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# BEST PRACTICES FOR ARCHAEOLOGICAL SITE MONITORING

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Facilities Engineering
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# BEST PRACTICES FOR ARCHAEOLOGICAL SITE MONITORING

1. Purpose.

a. This Public Works Technical Bulletin (PWTB) transmits information on best practices for monitoring the condition of archaeological sites. It is intended to assist cultural resource managers in monitoring sites effectively to better protect historic properties.

b. All PWTBs are available electronically (in Adobe® Acrobat® portable document format [PDF]) through the World Wide Web (WWW) at the National Institute of Building Sciences' Whole Building Design Guide web page, which is accessible through URL:

http://www.wbdg.org/ccb/browse_cat.php?o=31&c=215

2. Applicability. This PWTB applies to all U.S. Department of Defense installations and other Federal and state agencies that manage archaeological sites that are or may be eligible for nomination to the National Register of Historic Places.

3. References.

a. Army Regulation (AR) 200-1, "Environmental Protection and Enhancement," 13 December 2007.

b. Appendix E lists additional references.

4. Discussion.

a. Many U.S. Army Corps of Engineers Districts, Army installations, and other federally managed lands contain large numbers of prehistoric and historic archaeological sites. The National Historic Preservation Act of 1966 (as amended), Native American Graves Protection and Repatriation Act, Archaeological Resources Protection Act, as well as other laws and regulations require Federal agencies (including the Army) to identify, evaluate, and protect historic properties including archaeological sites. A wide range of natural processes and cultural actions can damage sites (e.g., erosion, military training, construction of infrastructure, looting). Compliance with the aforementioned laws requires resource managers to monitor sites in order to detect changes in site condition. Archaeological site monitoring is a neglected component of Cultural Resource Management, making it an area where Federal agencies are vulnerable to public criticism and lawsuits if important cultural and scientific information is lost.

b. Across the United States, sites vary greatly in terms of the nature of their archaeological deposits, local environment, and the kind of natural processes and human actions that threaten site condition. It is thus not possible to simply develop a single monitoring strategy that would be cost effective and appropriate for all areas.

c. This PWTB provides guidance for Cultural Resource Managers and others who need to develop a strategy for monitoring archaeological sites. A number of existing monitoring strategies that appear to be thoughtful and effective are reviewed, and best practices for effective site monitoring are identified. Best practices are described here in general terms so that Cultural Resource managers affiliated with Corps Districts, military installations, and other public lands can adapt to local conditions.

d. Appendix A discusses the need for archaeological site monitoring, including legal requirements and factors that result in damage to site deposits.

e. Appendix B provides overviews of several effective site monitoring strategies.

f. Appendix C identifies best practices for archaeological site monitoring.

g. Appendix D provides a summary and conclusions.

h. Appendix E lists references for the appendixes.

i. Appendix F presents examples of field forms used by the monitoring strategies discussed in Appendix B.

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# Appendix A

## The Need for Site Monitoring

Archaeological site monitoring consists of periodic visitations and inspections to detect change in a site’s condition. Archaeological resources are vulnerable to both intentional and inadvertent damage from many sources, and the level of risk to individual sites is not static. Changes in access (e.g., new roads or trails), pool levels in lakes and rivers, the nature or location of military training, agricultural practices, urban and suburban expansion, or even recreational activities can expose archaeological resources to new risks.

Monitoring is an important but neglected aspect of Cultural Resources Management (CRM). The laws, regulations, and policies that are the basis for national, state, and tribal historic preservation programs clearly specify requirements for identifying archaeological resources and evaluating their eligibility for the National Register of Historic Places (NRHP) (National Park Service 2002). A substantial body of professional literature, guidelines, and standardized practice has developed for these CRM activities (e.g., Hardesty and Little 2000; King 2000; National Park Service 1983). In contrast, the need for systematic monitoring is implied by requirements to protect historic properties, but is not discussed in detail. Site monitoring is thus often seen as an activity that is important but less critical than site discovery and evaluation. Given limited funding, many CRM programs focus their monitoring efforts on a very narrow range of highly sensitive and/or highly visible sites, such as rock shelters, rock art, mounds, cemeteries, and battlefields that are primarily threatened by looting and vandalism. Such efforts may (depending on field protocols and data management) be adequate for those sites, but highly selective monitoring is not really sufficient for compliance with the intent of relevant historic preservation law.

The current need for guidance on archaeological site monitoring methodology cannot be met by developing a single strategy suitable for all situations. The nature of archaeological sites and the types of adverse impacts to which they are exposed vary a great deal across the United States. Those who search for guidance in developing their own strategy will find in the professional literature many calls for better protection of the nation’s archaeological resources, but very few discussions of the methodology of monitoring (Christensen et al. 1988; McAllister 1991; Wildensen 1982; Wood and Johnson 1978).

This Public Works Technical Bulletin (PWTB) identifies a "best practices" approach for archaeological site monitoring. The web-based encyclopedia Wikipedia describes best practices as "…the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time…" (Wikipedia 2008). Because so few monitoring strategies are available for evaluation, the present effort to identify best practices should be viewed as a first step.

This PWTB is divided into four chapters (designated here as appendices). Appendix A explains how Federal laws that represent the backbone of the nation's historic preservation and CRM programs imply the need for archaeological site monitoring. A number of monitoring strategies that appear to be thoughtful and effective are summarized in Appendix B. Issues, variables, and methods that should be considered by those developing an archaeological site monitoring plan for their own situation are then discussed in Appendix C. Appendix D presents a brief summary. It is hoped that this PWTB will help Cultural Resource Managers use monitoring effectively to better protect historic properties.

## Legal Requirements for Site Monitoring

The National Historic Preservation Act (NHPA) of 1966 (as amended) plays a central role in the nation's historic preservation and CRM programs. Section 110 of the NHPA requires agencies to "establish ... a preservation program for the identification, evaluation, and nomination to the National Register of Historic Places, and *protection* of historic properties" (Section 110, 16 U.S.C. 470h-2) (emphasis added). Little guidance is provided as to how this protection can be accomplished. Nevertheless, this mandate to protect historic properties clearly demands an awareness of potential threats and changes (i.e., deterioration) in a site's condition.

Archaeological sites are at risk of being adversely impacted even before they have been identified and evaluated by a Federal agency or other organization. Many sites are discovered during the course of a field survey conducted in compliance with NHPA's Section 106 (16 U.S. Code [U.S.C.] 470f and its implementing regulations 36 Code of Federal Regulations [CFR] Part 800), which require Federal agencies to "... take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." Field surveys (supplemented by archival research) are designed to locate historic properties that may be impacted by planned or possible future undertakings. Federal land managing agencies also conduct archaeological surveys to comply with the NHPA Section 110 requirement that agencies maintain a historic preservation program to identify and protect historic properties. Large-scale surveys conducted on military installations under Section 110 sometimes identify dozens of sites that require a formal NRHP eligibility assessment. Often available funds permit the assessment of only a few sites per year, leaving many sites in the category of "potentially eligible." Both NRHP eligible and potentially eligible sites are vulnerable to a wide range of adverse impacts. Protecting historic properties (including archaeological resources) as mandated by NHPA clearly requires that sites be revisited periodically to ensure that they are not being damaged by natural processes or cultural activities.

Full compliance with several other Federal laws designed to protect archaeological resources also requires monitoring. The Archaeological Resources Protection Act (ARPA) of 1979, as amended (Public Law [P.L.] 96-95) is designed to preserve archaeological resources on public and Indian lands for the benefit of the American people. ARPA states that "No person may excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands or Indian lands unless pursuant to a permit ..." (ARPA Sec. 6 [a]). The Native American Graves Protection and Repatriation Act (NAGPRA) of 1991 (P.L. 101-601) requires anyone who intentionally excavates sites on Federal or Indian lands where human remains or items of cultural patrimony may be present to first secure an ARPA permit. A Cultural Resources Manager clearly cannot know if ARPA or NAGPRA violations are occurring unless he/or she monitors site conditions. A more comprehensive discussion of the legal basis for archaeological site monitoring written from a U.S. Army Corps of Engineers perspective can be found in the Omaha District's "Cultural Site Monitoring and Enforcement Plan" (Omaha District 2005).

## Sources of Adverse Impacts to Archaeological Sites

Adverse impacts to archaeological resources can result from a wide variety of sources (Jones 2007; Wildsen 1982; Wood and Johnson 1978). Not all of these impact sources will be relevant to any particular site. Individuals who develop monitoring strategies should, however, be certain that their field protocols are designed to capture evidence for all potentially relevant threats.

**Natural impacts**

Over time, the condition of many sites is altered by natural processes. Of greater concern, however, are the relatively short-term, intense effects of natural processes that are exacerbated by human actions and/or climate change (Christensen et al. 1988; Jones 2007; Wildsen 1982; Wood and Johnson 1978). For example, excessive rainfall can lead to the development of erosional gullies. Adverse effects associated with gullies (the horizontal and vertical displacement of artifacts, soils, and sediments) can become far more intense when new construction (e.g., large paved parking lots), fire, or vegetation clearing cause changes in local drainage patterns (Kelly and Mayberry 1980; Switzer 1974). Bank erosion can lead to severe damage to sites located near lakes or streams that see increases in commercial or recreational boating or changes in pool levels (Alaska District 2006; Lynott 1989; Speakman and Johnson 2006; Turnbaugh 1978). Bank erosion can also make sites more vulnerable to looting if artifacts or features are exposed. Wind erosion is also a serious threat to archaeological deposits, and its adverse effects can be greatly increased by loss of vegetative cover caused by climate change or land use patterns (e.g., over-grazing). When strong winds cause trees to tip over, archaeological deposits near the trees’ root systems can be displaced. Wind patterns can shift as a result of major changes in climate (e.g., an increased frequency of storms), but tree tips also become more common as a forest ages. Burrowing animals (ground hogs, armadillos, etc.) can damage stratigraphy and displace artifacts (Bocek 1986; Erlandson 1984). They can become more destructive in some areas as human changes in land use (e.g., urbanization) force their populations to relocate. Site impacts caused by the hooves of herd animals can endanger previously undamaged sites when grazing patterns shift (Osborn et al. 1987).

**Cultural impacts**

A far greater number of sites are seriously damaged or destroyed by human actions than by natural processes (Wildsen 1982; Wood and Johnson 1978). Among the most destructive are land modifications (e.g., grading) associated with urban/suburban development (including the construction of both roads and buildings) and agriculture (Williams and Corfield 2002).

Mechanized agriculture has homogenized the upper-most portions of many sites, whereas deep plowing and land leveling for agricultural purposes has resulted in the total destruction of many others (Medford 1972). Modifications to stream channels and the construction of lakes have impacted a disproportionately large number of sites because human occupation has long favored areas near water sources and travel routes. Military training and the construction and maintenance of associated infrastructure are major sources of site destruction (Carlson and Briuer 1986; Richardson and Hargrave 1998). Heavy military vehicle traffic can lead to a loss of vegetation, greater erosion, compaction or mixing of soil strata, fragmentation and displacement of artifacts, and destruction of architectural remains and other features. Recreational vehicle traffic is the source of similar impacts, albeit on a smaller scale. Commercial and recreational boating can increase bank erosion due to wave action.

Looting (unauthorized excavation) and vandalism are major problems, in part because they are strongly focused on particular site types, including cemeteries, caves and rock shelters, rock art, and rich habitation sites (Hargrave et al. 1998; McAllister 1991; McManamon 1991; Nickens et al. 1981; Nickens 1991). Effects of looting range from the removal of diagnostic artifacts from the surface to large scale excavations, desecration of graves, removal of rock art, and the introduction of painted or etched graffiti. Motivations for looting are highly variable. Small-scale looting by hikers, hunters, and others may be entirely unpremeditated. Artifact collectors who damage sites are often seeking to build their own collections, whereas “professional” looters range from impoverished indigenous people with few alternatives to relatively educated, non-local individuals motivated by greed. A well-established international market for antiquities ranging from projectile points and ceramic vessels to the rarest religious and culturally significant objects provides a strong incentive for commercial looters.

# Appendix B

## Examples of Site Monitoring Programs

Although monitoring is an essential component of efforts to protect archaeological sites on public lands, detailed discussions of archaeological monitoring strategies are difficult to find in professional journals and books. A number of documents purporting to be monitoring strategies or plans can be found on the Internet, but most of them pertain to the activities of an archaeologist who will be present at a particular site while construction or other earth-moving activities are under way. Such site-specific or impact-specific (e.g., grading for a new parking lot) monitoring is very important, but the focus here is on strategies to detect change in the condition of a relatively large number of sites over a long period of time. This appendix provides brief summaries of several existing monitoring strategies that appear to be thoughtful and effective. These strategies provide an empirical basis for the development of best practices in archaeological site monitoring presented in Appendix C.

### Historic Site Monitoring in New Zealand

A monitoring strategy developed for the management of historic sites or "places" in New Zealand (Walton 2003) provides an international perspective. Walton defines monitoring as "the act of measuring change in the state, number, or presence of characteristics of something (Department of Conservation 1998:4). It involves the repeated collection of a specific set or sets of information over time and analyzing the results to detect the changes that are occurring" (Walton 2003:6). He argues that all managed sites require some degree of monitoring to detect the nature and rate of deterioration. The most important aspects of a monitoring strategy are "ease of recording, repeatability, cost-effectiveness and…the avoidance of subjective assessment" (Walton 2003:7).

An initial, baseline visit that involves the collection of detailed information is important to provide guidance on the type and amount of information to be collected during subsequent monitoring visits (Walton 2003:8). Monitoring visits typically conform to a schedule and, if site condition is stable, may involve little more than an updating of records. The New Zealand monitoring form (Appendix F, Figure F-1) requires information about a variety of issues including land use, vegetation, soils, slopes, erosion, “visitor pressure,” and agricultural and livestock issues. Walton advocates the use of a standard terminology; in this case, operational definitions for common terms describing quality of preservation (good, fair, poor, etc.) developed by the English Heritage Data Standards Unit. (The English Heritage is a public body in the United Kingdom responsible for historic environment.) The New Zealand monitoring forms “require an assessment of what is causing damage and the extent and seriousness of the problem” (Walton 2003:10-11).

Photography plays a central role in the New Zealand monitoring strategy. Aerial photographs can be extremely useful, particularly for large sites and those covered in grass. Standard (ground-based) photographs taken during monitoring visits provide a basis for detecting changes in site condition. Walton provides a detailed discussion of “photo-points”—carefully chosen locations from which photographs should be taken during successive monitoring visits (Elwood 1998). A series of photographs taken of the same subject from the same position provides an effective way to detect change. Photo-points should be numbered and unobtrusively marked. Details such as focal length and aperture, camera height, etc. should be recorded. “The monitoring programme should generate a substantial body of archive material including checklists, condition reports, and photographs” (Walton 2003:16). Walton recognizes the importance of storing monitoring information in a manner that allows it to be used effectively, but few details are provided as to how this can best be done.

## River Corridor Monitoring Program

The Colorado River Corridor Monitoring Program (RCMP) is responsible for monitoring the condition of NRHP-eligible sites along the Colorado River that are vulnerable to impacts by the operation of the Glen Canyon Dam. Monitoring is defined as “repeat visitation to determine if the historic properties retain the elements that make them eligible for listing on the NRHP. This is determined by comparing site condition through time and identifying the processes that affect site condition, which may lead to management recommendations for treatment” (Dierker and Leap 2005:7).

Verifying site locations is an important task in the RCMP’s initial monitoring visits. Prior to the ready availability of hand-held global positioning system (GPS) units, site locations were plotted onto aerial photographs and Universal Transverse

Mercator (UTM) coordinates were later calculated in the laboratory. Use of GPS has demonstrated that site locations were sometimes substantially in error. Locational errors of this kind are likely to occur throughout the United States.

Monitoring visits made to 37 sites in 2003 documented a range of impacts including surface erosion, gullying, bank slumping, arroyo cutting, eolian (wind) activity, and site visitation (e.g., by hikers) (Dierker and Leap 2005:3). When impacts are observed, monitoring individuals make recommendations about the treatment needed. RCMP staff then consult with specialists (e.g., in vegetation, trail maintenance) in assessing the type of remedial action needed to prevent additional impacts (Dierker and Leap 2005:5).

The RCMP has developed very detailed Standard Operating Procedures (SOPs) (Dierker and Leap 2005:106). The SOPs specify the supplies and forms to be taken into the field, provide guidance on completing field forms, instructions in the use of project cameras and light meters, operational definitions of impact types, and treatment options that can be recommended (e.g., trail work, plant vegetation, install check-dams) (Dierker and Leap 2005:113).

The examination in the field of photographs from previous RCMP monitoring visits is a basis for detecting recent changes. The goal is to identify the presence or absence of impacts and to determine if they have been “active” (worsened) since the last visit. Large impact areas such as those caused by erosion are delimited by taking at least four GPS readings in the affected area. Photographs are taken from the same location and view during each monitoring visit, and a detailed photo log is maintained, including the requirement for a narrative description of each photograph’s subject, view (compass bearing), etc.

Data are collected in the field on a standardized form (Dierker and Leap 2005; see Appendix F, Figure F-2). A prominent component of the RCMP monitoring form is a table with types of impact occupying the rows and resource types (roasters, hearths, rock images, artifacts, etc.) in the columns. Values entered into the cells are 0 (absent), 1 (active), 2 (inactive), and 3 (not applicable). Space is provided for written comments, and recommendations include the frequency of monitoring (discontinue, semiannual, annual, biennial, every 3-5 years). Preservation actions (e.g., trail work, vegetation planting, installation of check-dams) are indicated with a 0 (no) or 1 (yes). The same approach is used to code recovery options (e.g., research, data recovery).

Monitoring data recorded on standardized forms in the field are entered into specialized software developed in Microsoft (MS) Access. Step-by-step instructions are provided as to how data should be entered. Dierker and Leap (2005:119-125) provide figures that show a number of the database's user-interface screens, although the software's capabilities are not discussed.

**Omaha District's Cultural Site Monitoring and Enforcement Plan**

A monitoring program developed by the U.S. Army Corps of Engineers Omaha District is particularly relevant to the present discussion. The Omaha District plan (the authors are not identified) is designed for sites located within the Missouri River Main Stem System. Common impacts to sites in that region include (Omaha District 2005:5):

1. Erosion (wave action, sheet erosion, and shear erosion);

2. "[U]ncontrolled impacts" (natural, uncontrolled factors such as prairie dog burrows, natural disasters); and

3. Human impacts, including construction, artifact collecting, vandalism, plowing, terracing, grazing, and controlled burning.

Initial (baseline) monitoring visits, conducted by individuals who meet the professional qualifications described in 36 CFR Part 61 (Appendix A, Professional Qualifications Standards) focus on updating the site form (including the acquisition of GPS data) and photography. The goal is to determine "the relative level of disturbance and current conditions" (Omaha District 2005:7). Baseline monitoring procedures include a general evaluation: walk the site, locate the boundaries, search for human and natural impacts, and take photographs from each corner of the site and elsewhere as needed. Erosion, agricultural, grazing, and construction impacts will be documented using GPS and photography: "Photographs will be taken from the same position on the site, oriented the same direction every year to ensure comparability of results" (Omaha District 2005:7). Evidence of artifact collecting and looting will be recorded on the site form and documented with photographs. That information will be passed on to law enforcement personnel.

Routine monitoring can be conducted by individuals who do not meet the requirements stipulated in 36 CFR Part 61. Monitoring visits will focus on the collection of GPS and photographic data that can be compared with data from previous visits in order to detect the existence and magnitude of changes in site condition. Photographs must be well documented as to the camera's location and view. A prominent component of the Omaha District's field form (Appendix F Figure F-3) is a table (clearly inspired by the RCMP field form) that cross-tabulates impacts with resource types.

All monitoring data (including photographs, GPS data, and site forms) are entered into the Omaha District Archaeological Database. No detailed information about that database is provided, however, in the monitoring plan.

**Automated Tool for Monitoring Archaeological Sites (ATMAS 1.0 and 2.0)**

Researchers at the U.S. Army Engineer Research and Development Center (ERDC), Construction Engineering Research Laboratory (CERL) developed ATMAS 1.0 in 2002 for use at Fort Riley, KS (Hargrave and Meyer 2002). ATMAS 1.0 was significantly revised in 2003 (ATMAS 2.0) for use at Fort Irwin, CA (Meyer and Hargrave 2003). Both versions of ATMAS were developed on the MS Access 97 database platform with a user-friendly graphical user interface. Modifications to Access 2000 have unfortunately rendered ATMAS 1.0 and 2.0 incompatible with current MS operating systems.

ATMAS 1.0 was developed as a data management tool rather than a monitoring data collection protocol. It allows installation cultural resources (CR) managers to:

1. Systematically assign sites to high, medium, and low priority categories;

2. Schedule sites for monitoring during a particular year (or other period); and

3. Manage information resulting from periodic monitoring visits.

These capabilities are important for large military installations (such as Fort Riley and Fort Irwin) that have many sites, limited staff, and intense military training programs. When ATMAS 1.0 was developed, for example, Fort Riley had more than 1,000 documented sites, many of them not recognizable based on surface characteristics (much of the installation is covered in prairie grasses). Many of the known sites (as well as sites in nonsurveyed tracts) were vulnerable to adverse impacts from military training that included the use of tanks and other heavy vehicles. It was not feasible for Fort Riley's CR staff to monitor all of the sites on a regular basis (Hargrave and Meyer 2002).

While eligibility for the NRHP is technically a threshold (a site cannot be "a little eligible"), it was recognized that, based on their condition, intrinsic characteristics, and ability to provide data relevant to important research questions, some sites can be viewed as "more important" than others. ATMAS 1.0 uses a sequence of "if-then" statements to assign the sites to high, medium, and low priority groups for each of three key management criteria. These criteria are:

1. The likelihood that a site will be eligible for the NRHP under Criterion D;

2. The likelihood that a site will be of particular relevance to Native American groups (usually based on the possible presence of human remains); and

3. The risk of future adverse impacts to a site.

A simple formula is then used to combine the three rankings into a single weighted ranking that also consists of high, medium, and low priority groups. Here priority refers to the overall need for periodic monitoring to prevent adverse impacts to sites (Hargrave and Meyer 2002).

ATMAS 1.0 allows the user to decide how many monitoring visits will be conducted during each year (or other time interval). The user then decides how to distribute the visits among the high, medium, and low priority groups. ATMAS 1.0 uses this information to randomly select sites for monitoring from each group. A list of the selected sites can be printed for use as an assignment or check sheet for the personnel tasked with conducting the monitoring visits (Hargrave and Meyer 2002).

Monitoring visits are intended to be brief, thereby increasing the number of sites that can be visited each year. Immediately following each visit, the user should input information into ATMAS 1.0 about the number or presence/absence of a set of possible adverse impacts. These impacts include the number of potholes, fighting positions, vehicle defilades, and the presence/absence of bivouac areas, vehicle tracks, agriculture, erosion, roads or vehicle trails, bioturbations, and other impacts. ATMAS 1.0 displays the monitoring records for each site in chronological order. The user can inspect these records and easily detect increases in the occurrence of adverse impacts. If appropriate, the user can modify the value for Risk, and this may move the site into a higher priority group (Hargrave and Meyer 2002).

Because Fort Riley had so many known sites, it was not feasible to do a baseline monitoring visit to each. Instead, ATMAS 1.0 used three variables from the Kansas State Historical Society site forms: cultural component, site type, and disturbance. Since the site forms had been compiled over many years by many different individuals, there was a great deal of variation in the quantity and quality of information (Hargrave and Meyer 2002).

Several practices were recommended to optimize the usefulness of ATMAS 1.0:

1. Users must be consistent in how they apply the categories that are included in the if-then statements. Newly discovered sites should be categorized using the same definitions for Site Types and Cultural Components as used when ATMAS 1.0 was developed.

2. Users should develop, record, and consistently apply operational definitions for the impacts that are recorded on the site monitoring records. For example, installation personnel need to decide what constitutes evidence that a site has been used as a bivouac area, what constitutes enough erosion to record it as being present, and so forth. Almost all sites will exhibit some erosion, but if erosion is simply recorded as being present at all sites, that variable will be of no value in the monitoring program. Only those who are very familiar with the condition of prehistoric sites at Fort Riley can develop viable operational definitions for the impact variables. An explicit recording of operational definitions is essential to ensure that changes in site condition can be detected through a series of monitoring visits conducted by different people.

3. New information should be entered into ATMAS 1.0 as it becomes available. Ideally, the same individual who visits the sites should fill out the new site monitoring records.

4. The user should not reprioritize the sites (recalculate site status) on a frequent basis. Reprioritizing the sites will result in a different sample of sites being selected for monitoring, even if no new data have been added (ATMAS 1.0 selects the sites randomly). It is recommended that ATMAS 1.0 be used to reprioritize the sites once per year (Hargrave and Meyer 2002).

**ATMAS 2.0**

Similar to Fort Riley, Fort Irwin had more than 1,000 documented sites along with an intense program of mechanized (including tanks and other heavy vehicles) training. ATMAS 2.0, developed for use at Fort Irwin (Meyer and Hargrave 2003), prioritizes the Fort Irwin sites based on three management factors:

- their information potential,
- observed risk, and
- predicted risk of future adverse impacts.

The system for determining the information potential of each site was developed by Fort Irwin cultural resource managers and already in use when ATMAS 2.0 was designed (Table B-1) (Fort Irwin DPW 2001). The Fort Irwin system assigns 0 to 3 points to a site for each of six variables:

- NRHP eligibility,
- site type,
- site age,
- integrity,
- subsurface deposits, and
- area.

Points are assigned using data available in the Fort Irwin archaeological site database. Information potential can hypothetically range from 0 (for a site known to exist, but for which essentially no data are available) to 18 (for a site that gets 3 points for each of the 6 characteristics).

Two types of risk considered by ATMAS 2.0 are observed risk and predicted risk. Observed risk is based on the assumption that evidence for past adverse impacts is a good predictor for the risk of similar impacts in the future. Observed risk is calculated using information derived from monitoring visits (Table B-2). For example, if a particular site has sustained damage from numerous fighting positions and tank tracks, it can be assumed that similar damage may occur in the future (Meyer and Hargrave 2003).

Table B-1: Criteria used to score sites by information potential (Fort Irwin DPW 2001: 92).

| POINT VALUE | | | | |
|---|---|---|---|---|
| CHARACTERISTIC | 0 | 1 | 2 | 3 |
| NRHP Eligibility | Not Eligible | Potentially Eligible | Eligible | Listed on NRHP |
| Site Type | No Data | C, CNP, LRS, LS, SC, TP, CNH, R, WSS | CS, FH, FPS, HUNTS, LQ, PS, MILS, MS, RS | HS, RAS, RSS, VS, HCS, HSS, RDS, RES |
| Site Age | No Data | Prehistoric, but period unknown | -- | Any Site Assigned to a Particular Period |
| Integrity | No Data | >80% Disturbed | 30-80% Disturbed | <30% Disturbed |
| Subsurface Deposits | No Data | Surface Only | -- | Subsurface Deposits |
| Area | No Data | <120 $m^2$ | 120 $m^2$-44,500 $m^2$ | >44,500 $m^2$ |

Notes: C=Clearing, CNP=Cairn (prehistoric), LRS=Lithic Reduction Site, LS=Lithic Scatter, SC=stone circle, TP=trail, CNH=Cairn (historic), R=road, WSS=Water storage site, CS=Camp Site, FH=Fire Hearth, FPS=Food Processing Site, HUNTS=Hunting site, LQ=Lithic Quarry, PS=Pottery scatter, MILS=Military site, MS=Mining site, RS=Ranch Site, HS=Habitation site, RAS=Rock art site, RSS=Rock shelter, VS=Village site, HCS=Historic campsite, HSS=Homesteading site, RDS=Refuse disposal site, RES=Residential site.

Predicted risk is based on information about planned changes in training, infrastructure development, or other activities that may impact site condition. For example, the Fort Irwin cultural resource managers may be informed that, over the next few years, a particular management area will be used more intensively for training, and that several new tank trails will be constructed there. It is logical to predict that the sites in that training area are at a heightened risk of adverse impacts and should therefore be monitored more frequently. Predicted risk is set by the ATMAS programmers (using information from the Installation Cultural Resources Management Plan, August 2001), but can be changed upon request from Fort Irwin. ATMAS also provides a "predicted risk override" capability by which the Fort Irwin user can ensure that selected sites will be allocated the highest prioritization. This capability would be used in the case of particularly important and/or threatened sites that need to be monitored more frequently than would result from normal use of ATMAS (Meyer and Hargrave 2003).

Table B-2: List of adverse impacts to be recorded during monitoring visits (ATMAS 2.0).

| None, Low, Medium, or High | Present or Absent |
|---|---|
| Tank Tracks | Vehicle Parking |
| Wheel Ruts | Bivouacking |
| Fighting Positions | Littering |
| Latrines | Oil Clean-up |
| Tank Traps | Building Construction |
| Other Mechanized Excavations | Road Construction |
| Artillery Impacts | Utility Construction |
| Small Arms Impacts | Fill Borrow Construction |
| Potential for Vandalism | Check-dam Construction |
| Looter Holes | Re-vegetation |
| Target Construction | Other Ground Disturbance-Facilities |
| Trail Construction | Other Ground Disturbance-Erosion |
| Horseback Riding or Hiking | |
| Rock Painting | |

A very useful feature of ATMAS 2.0 is the ability to display in chronological order the data recorded during previous monitoring visits to a site. This feature allows the user to see evidence for a change in site condition (e.g., an increase in the level of impact from tank tracks).

Like ATMAS 1.0, ATMAS 2.0 allows the user to decide how many monitoring visits will be conducted during each year (or other time interval) and how to distribute the visits among the high, medium, and low priority groups.

ERDC/CERL provided Fort Irwin with a preliminary list of operational definitions for impacts that would be documented using ATMAS 2.0 (e.g., tank tracks, wheel ruts, fighting position). It is important, however, for CRM programs that use tools like ATMAS 2.0 to define their own criteria for recording impacts, in order to ensure consistent observations between different personnel and through time (Meyer and Hargrave 2003).

**Summary and Comparison of Existing Strategies**

The five existing monitoring strategies reviewed in this chapter are, in some ways, highly diverse. ATMAS 1.0 and 2.0, for example, are primarily data management tools, whereas the available reports for the New Zealand and Omaha District (and, to a lesser extent, the RCMP) focus primarily on field methodology. In some ways, the Omaha District and RCMP are very similar, and ATMAS 2.0 is clearly an outgrowth of ATMAS 1.0 (although the criteria used to prioritize sites are quite different).

Table B-3 summarizes the characteristics and capabilities of the extant monitoring strategies discussed above. This summary is based on examination of readily available documents and reports and may contain some omissions. For example, a list of operational definitions for impacts, condition categories, and other relevant issues may, in fact, be available at the Omaha District. Similarly, the ATMAS 1.0 and 2.0 user’s manuals do not specify that photographs taken during successive visits should be taken from the same location, although such a statement could easily be added. Table B-3 is not intended to provide a basis for identifying the best monitoring strategy. The table is instead intended to identify key characteristics and capabilities that should be included in a “best practices” strategy.

Table B-3: Characteristics of monitoring strategies discussed in the text.

| | New Zealand | Colorado RCMP | Omaha District | ATMAS 1.0 Fort Riley | ATMAS 2.0 Fort Irwin |
|---|---|---|---|---|---|
| Baseline data from monitoring visits | yes | yes | yes | no | no |
| Baseline data from site forms | no | no | no | yes | yes |
| Photographs used to detect change | yes | yes | yes | no | yes |
| Photographs taken from fixed positions | yes | yes | yes | no | no |
| GPS used to delimit impacts | no | yes | yes | no | no |
| Monitoring includes recommendations for specialized assessments | yes | yes | no | no | no |
| Detailed SOP for field observations | yes[3] | yes | yes[1] | no | no |
| Detailed SOP for data management | no | yes | no | yes | yes |
| Specialized software for data management | no | yes | no[2] | yes | yes |
| Operational definitions provided | yes (for condition) | yes | yes | no | yes |
| Software can prioritize sites | no | no | no | yes | yes |

1 Much less detailed than Colorado RCMP SOP.

2 Monitoring data are entered into the District's cultural resources data base.

3 Only for photographs.

# Appendix C

## Best Practices in Archaeological Site Monitoring

A review of a number of existing strategies for monitoring archaeological sites (Appendix B) provides the basis for identifying best practices. It is important to keep in mind that there is a great deal of variability in the nature of archaeological resources, their vulnerability to adverse impacts, and the resources available for monitoring. Highly effective monitoring strategies could be developed that do not include all of the best practices discussed below. When developing a monitoring plan, however, each of the best practice features should be evaluated in terms of its costs and benefits, and the implications of its exclusion from the strategy.

### Identify Goals

Collecting and managing information about the condition of a large number of sites is time consuming and expensive. Given the limited resources available to most CRM programs, every hour allocated to one effort detracts from another important effort (e.g., site survey, NRHP evaluation, curation, report preparation, public outreach). It is not a good use of limited resources to collect and manage detailed information that does not contribute directly to one's goals. Existing strategies reviewed in this document had several goals. All shared the fundamental objective of detecting change in the condition of archaeological resources. More specifically, monitoring should focus on changes in the condition of those characteristics that make a site eligible for the NRHP. Typically those characteristics relate to two properties: (1) integrity and (2) meeting the requirements of one or more of the four NRHP eligibility criteria (National Park Service 2002). For example, an archaeological site that is eligible for the NRHP based on its prehistoric deposits may also include the remains of an abandoned but recent historic structure that does not contribute to the site's eligibility. It would be useful to record during monitoring visits evidence that the building has recently been vandalized, since that would alert cultural resource managers to a possible threat to the prehistoric deposits. It would not be cost effective, however, to record highly detailed observations about the building's condition.

## Identify Possible Impacts

The nature of factors that can result in adverse impacts to archaeological resources can vary greatly. It is unlikely that consistent, useful data will be collected concerning a particular impact that is not mentioned on the monitoring form. Yet there is no need to require information about tree-falls for areas that have few trees, or military training impacts on civilian lands located far from military use areas. The types of potential impacts to be included on monitoring forms should be selected by individuals who have visited many sites in the region, and who have done enough site excavation to have an understanding of how particular processes or actions can damage archaeological deposits. Table C-1 provides an incomplete list of possible impacts that can be used as a point of departure.

Table C-1: Partial list of natural and human impacts to archaeological resources.

| |
|---|
| **Military Impacts**<br>- Tracked vehicle ruts<br>- Wheeled vehicle ruts<br>- Vegetation damage, erosion<br>- Munitions impact craters<br>- Mechanized excavation (e.g., defilades)<br>- Hand excavation of fighting positions (i.e., “foxholes”)<br>- Bivouac impacts (trash discard, vegetation clearing)<br>- Artifact collecting<br>- Fuel, oil, or other spills<br>- Grading to remove remains of civilian architecture |
| **Agricultural and Grazing Impacts**<br>- Shallow plowing and disking<br>- Deep (chisel) plowing<br>- Land leveling, terracing<br>- Wheeled vehicle traffic<br>- Removal of trees<br>- Excavation of drainage ditches<br>- Installation of drainage tiles<br>- Discard or loss of equipment parts<br>- Artifact collecting<br>- Construction of fences<br>- Soil churning from animal hooves<br>- Vegetation loss and erosion from over-grazing |
| **Infrastructure Construction and Maintenance**<br>- Earth moving (grading, trenching)<br>- Removal of trees and vegetation<br>- Excavation of drainage ditches<br>- Paving and other changes to local drainage<br>- Excavation of cellars, utility lines |

| |
|---|
| - Road construction |
| **Lakes and Streams**<br>- Bank erosion from wave action, changes in pool level<br>- Construction of check dams, etc.<br>- Construction of boat access ramps, piers, etc. |
| **Recreation**<br>- Construction of access roads, trails, fire breaks, parking areas, etc.<br>- Increased visitation (artifact collecting, erosion, vandalism)<br>- Wheeled vehicle traffic |
| **Animal Impacts (other than livestock)**<br>- Rodent burrows, tunnels, dens<br>- Wallows |
| **Insect Impacts**<br>- Earthworms, etc. |
| **Wind Erosion**<br>- "Normal" eolian processes<br>- Storm surges |
| **Earthquakes, Landslides, Hurricanes, Forest Fires** |

## Develop Field Monitoring Forms

Field forms should require adequate information about site location (including accurate GPS data), site surface and vegetation conditions, and access. For those who design the field monitoring form, the goal is to prompt field personnel to make and record the observations needed to detect and measure changes in relevant aspects of site condition. At the same time, the form should not require field personnel to allocate time and enthusiasm to needless detail. Forms should be well-organized; for example, locational information should not be interspersed with aspects of site condition. All terms should be unambiguous (see the discussion of SOP below). The form should be organized to maximize the specificity of observations. For example, note how the RCMP and Omaha District forms (Appendix F Figures F-2 and F-3) allow impacts to be related to feature or other resource types (Dierker and Leap 2005; Omaha District 2005). Forms should use a "multiple choice" format when possible to minimize the amount of narrative writing. Short "essay" answers should be required, however, when it is important to elicit observations that are difficult to quantify or categorize. The form should be designed and updated as needed to ensure that no ambiguity or errors are introduced when data from the form are entered into an electronic database or other software tool. For example, a common difficulty encountered when querying a data base is the use of multiple variants for a single term, requiring a potentially significant amount of data cleanup before data can be used. Newly developed monitoring field forms should be tested during visits to a wide variety of sites.

The decision whether to use paper or digital field forms is a significant issue. Paper forms are immune from technology glitches but can, of course, be damaged or destroyed by moisture. Use of digital forms with a laptop computer or handheld “personal digital assistant” (PDA) offers advantages such as avoidance of transcription costs and errors. Disadvantages may include the device’s initial cost, reliability, and eventual obsolescence. Revising digital forms and data management programs to ensure continued viability may be a minor task in some cases or a significant expenditure in others.

## Develop SOPs

Detecting change, particularly when it concerns the subtle, initial stages of site deterioration, demands consistent observations through time and among different individuals. The only way to achieve such consistency is to develop detailed, written guidance in the form of an SOP. The RCMP SOP is an excellent example, providing detailed information on how to inspect sites, take photographs, etc. (Dierker and Leap 2005). Definitions of all key terms are absolutely essential, particularly when they involve commonly used but potentially ambiguous terms (good, many, etc.). Also essential are clear descriptions of the characteristics of various impact types. For example, many sites exhibit at least some evidence for erosion. If a monitoring form requires “erosion” to be marked as present or absent, it is critical to define how much erosion must be observed to be categorized as present. Ideally, the SOP should specify necessary and sufficient conditions to help monitoring personnel make consistent, useful observations.

## Baseline Monitoring

Baseline monitoring (an initial site visit that involves collection of relatively detailed information) is particularly important in situations where existing data about site condition are scant or unreliable. Where large numbers of sites require monitoring (some military installations manage thousands of known sites), prioritization is often useful, and this requires reliable data. High priority sites (those with relatively great research or cultural value, and those that are relatively vulnerable to adverse impacts) may need to be monitored more frequently than others. The baseline monitoring visit must ensure accurate information on site location, vegetation and surface conditions, and existing impacts. The Omaha District monitoring strategy specifies that a higher level of professional experience is required for those who conduct baseline monitoring than those involved in subsequent monitoring (Omaha District 2005). Baseline monitoring may well require a separate field form, often an expanded version of the form developed for subsequent monitoring visits. Here too a detailed SOP is essential. The baseline data about site characteristics and condition are the point of departure for future efforts to detect change, so it is essential that all observations are consistent.

## Routine Monitoring

Several of the important issues relevant to routine monitoring have already been addressed: the need for a well-designed field form, a comprehensive suite of possible adverse impacts, an explicit SOP, and the need for accurate baseline data. The importance of consistent observations cannot be stressed too much. One way to ensure consistency (in addition to an SOP) would be for new monitoring personnel to be trained by experienced monitors (that is, jointly visiting a number of sites). A second practice that would increase consistency would be for site monitoring to occur on a regular basis throughout the year, not as intensive efforts a few times per year. Frequent monitoring would minimize “drift” (variation through time) in how monitoring personnel use relevant terms.

## GPS Data

Collecting accurate GPS data should be a component of all baseline and standard monitoring. The SOP should include step-by-step instructions for the particular GPS instrument that will be used by monitoring personnel. It should include a basic discussion of the factors that contribute to the accuracy of GPS data: instrument grade, number of satellites used, signal-to-noise ratio, and position dilution of precision. Such guidance is readily available on the Internet. Also important is the guidance on how GPS should be used (e.g., how many readings around the perimeter) to delimit the extent of site boundaries, impacted areas, etc. For example, the Omaha District SOP requires field personnel to collect GPS data for at least four points along an erosion line (Omaha District 2005). Such requirements should be specified after consultation with the program's GPS/GIS coordinator. It would, for example, probably be a waste of time to collect readings on each side of a small feature whose dimensions are less than the "plus or minus" distance of a particular GPS instrument application.

## Photography

The RCMP, Omaha District, and New Zealand monitoring plans all focus on photography as a basis for detecting change in site condition (Dierker and Leap 2005; Omaha District 2005; Walton 2003). Given the importance of photography, it would be wise for the SOP to include detailed instructions in using the particular cameras, light meters, and "mug board" (a chalk board or menu board that provides information about the subject of a photograph). The use of predetermined, well-marked photo-points is recommended as a means of ensuring consistency and comparability among photographs taken on successive monitoring visits. Digital photography is strongly recommended because photographs are easy to view in the field, store, and optimize using commercial software. The SOP should specify that, in addition to a mug board, photographs include a north arrow and scale. Where the subject of a photograph is an area (such as an area that has eroded), standard markers might be used to mark the edges of the area and the locations of GPS readings. Photographs should be renamed (given a new file name) that provides more useful information than the consecutive number assigned by most cameras.

## Recommendations for Treatment

Several of the existing monitoring programs require or allow monitoring personnel to make recommendations for treatment. This practice provides an opportunity to benefit from the first-hand input of individuals who have recently inspected the site. On the other hand, monitoring personnel may or may not have sufficient expertise in treatment options to make proper recommendations. The Omaha District monitoring strategy notes that those who do baseline monitoring need to meet Department of Interior Standards, but those who do subsequent monitoring can have less experience (Omaha District 2005). On balance, decisions about whether monitoring personnel should make formal recommendations for treatment probably depend upon the individuals in question, and should be made by the program manager.

**Data Management**

The final area of concern — managing the monitoring data — may be the most problematic. The New Zealand, RCMP, and Omaha District monitoring strategies differed greatly in terms of the level of detail with which data management issues were discussed. In contrast, ERDC/CERL's ATMAS 1.0 and 2.0 are primarily data management tools. The impacts to be documented during monitoring visits were selected in close consultation with Fort Riley (ATMAS 1.0) and Fort Irwin (ATMAS 2.0). Draft operational definitions were provided, but it was viewed as the responsibility of the users to develop or fine-tune all aspects of the SOP for fieldwork. Unfortunately, ATMAS 1.0 and 2.0 were both delivered to their respective installations at a time of personnel changes, and neither was ever integrated into site management. ATMAS 1.0 and 2.0 — both developed on an Access 97 platform — are not compatible with Access 2000 (Hargrave and Meyer 2002; Meyer and Hargrave 2003).

Nevertheless, ATMAS' capability to prioritize sites is a valuable feature. It makes sense that the sites that are highly ranked, either because of their high research or cultural value, or because they are most at risk, should be monitored more intensively than the other sites. ATMAS 1.0 and 2.0 both allow the user to decide what percentage of the monitoring visits should be allocated to high, medium, and low priority sites (Hargrave and Meyer 2002; Meyer and Hargrave 2003).

ATMAS 1.0 and 2.0's capability to select a random sample of each priority group may be viewed as an attractive feature by some CR managers, particularly if he/she manages a very large number of sites and resources for monitoring are relatively limited. If the number of sites to be monitored is relatively small, it may be preferable to simply develop a monitoring schedule. Some sites would be monitored yearly or even more frequently, whereas others might be visited every 2 or 3 years (Hargrave and Meyer 2002; Meyer and Hargrave 2003).

# Appendix D

## Summary and Conclusions

Although monitoring per se is not mentioned in the NHPA of 1966, (as amended), its implementing regulations (36 CFR 800), the NAGPRA, or the ARPA of 1979, monitoring is clearly an essential component of an effective cultural resource management program. Identifying an archaeological site and evaluating its eligibility for nomination to the NRHP does not, in and of itself, afford adequate protection to the site. Archaeological sites are vulnerable to adverse impacts from a wide range of natural processes and human actions, and vulnerability can increase as a result of changes in accessibility, land use, vegetation, climate, and many other factors. Section 110 of the NHPA's mandate to protect historic properties clearly requires current, reliable information about changes in site condition.

Given the great range of variability in natural environment, human activities, and site characteristics, it is not feasible to develop a single monitoring strategy that would be appropriate for all situations. This PWTB's review of a number of existing strategies for monitoring the condition of archaeological sites has provided an empirical basis for identifying best practices for archaeological site monitoring. Individuals who need to develop or refine a monitoring strategy should consider each topic addressed in Chapter 3, weighing the costs and benefits of each component. Great care should be taken to develop a field protocol and monitoring form that elicit essential observations about site condition but minimize the need to collect information of marginal value. A detailed, written SOP should be developed, and an emphasis should be placed on a consistent use of well-defined terms and categories. An equal emphasis should be placed on the protocol for data management.

# Appendix E

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# Appendix F

## Monitoring Field Forms

**DEPARTMENT OF CONSERVATION ARCHAEOLOGICAL MONITORING FORM**

*Use baseline form and previous visit form for reference *Use archaeological form guide for assistance

| | |
|---|---|
| Name of site or area: | NZAA site number:<br>Site type: |
| Location of site or area: | Metric Grid Reference: Easting I I I I I I<br>Northing I I I I I I |

| | |
|---|---|
| Local Authority: | Date: |
| Name of Fieldworker(s): | Organisation(s): |

| | | |
|---|---|---|
| **Size of Site ($m^2$):** | **Area:** | **Height:** |

| **Indicator** | **Rating** | **Estimate** (Tick appropriate box) | **Notes** (location of damage, particular species, etc.) |
|---|---|---|---|
| Current land use | | ❑ Grazing<br>❑ Production forestry<br>❑ Reserve or other protected public land<br>❑ Cultivation<br>❑ Under development<br>❑ Residential / Commercial / Industrial (specify)<br>❑ Other (specify) | |
| Current land use adjacent to place or area | | ❑ Same<br>❑ Different | Specify any differences |
| Type of vegetation cover surrounding place or area | | ❑ Pasture<br>❑ Predominantly exotic weed or scrubland<br>❑ Exotic or Indigenous forest<br>❑ No vegetation<br>❑ Other (specify) | |
| Overall assessment of condition | 1<br>2<br>3<br>4 | ❑ None or very few signs of disruption to site/area<br>❑ Small areas of disruption to site/area<br>❑ Large areas of disruption to site/area<br>❑ Site/area almost completely or completely disrupted | Specify areas and types of disruption |
| Extent of loss | 1<br>2<br>3<br>4<br>5 | ❑ Site/area been added to<br>❑ Site/area the same size as previous visit<br>❑ 20% or less of site/area lost since previous visit<br>❑ 20% or more of site/area lost since previous visit<br>❑ Site/area completely destroyed or not located | Specify percentage and features lost / gained |
| Speed of deterioration | 1<br>2<br>3<br>4 | ❑ No deterioration visible since previous visit<br>❑ Slow, ongoing deterioration visible<br>❑ Rapid, ongoing deterioration visible<br>❑ Severe periodic / one-off deterioration visible | |
| Integrity of site/area | 1<br>2<br>3<br>4 | ❑ Not modified or slightly modified (<20% of place or area)<br>❑ Partially modified (20–50% of place or area)<br>❑ Heavily modified (50–80% of place or area)<br>❑ Almost completely destroyed or removed (>80% of place or area) | |

*Continued next page >>*

| Indicator | Rating | Estimate (Tick appropriate box) | Notes (location of damage, particular species, etc.) |
|---|---|---|---|
| Extent of vegetation cover over place or area (excluding pasture) | 1<br>2<br>3<br>4 | ☐ Vegetation absent or very uncommon (<10% of place or area)<br>☐ Vegetation over 10–20% of place or area<br>☐ Vegetation over 20–50% of place or area<br>☐ Abundant vegetation over 50% or more of place or area | Specify whether indigenous or exotic species |
| Effects of erosion or subsidence | 1<br>2<br>3<br>4 | ☐ No signs of erosion or subsidence<br>☐ Occasional signs of erosion or subsidence (<10% of area)<br>☐ Common signs of erosion or subsidence (20–50% of area)<br>☐ Abundant or extensive sign (stock on site) of stock/animal damage to site/area | |
| Effects of stock/animals | 1<br>2<br>3<br>4 | ☐ No sign of stock/animal damage to site/area<br>☐ Occasional or old sign of stock/animal damage to site/area<br>☐ Common or fresh sign of stock/animal damage to site/area<br>☐ Abundant or extensive sign (stock on site) of stock/animal damage to site/area | |
| Disasters | 1<br>2<br>3<br>4 | ☐ No sign of any disaster (e.g., fire, landslide, earthquake)<br>☐ Sign of an adjacent disaster since last visit to site or area, but site not damaged<br>☐ Limited or localised damage to site or area as the result of a disaster since last visit<br>☐ Severe or widespread damage to site or area from disaster since last visit | |
| Effects of Development | 1<br>2<br>3<br>4 | ☐ No signs of construction, roading or other development activities<br>☐ Occasional, localised signs of construction, roading or other development activities<br>☐ Common signs of construction, roading or other development activities, but limited to certain areas.<br>☐ Widespread signs of construction, roading or other development activities throughout the area. | Specify types of development |
| Effects of Visitors | 1<br>2<br>3<br>4 | ☐ No signs of visitor impact upon place or area<br>☐ Occasional localised signs of trampling, vehicular damage, rubbish, fossicking or other visitor impact<br>☐ Common signs of trampling, vehicular damage, rubbish, fossicking or other visitor impact<br>☐ Abundant signs of trampling, vehicular damage, rubbish, fossicking or other visitor damage | Specify types of impact |
| Fencing | 1<br>2<br>3<br>4 | ☐ Secure, intact fencing around site<br>☐ Most of site fences or secure site fence poorly maintained<br>☐ Surrounding area fenced<br>☐ No fencing or fencing through site | Specify purpose of and effects of fencing |
| Effects of Repair Work/Management | 1<br>2<br>3<br>4 | ☐ Repair work or management visible that has improved the condition and integrity of the place or area<br>☐ No repair work or management impact visible<br>☐ Repair work or management undertaken that has caused limited, localised damage to the place or area<br>☐ Repair work or management work undertaken that has caused widespread damage or destroyed place or area | |
| Other effects upon place or area | | | Please specify |

*Continued next page >>*

| **Recommended management actions** | **By whom** | **By when** |
|---|---|---|
| | | |
| Have management actions been undertaken as recommended by previous visit? | ☐ Yes | ☐ No |
| Any resource consent or NZHPT authority applications concerning place or area since last visit? | ☐ Yes | ☐ No |
| Change of ownership since last visit? | ☐ Yes | ☐ No |
| Information entered and processed | ☐ Yes | ☐ No |
| Date of next visit: | | |

| **Photopoint Data** | | |
|---|---|---|
| Number of Photopoints Established: | Photographer: | Date Established: |
| | | |

| **Photopoints:** | | |
|---|---|---|
| Photopoint Number: | Description of photopoint (i.e. location of photopoint, description of object photo of, whether peg placed at photopoint, rid reference, bearing, distance to object, other reference points, etc. | Film & Photo No. |
| | | |

| Sketch plan (include photopoint location and reference points, direction of photo, GPS Point location) and/or additional notes. | | |
|---|---|---|
| | | |

Figure F-1: Archaeological site monitoring form developed for use in New Zealand (from Walton 2003:25-30).

3/00 Grand Canyon National Park and Glen Canyon National Recreation Area

## RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

### MANAGEMENT

1. Site Number AZ ____________ 2. Monitor Session ____________
3. River Mile ______ Bank (L/R/B) ______ 4. Date ____________
5. Property Type: ____________
6. Monitor(s) ____________
7. PA Signatories ____________

### PHYSICAL IMPACTS

Coding: 0 = Absent, 1 = Active, 2 = Inactive, 3 = NA (for items 8 - 14)

| | | Structures / Storage | Artifacts | Roasters / Hearths | Perishables / Midden | Rock Images | Other |
|---|---|---|---|---|---|---|---|
| 8. | Surface Erosion (0 - 10 cm) | | | | | | |
| 9. | Gullying (10 - 100 cm) | | | | | | |
| 10. | Arroyo Cuttin (> 1 m) | | | | | | |
| 11. | Bank Slump | | | | | | |
| 12. | Eolian/Alluvial Erosion/Deposition | | | | | | |
| 13. | Side Canyon Erosion | | | | | | |
| 14. | Other Physical Impacts (animals spalling, roots) | | | | | | |

15. Drainage Type (river, terrace, or side canyon-based or no drainages): ____________

16. Do any of the above impacts appear to have occurred since the last monitoring episode
0 = No, 1 = Yes. If yes, explain in Question # 17. ______

17. Comments:

*Continued next page>>*

3/00 Grand Canyon National Park and Glen Canyon National Recreation Area

**RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM**

**VISITOR-RELATED IMPACTS**

Site Number:
Monitor Session:

Coding: 0 = Absent, 1 = Present, 3 = NA (for items 18 - 2

| | | Structures / Storage | Artifacts | Roasters / Hearths | Perishables / Midden | Rock Images | Other |
|---|---|---|---|---|---|---|---|
| 18. | Visitor Impacts | | | | | | |

19. Collection Piles: If present, explain in Question # 2 ________
20. Trails On-Site: If present, explain in Question # 26. Explain any off-site trails als ________
21. Camping On-Site: If present, explain in Question # 26 ________
22. Criminal vandalism/ARPA violations: If present, explain in Question # 2 ________
23. Other visitor impacts: If present, explain in Question # 2 ________
24. Visitor-related impacts since last monitoring: ________
25. Are any visitor-related impacts directly related to river fluctuations and/or dam operations, i.e. development of new trails to avoid high water, availability of new beaches in proximity of site 0 = No, 1 = Yes. If yes, explain in Question # 26 ________
26. Comments:

**RECOMMENDATIONS**

27. Monitor Schedule: 1) Discontinue 2) Semiannual 3) Annual 4) Biennial 5) Every three to five years 6) Inactive 7) Control Group ____________
28. Preservation Options: 0 = No, 1 = Yes
    Trail Work ________ Plant vegetation ________ Other Preservation Options ________
    Install checkdams ________
29. Recovery Options: 0 = No, 1 = Yes
    Research ________ Data Recovery ________ Other Recovery Options ________
30. Comments:

Figure F-2: Field form used by the Colorado River Corridor Monitoring Program (from Dierker and Leap 2005).

*SITE MONITORING FORM*

**MANAGEMENT:**

1. Site Number: ________ 2. Monitor Session: ________ 3. Date: ________
4. River Mile: RM ________ 5. Bank (E/W/N/S): ________ 6. Access: ________
7. Site Type/Monitoring Type: ________
8. Monitor(s): ________ 9. Time to Monitor (hrs/people): ________
10. Participants: ________

11. UTM Points to Monitor

Feature Name: ________ ________ m. Easting ________ m. Northing
Feature Name: ________ ________ m. Easting ________ m. Northing
Feature Name: ________ ________ m. Easting ________ m. Northing

**PHYSICAL IMPACTS:**

0 = Absent; 1 = Present; 2 = Increase; 3 = Decrease; 4 = NA (for table items)

| Impact Type | Building /Structures | Artifacts | Hearths / Ovens | Midden/ FCR Layer | House Pit | Other |
|---|---|---|---|---|---|---|
| Surface Erosion (0-10 cm) | | | | | | |
| Gullying (10-100 cm) | | | | | | |
| Channel Cutting (>1 m) | | | | | | |
| Bank Slumpage | | | | | | |
| Bank Loss | | | | | | |
| Eolian/Alluvial Erosion/Deposition | | | | | | |
| Animal Caused Erosion (trails/burrows) | | | | | | |
| Other Natural Impacts | | | | | | |

12. If channels or gullies are present, do they drain to the river? (Note: some drainages die out in dune fields or on terraces before reaching the river.) 0 = no; 1 = yes; 2 = NA: ________

13. Do any of the above impacts appear to have occurred since the last monitoring episode? 0 = no; 1 = yes. If yes, explain in Number 14. ________

14. Comments:

Photos: Roll # ________ Frame ________

Digital Photos: ________

Videotape # ________ Frame # ________

Note: Attach photographs or other documentation on and after this page to complete the report.

Figure F-3: Field form used by the Omaha District monitoring plan (Omaha District 2005).