Date of Report: June 30, 2000
LCMR Work Program Final Report

Date of Next Status Report: June 30, 2000
Date of Workprogram Approval: October 25, 1997
Project Completion Date: June 30, 2000

LCMR Work Program 1997

1. **PROJECT TITLE:** JEFFERS PETROGLYPHS ENVIRONMENTAL ASSESSMENT AND PRAIRIE RESTORATION A-1 0

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Total Biennial Project Budget:

$ LCMR:	$ 125,000.00
$ LCMR Amount Spent:	$ 65,319.48
= $ **LCMR Balance:**	$ 59,680.51

A. Legal Citation: ML 1997, Chap. 216, Sec. 15, Subd. 5 (c).
Carryforward ML 1998, The availability of the appropriations for the following projects is extended to June 30, 2000: Laws 1997, chapter 216, section 15, Subdivision 5, paragraph (c) Jeffers petroglyphs environmental assessment and prairie restoration. Appropriation Language: This appropriation is from the future resources fund to the Minnesota Historical Society to establish an environmental monitoring program and assess environmental effects on the petroglyphs and restore native prairie to parts of this state site.

B. Status of Match Requirement: None Required
During the project period from July 1997 through June 1999 an estimate of $10,000 in-kind match will be generated in equivalent salaries from research conducted by students in a proposed university archaeological field school. Student salaries are equivalent to student intern salaries which are valued at $10.00 per hour. A 6 week field school for a conservative number of 4 students is valued at approximately $10,000.

II. Progress Summary and Results:

The study will provide quantitative and qualitative data about environmental conditions existing at the petroglyphs rock art site in Cottonwood County. The establishment and long term monitoring of environmental trends and weathering profiles will allow the creation of proper management practices assuring the long term preservation of the site. Furthermore, regular updates of both raw data and analysis will be posted on the internet for use by the general public and rock art specialists worldwide. Limited archaeological test excavations will help determine the extent and condition of buried portions of the site. Glyphs that were recorded in the early 1970s have since become buried by wind deposited soil. Buried glyphs will be documented and related to currently unknown site degradation processes. A detailed assessment of the damaging effects of common lichens adhering to large portions of the rock face will be undertaken. It is expected that the removal of these lichens will eliminate a major mechanical and chemical agent contributing to site deterioration.

The restoration of native prairie plants will provide the finishing touches to site development. About half of the 80 acre site is currently covered by native prairie vegetation, and the other half is covered by a prairie restoration done in the 1960s. The current restored prairie is a fine example of early restoration efforts, but the origin of the vegetation is Nebraska - the only source of prairie seeds at the time. Approximately 35 acres of this area will be replaced by plants native to Minnesota. Visitors walking on the new trails through the site will be able to compare and contrast virgin prairie with the most up-to-date restoration efforts.

III. Progress Summary:

During July a nationally recognized expert rock art conservator, J. Claire Dean of Dean and Associates from Portland, Oregon, produced what is known in the profession as a 19 condition assessment" for the Jeffers site. This assessment describes in detail the relevant existing conditions and includes a series of recommendations for future action. Among those recommendations were the establishment of an environmental monitoring system that includes visual recording, an up-to-date detailed recording of the current condition of the glyphs, a record of all known graffiti and a monitoring plan, and a study of the lichen and an evaluation of its effects on the site. Two archaeological test units excavated along the lower edge of the rock face were used to evaluate the effects of recent soil covering and to assess the effects of vegetation growing on that soil.

The project manager attended an international rock art congress in northern Italy in October. At that congress a research paper was presented on the Jeffers site and consultation was initiated with rock art researchers and site managers about site condition assessments, future preservation efforts, and research goals. A number of petroglyph sites were visited and documentation was generated on variable site

conditions as well as on methods of site management, interpretation, and data recording.

During the conference It was learned that a program similar to the one proposed at Jeffers has just been initiated in western Norway. Consultation with the Norwegian project manager provided valuable information about process and pitfalls to be avoided. Data from the Norwegian site, which is just beginning to be collected, will be available for a comparative study at Jeffers.

As a result of the conservator's recommendations, the tower to be used for holding the environmental monitoring equipment was purchased and the foundation was prepared for installation of the equipment in late winter/early spring. A list of necessary instrumentation is currently being developed.

July 1, 1998
Study teams for both the prairie restoration and specializations necessary to make a detailed review of the petroglyphs are currently being established. The current plan is to keep the membership in core teams small and bring in other specialists for review and/or to provide expertise as necessary. As presently conceived, prairie, soils, and interpretive specialists will be a part of the prairie restoration team; a lichen specialist, climatologist, geologist, and archaeologist will form the core of the petroglyphs study team.

The discovery of a federally designated and protected species, the prairie bush clover, in the restored prairie has resulted in a reassessment of the proposed restoration of the 1960's seeded (restored) prairie. The prairie research team met to discuss the ramifications of such a find and to recommend action in the wake of the discovery. As a result of the fact that no one inventoried the seed planted in the 1960s, an action plan was developed that will first consist of a plant inventory of the restored prairie. The inventory will also include a distribution pattern for the species much as a forest inventory would be undertaken. This information will be mapped and reviewed by the team as the basis from which to make recommendations about the next steps in the process. The prairie study is scheduled for mid-July which will allow ample time to make restoration decisions and undertake seed harvesting on nearby prairies. Through a cooperative agreement with the DNR, a lichen specialist will inventory the species at the site to begin an evaluation of the effects of lichen on the quartzite. This will serve as necessary baseline data by which to evaluate the need to remove lichen from the rock surface.

The delivery and installation of environmental monitoring equipment is behind schedule due to backordered parts and severe weather this spring. The monitoring tower has been installed, electrical power is now available for the equipment, and the measuring equipment is rescheduled for delivery and installation during July.

Due to a changing schedule structure at the University of Minnesota and the

unavailability of rock art specialists to train students in recording techniques during the summer of 1998, the archaeological field school has been rescheduled for May and June 1999. The project director has been invited to participate in a workshop on petroglyph research and management and will deliver a research paper on petroglyph management at the International Rock Art Congress (IRAC - 98) in northern Portugal (Coa rock art area) in September. The LCMR project will not be assessed any costs associated with this effort.

December 31, 1998
Due to the discovery of the presence of the Prairie Bush Clover endangered species it has been necessary to understand the extent of this plant's distribution at the Jeffers site before undertaking restoration efforts. Because of the presence of this endangered species, planning for prairie restoration has involved a process that is more lengthy than originally anticipated. As a result, a request has been made for an extension of the deadline for project completion to June 30, 2000. This will allow for time to implement the restoration efforts which are now scheduled to be undertaken in the late summer of 1999 and spring of 2000. While all this work could all have been under contract within the original time schedule, discussions with LCMR staff indicated that they prefer to have all work completed and payments finalized before the project completion date. The solution to this is an completion date extension until June 30, 2000. A revised schedule is found below.

In July, an extensive prairie survey was completed with a group of volunteers that included prairie specialists from the MNDNR, the federal protected species program, university students, site staff, and interested lay persons previous prairie plant identification experience. The restored prairie was gridded off in 50 meter squares and the surveyors clearly delineated areas that contained Prairie Bush Clover, a federally endangered species, and other information about the nature of the prairie in each quadrant. Prairie specialists from the MNDNR compiled the data and produced a map that not only detailed areas of concern for protection of the Prairie Bush Clover, but also areas that contained relatively good and relatively poor quality native prairie. This documentation has provided the basis for producing a detailed prairie restoration plan that underlies a request for services contract that will go out for bids later this winter. The restoration will focus primarily on the "old field" area in the north eastern corner of the property and in areas recently disturbed from the construction of the site's new interpretive facility. Once restored using a modern approach to prairie restoration, these areas will become an educational and comparative tool for long term prairie studies.

It was recognized early on that certain aspects of the LCMR project had the appearance of being in conflict with each other. Because of the potential outcome of the proposed prairie restoration work and possible recommendations resulting from the of long-term environmental studies, an *"Issues Workshop"* was developed as an element of the continued project planning and implementation. Participants in the workshop included representatives from a number of interested communities: the Native American community, interpreters, natural resources, archaeology, historic preservation, and

historic sites operations and management. Some of these participants are also members of the study teams established earlier in the year. The workshop cleared up misconceptions about what was likely to happen to the site in the future and allowed all the issues to be "put on the table" so that the interrelationships of the various

components of this project and others were readily apparent. It also allowed representatives of the various "communities" to express their interests and understand how the current projects relate to their concerns. A byproduct of this workshop was that the site management staff was able to develop a clear direction and priorities for messages about preservation to the visiting public.

The *issues workshop* produced a great many more products than those related only to preservation and prairie restoration. The workshop even resulted in redefining the sites mission to one more focused on site preservation and prairie management. The issues identified and incorporated into a long range management plan for the site that are part the product of the current LCMR project are as follows: research opportunities, educational opportunities, natural resource management, site preservation, visitor impact, better understanding of the prairie ecosystem. One of the biggest deficiencies recognized by the workshop participants was the lack of a comprehensive management plan. This was and continues to be a component of this LCMR proposal. In retrospect it is gratifying that the workshop participants, not only supported, but saw as critical, the completion of every initiative in the current LCMR workprogram.

July 1, 1999
The site was revisited by J. Claire Dean, rock art conservator, in June. The purpose of the consultation was to evaluate steps taken in meeting conservation priorities made during the 1997 initial condition assessment. Her conclusion, to be submitted in a follow up report was that a number of the recommendations she of the site have been completed or are in the process of implementation. A lichen test patch was removed for regrowth monitoring. The marine varnish that was painted over the glyphs until 1990 has weathered away in most areas of the site but has continued unabated in a few of the deeper glyphs. The varnish traps moisture and soil that increases the rate of degradation of the glyphs. Monitoring of these situations will continue and if significant change doesn't occur in the near future the varnish will be removed by a qualified rock art conservator. Marked trails and boardwalks have been installed that significantly increases limitations on visitor movement and reduces potential damage from visitors at the site. Additional signage along the trails and in the new visitor's center now provides a better context for visitors to understand the respect and care for the site's resources. Detailed site documentation is underway through the archaeological field school as recommended by the initial conservation assessment completed in 1997.

The archaeological field school is currently underway with 4 students from various Minnesota universities, focusing on rock art recording, management, and conservation, is training students with majors in archaeology towards developing another generation

of specialists to care for sites in the future. The course, half completed as of this writing, has already identified 25% more glyphs than were previously known for the upper rock outcrop (the smaller of the two outcrops) at the Jeffers site. New survey and documentation is using recently developed, but thoroughly tested, recording methods that includes specialized photographic techniques and peck-by-peck tracing of the glyphs will allow for the first comprehensive direct recording of the site in the history of the site. Much of the work is being done after dark so that lighting can be controlled both for identification as well as for photography.

The LCMR project manager was invited to present a paper on the LCMR project in a session on Rock Art Conservation and Management at the International Rock Art Congress held in Ripon, Wisconsin in May. The conference, attended by over 300 individuals from 40 countries, provided an excellent venue that lead to discussions on management methods and techniques the creation of a network of rock art managers with whom we can consult and share ideas. The session identified a number of new directions as well as identifying concerns that need to be addressed in rock art site management. These issues included those related to lichen removal, visitor management methods, documentation procedures, and legal issues surrounding the protection of such sites. A detailed site management policy, principles, and procedures has been developed for Jeffers and was presented to conference participants. This site "charter" met favorable review and participants recommended implementation at Jeffers to provide a detailed context by which to review any future activity at the site.

Because rock art is a world wide phenomena, we have sought out a number of the most highly qualified specialists in specific areas of rock art research, recording, and management. Interpretation is important since its significance and its meaning determine the type of management methods can be used and use to which the site can be put rock art recording and identification by Christopher Chippindale, curator at the Museum of Anthropology and Archaeology at Cambridge University, was co-author of one textbook being used for the field school course. Chippindale's expertise from research on rock art sites world-wide has helped develop methods for defining and locating rock carvings--especially those that are shallowly carved. Another specialist, Linda Olson, Assistant Professor at Minot State University, has developed a more accurate rock recording method and is a co-author of the other course text that focuses on rock art recording methods. Olson has developed methods for recording that focus on the manufacturing rather than the outline of forms to more accurately record glyphs without interpretive bias.

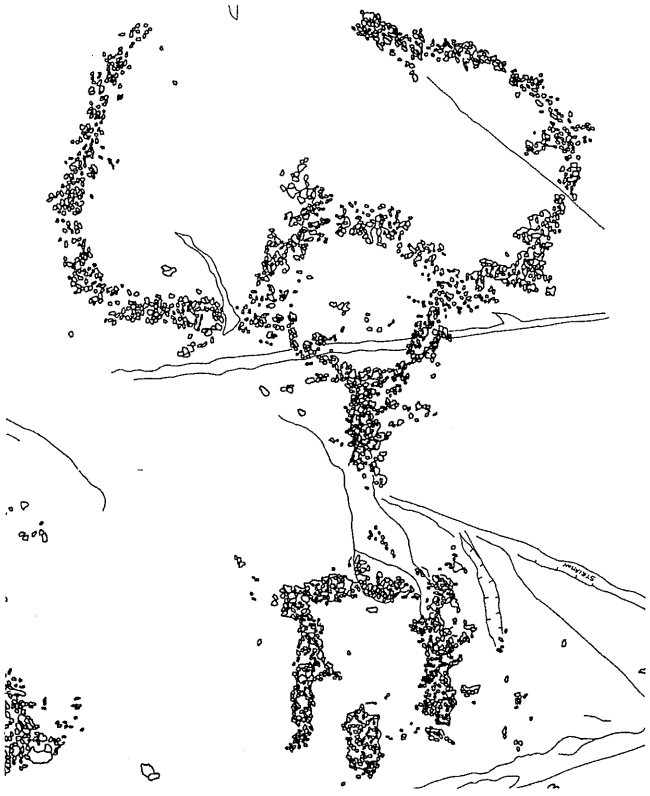
After some negotiations with the local power company, an electrical transformer and power supply has finally been reestablished to the environmental monitoring station that had been removed during the demolition of the old visitors' contact station. The case to hold the monitoring receiver in the new Jeffers Petroglyphs visitors' center has been completed and installed.

The first phase of the prairie restoration is underway. The initial work is focusing on

those areas disturbed by the construction of the visitors center and parking lot. A request for bids has been initiated to begin the restoration of the north field. Field work will begin in August and continue into the fall, with follow-up in the spring of 2000.

December 31, 1999

The recording methods taught in the field school class were implemented by the students and the LCMR program manager resulting in detailed recording of about 20 per cent of the known glyphs at the site. The entire upper outcrop (outcrop "A") was re-mapped in order to examine the effects of soil accretion to the site. In some of the lower areas of the outcrop over 30 cm of lateral accretion was documented in the 28 years since it was initially recorded. An example of the results of the new methods of recording is incorporated here in comparison with the original documentation undertaken in 1971. The new methods provide baseline documentation that will allow the ability to evaluate carving methods and the nature of what was actually produced for a less biased interpretation of the meanings of the glyphs. It also allows researchers to evaluate the extent to which natural features were incorporated into the glyphs.



1999 glyph documentation

1971 glyph documentation

A conservation issue was recently defined with the abundance of small limestone and quartzite gravel on the surface of the upper outcrop. The source of the gravel is the

adjacent roadway from which passing cars "kick" road gravel onto the rock face. An inexpensive solution has been devised to this preservation challenge that will attach small mesh screen to the existing fence that will trap airborne stones before they reach the outcrop.

The first phase of prairie restoration has been completed in the disturbed areas around the new visitors center and parking lot. However an attempt to get a sign off on specifications for the restoration of the old field in the northeast corner of the property resulted in vacillation by MNDNR prairie specialists. The heretofore agreed upon restoration was halted by MNDNR prairie specialists over a concern for protection of the Prairie Bush Clover (a federally protected species) that has expanded into that area of the Jeffers property. It was at this point the LCMR project manager learned of previous agreements established between the MHS and the DNR and between the MHS and USDA on the management of the site. These agreements result in restrictions on activities that can be performed on the site. As a result of having missed the fall planting season, I have initiated efforts, currently underway, that will result in the resolution of this issue by mid-January. This will assure that a contract for completion of prairie restoration can be let for spring planting.

June 30, 2000

The final 6 months of the project saw a flurry of activity that included an evaluation of chemical effects of lichen growth on the rock substrate of the site, the completion of a management plan, final installation of monitoring instrumentation, and the restoration of approximately 30 acres of prairie. Each of these components is briefly summarized below:

A chemical analysis of the effects of lichen growth on the Sioux quartzite (pink orthoquarzite) at the Jeffers Petroglyphs site was undertaken by Debra E. Dandridge, Texas A&M University and Dr. Jim Meen, University of Houston. Based on six rock core samples taken from an outcrop adjacent to the Jeffers Petroglyph Site on private land, a geochemical analysis was performed on the rock. The samples were not taken from within the current boundaries of the state petroglyph site due to the damage that would occur to the site itself. The cores were approximately one inch in diameter and ranged from two to four inches in length. The geochemical analysis was conducted at the University of Houston Super Conductivity Laboratory by Dr. Jim Meen who also directed the research. The samples were examined by a scanning electron microscope and an electron probe. Each sample was studied and the surface characterized for chemical content. Comparisons between lichen impacted surfaces, non-lichen surfaces, and interior surfaces (i.e. unexposed surfaces not affected by weathering) were made.

The objective of the study was to determine what, if any, geochemical changes in the rock surface could be identified on exposed quartizite surfaces impacted by lichen growth. This information could be critical to understanding natural weathering processes so that preservation of rock glyphs (rock art) can be facilitated. Samples of

surfaces impacted by lichen were needed as well as similar surfaces not obviously impacted by lichen growth. The interior surface of the core samples were analyzed to provide base information about the quartzite in a non-weathered state.

The parent rock at the Jeffers site is dominated by SiO2 grains (quartzite) and has some interstitial material of various types acting as cement. The cement includes iron silicate (hence the red color of the rock), probably hydrated. The quartzite is very fine grained and possibly not crystalline. There are a few crystals of Fe, Cu oxide (iron, copper) that were probably precipitated as sulfide and oxidized during diagenesis. There is almost no sulfur in the rock. There are a few crystals of NaCl (halite) and KCl (sylvite) -- no doubt left from seawater over 150 million years ago. Some of the cement is aluminum silicate (no other cations), probably Al4Si4O10 (OH)8 (kaolinite). Calcium minerals are notably absent.

The weathered surface without lichen is quite different from that containing lichen. The single most common surface mineral is a potassium aluminum silicate probably illites: K(1-1.5)Al4[Si(7-6.5)Al(1-1.5)O20](OH)4. It is speculated that the illites in this sample formed from kaolinite reacting with the environment There is significantly less silica compared to the unexposed sample.

In the portion of the sample surface that had been covered by lichen, there are very significant differences from the non-lichenated regions to lichen covered regions. There is no illite, but there is some kaolinite. And, there is quite a bit of silica. The most notable difference is the presence everywhere of Ca (calcium). In several places there are high K (potassium) contexts associated with the Ca. Most of the K-rich area have no Al so it is not a clay or mica or feldspar source; also Cl (chlorine) and S (sulfur) was found.

The presence of silica, the primary component of quartz, is significantly reduced. Quartz is not very soluble in rain water. The presence of potassium is curious, possibly coming from the presence of muscovite, possibly from overlying soils, possibly introduced from groundwater, or possibly introduced by anthropogenic processes such as agricultural production. Titanium and iron are present on this surface in unexpected quantities.

When a sandstone (from which quartzite is formed) is weathered without the addition of other material, one expects dissolution of the more readily attacked cement (calcite if present; any non-clays next) and sand grains fall out.

It is highly apparent that the presence of lichen chemically alters the surface of Sioux quartzite found at the Jeffers Petroglyph Site. Three forms - crustose, foliose, and fruticose - of lichen are present at the Jeffers site. While the mechanical growth processes that are detrimental to rock surfaces are well known, the metabolic processes by which lichen incorporate minerals into their life cycle is little understood at present. It appears that lichen are concentrating some minerals and eliminating, or altering, others during their life cycle. This possibly can account for the high presence of

potassium on the lichenated surfaces. Lichen life cycles can be disrupted by the presence of acid rain and possibly petroleum products. Rock surfaces heavily encrusted by lichen at one time could now be bereft of lichen growth due to anthropogenic processes. Some of these processes may be linked to activities such as site visitors, chemical applications, the use of herbicides and fertilizers and acid rain. It is evident that lichen are impacting the surfaces on which the petroglyphs are found. Relict lichenated surfaces may now be exposed to mechanical weathering (wind, rain, heat, cold) after having been affected by lichen growth. The surface altered by lichen chemical byproducts may now be weathering at rates greater than surfaces unaffected by lichen growth. This is an element that needs significant future monitoring in areas where the interstices between grains are greater in size resulting in weaker bonds between grains.

Many site visitors, and even rock art researchers, may feel that because of the antiquity of the rock images and their survival to the present, the stability and preservation of the glyphs at Jeffers is secure. However, in geological terms this site is not very ancient, and it is a fact that, where sites are not being maintained, images have been and continue to be lost through weathering processes and human actions. Changing land uses and the presence of toxic materials in rain and snow and in wind-blown soil, and vegetative growth are hastening the deterioration of these images. The presence of visitors at the site are also threatening the very resource they are here to learn from.

As part of a larger consideration of management issues in general, rock art site management is, within our ability, the control of the elements which make up the physical and social environment of a rock art site (Clouse 2001). This environment includes the current physical condition, land use, human visitation, site interpretation, and natural processes that produce a predicted future condition. In order to understand the Jeffers site it is perhaps important to place it within a larger context of rock art sites in general. The goal of rock art management in its broadest sense, like that aimed at heritage preservation in general, is towards the identification, explanation, and maintenance of the values inherent in such sites. It encourages the implementation of management practices which minimize the destruction of rock art sites while establishing strategies for long term conservation and preservation of sites through legal and physical protection and through interpretation and visitor management.

The application of principles of resource sustainability serve as a model for rock art site management. The concept of *sustainability* is based on the ethical premise that current growth shall not be achieved at the expense of future generations who should not inherit a diminished environment. For all intents and purposes this is only attainable in the abstract. Sustainable resource management stipulates that the development, protection, and use of resources for the achievement of economic and social well being must be done without damaging the resource base or compromising the ability of future generations to meet their needs. Sustainability concepts have been developed in response to behavior associated with human actions. The concepts of sustainability

were developed with a focus primarily on renewable resources, however rock art sites and other archaeological resources are non-renewable and adverse effects on them are irreversible. It is this combination of irreversibility, uncertainty, multiple unknown aspects, and the absence of substitutes that make archaeological resources unique and vital--or in sustainability terminology--*critical resources. Critical resources* are, by definition, constraints on sustainable development. The loss of critical resources, such as social and cultural resources, effects qualitative aspects of the environment that require fundamental reappraisal of ethics towards the future and sustainability principles.

Acceptable management and conservation practices require proper consultation and adherence to agreed standards and conventions. This process assumes that management personnel are committed to these principles. These standards are absolutely basic to satisfactory preservation practices and are assumed to be an integral part of all procedures. At the core of such management efforts are the principles upon which they are based. These principles were established by the Burra Charter in Australia, where protection and preservation of rock art sites is a national focus. That well-developed and organized document serves as a basis for present and future actions at rock art sites. Relevant aspects of that charter have been modified, assembled and incorporated for use here into a *Jeffers Petroglyphs Management Guidelines* document . The following management guidelines were presented in a research paper at the International Rock Art Congress in 1999 by the project manager and subsequently published in the *Proceedings of the 1999 International Rock Art Congress, Volume I* (Clouse 2001).

Twenty-one articles of policy, principle, and practice serve as the nucleus of this management document (see below). Overall, effective management of rock art sites involves the following:

1. Location, identification and documentation;
2. Assessment of the value or significance;
3. Weighing the values, requirements, and constraints to developing a management policy for the future; and
4. Implementation of management practices within management policy.

Once identified, the second management step is the most critical and most challenging since it, in effect, determines the policy for any particular site, with options ranging from destruction to active conservation. The weighing of values and policy implementation (3 and 4 above) acknowledges the interrelationship of the educational values for the use of sites as publicly interpreted places and the goal of long term site preservation. It is within this context that the *Management Guidelines* are developed.

Jeffers Petroglyphs Management Guidelines

Preservation Policy

Article 1. It is the stated policy of the Minnesota Historical Society that the Jeffers site represents a unique resource in Minnesota and in the region and that the preservation of the site and its interpretation to the public is a insititutional goal and its availability to descendants of its creators/users be assured.
Article 2. *Preservation* of the site is paramount and in the event that the preservation of the site cannot be asssured due to public utilization, the site will be closed to the public.
Article 3. Study of the site by any intervention in the fabric or by archaeological excavation shall be permitted only when necessary to provide data essential for decisions on the *preservation* of the place and/or to secure evidence about to be lost or made inaccessible through unavoidable (i.e. natural) action. Investigation of the site which requires physical disturbance and which adds substantially to a scientific body of knowledge may be permitted, provided that it is consistent with the management practices and preservation policy for the site.
Article 4. The *preservation policy* appropriate to a place must first be determined by and through an understanding of its *cultural significance.*
Article 5. The *preservation policy* will determine which uses are compatible.

Preservation Principles

Article 6. The aim of pre*servation* is to retain the *cultural significance* of a place and must include provision for its security, its maintenance, and its future.
Article 7. *Preservation* is based on a respect for the existing fabric and should involve the least possible physical intervention. It should not distort the evidence provided by the *fabric*.
Article 8. *Preservation* should make use of all the disciplines which can contribute to the study and safeguarding of this site. Techniques employed should be traditional (i.e. not experimental) but should be the most modern ones for which a firm scientific basis exists and which have been supported by a body of experience.
Article 9. *Preservation* of the site should take into consideration *all* aspects of its cultural significance, without unwarranted emphasis on any one aspect at the expense of others.
Article 10. *Preservation* requires the maintenance of an appropriate visual setting: e.g., form, scale, color, texture, and materials. No new construction, demolition, or modification, which could significantly adversely affect the setting should be allowed. Environmental intrusions which adversely affect appreciation or enjoyment of the place should be excluded except were those intrusions may be necessary to insure the long term preservation of the site.
Article 11. The removal of contents which form part of the cultural significance of the place is unacceptable unless it is the **sole** means of ensuring security and *preservation.*
Article 12. Significant aspects of the site should remain in their historical location. The

moving of glyphs is unacceptable unless this is the **sole** means of ensuring its survival.
Article 13. *Preservation* is limited to the protection, maintenance and, where necessary, the stabilization of the existing fabric but without the distortion of it cultural significance.

Preservation Practice

Article 14. The Society will make every effort to assure that the site is protected during its presentation to the public and it use by Native Americans.
Article 15. Any work on the site must be preceded by professionally prepared studies of the physical, documentary and other evidence, and the existing fabric recorded before any intervention in the place.
Article 16. Study of the site by any intervention in the fabric or by archaeological excavation should be undertaken only when necessary to provide data essential for decisions on the *preservation* of the place and/or to secure evidence about to be lost or made inaccessible through necessary conservation or other unavoidable action. Investigation of the site or any other reason which requires physical disturbance and which adds substantially to a scientific body of knowledge may be permitted, provided that it is consistent with the preservation policy.
Article 17. A written statement of preservation policy must be professionally prepared setting out the *cultural significance* and proposed *preservation procedure* together with justification and supporting evidence, including photographs, drawings and all appropriate samples.
Article 18. The organizational structure for and individuals responsible for policy decisions must be named and specific responsibility taken for each such decision.
Article 19. Appropriate professional direction and supervision must be maintained at all stages of the work and detailed records kept of new evidence and additional decisions.
Article 20. All items recovered should be professionally cataloged and curated.
Article 21. The records required by the Articles will be publicly available.

The core policy, principles, and practices of the *Jeffers Petroglyphs Management Guidelines* have been used to direct a number of actions in the last few years and the majority undertaken as a part of this LCMR project in the last 3 years. These actions include:

- the removal of the old visitor's center adjacent to the rock outcrop and its replacement with a new center at a distance from the rock,
- a draft management manual,
- conduct of an Issues Workshop,
- a site condition assessment,
- a successful grant application for long-term site study (this study),
- archaeological testing to evaluate buried components of the site,
- the initiation of an environmental monitoring program,
- new trails and markers including boardwalks,

- ongoing consultation with Native Americans,
- change in management and interpretive methods that allowed natural processes to remove varnish from site,
- on-site interpreters to better protect and interpret the site,
- full-time professional site management staff,
- a new interpretive publication about the site available next year,
- a survey of the surrounding prairie environment, and
- a major glyph recording effort.

The management plan also includes a mechanism for using the team concept for management. The multiple teams incorporate overlapping team membership with the groups composed of both specialists and managers. Future studies will include visitor impacts and long-term environmental monitoring of natural impacts due to soil cover and subsequent vegetative invasions.

Management guidelines developed for the Jeffers site serve to provide direction to any individual undertaking work on this site. Each person is bound by the rules and principles contained therein. Adherence to the rules and conventions greatly reduces the risk of error in the application of preservation methods while assuring consistency in the process of their implementation.

The development of a comprehensive management policy is a critical first step for site management personnel to recognize and understand the various sources that threaten this (or any other) site and lead to its deterioration, to know how to deal with a variety of management and preservation issues, and to know when to ask for expert assistance. Such a document also makes explicit the decision-making process and the basis for those decisions relating to actions undertaken at the site. This process is a crucial component of the plan because some decisions that we make today may result in irreversible consequences for the future (Clouse 2001). By utilizing the processes and procedures contained in a formal document and having all work conducted under the auspices of the *Guidelines,* those significant elements of the Jeffers site can be maintained for future generations.

The 80 acres that is designated the Jeffers Petroglyphs contains a mesic prairie. A mesic prairie is dominated by grasses. Big Bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*) and prairie dropseed (*Sporobolus neterolepis*) are the dominant grasses on most sites. On drier sites little bluestem (*Schizachyrium scoparium*) and porcupine grass (*Stipia spartea*) are important species. Wetter sites commonly have switchgrass (*Panicum virgatum*) and prairie cordgrass (*Spartina pectinata*). All the above listed species appears at the Jeffers site.

Forbs are also abundant, but never dominant, with considerable diversity depending on the local setting in well-preserved prairie acreage. Forbs also vary in relation to soil moisture and soil depth. Common forbs include the purple prairie clover (*Petalostemon purpureum*), white prairie clover (*P. candidum*), prairie turnip (*Psoralea esculenta*),

rough blazing-star (*Liatris aspera*), various types of goldenrod, smooth aster (*Aster laevis*), white sage (*Artemisia ludoviciana*), multiple types of milkweed, and the purple coneflower (*Echinacea angustifolia*). Low shrubs present at Jeffers include leadplant (*Amorpha canescens*) and prairie rose (*Rosa arkansana*) (Aasneng et al 1993). In the 1980s a list of species identified at the site was compiled by Florence Roefer, former site manager.

Originally the site contained both a dry and a wet mesic prairie, however the wetter, lower portions of the site were turned under by the plow over 100 years ago. When the State of Minnesota acquired the site in the 1960s one of the first actions undertaken was an attempt at a prairie restoration in the cultivated portions of the site. Because considerably less was known about prairie environments at that time a detailed study of the process of and the ecological and seed requirements were not undertaken.

A significant part of the funding for this LCMR project was for the prairie restoration component of the project. Rationale for this undertaking was based on the vast difference between the restored prairie undertaken in the 1960s on areas formerly cultivated using almost a monoculture seed mix consisting almost exclusively of big bluestem from a source in Nebraska—one of the few sources at that time—and the native prairie at the site. Since the restored prairie planting in the 1960s, some diversity has developed, but in general is was not considered close to being equal to that of the native prairie found on the uncultivated portions of the 80 acre parcel. The project goal was to augment and manage prairie communities that have established themselves or been restored in areas formerly converted to agricultural fields and to manage and provide additional protection to the high quality core areas of native plant communities.

Working with prairie specialists Nancy Sather and Ellen Fuge at the MnDNR, an assessment of the relative quality of the existing restored prairie was undertaken during the summer of 1998. Utilizing a group of prairie specialists and knowledgeable volunteers, teams of 5 to 6 individuals surveyed staked tracts that measured 50 by 50 meters throughout the restored prairie area of the site. Each 50 by 50 meter area or subarea was graded (on a scale of A to F) on the quality and diversity of the prairie. Individual plants and areas containing prairie bush clover (*Lespedeza leptostachya*), a federally protected species, were also documented during the survey. A map showing the results of the survey.

Through a protracted process the results of the survey assisted in the formulation of a prairie restoration plan that was converted to contract specifications. A request for bids that detailed those specifications was advertised in the *State Register* during the late winter of 1999-2000. Copies of the bid package were sent to 40 firms that had expressed an interest in undertaking prairie restoration projects. Only one bid was received—that from Salix Ecological Resources of Windom, Minnesota. Being qualified to do the work, having had experience in this type of project before, having qualified and experienced staff, and having access to an acceptable seed source, the bid was accepted. The ultimate scope of the project involved burning approximately 60 acres in

the southeast and northeast parts of the 80 acre parcel and interseeding 30 of the acres that had been planted with big bluestem in the 1960s.

One of the reasons of the importance of the Jeffers property as a prairie is the presence of prairie bush clover(*Lespedeza leptostachya*), a federally listed threatened species. The presence here of prairie bush clover is a rare occurrence. This is one of only 40 sites in 23 counties of Iowa, Minnesota, Illinois, and Wisconsin where this plant is found in the United States.

The mesic prairie is a fire-dependent community. It is only the presence of fire that stops the invasion of brush and trees. The Jeffers site, along with numerous other prairie remnants, are subjected to controlled burns on a periodic basis in order to thwart a woody species invasion. Until this year the Society depended on the MnDNR to undertake burns to maintain the prairie ecosystem.

Because of the pressing needs of MnDNR staff to manage a large number of sites around the state and the fact that the Society now manages 5 prairie areas, discussions with LCMR staff allowed the purchase of controlled burn equipment and necessary safety gear to begin the management of their own properties. Equipment included drip torches, fire swatters, shovels, back pack pumps, and a broad range of safety clothing, masks and goggles. The project also provided the opportunity to begin training of Society staff in the burn process. One of the longest term products of his project will be the ability of Society staff to begin appropriate management of many of the natural resources under its control.

Eventually, the entire suite of conditions and species the same as those found in undisturbed native prairie may once again occupy this site.

IV. Outline of Project Results:

Result 1: Excavate and evaluate buried petroglyphs
LCMR Budget: $14,000 Balance: $ 6,000
Match: (in kind) $10,000 Match Balance: $1,250

Based on knowledge of the current geological processes acting on the site and initial and limited archaeological testing conducted in 1996, an unknown number of glyphs lie buried along the downslope edge of the site. Site evaluation and documentation, conducted in conjunction with an archaeological field school at the University of Minnesota, will attempt to determine the extent of buried glyphs at the site. Evaluation of the condition of these glyphs will provide comparative data for exposed portions of the site. Budget apportionment will pay for archaeological staff and living expenses and match will be derived from in-kind donated hours by student excavators. A revised project schedule is provided below.

Deliverable: A report will be produced describing the results of the investigations.

Result 2: Restore prairie with Minnesota plants
LCMR Budget: $48,000 Balance: $16,074.89
Match: $0 Match Balance: $0

The restored prairie consists of vegetation derived from Nebraska seeds. Elements of that restoration are encroaching into the native Minnesota prairie existing at the site. A prescribed burn at the site will prepare the area for seeding of Minnesota plants. DNR and Nature Conservancy specialists will assist in determining details of the process. Actual planting will depend on seasonal conditions but is proposed for fall 1998 with follow-up additional plantings in spring 1999.

Deliverable: Prairie restored with Minnesota seeds and plants on ca. 35 acres of site.

Result 3: Install environmental Instrumentation monitoring station LCMR
Budget:$59,700 Balance: $ 37,242.40
Match: $0 Match Balance: $0

With the assistance of a rock art conservator, an additional review and analysis of the site conditions will be made. Purchase and installation of environmental monitoring instrumentation is proposed for fall of 1997. Temperature (rock, ground, and air), wind speed and direction, and airborne particulates, moisture levels, and other data will be collected to evaluate in conjunction with visible weathering on the site surface. Data links will be established with the site's interpretive center and through the internet and monitoring through the winter and early spring will provide information to work out bugs in the system.

Deliverable: Establishment of environmental monitoring/weather station and rock art conservator's condition assessment report.

Result 4: Remote internet link through MHS web server
LCMR Budget:$3,300 Balance: $3,300
Match: $0 Match Balance: $0

Deliverable: An internet link will be established following the installation of the environmental monitoring instrumentation.

V. Dissemination:
Information about the project and the results of the environmental monitoring station will be available on the internet on the MHS Archaeology Department world wide web pages (www.umn.edu/marp/). A brochure will be prepared for visitors to this MHS historic site providing information about the project. As data is generated it will be displayed in the new interpretive center apprising visitors of the ongoing environmental monitoring and conditions currently existing at the site.

VI: Context:

A. Significance:
The state-owned Jeffers Petroglyphs site represents a unique and irreplaceable resource in Minnesota. Petroglyphs or rock carvings (also called "rock art") provide valuable insight into ancient Native American lifeways that are available from no other source, and the surrounding landscape is a valuable remnant of the vast prairie vegetation that once

covered the region. The Jeffers rock outcrop in Cottonwood County contains nearly 2,000 stone carvings left by Native Americans. The earliest glyphs appear to have been created some 5,000 years ago. The Jeffers site is the largest known concentration of rock art east of the Great Plains. Some of the glyphs that were recorded only 20 years ago have already become buried by downslope erosion and windblown soils. Recent environmental changes, pollution, and adjacent land use are having a detrimental effect on the site, but the severity of these actions is as yet unknown. It is necessary to begin the documentation process now so that we can evaluate the effects of numerous microenvironmental factors existing at this location and assess their effects.

B. Time:
The establishment of monitoring equipment, possible removal of lichen, and prairie restoration will be completed in two years. However, long term monitoring will continue into the foreseeable future to document the effect of specific conditions of the environment acting on these fragile resources. Short term data may assist in developing strategies for corrective actions, but care must be taken to avoid irreversible processes (such as mechanical cleaning) as solutions to short term problems.

a: **Budget Context:**

July 1996 - June 1997		July 1997 - June 2000	July 2000 - June 2002
Prior expenditures on this project		Project Period	Future expenditures on this project
LCMR		$125,000	
Other State	$	$	
Non State $ Match	$1,000	$	
In Kind	$5,500	$ 10,000	$13,000
Total	$6,500	$ 65,319.49	$13,000

Budget.

Personnel: $ 24,000 (including $10,000 in-kind match) for Assistant Field Director for 3 months and travel/field living expenses and for consultants

Equipment: $ 59,700 (environmental instrumentation stations)

Acquisition-	**$**	0
Development:	**$**	48,000 (prairie restoration)
Other:	**$**	3,300 (internet link hardware for the site)
Total:		$ 135,000

VII: Cooperation:
Not Applicable

VIII. LOCATION

A map of the state is attached showing the location of the project. A plan of the Jeffers Petroglyphs state historic site is attached showing the arrangement of features on the property.

IX. Reporting Requirements:
Periodic workprogram progress reports will be submitted not later than January 1, 1998, July 1, 1998, January 1, 1999, July 1, 1999, and January 1, 2000. A final workprogram report and associated products will be submitted by June 30, 2000, or by the completion date as set in the appropriation.

X. For Research Projects: Not Applicable

REVISED SCHEDULE: JEFFERS PETROGLYPHS ENVIRONMENTAL ASSESSMENT AND PRAIRIE RESTORATION A-10

	1997	1998											1999												2000											
	J	A	S	0	N	D	J	F	M	A	M	J	J	A	S	0	N	D	J	F	M	A	M	J	J	A	S	0	N	D	J	F	M	A	M	J
Conservator Review	xxxx																	xxx																			
Equipment installation																													xxxxxxx							
Archaeological Testing	xxx																								xxxx											
Prairie restoration																		xxxx					xxxxx											xxxx		
Establish Internet link																														xxxxxx						