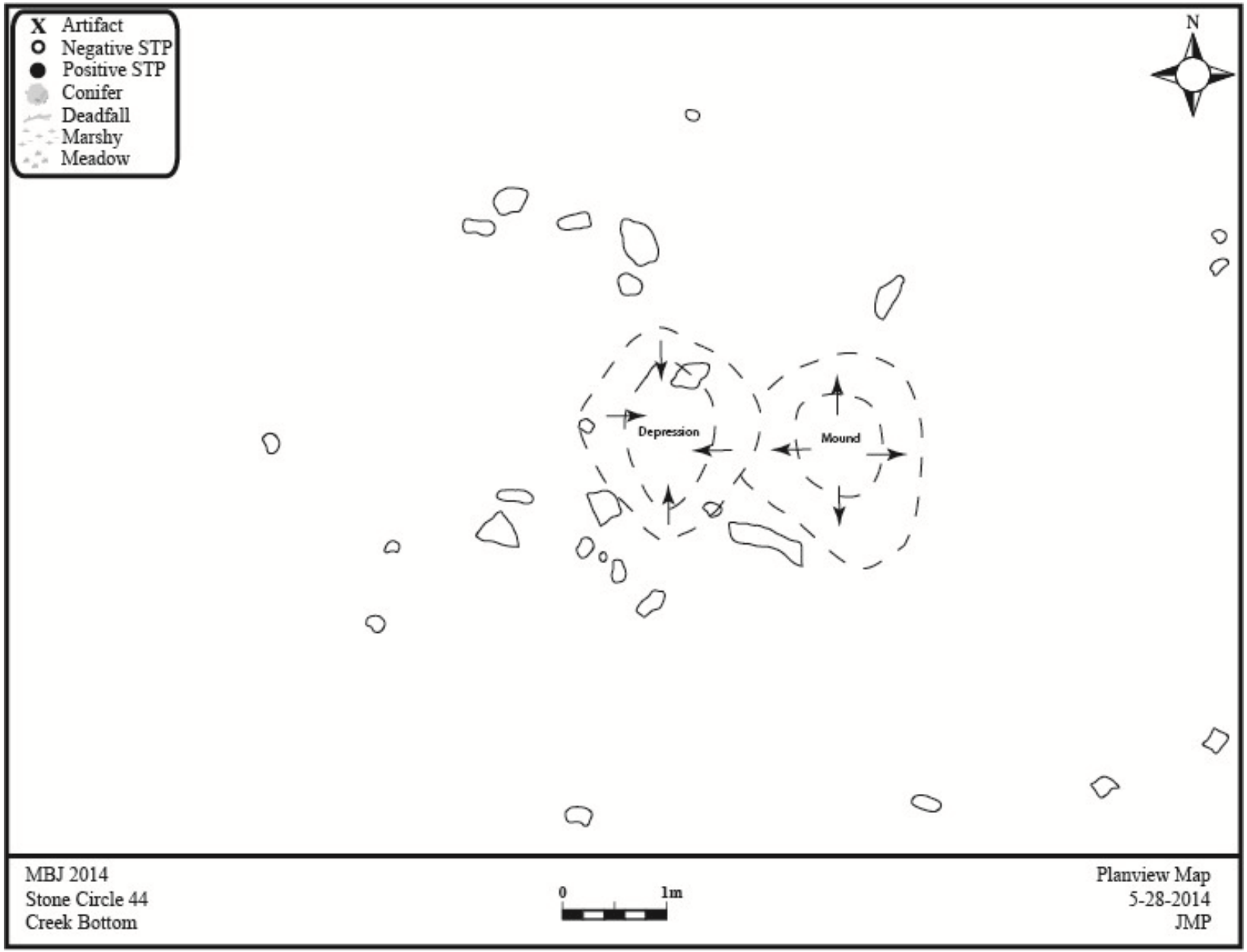

X Artifact
O Negative STP
● Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door(?)
SC #38
(1m)
Small
Bush
MBJ 2014
Stone Circle 39
North Ridge Area
0
1m
Planview Map
5-27-2014
MRN

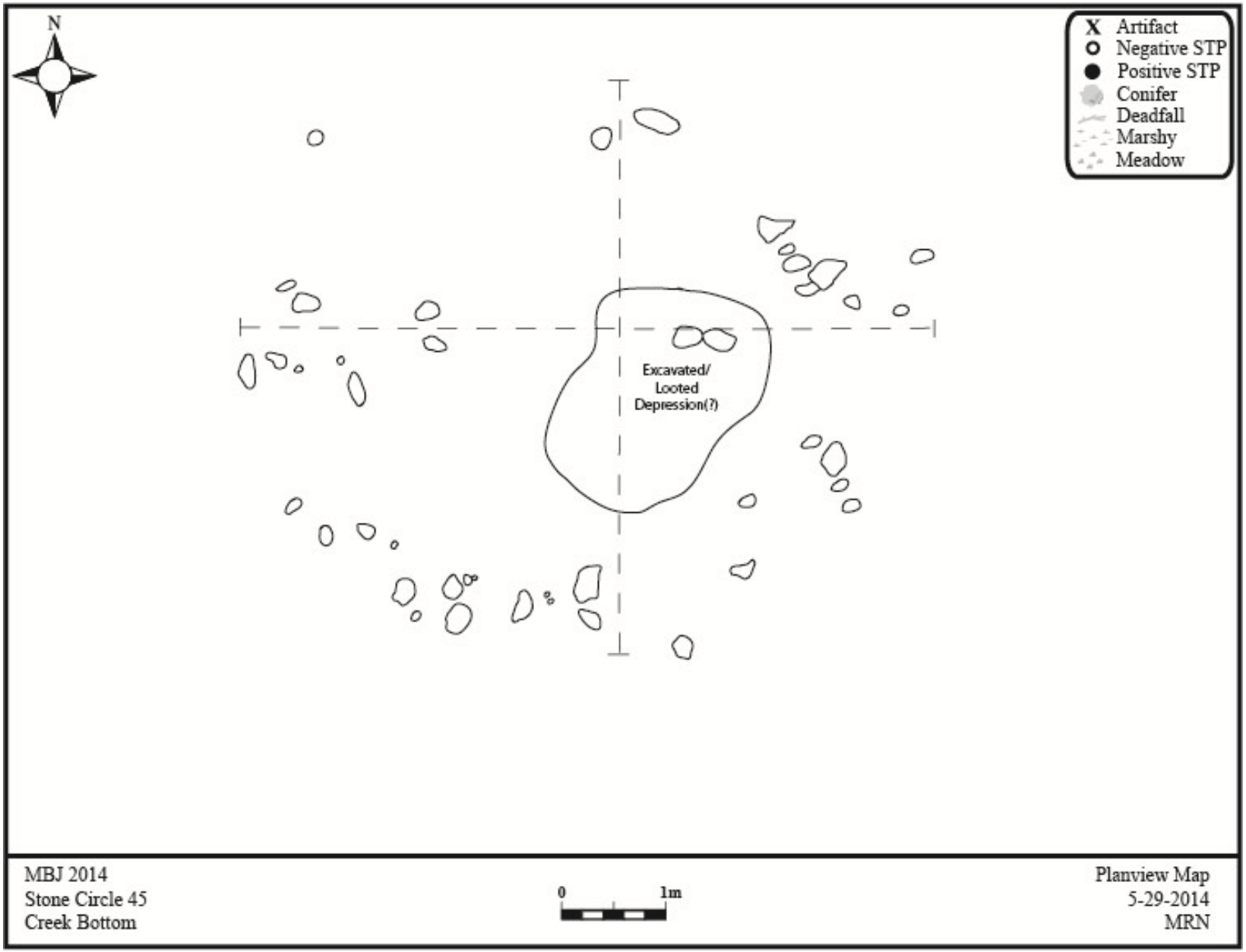

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Pit(?)
MBJ 2014
Stone Circle 40
Lower Area
0
1m
Planview Map
5-29-2014
MRN

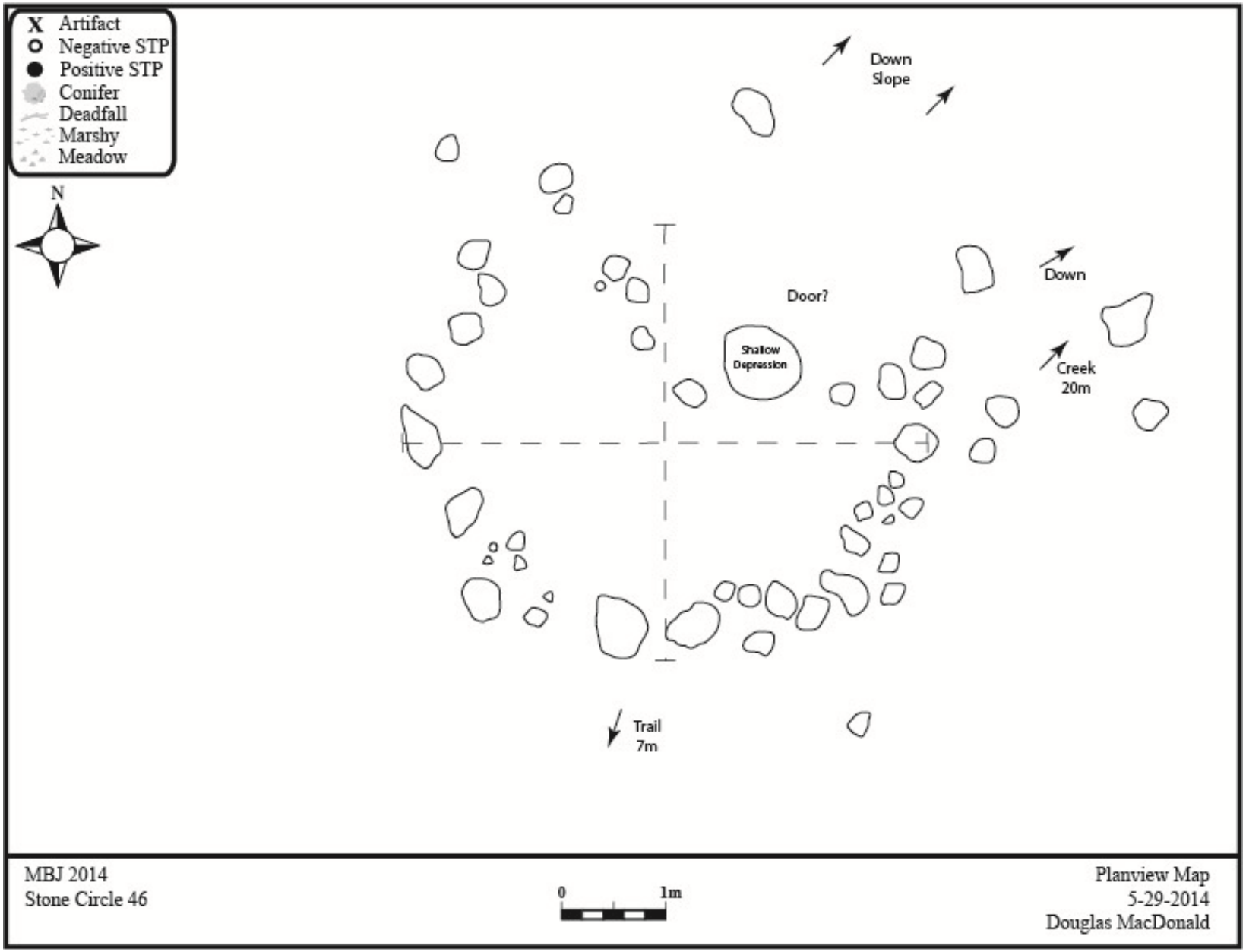

N
Creek
75m
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
- Grassy meadow
- High Grass
- Rocks mostly buried, difficult to see
MBJ 2014
Stone Circle 41
Creek Terrace
0
1m
Planview Map
5-29-2014
Douglas MacDonald

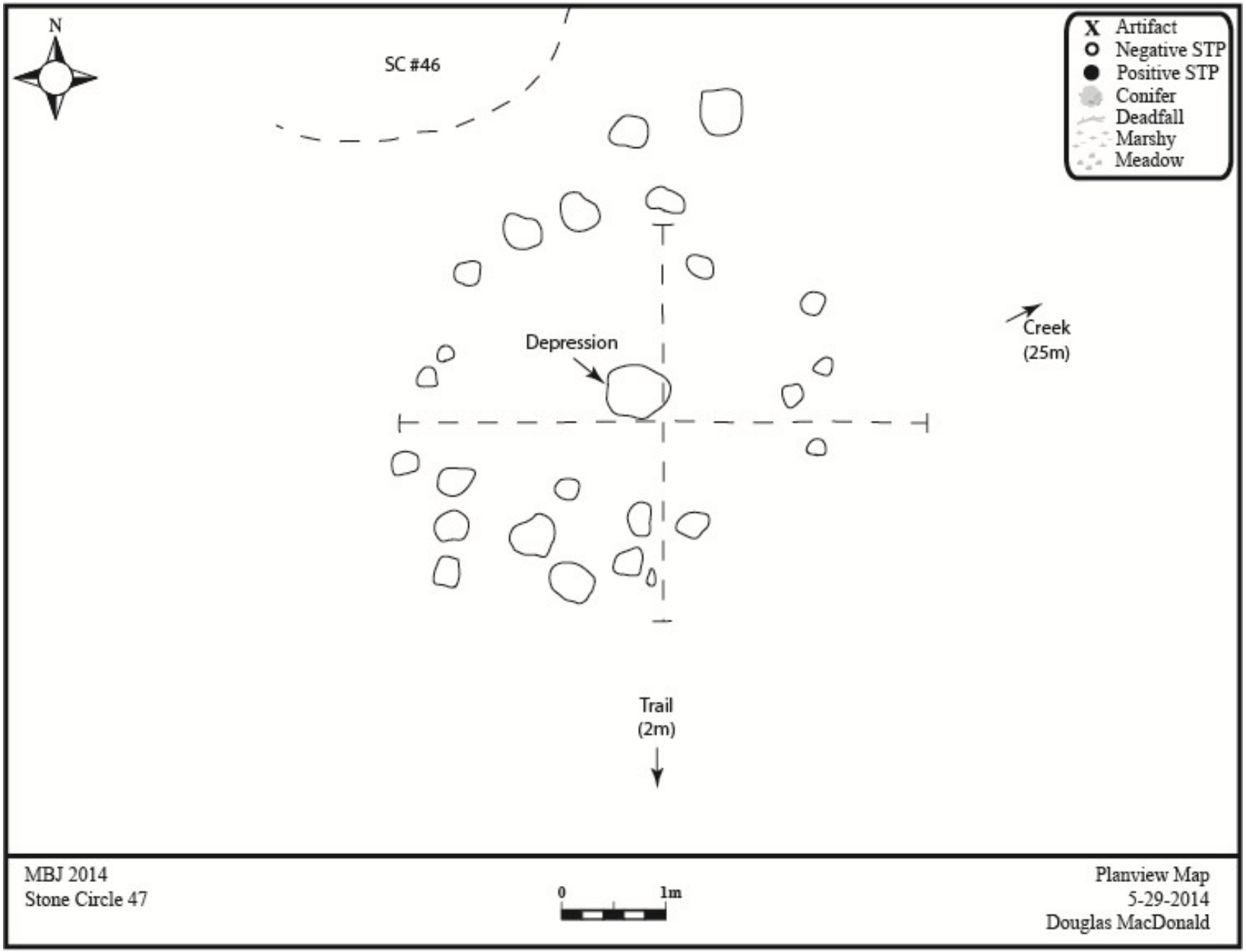

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Depression
Trail (1m)
MBJ 2014
Stone Circle 42
Creek Bottom
0
1m
Planview Map
5-28-2014
JMP

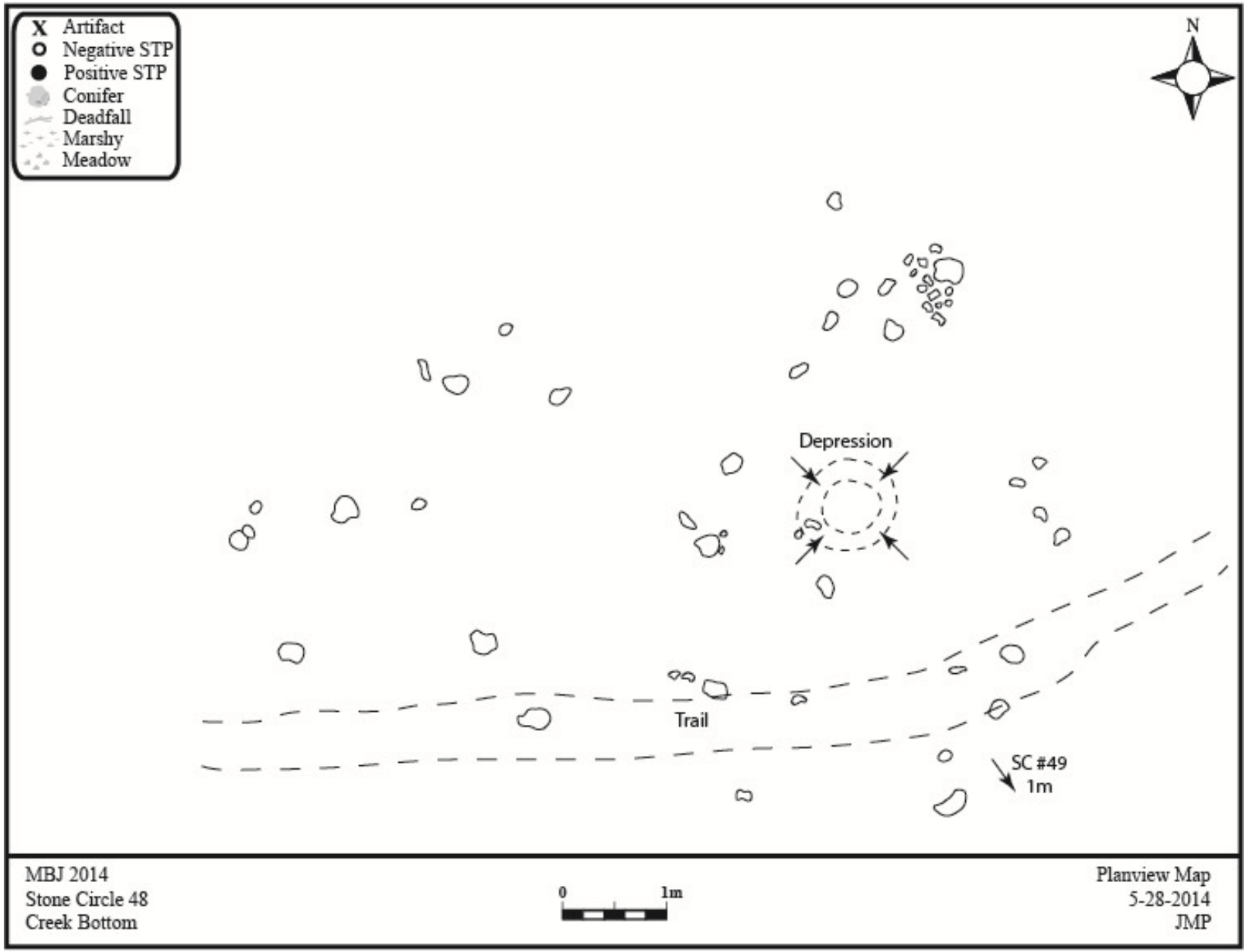

Creek edge
(75m)
SC #41
(15m)
N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
- Grassy Meadow
- Rocks mostly buried
MBJ 2014
Stone Circle 43
Creek Bottom
0
1m
Planview Map
5-29-2014
Douglas MacDonald

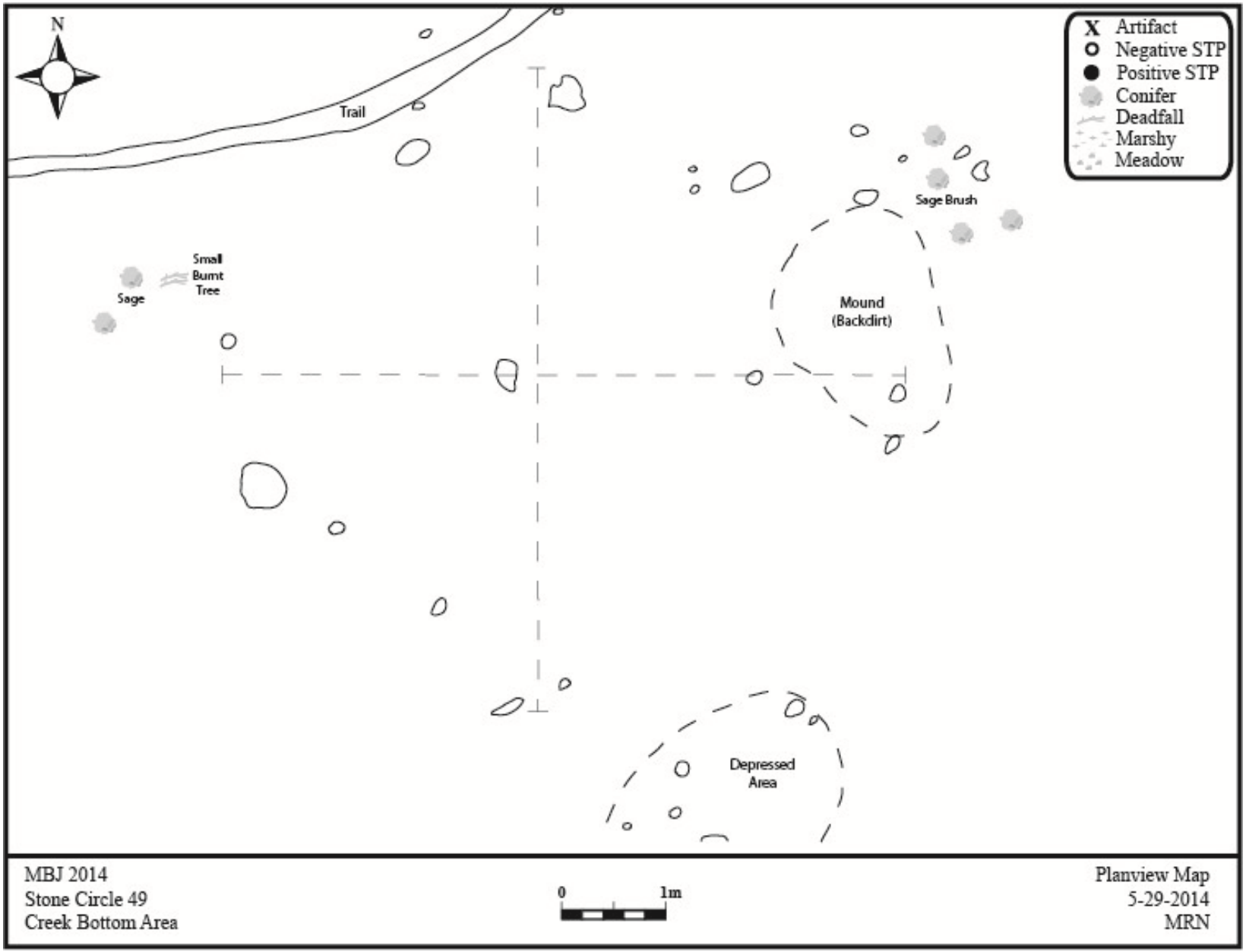

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Depression
Mound
MBJ 2014
Stone Circle 44
Creek Bottom
0
1m
Planview Map
5-28-2014
JMP

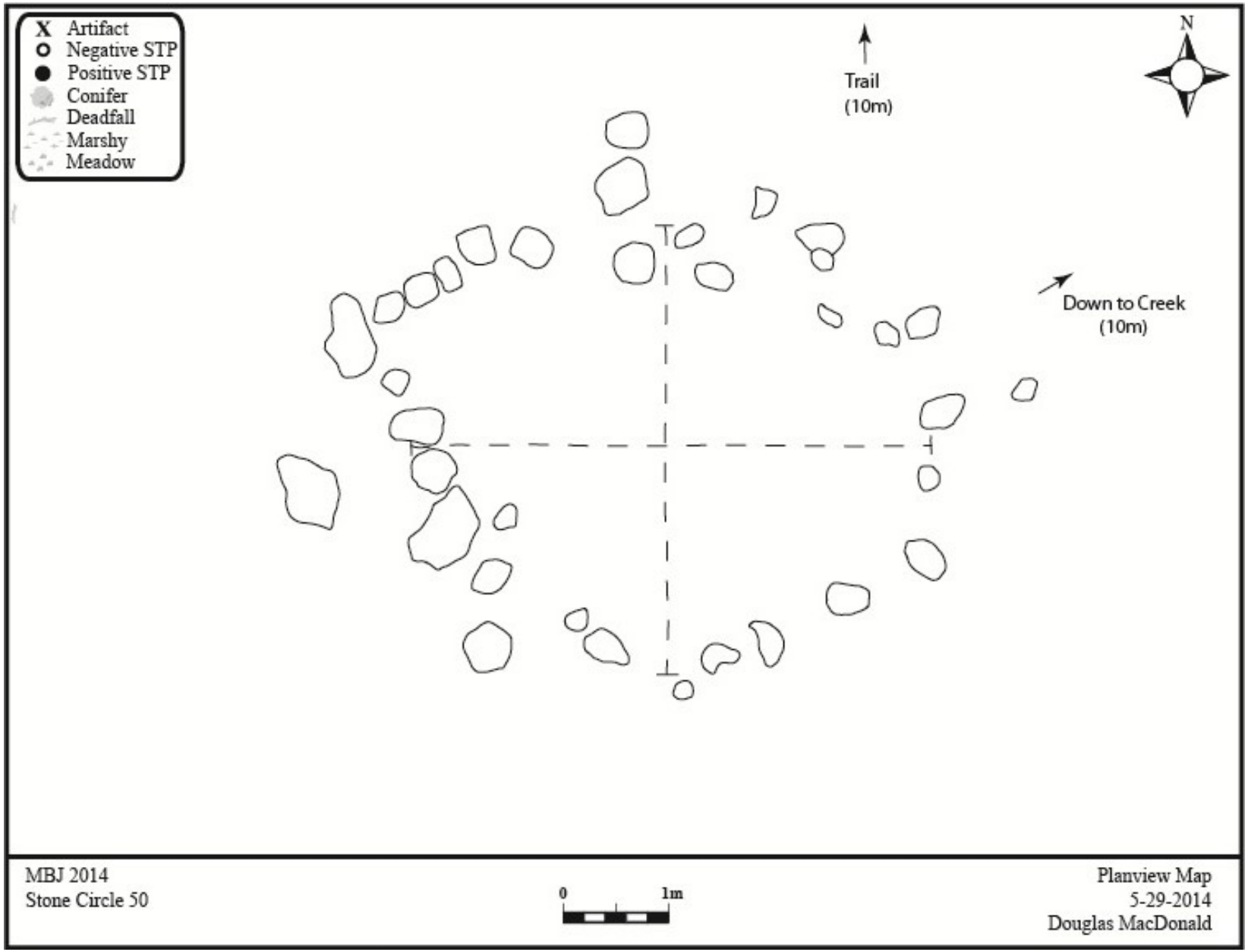

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Excavated/
Looted
Depression(?)
MBJ 2014
Stone Circle 45
Creek Bottom
0
1m
Planview Map
5-29-2014
MRN

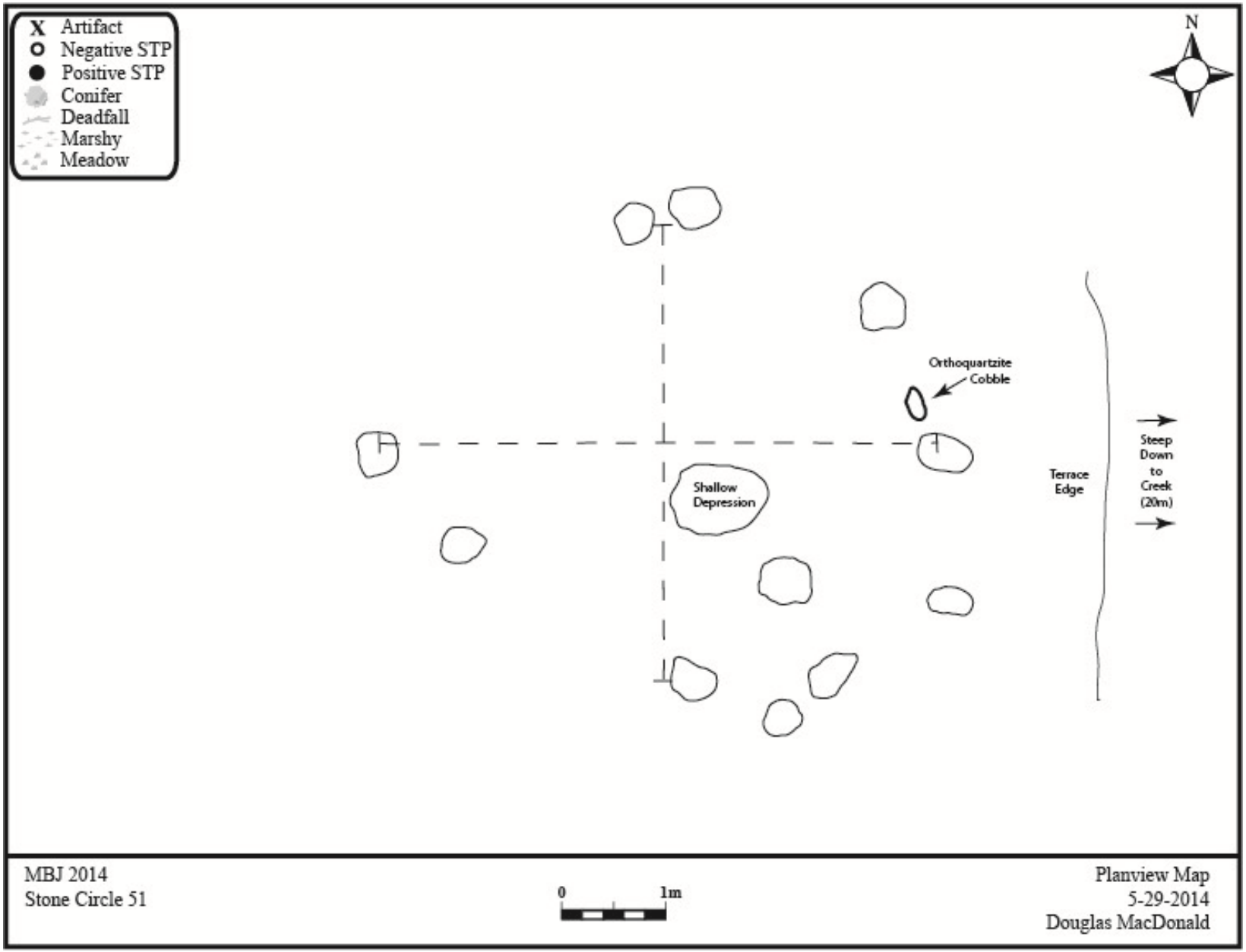

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Down
Slope
Door?
Shallow
Depression
Down
Creek
20m
Trail
7m
MBJ 2014
Stone Circle 46
0
1m
Planview Map
5-29-2014
Douglas MacDonald

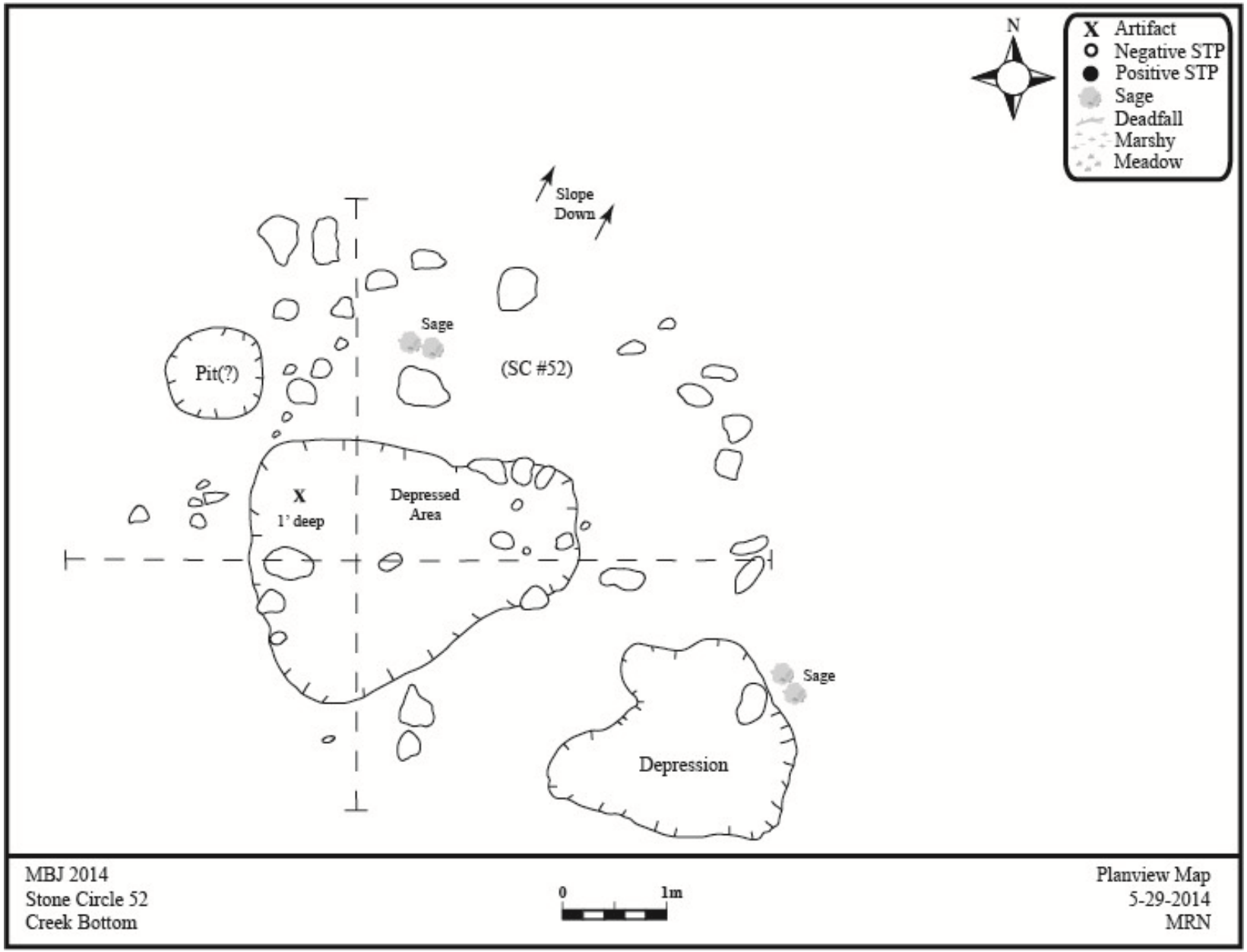

N
SC #46
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Depression
Creek
(25m)
Trail
(2m)
MBJ 2014
Stone Circle 47
0
1m
Planview Map
5-29-2014
Douglas MacDonald

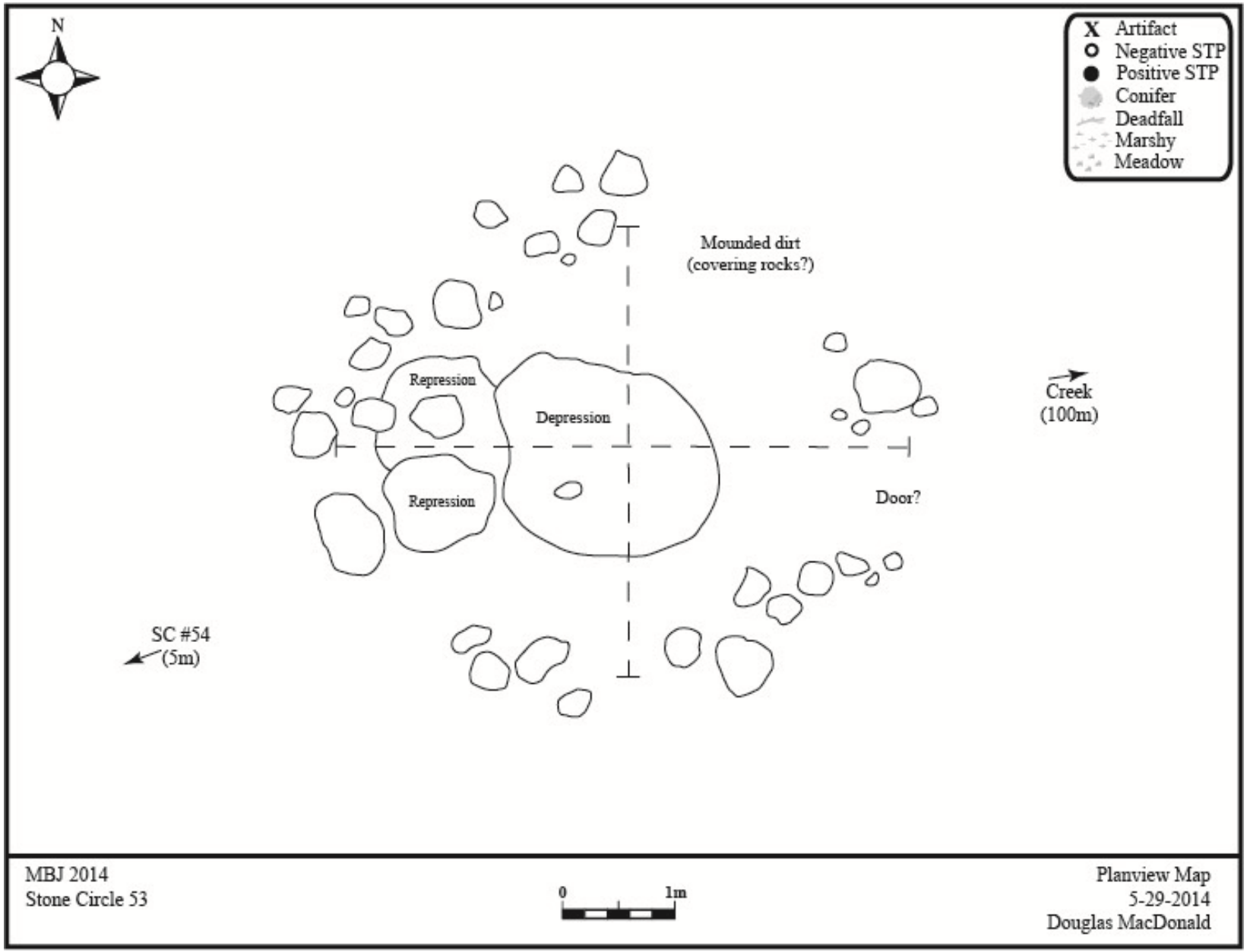

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Depression
Trail
SC #49
1m
MBJ 2014
Stone Circle 48
Creek Bottom
0
1m
Planview Map
5-28-2014
JMP

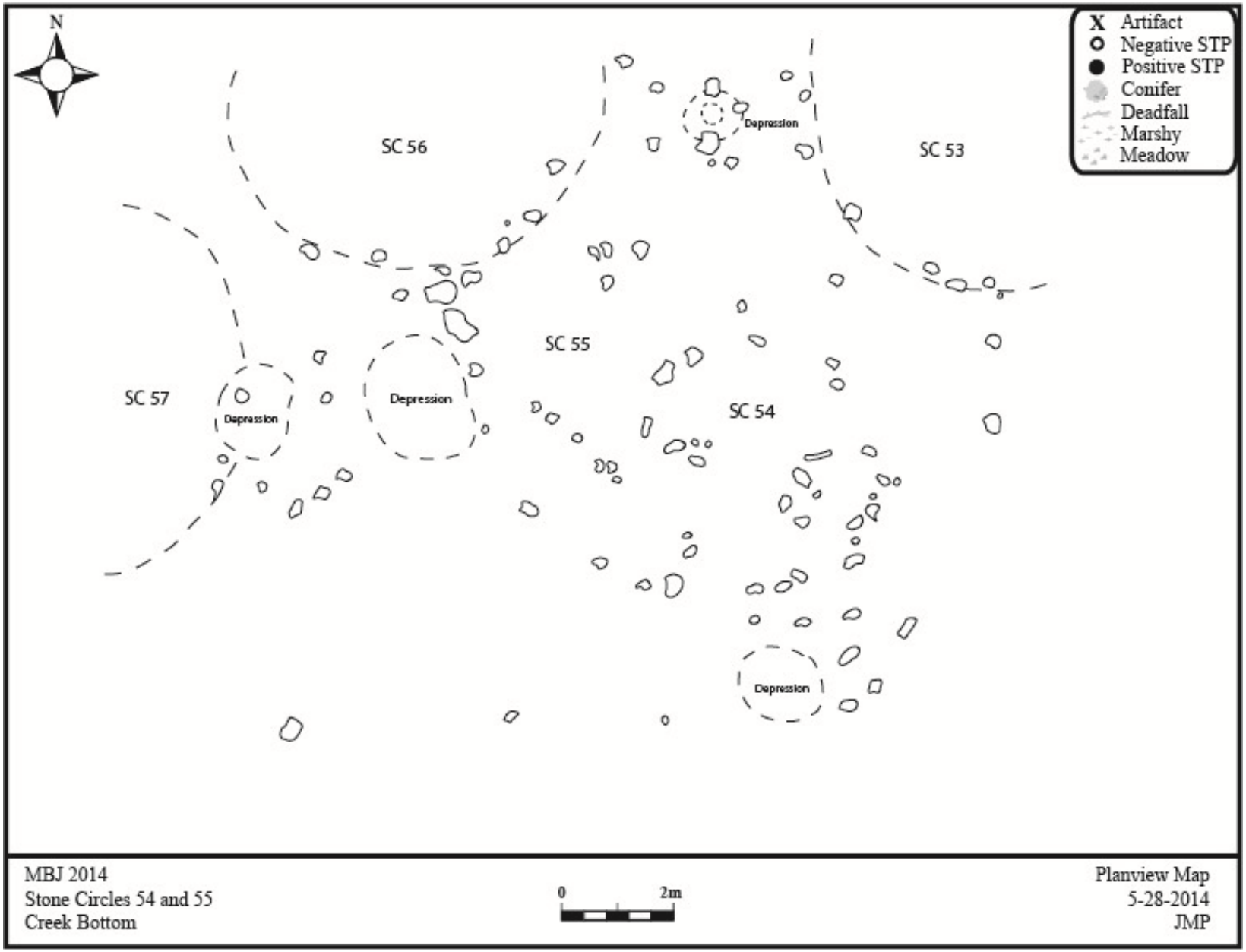

N
Trail
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Sage Brush
Small
Burnt
Tree
Sage
Mound
(Backdirt)
Depressed
Area
MBJ 2014
Stone Circle 49
Creek Bottom Area
0
1m
Planview Map
5-29-2014
MRN

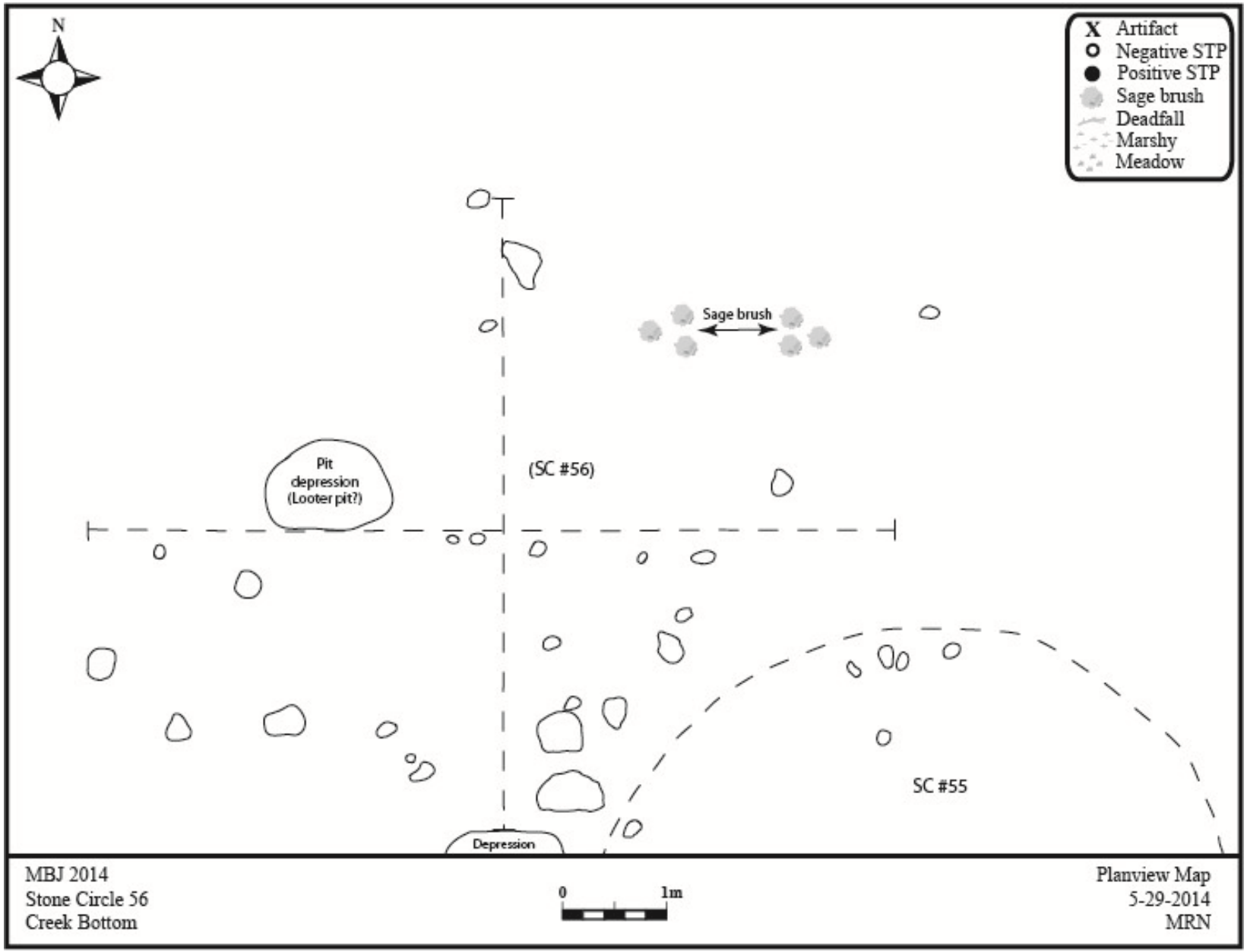

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
(10m)
N
Down to Creek
(10m)
MBJ 2014
Stone Circle 50
0
1m
Planview Map
5-29-2014
Douglas MacDonald

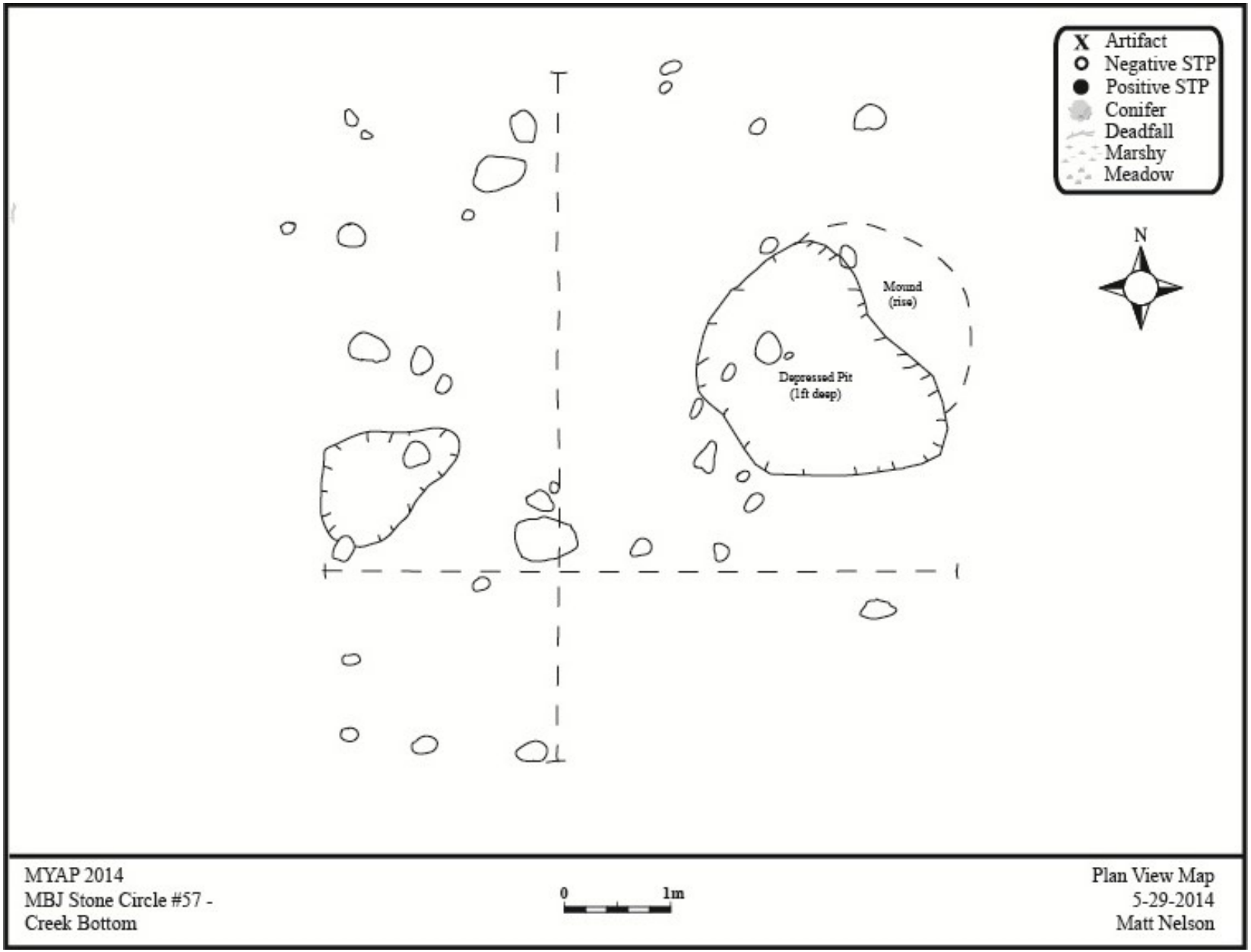

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Orthoquartzite Cobble
Shallow Depression
Terrace Edge
Steep Down to Creek (20m)
MBJ 2014
Stone Circle 51
0
1m
Planview Map
5-29-2014
Douglas MacDonald

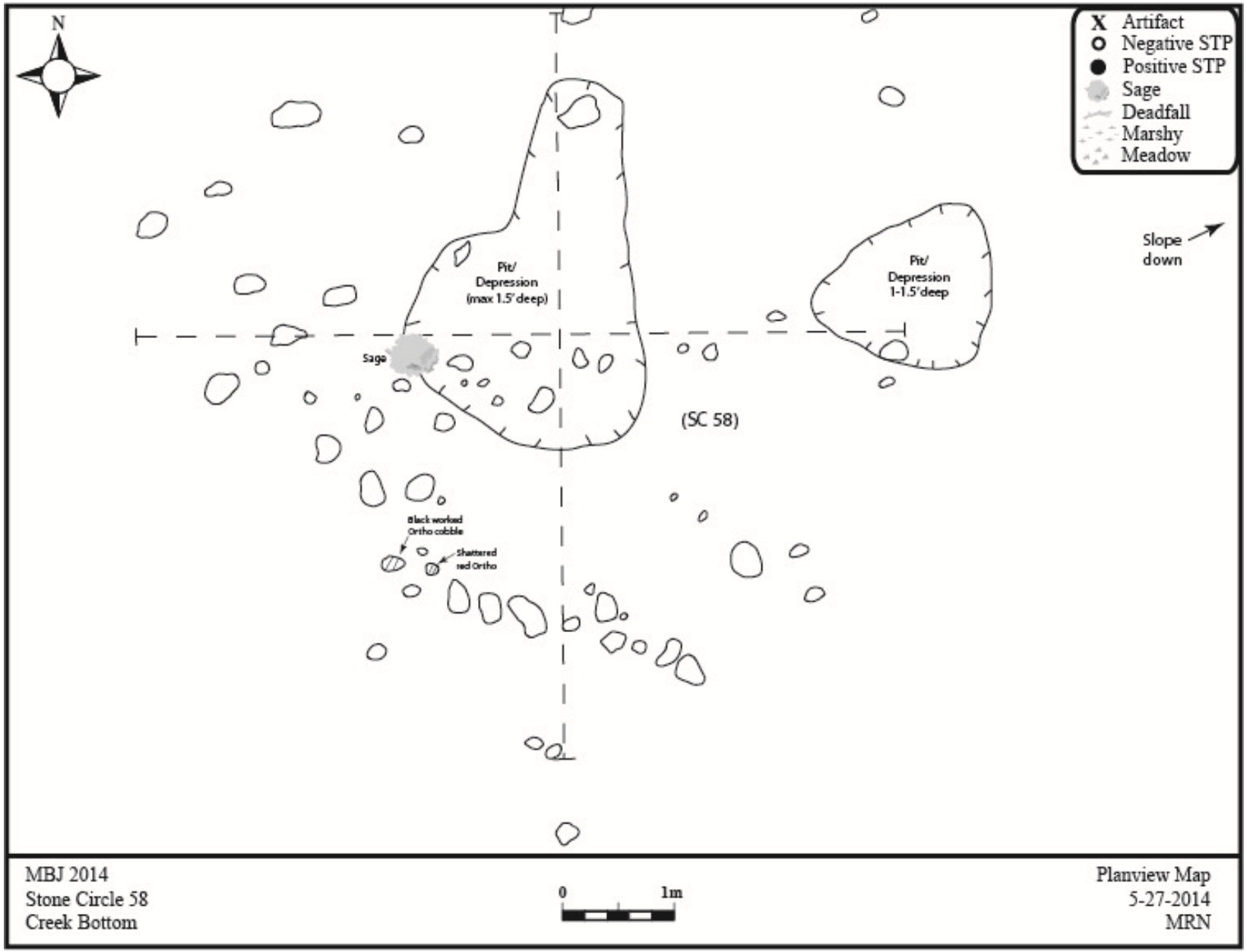

N
X Artifact
Negative STP
Positive STP
Sage
Deadfall
Marshy
Meadow
Slope
Down
Sage
Pit(?)
(SC #52)
X
1' deep
Depressed
Area
Sage
Depression
MBJ 2014
Stone Circle 52
Creek Bottom
0
1m
Planview Map
5-29-2014
MRN

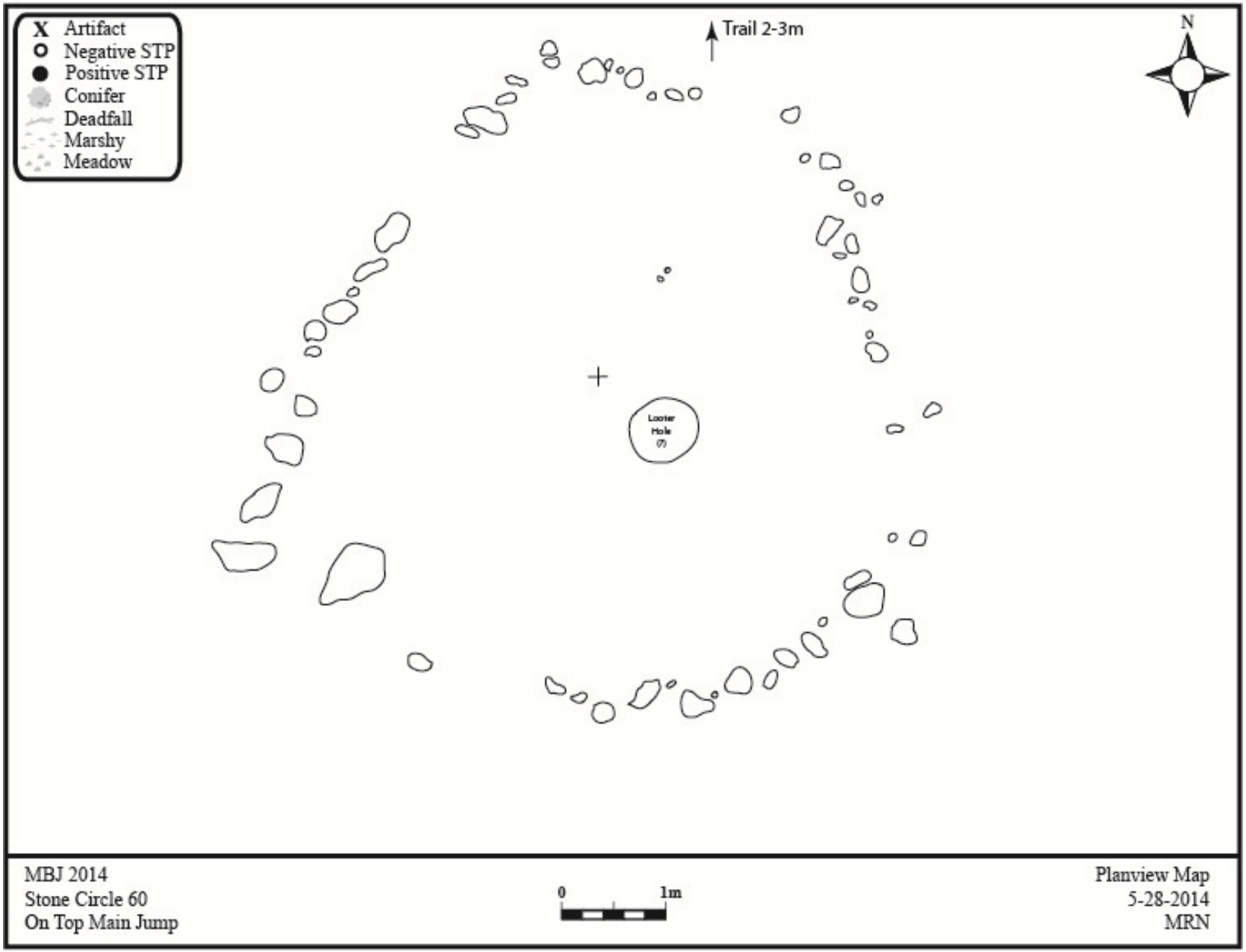

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Mounded dirt
(covering rocks?)
Repression
Depression
Repression
Creek
(100m)
Door?
SC #54
(5m)
MBJ 2014
Stone Circle 53
0
1m
Planview Map
5-29-2014
Douglas MacDonald

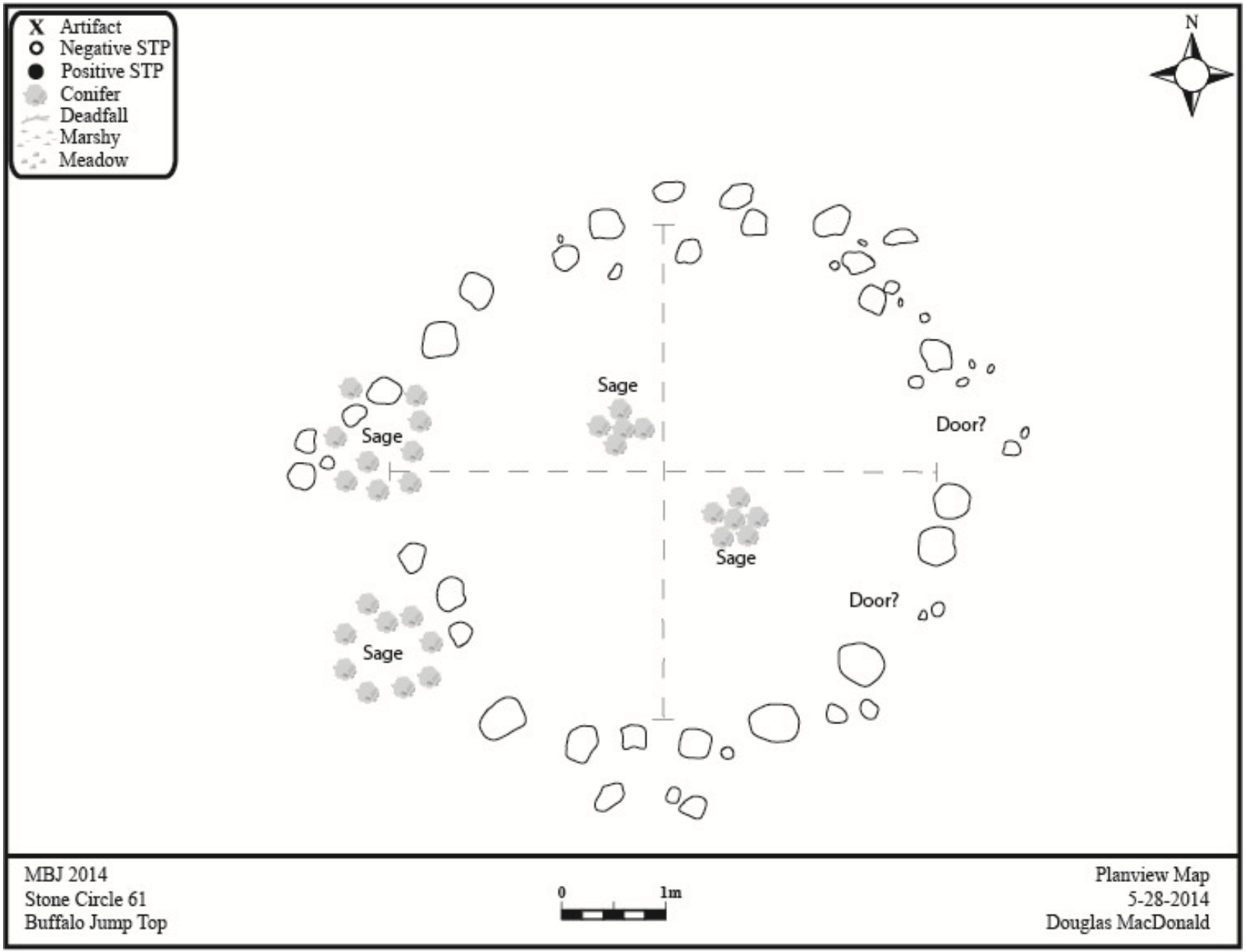

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
SC 56
SC 53
SC 55
SC 57
SC 54
Depression
Depression
Depression
Depression
MBJ 2014
Stone Circles 54 and 55
Creek Bottom
0
2m
Planview Map
5-28-2014
JMP

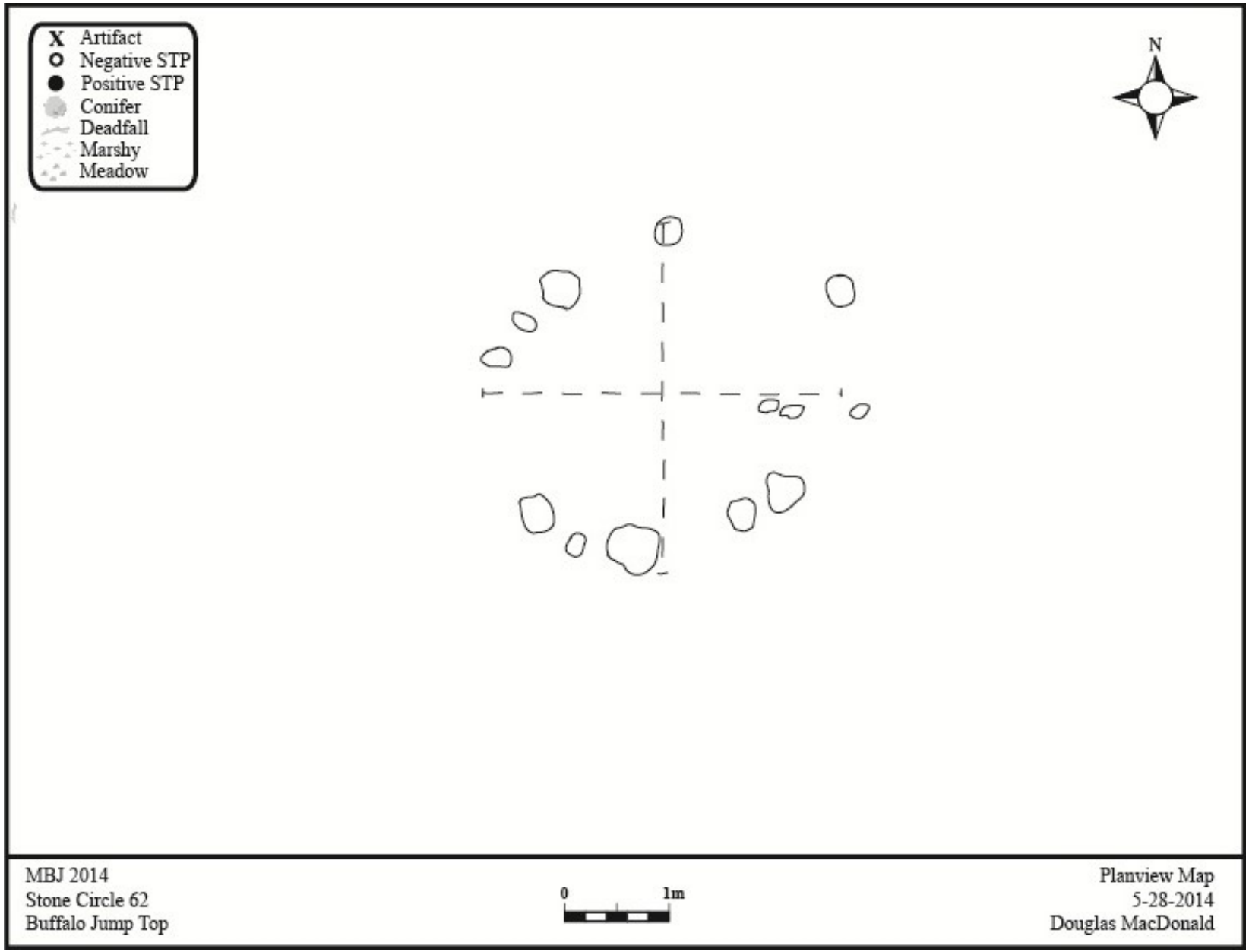

N
X Artifact
Negative STP
Positive STP
Sage brush
Deadfall
Marshy
Meadow
Sage brush
Pit
depression
(Looter pit?)
(SC #56)
SC #55
Depression
MBJ 2014
Stone Circle 56
Creek Bottom
0
1m
Planview Map
5-29-2014
MRN

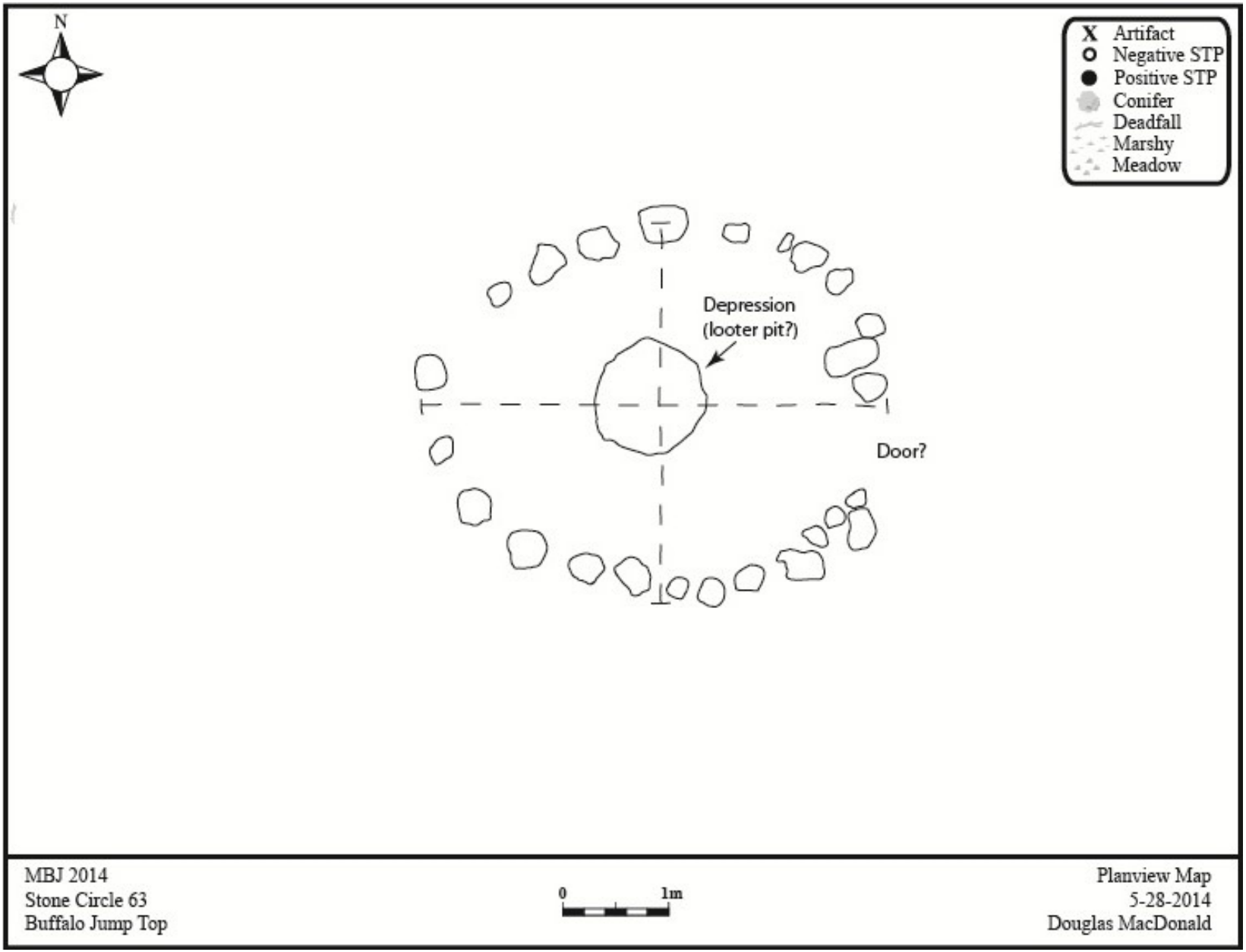

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Mound
(rise)
Depressed Pit
(1ft deep)
MYAP 2014
MBJ Stone Circle #57 -
Creek Bottom
0
1m
Plan View Map
5-29-2014
Matt Nelson

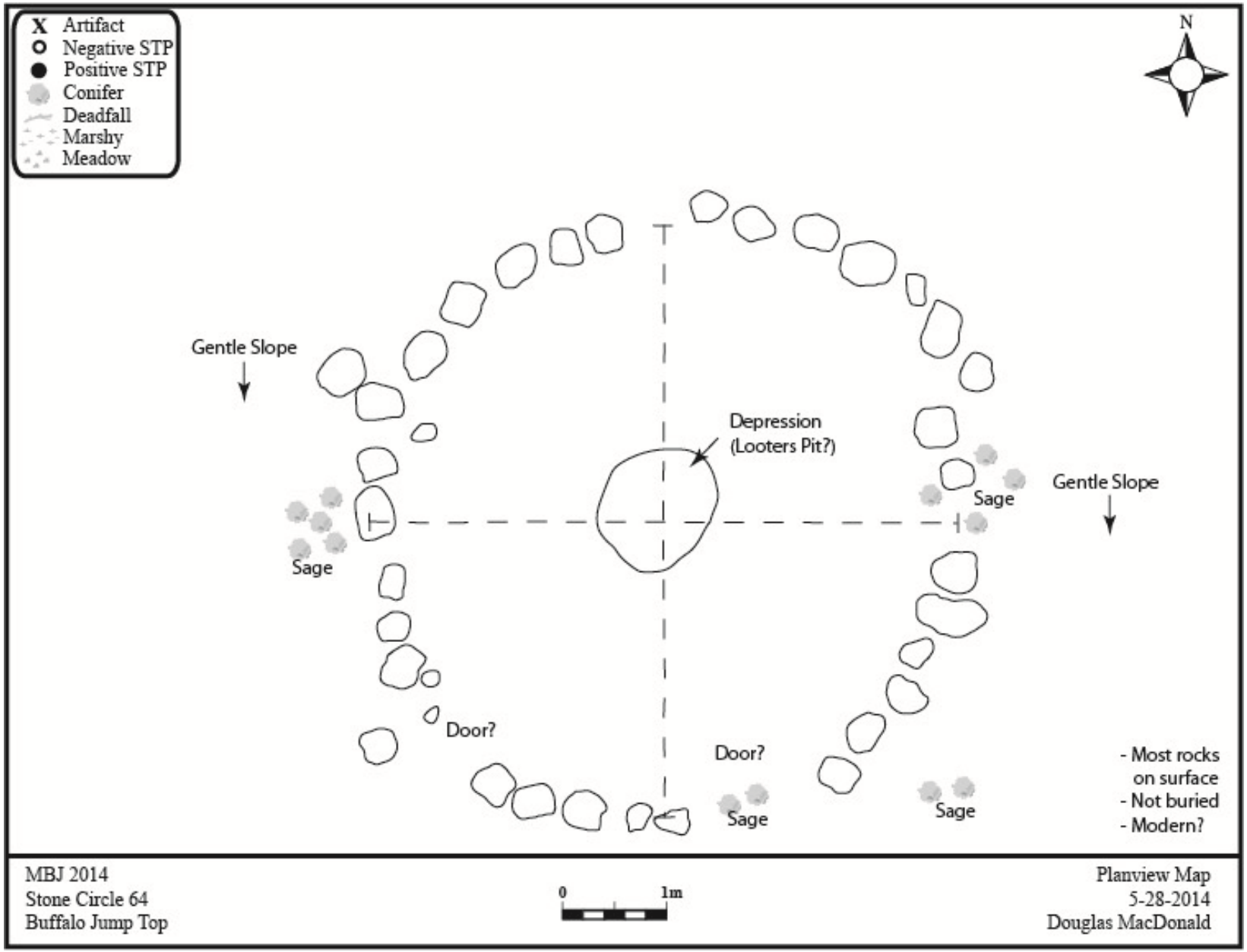

N
X Artifact
Negative STP
Positive STP
Sage
Deadfall
Marshy
Meadow
Slope down
Pit/ Depression (max 1.5' deep)
Pit/ Depression 1-1.5' deep
Sage
(SC 58)
Black worked Ortho cobble
Shattered red Ortho
MBJ 2014
Stone Circle 58
Creek Bottom
0
1m
Planview Map
5-27-2014
MRN

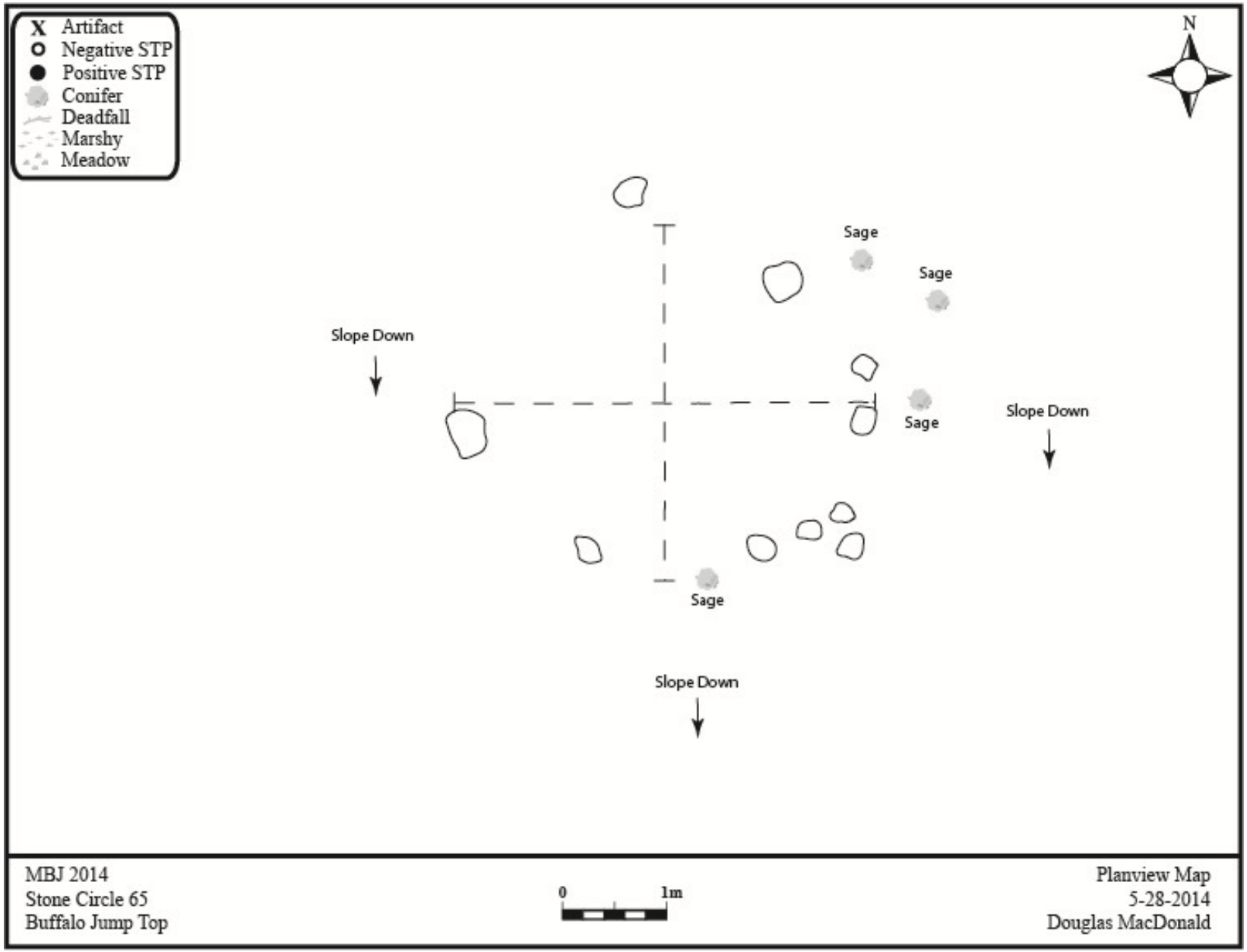

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail 2-3m
N
Looter Hole (?)
MBJ 2014
Stone Circle 60
On Top Main Jump
0
1m
Planview Map
5-28-2014
MRN

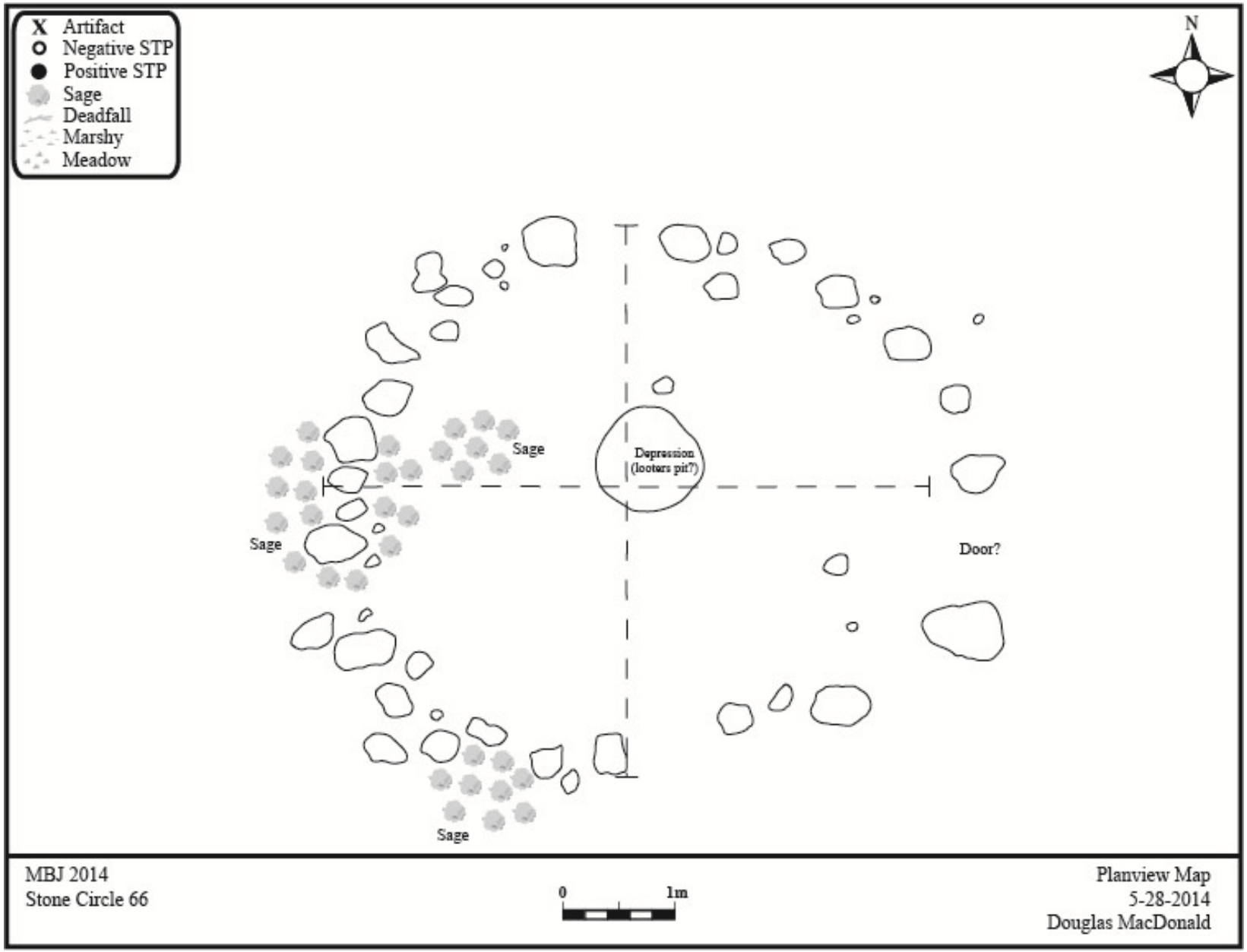

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Sage
Sage
Sage
Sage
Door?
Door?
MBJ 2014
Stone Circle 61
Buffalo Jump Top
0
1m
Planview Map
5-28-2014
Douglas MacDonald

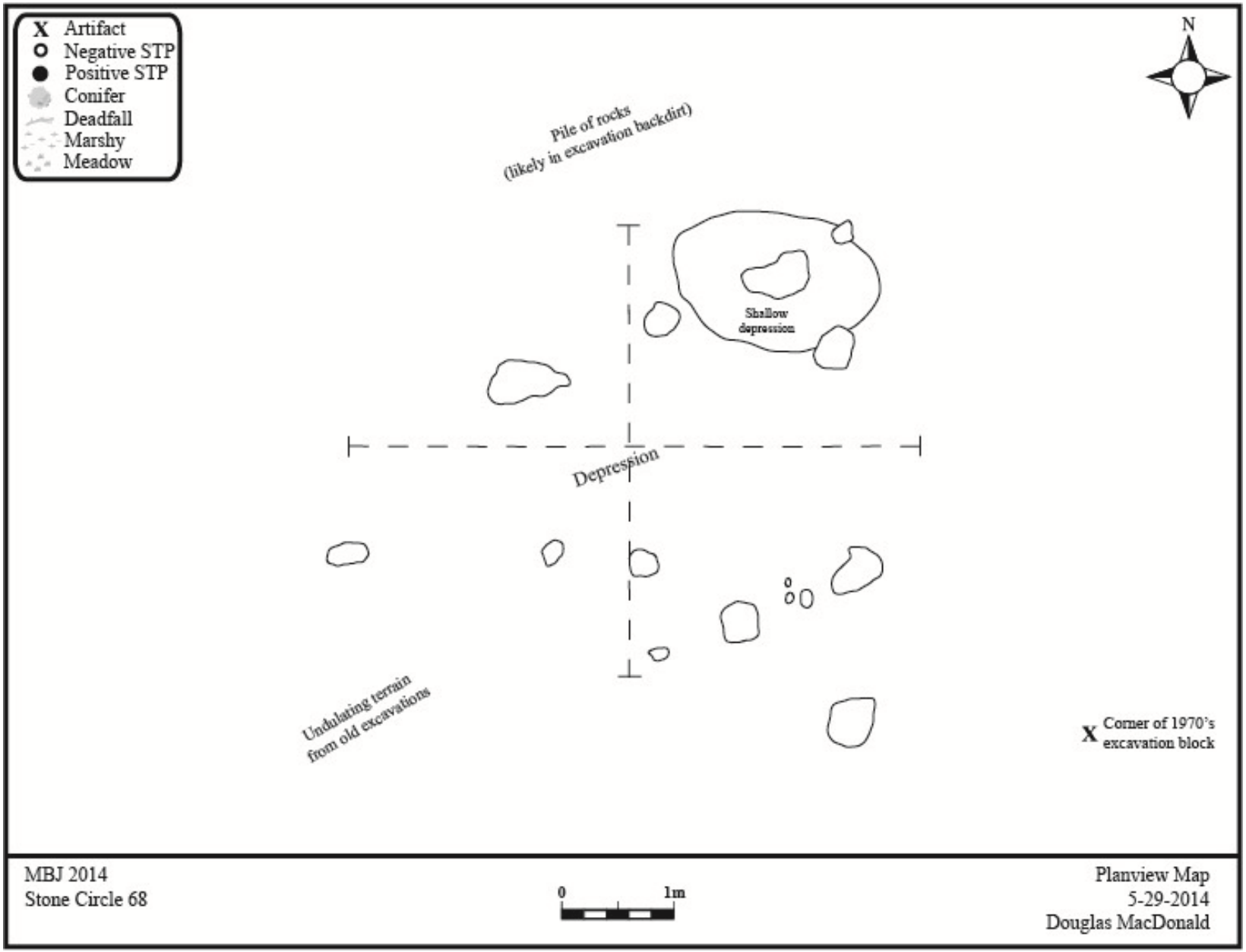

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
MBJ 2014
Stone Circle 62
Buffalo Jump Top
0
1m
Planview Map
5-28-2014
Douglas MacDonald

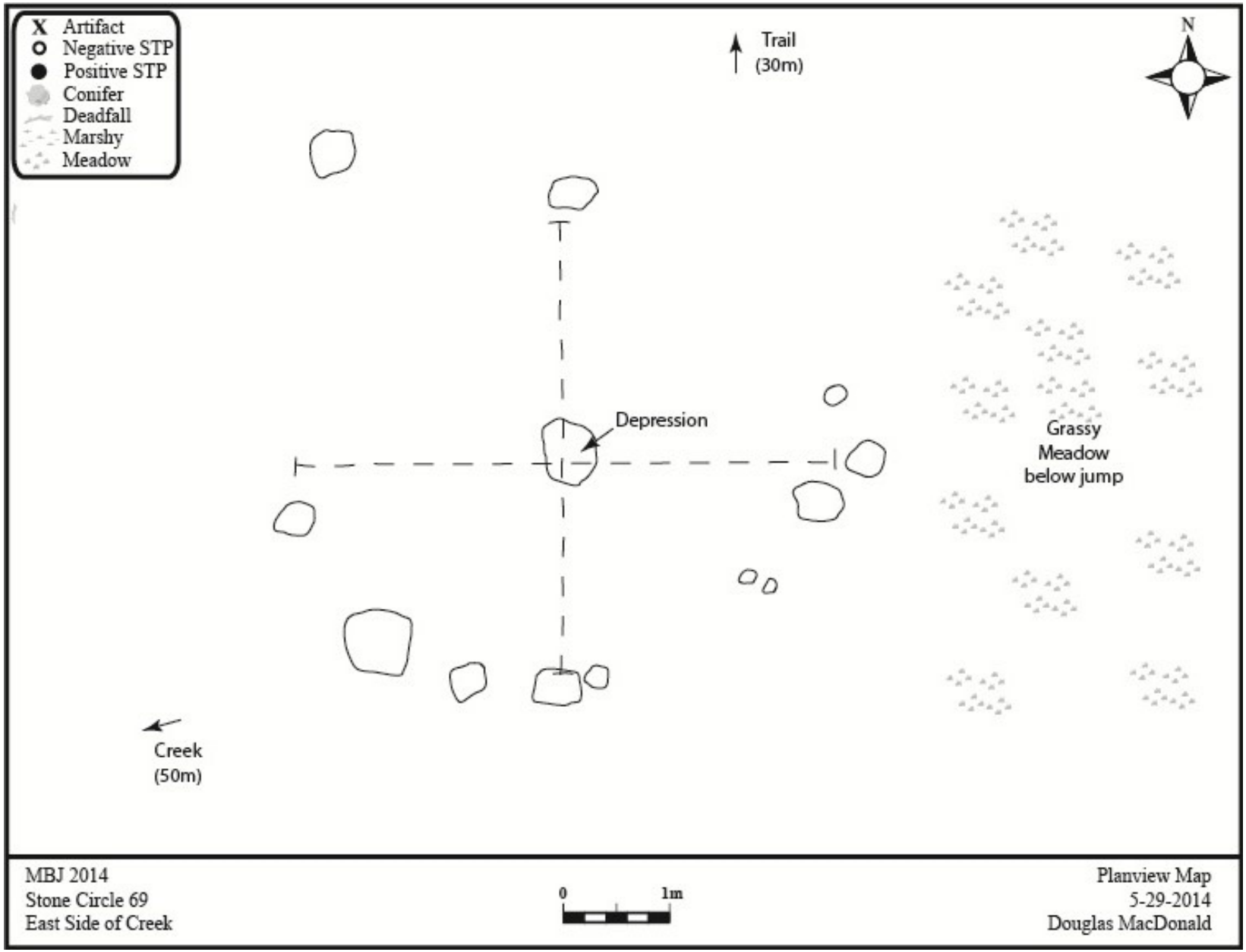

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Depression
(looter pit?)
Door?
MBJ 2014
Stone Circle 63
Buffalo Jump Top
0
1m
Planview Map
5-28-2014
Douglas MacDonald

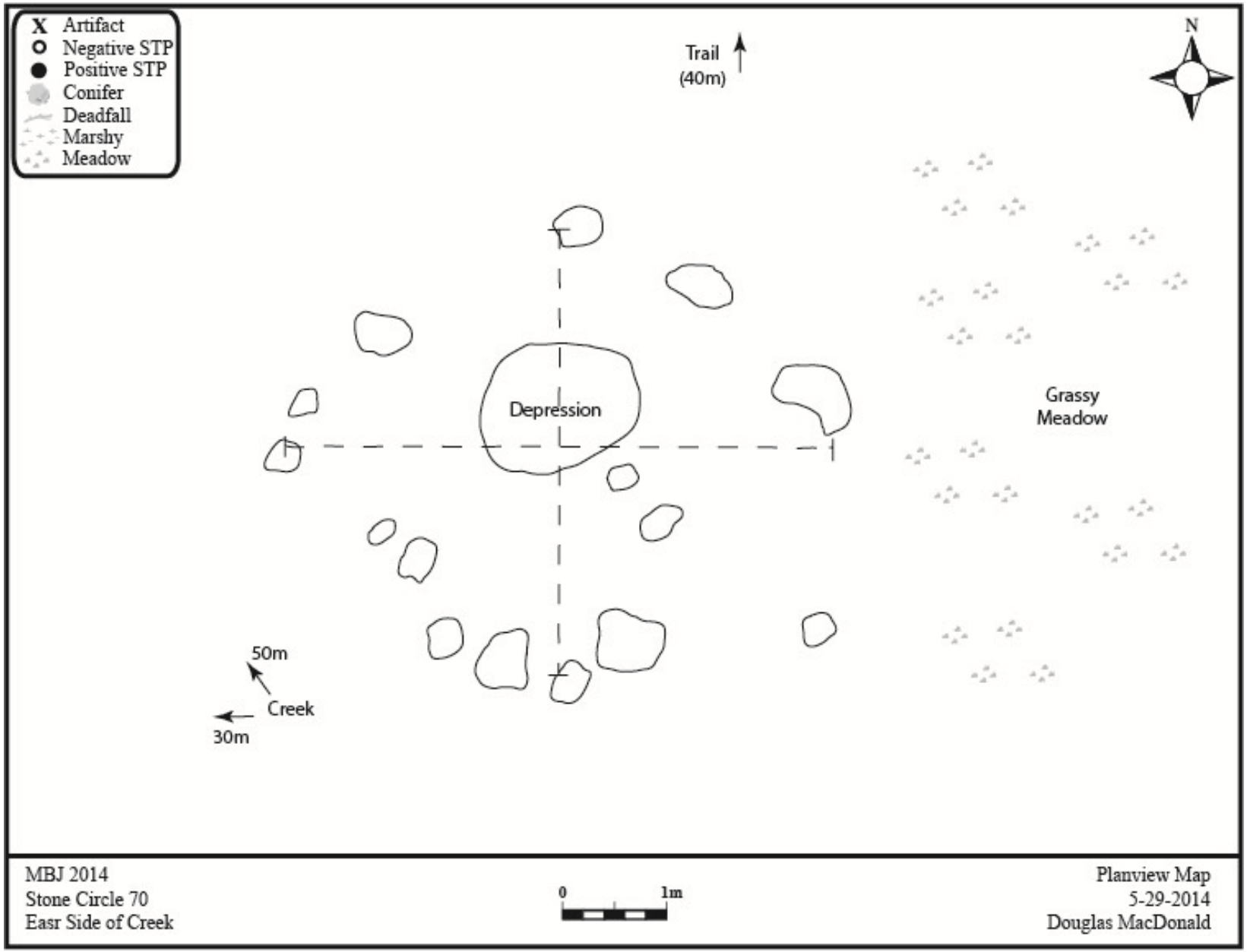

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Gentle Slope
Depression
(Looters Pit?)
Gentle Slope
Sage
Sage
Door?
Door?
Sage
Sage
- Most rocks
on surface
- Not buried
- Modern?
MBJ 2014
Stone Circle 64
Buffalo Jump Top
0
1m
Planview Map
5-28-2014
Douglas MacDonald

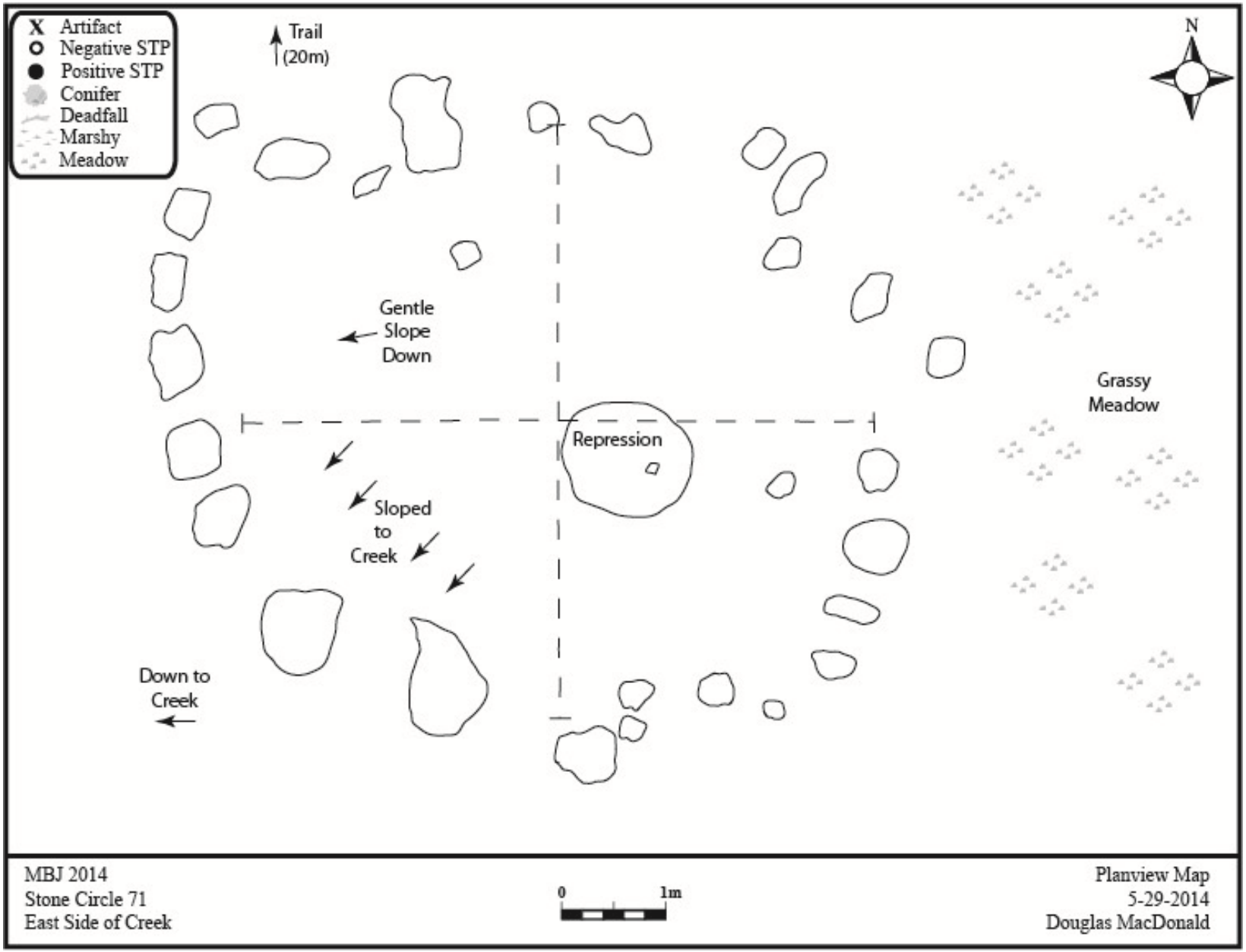

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Sage
Sage
Sage
Sage
Slope Down
Slope Down
Slope Down
MBJ 2014
Stone Circle 65
Buffalo Jump Top
0
1m
Planview Map
5-28-2014
Douglas MacDonald

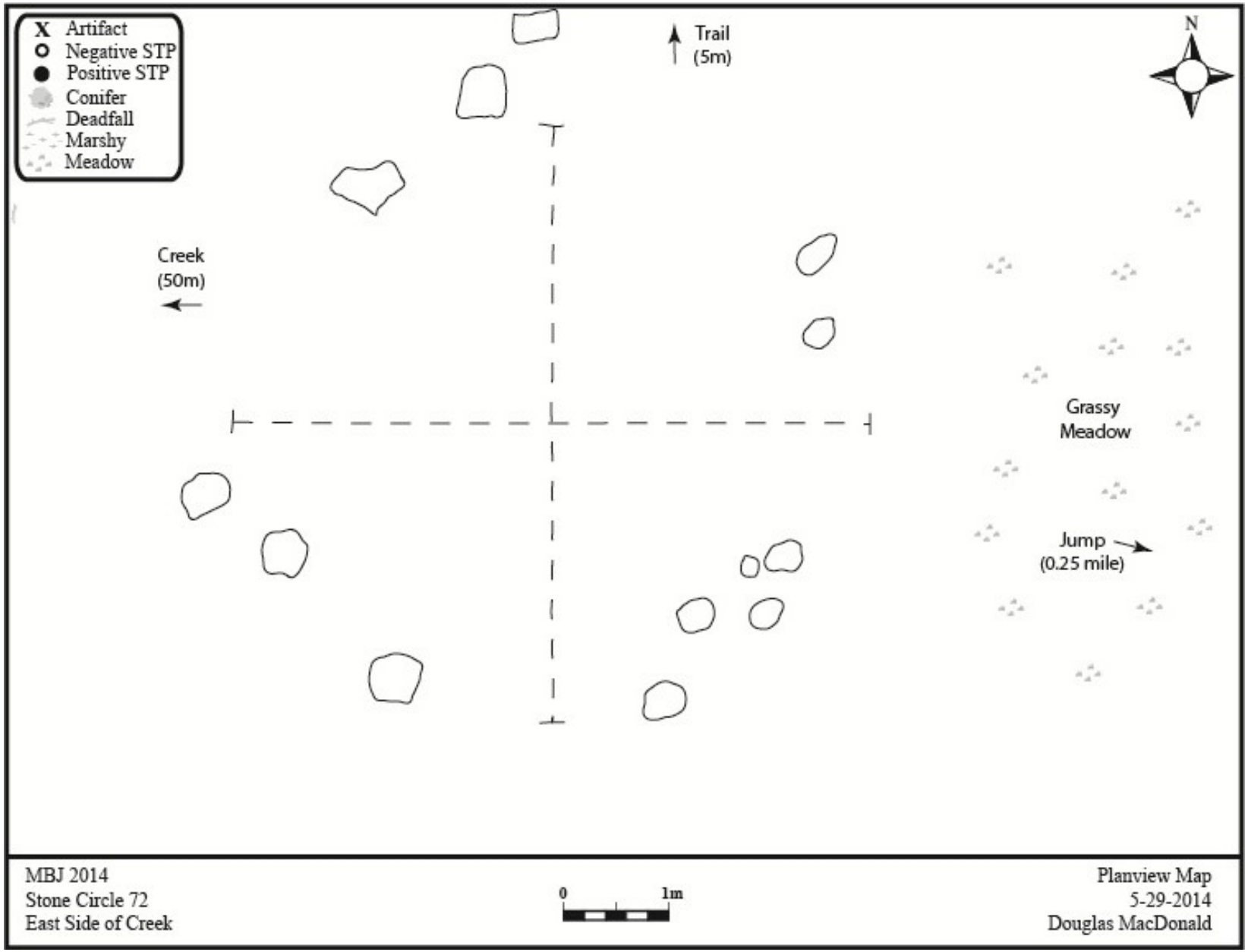

X Artifact
Negative STP
Positive STP
Sage
Deadfall
Marshy
Meadow
N
Sage
Depression
(looters pit?)
Sage
Door?
Sage
MBJ 2014
Stone Circle 66
0
1m
Planview Map
5-28-2014
Douglas MacDonald

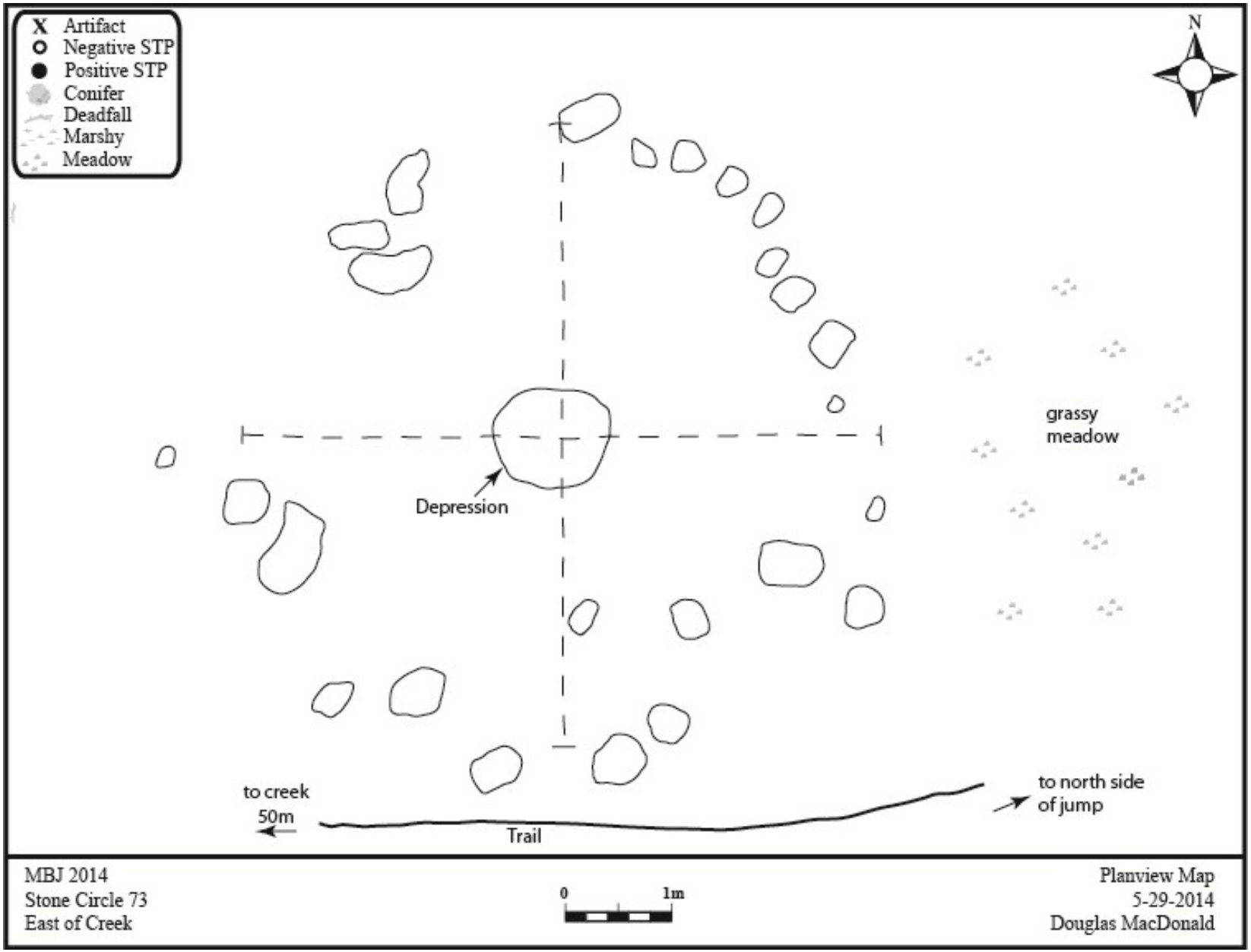

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Pile of rocks
(likely in excavation backdirt)
Shallow
depression
Depression
Undulating terrain
from old excavations
X Corner of 1970's
excavation block
MBJ 2014
Stone Circle 68
0
1m
Planview Map
5-29-2014
Douglas MacDonald

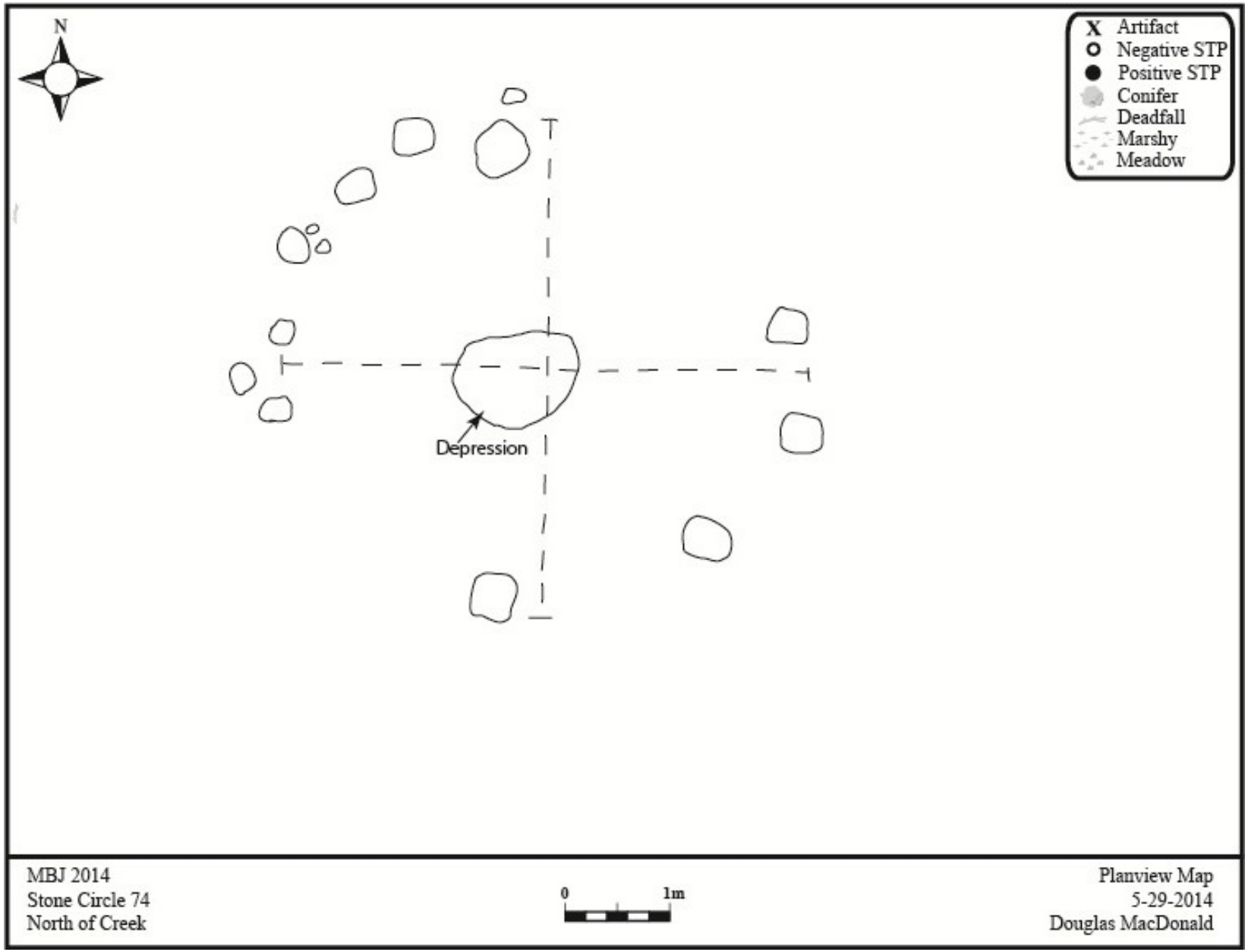

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
(30m)
N
Depression
Grassy
Meadow
below jump
Creek
(50m)
MBJ 2014
Stone Circle 69
East Side of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald

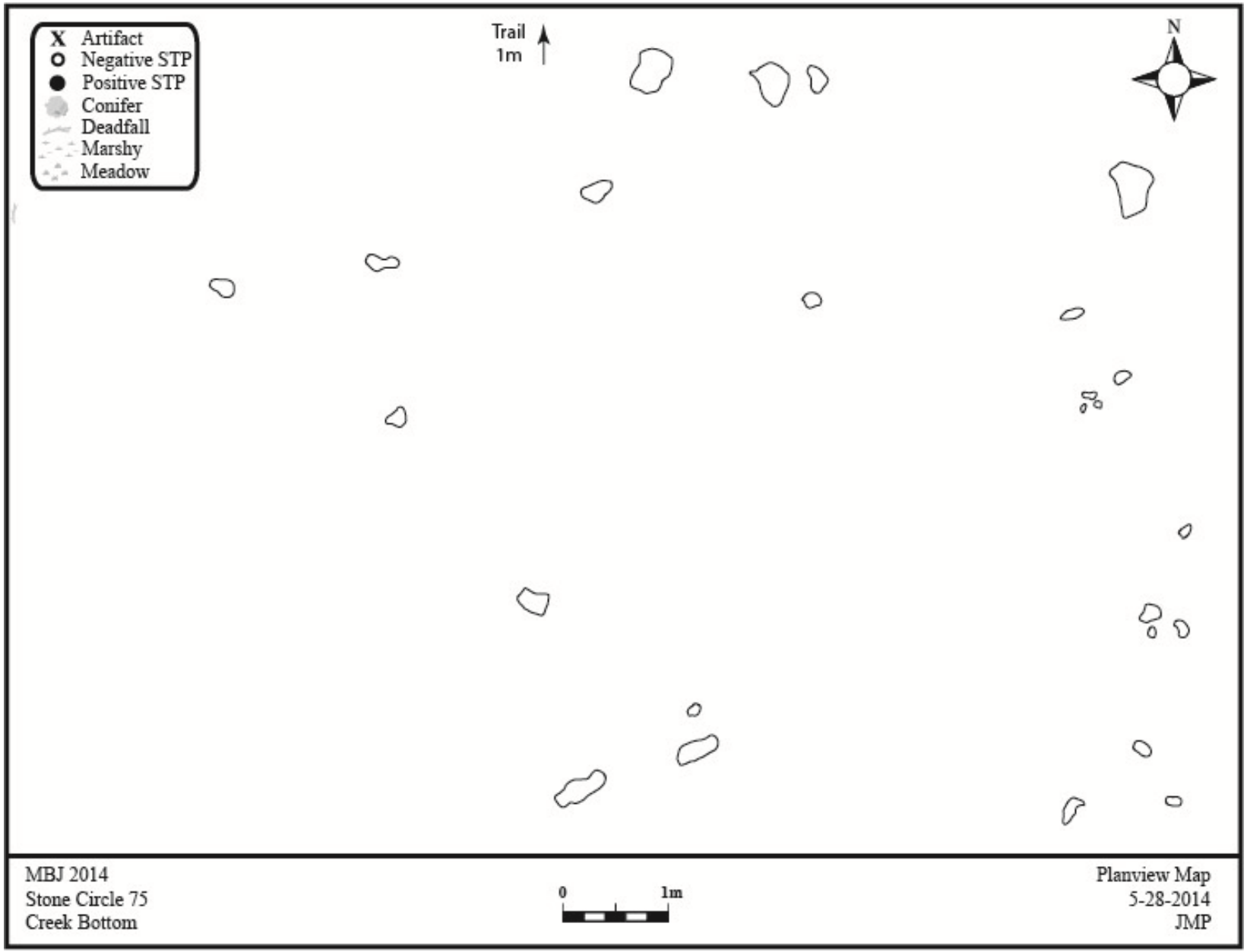

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
(40m)
N
Depression
Grassy
Meadow
50m
Creek
30m
MBJ 2014
Stone Circle 70
Easr Side of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald

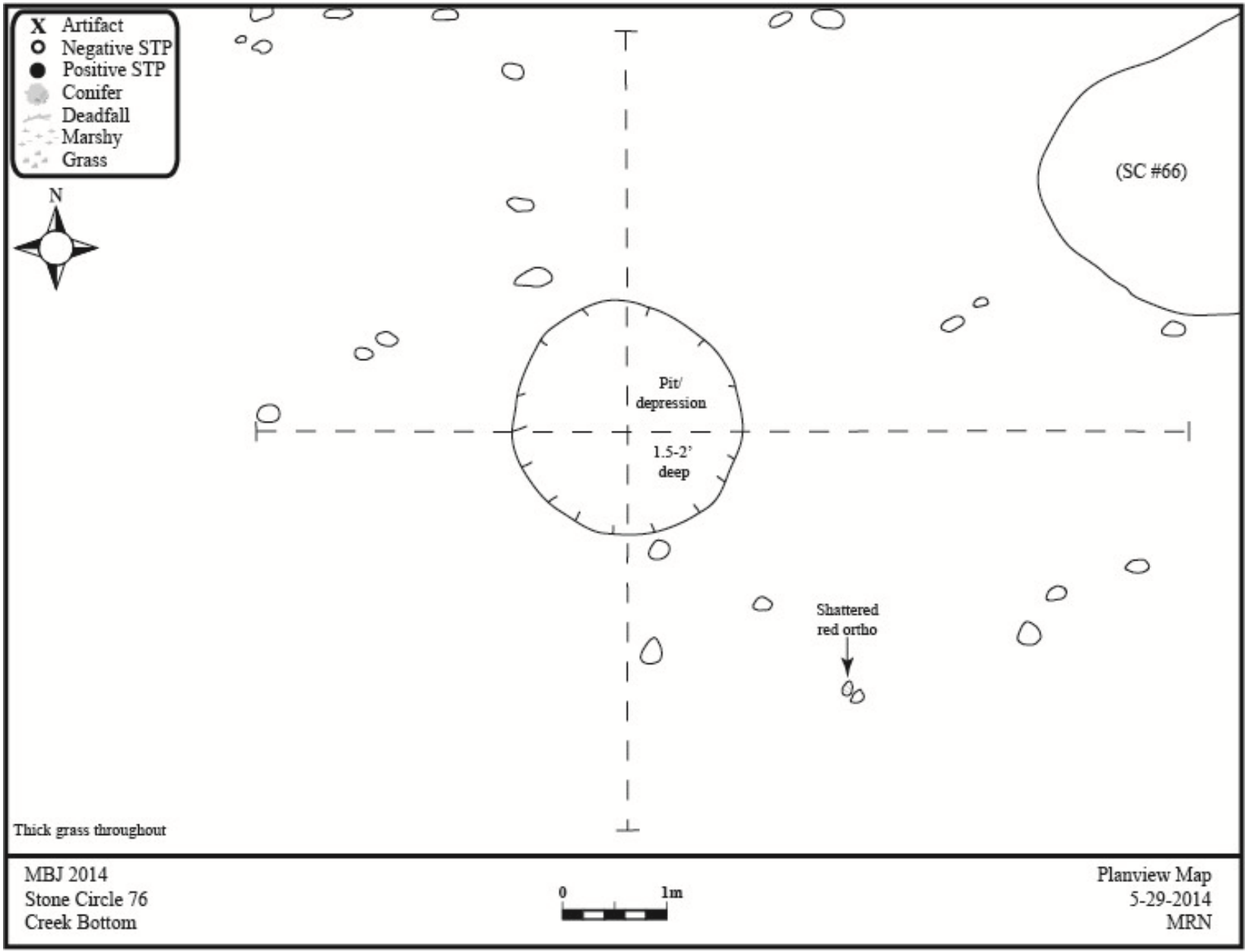

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
(20m)
N
Gentle
Slope
Down
Grassy
Meadow
Repression
Sloped
to
Creek
Down to
Creek
MBJ 2014
Stone Circle 71
East Side of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald

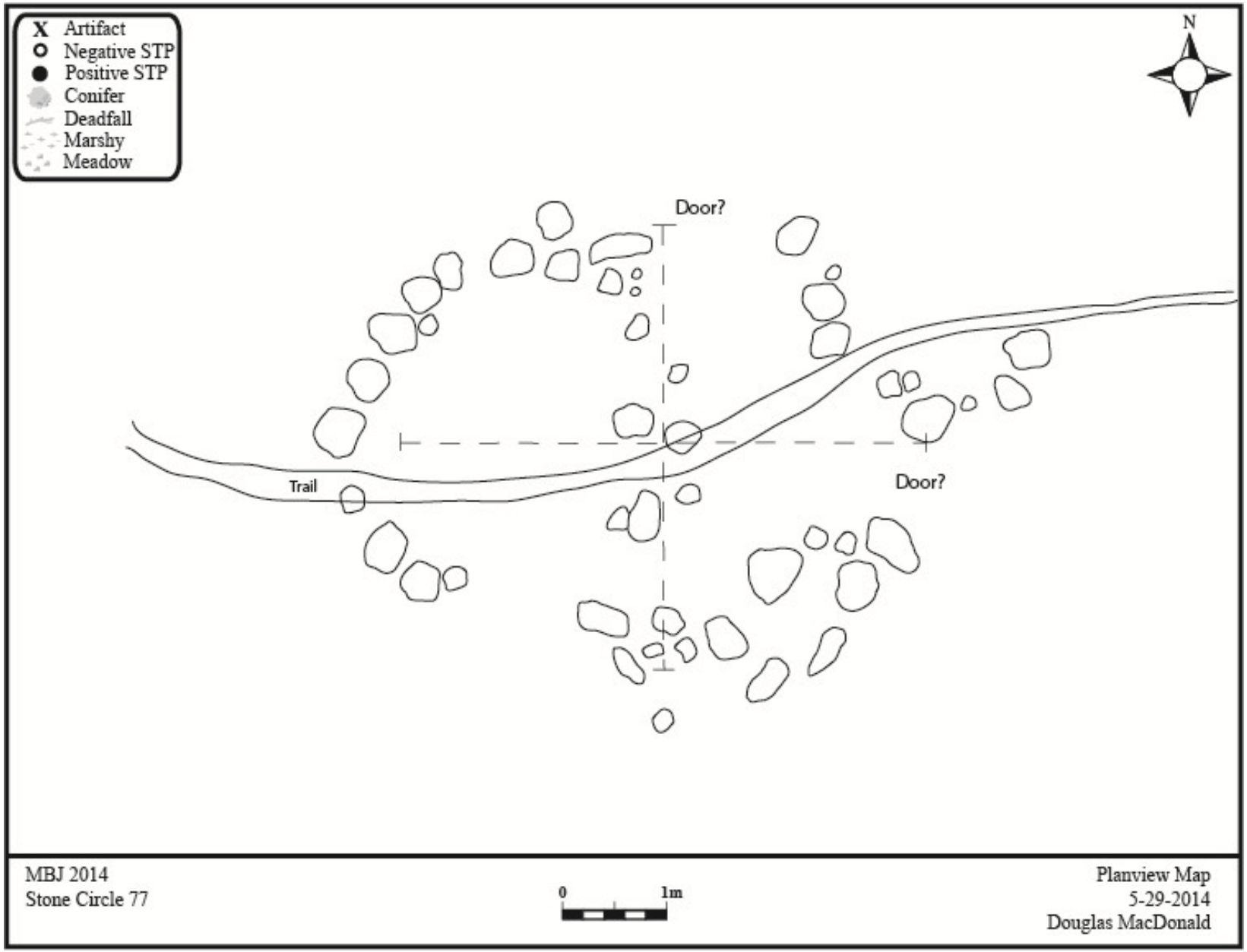

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
(5m)
N
Creek
(50m)
Grassy
Meadow
Jump
(0.25 mile)
MBJ 2014
Stone Circle 72
East Side of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
grassy
meadow
Depression
to creek
50m
Trail
to north side
of jump
MBJ 2014
Stone Circle 73
East of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald

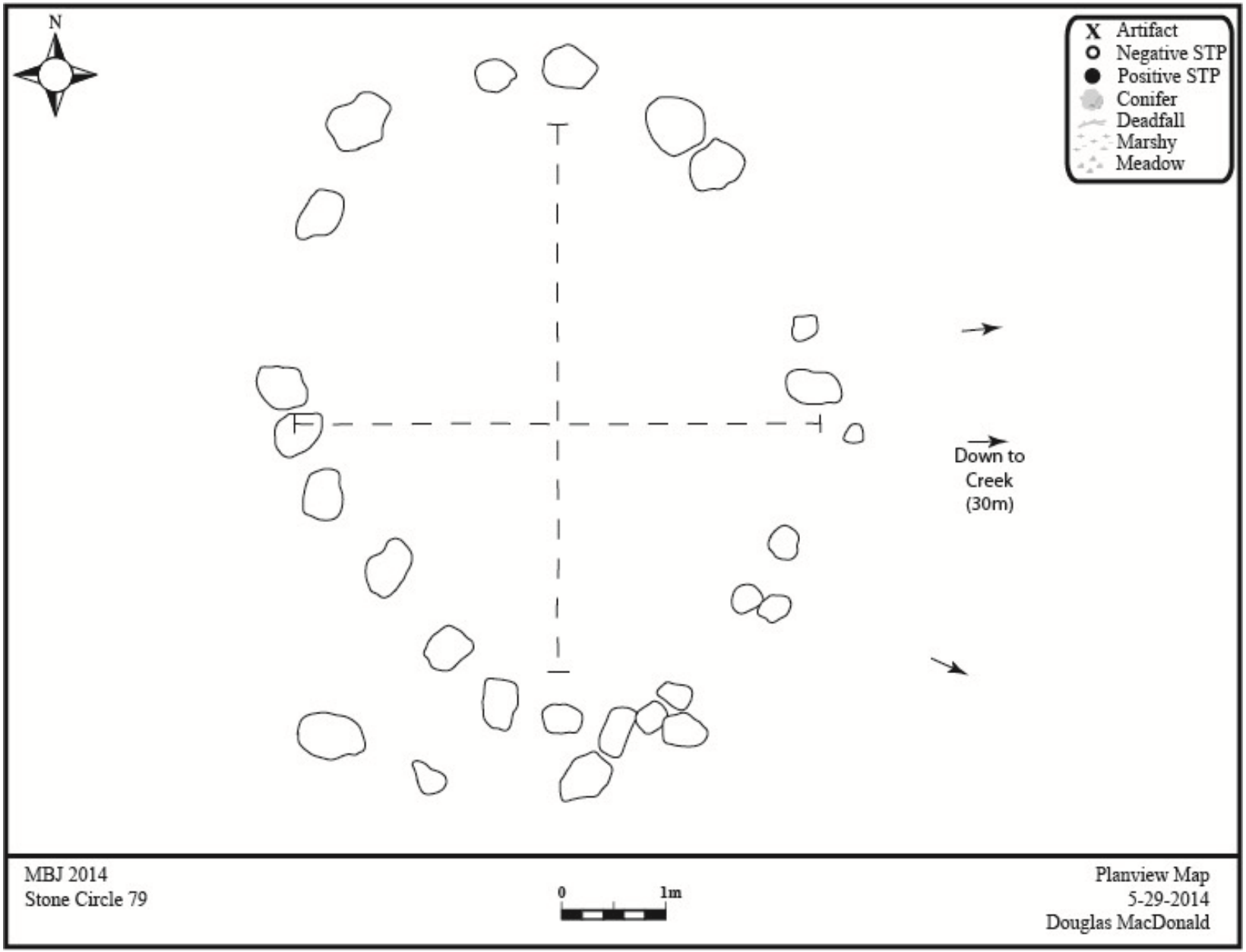

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Depression
MBJ 2014
Stone Circle 74
North of Creek
0
1m
Planview Map
5-29-2014
Douglas MacDonald

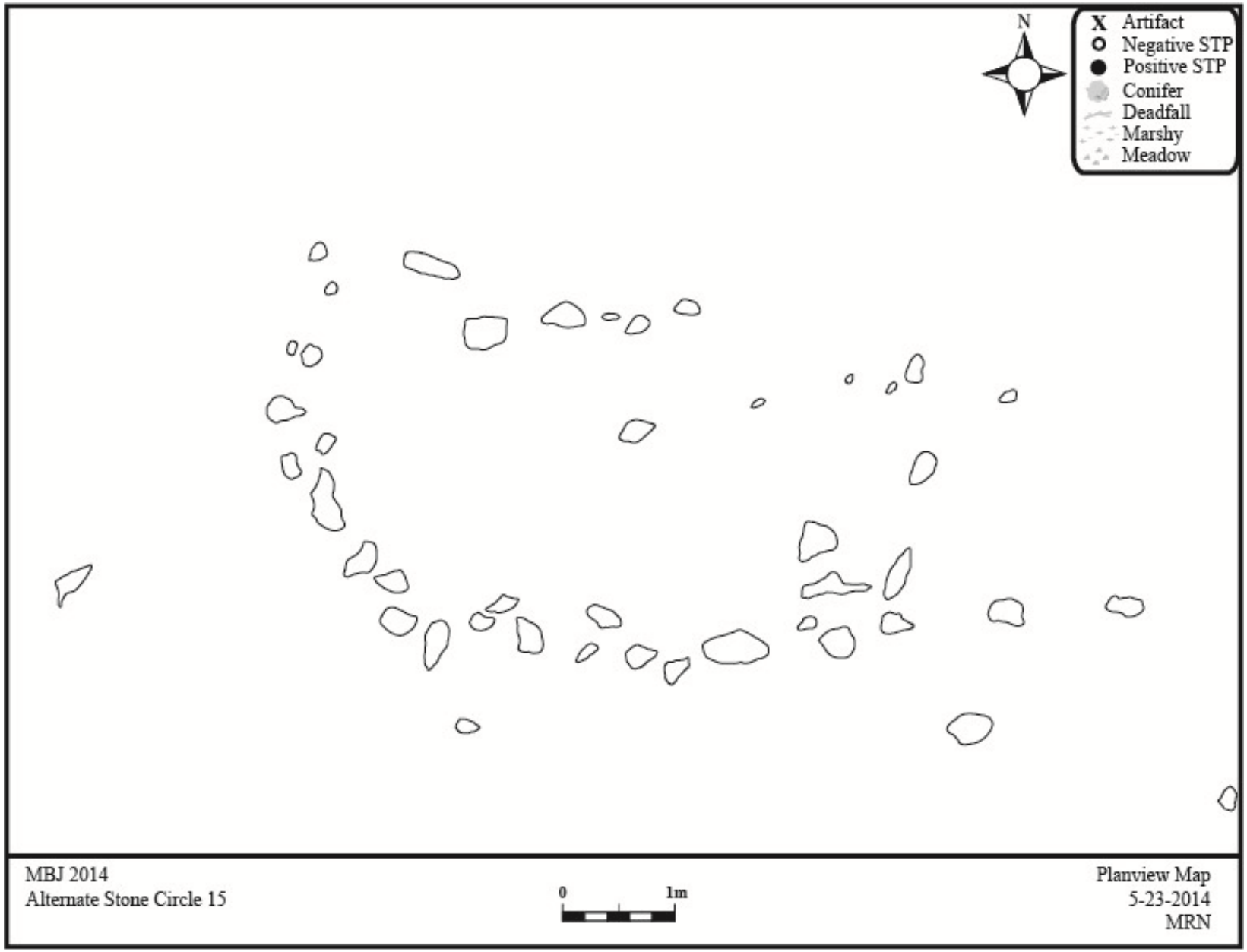

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Trail
1m
N
MBJ 2014
Stone Circle 75
Creek Bottom
0
1m
Planview Map
5-28-2014
JMP

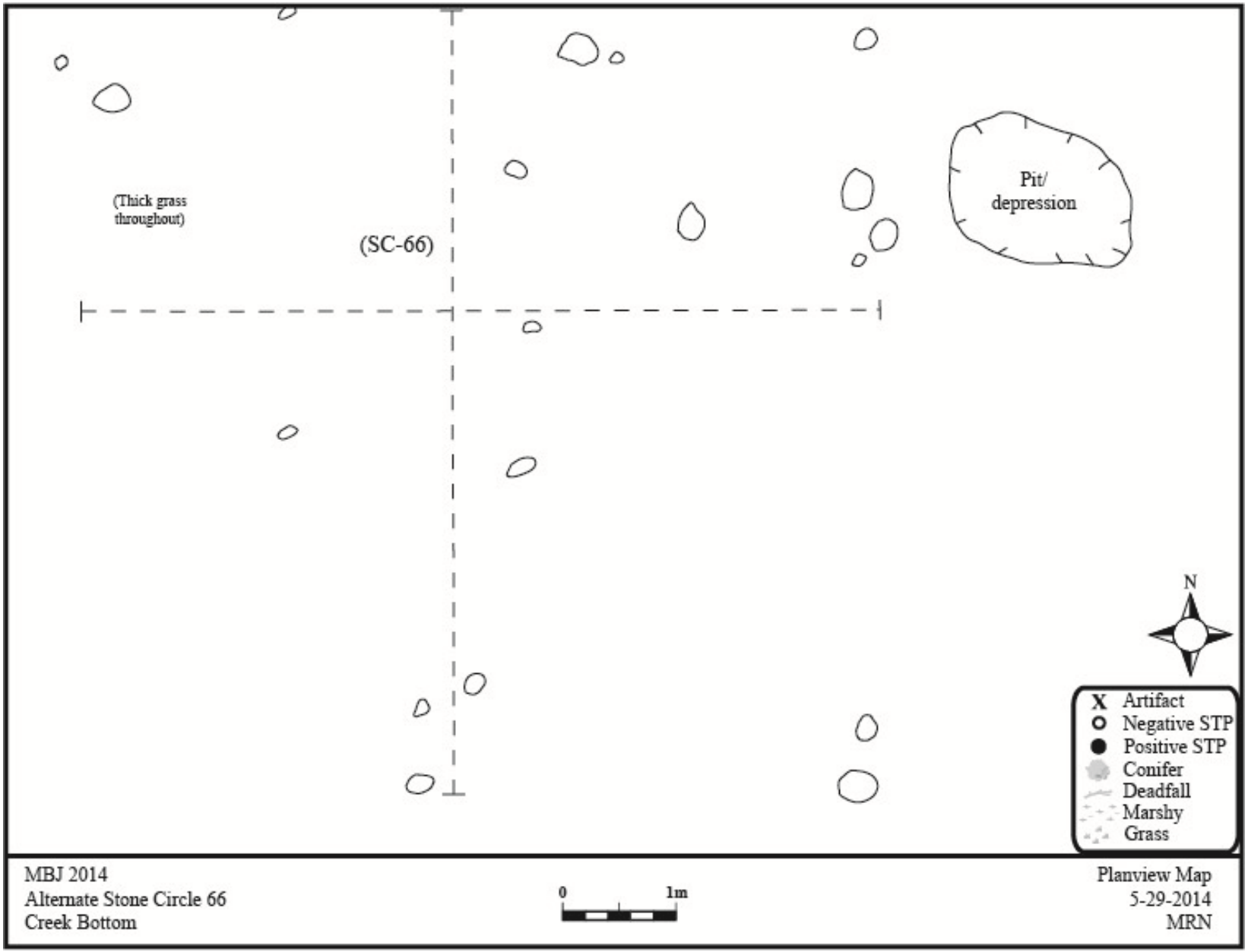

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Grass
N
(SC #66)
Pit/
depression
1.5-2'
deep
Shattered
red ortho
Thick grass throughout
MBJ 2014
Stone Circle 76
Creek Bottom
0
1m
Planview Map
5-29-2014
MRN

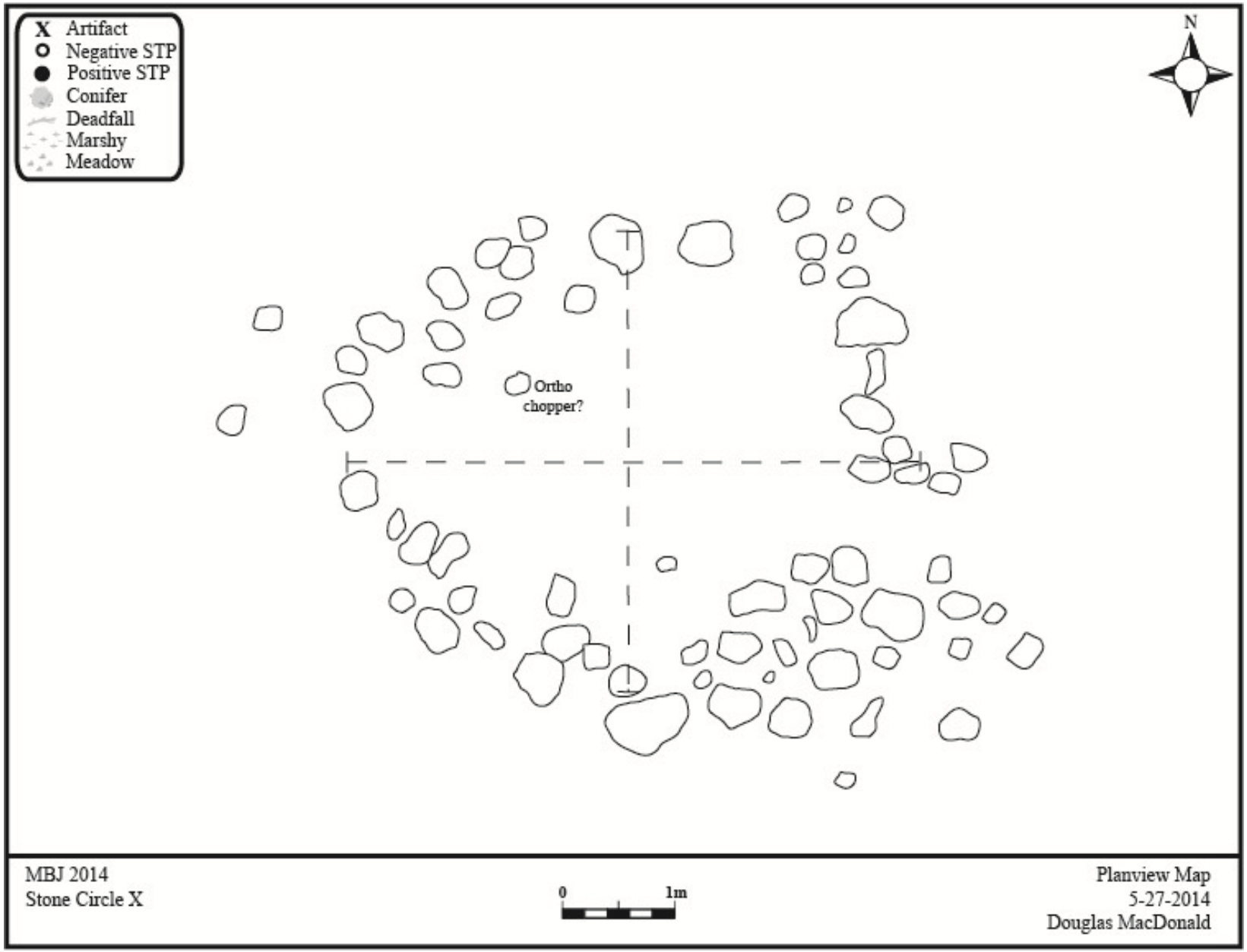

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Door?
Trail
Door?
MBJ 2014
Stone Circle 77
0
1m
Planview Map
5-29-2014
Douglas MacDonald

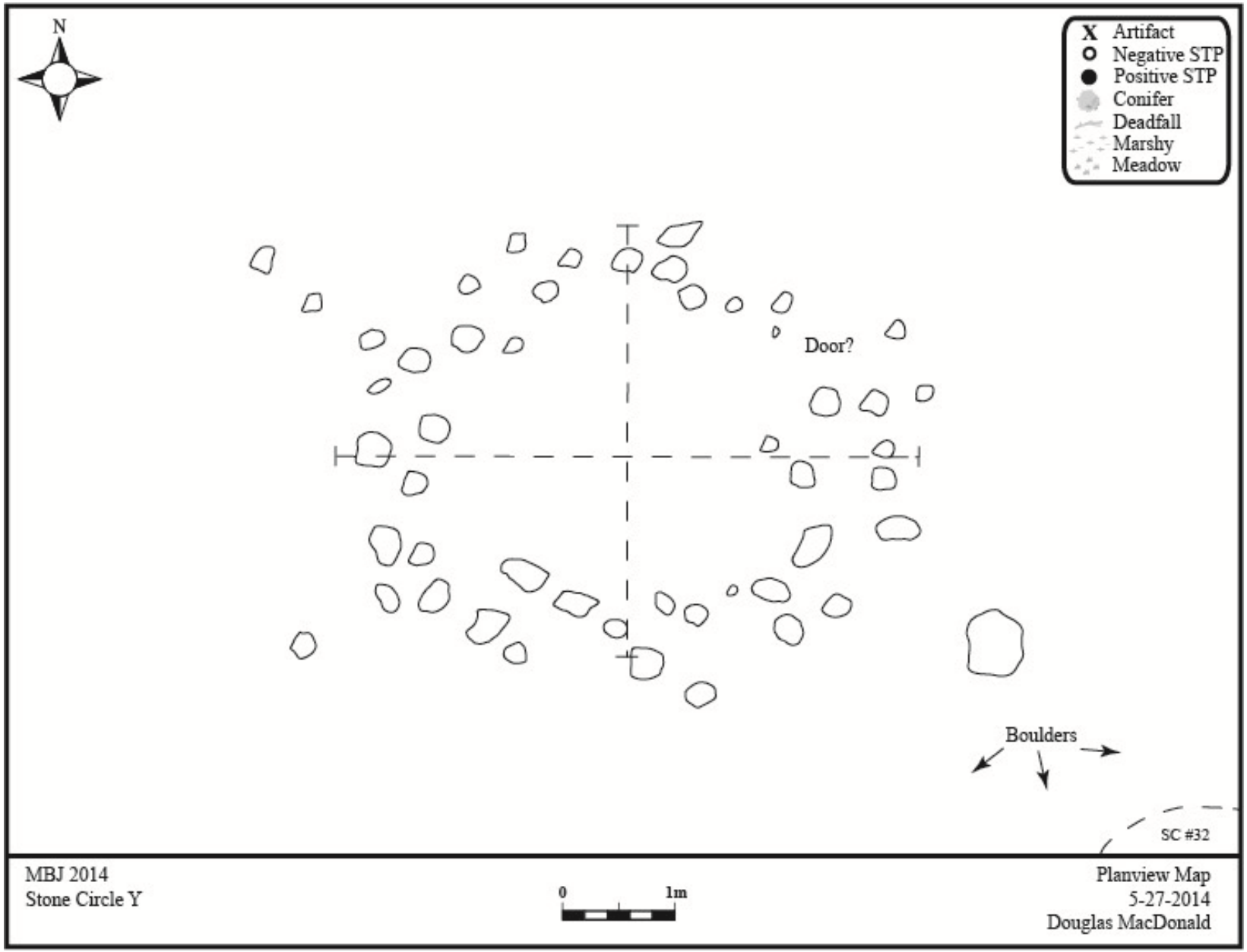

X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Creek
(20m)
SC #77
(10m)
Trail
MBJ 2014
Stone Circle 78
0
1m
Planview Map
5-29-2014
Douglas MacDonald

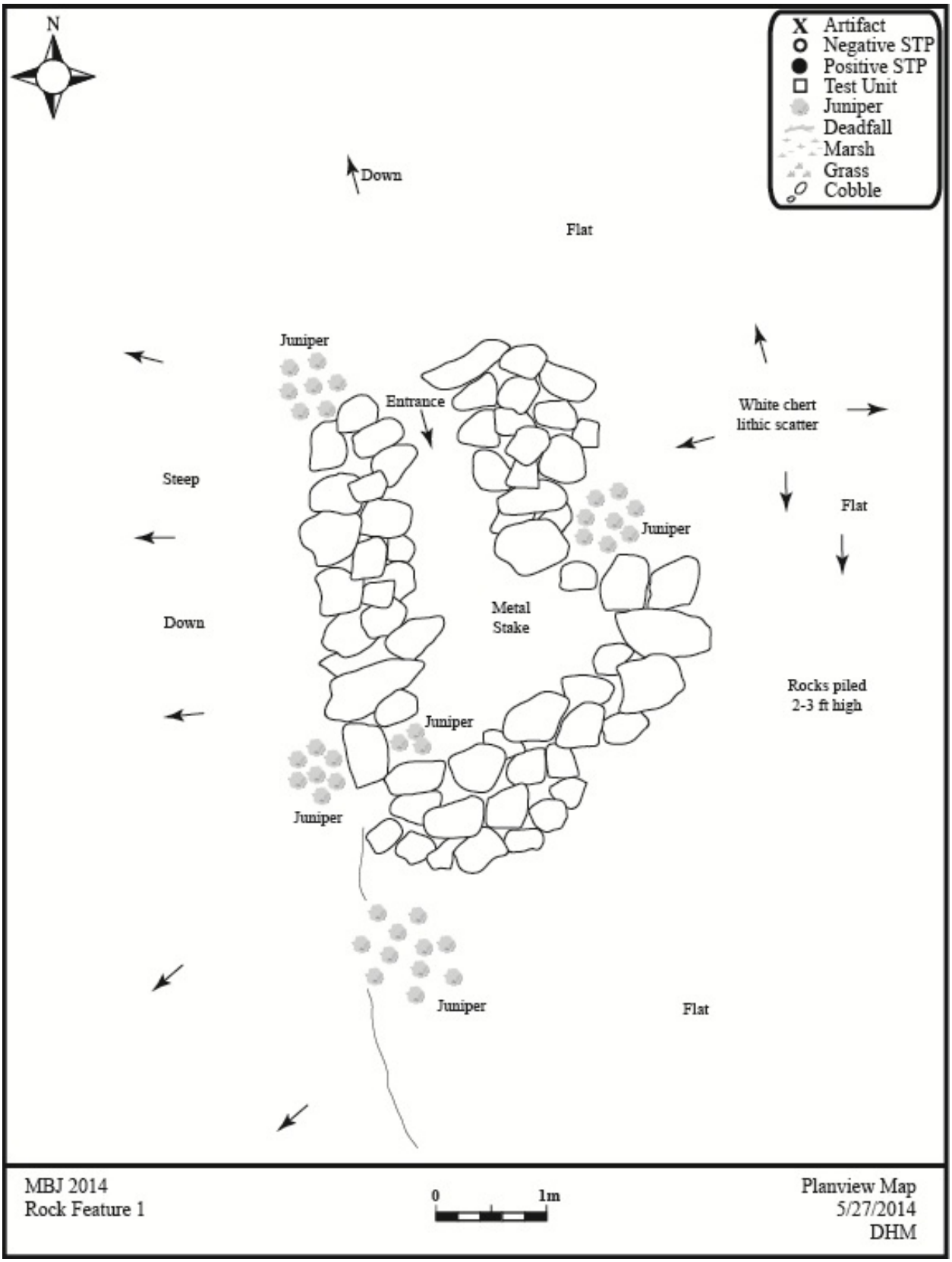

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Down to
Creek
(30m)
MBJ 2014
Stone Circle 79
0
1m
Planview Map
5-29-2014
Douglas MacDonald

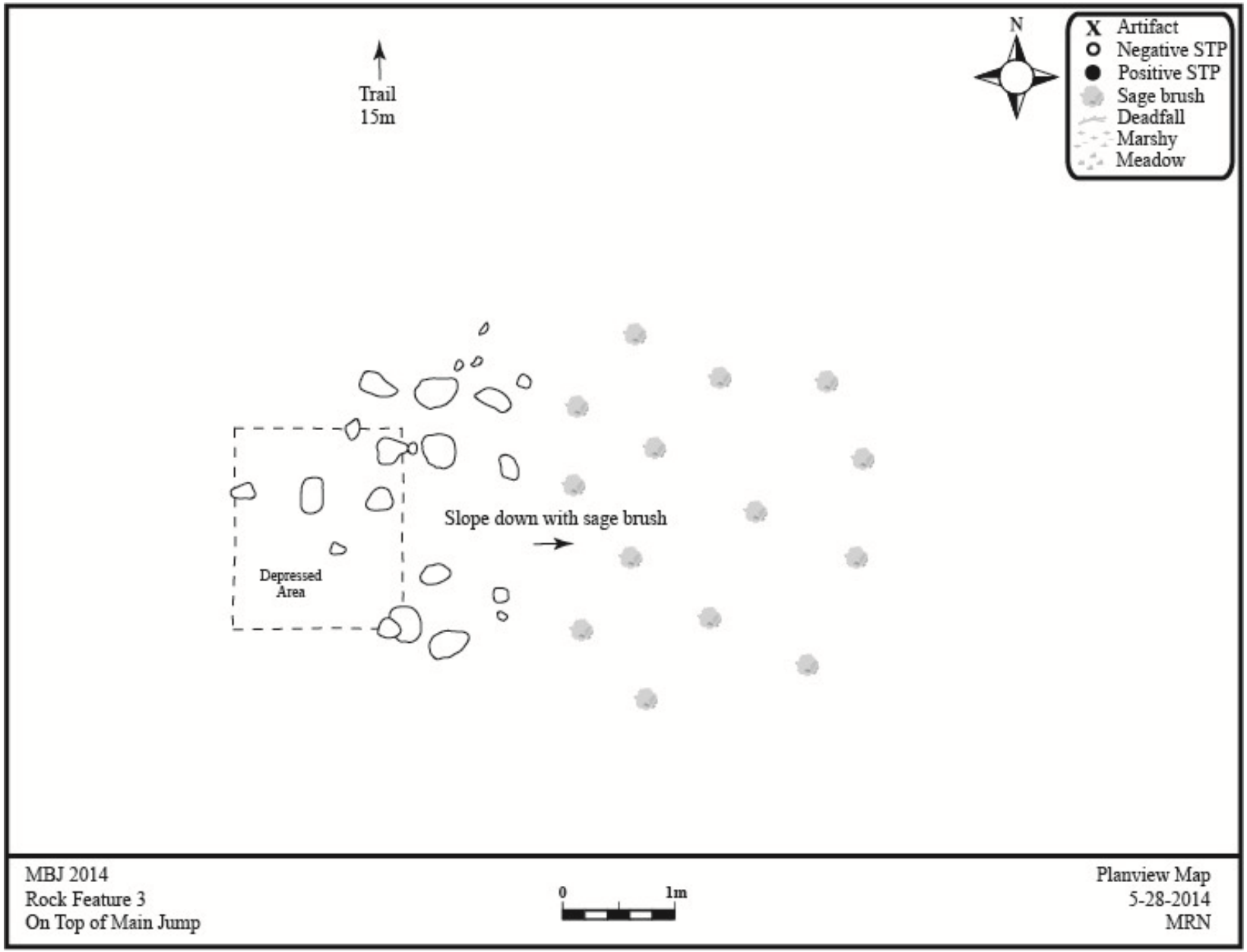

N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
MBJ 2014
Alternate Stone Circle 15
0
1m
Planview Map
5-23-2014
MRN


(Thick grass throughout)
(SC-66)
Pit/ depression
N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Grass
MBJ 2014
Alternate Stone Circle 66
Creek Bottom
0
1m
Planview Map
5-29-2014
MRN


X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
N
Ortho chopper?
MBJ 2014
Stone Circle X
0
1m
Planview Map
5-27-2014
Douglas MacDonald


N
X Artifact
Negative STP
Positive STP
Conifer
Deadfall
Marshy
Meadow
Door?
Boulders
SC #32
MBJ 2014
Stone Circle Y
0
1m
Planview Map
5-27-2014
Douglas MacDonald


N
Artifact
Negative STP
Positive STP
Test Unit
Juniper
Deadfall
Marsh
Grass
Cobble
Down
Flat
Juniper
Entrance
White chert
lithic scatter
Steep
Flat
Juniper
Down
Metal
Stake
Rocks piled
2-3 ft high
Juniper
Juniper
Juniper
Flat
MBJ 2014
Rock Feature 1
0
1m
Planview Map
5/27/2014
DHM


Trail
15m
N
X Artifact
Negative STP
Positive STP
Sage brush
Deadfall
Marshy
Meadow
Slope down with sage brush
Depressed
Area
MBJ 2014
Rock Feature 3
On Top of Main Jump
0
1m
Planview Map
5-28-2014
MRN